# ACCELERATED MULTI-ENGINE GROUND SCHOOL
# CHECK-RIDE PREP

SKYVIEW
AVIATION, LLC

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# Preparation & Safety

- **A key to your success is to self-study the entire packet, maneuvers, emergency procedures, FAA literature, PRIOR to your arrival. A pre-checkride 50 question test is required before you receive any test endorsement.**
- **It is also key for all AMEL IFR students to come prepared to demonstrate proficiency in hand flying IFR approaches. If you use an autopilot regularly or are not proficient at flying approaches, we encourage you to get instruction from a qualified CFII prior to arrival. Failure to do so may result in added expense for your cost of training.**
- **We cannot guarantee any successful course completion, certificate, or check-ride outcome, or a DPE check-ride but will strive to meet your needs in training and help you have a positive training experience to the best of our abilities.**
- **DPEs are independent of and not employees or affiliated with Skyview Aviation, LLC.**

# Multi-Ground Training

- **Introductions**
- Documents you will need
  - Pilot Logbook
  - Pilot Certificate
  - Medical or Basic Med (originals)
  - IACRA login
  - FTN number
  - Gov Issued Photo ID
  - Birth Cert or Passport
- Other important items
  - Headset
  - View Limiting Device (foggles)
  - Skyview Course Fee Balance (Cert ck, Cash, Venmo)
    - Note: Using Venmo may require coordinating $ limits with your bank daily
    - Credit Cards are welcome with processing fee
  - DPE Fee (cash $875) **NO CHECKS PLEASE**


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# Training Schedule


**Before Arrival** – Self-Study all materials and complete ME Ground School via Zoom

**Day 1**

Arrival, Check-in, Documents, Ground, Pre-flight & Maneuvers, Intro to Single Engine Operations, OEI RNAV

**Day 2**

AM, Ground, Pre-flight, Single Engine Operations

PM, Ground, Pre-flight, Emergency Procedures & Instrument Approaches

**Day 3**

AM, Ground, Pre-flight, Check-ride Prep, Mock Check-ride Flight

PM, Pre-flight, Check-ride with your DPE

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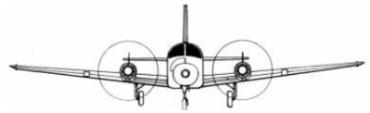
# Multi-Maneuvers




1. Slow Flight
2. Steep Turns (50° Com/45°PVT) (+/- 100’) (+/-5°)
3. Stalls (Power off, Power on, Accelerated)
4. Normal Take-off & Landing
5. Short Field Take-off & Landing
6. Emergency Descent
7. Engine Failure (Take-off roll, initial climb, cruise)
8. Single engine pattern with landing
9. In air engine restart
10. Single engine instrument approach
11. Vmc demonstration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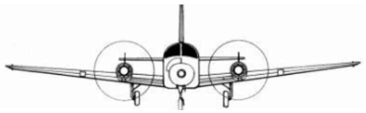
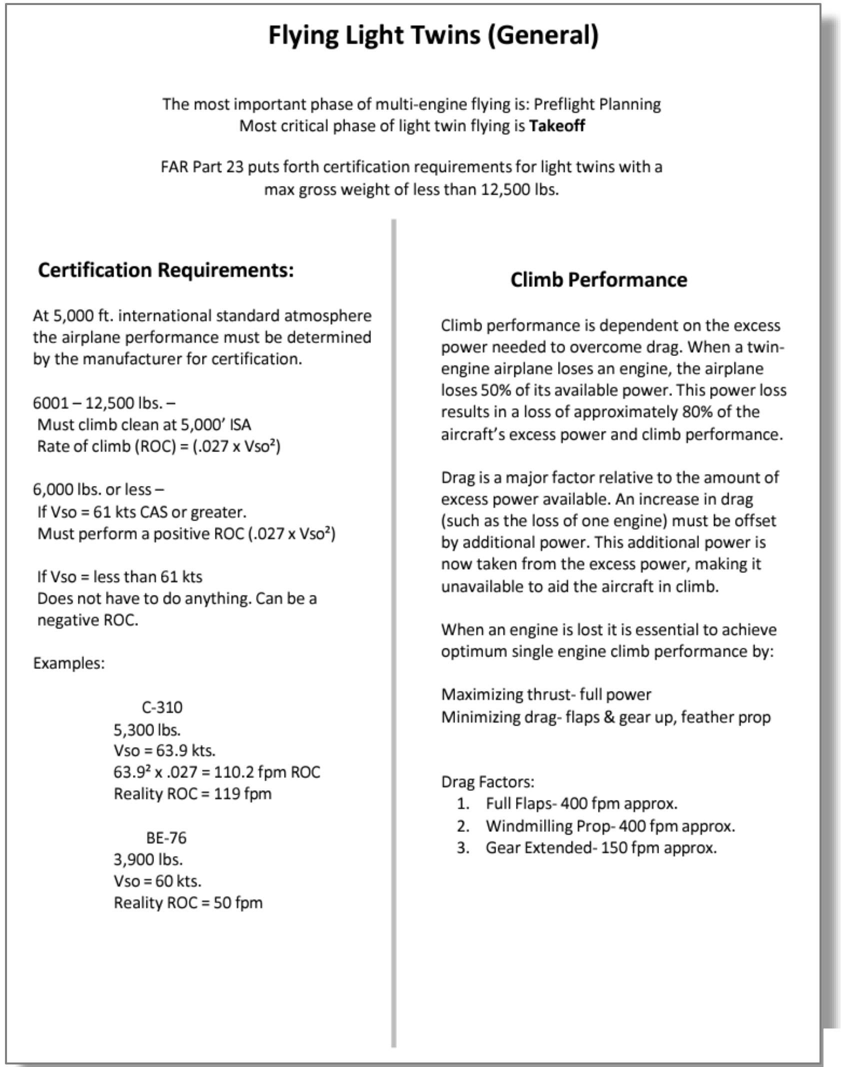
# Flying Light Twins




- The Most Critical Phase of Flight
  - Takeoff
- Far Part 23 Certification
  - Max Gross < 12,500
    - 6,000-12,500
    - 6,000 or less
      - Vso < 61 kts
- Climb Performance (none required for TA)
- How much power is lost when you lose an engine? 50%
- Performance Loss? →80%

Drag Factors
- Full Flaps – 400 fpm approx.
- Windmilling Prop – 400 fpm approx.
- Gear Extended – 150 fpm approx.



**Flying Light Twins (General)**

The most important phase of multi-engine flying is: Preflight Planning
Most critical phase of light twin flying is **Takeoff**

FAR Part 23 puts forth certification requirements for light twins with a max gross weight of less than 12,500 lbs.

**Certification Requirements:**

At 5,000 ft. international standard atmosphere the airplane performance must be determined by the manufacturer for certification.

6001 – 12,500 lbs. –
Must climb clean at 5,000' ISA
Rate of climb (ROC) = (.027 x $Vso^2$)

6,000 lbs. or less –
If Vso = 61 kts CAS or greater.
Must perform a positive ROC (.027 x $Vso^2$)

If Vso = less than 61 kts
Does not have to do anything. Can be a negative ROC.

Examples:

C-310
5,300 lbs.
Vso = 63.9 kts.
$63.9^2$ x .027 = 110.2 fpm ROC
Reality ROC = 119 fpm

BE-76
3,900 lbs.
Vso = 60 kts.
Reality ROC = 50 fpm

**Climb Performance**

Climb performance is dependent on the excess power needed to overcome drag. When a twin-engine airplane loses an engine, the airplane loses 50% of its available power. This power loss results in a loss of approximately 80% of the aircraft's excess power and climb performance.

Drag is a major factor relative to the amount of excess power available. An increase in drag (such as the loss of one engine) must be offset by additional power. This additional power is now taken from the excess power, making it unavailable to aid the aircraft in climb.

When an engine is lost it is essential to achieve optimum single engine climb performance by:

Maximizing thrust- full power
Minimizing drag- flaps & gear up, feather prop

Drag Factors:
1. Full Flaps- 400 fpm approx.
2. Windmilling Prop- 400 fpm approx.
3. Gear Extended- 150 fpm approx.

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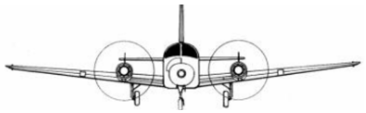
# Multi-Engine Terms and definitions




- **Service Ceiling** - This is the maximum density altitude where the best rate of climb airspeed (Vy) will produce a 100 fpm climb with both engines at max continuous power.
- **Absolute Ceiling** - This is the maximum density altitude that the airplane can attain or maintain at max gross weight in the clean configuration and max continuous power. As altitude increases, Vx increases, while Vy decreases. Where these two speeds converge is absolute ceiling.
- **Absolute Single Engine Ceiling** – This is the maximum density altitude the airplane can attain on one engine and the rate of climb is zero.
  - This is critically important, especially when flying over mountainous terrain. If the aircraft is above the single-engine absolute ceiling when an engine fails, it will slowly drift down to its single engine absolute ceiling.
    - **Example**: Aircraft cruising altitude: 12,000’ MEA: 9,500’ Single engine absolute ceiling of 5,850’. If the aircraft has an engine failure at 12,000’, it will drift down to 5,850’ (or less). If you are IMC this could be very bad. Always plan for an engine to fail! Choose a different route with a lower MEA.
- **Single Engine Service Ceiling**- This is the maximum density altitude at which the aircraft can maintain a 50 fpm climb with one engine operating at full power and one engine with a feathered propeller.

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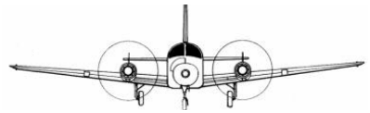
# Multi-Engine Terms and definitions, continued




- **Vyse** - This is best rate of climb single engine. This is identified by the blue radial on the airspeed indicator. Always pitch for blue line when an engine fails. It will give you the best single engine performance, although it may not be a climb.
- **Vxse** - Best angle of climb single engine. If you have obstacles to clear with an engine failed, use Vxse. Once the obstacles are cleared, pitch for Vyse.
- **Vsse** – The minimum speed at which an intentional engine cut can be performed. It gives a safety margin from Vmc for safe engine cuts while training.
- **Vmc** – This is the calibrated airspeed at which, following the sudden critical loss of thrust, it is possible to maintain control of the airplane.
- **Zero Fuel Weight** – This is the maximum weight of passengers and baggage, less the fuel weight that the plane an withstand before structural damage occurs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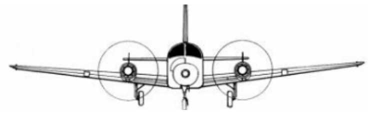
# Single Engine Aerodynamics




- Engines rotating the same direction (right as seen inside the cockpit)
- Compared to counter-rotating props
- What happens with the loss of an engine?
- Why does this happen?

Yaw and Roll toward the dead engine
Asymmetric - Lift, Thrust, and Drag

Asymmetric thrust will cause a yawing moment around the C.G. towards the dead engine.
Accelerated slipstream (or induced flow) is extra lift created by air accelerated from an operating engine forced over the wing. There is a lack of this induced flow over the wing with the failed engine. This results in a rolling moment around the C.G. toward the inoperative engine.

## DEAD FOOT – DEAD ENGINE

**To counteract the roll and yaw, you must apply rudder towards the operating engine!**

## Let’s talk about the “Critical Engine”

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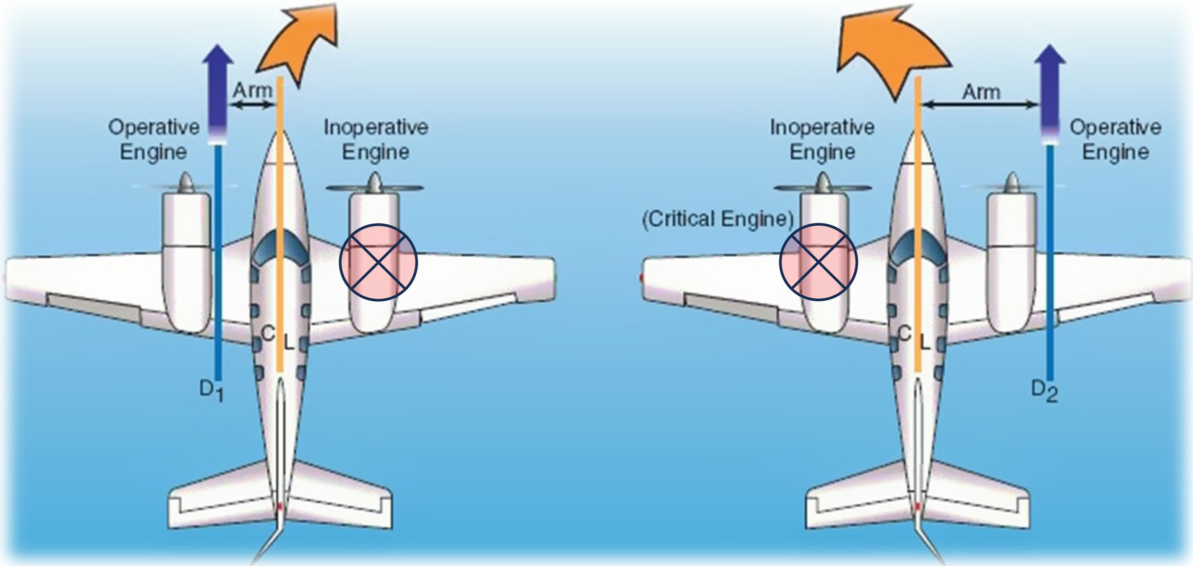
# What is a “Critical Engine”

A critical engine is the engine which, if lost, will most adversely affect the performance and handling characteristics of the aircraft. The effect of the critical engine is most significant when operating at low airspeeds with a high-power setting, thus producing more p-factor and torque.

On conventional twins with the propellers rotating clockwise, the critical engine is the left engine. On aircraft with counter-rotating propellers, such as the Beechcraft Duchess or Piper Seminole, there is no critical engine due to the turning tendencies cancelling each other out.  An engine can also be termed as a critical engine if important systems are operated off that engine. (i.e. landing gear, pressure system, etc.)

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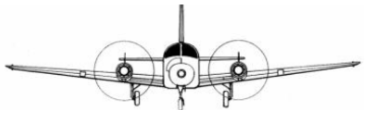
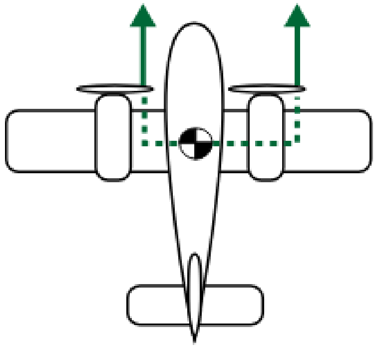
# Factors used in determining the critical engine

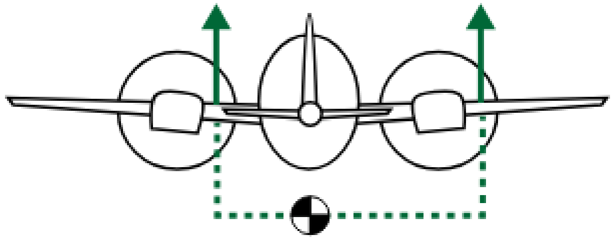



| Factor | Explained |
|---|---|
| P-Factor | Right propeller blade (farther away) is producing more thrust (yawing moment) |
| Accelerated Slipstream | The air being forced over the wing by the operating engine creates extra lift (rolling moment) |
| Spiraling Slipstream | Loss of air from the left engine (out) impact rudder control (less effective rudder) |
| Torque | Torque tries to roll the airplane opposite of the propeller's direction of rotation. If the left engine fails, torque tries to roll the aircraft to the left, making it more difficult to raise the dead engine. |

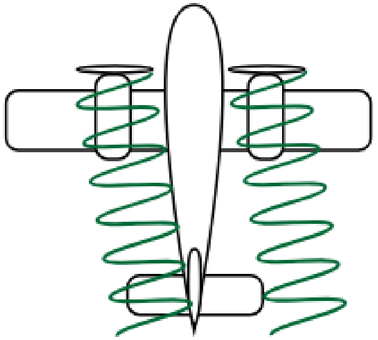
**P**-Factor



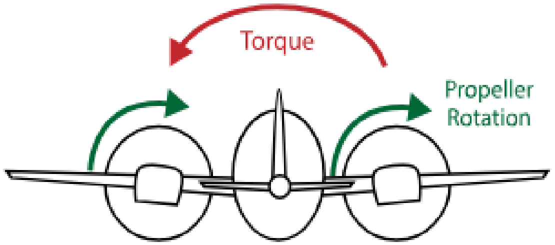
**A**ccelerated Slipstream



**S**piraling Slipstream



**T**orque

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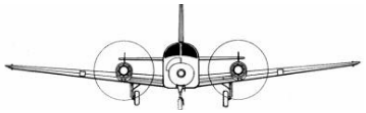
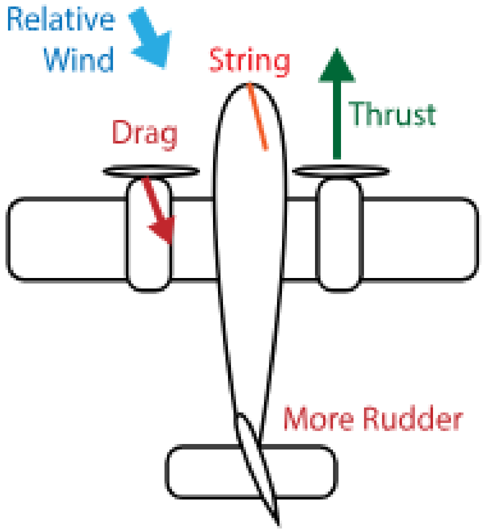
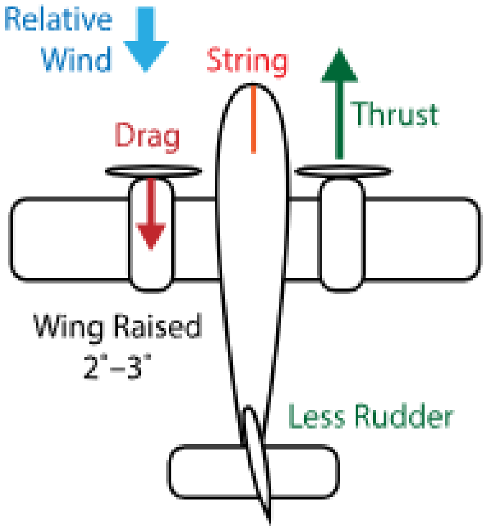
# Counter-acting the "dead engine" - Zero Side-Slip




- Just using rudder to maintain direction will put the aircraft into a sideslip, which introduces the fuselage to the relative wind creating a large amount of drag. We need to minimize this drag as much as possible while still maintaining heading. The solution is to improve performance by using a zero-sideslip condition.
- When the aircraft is banked 2°- 5° toward the operating engine, the dihedral of the wing will create a horizontal component of lift. This will minimize the rudder deflection required to align the longitudinal axis of the airplane to the relative wind. With this bank, the appropriate amount of rudder deflection will be indicated on the inclinometer by the ball being halfway deflected toward the operating engine.

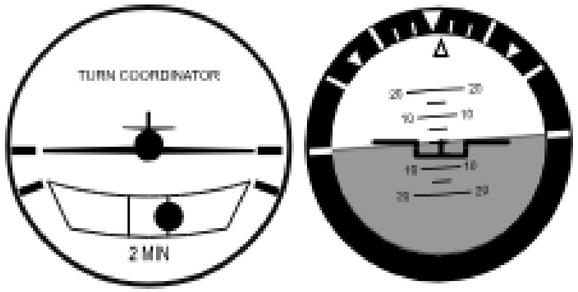



Wings Level with OEI




Zero Sideslip Condition

## "Raise the Dead Engine"




Instrument Indications of a Zero Sideslip Condition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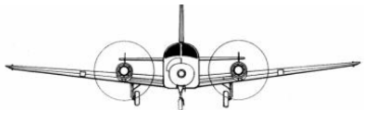
# Determining Vmc




FAR 23.149- Vmc is the calibrated airspeed, at which, when the critical engine is suddenly made inoperative it is possible to:

- Maintain control of the airplane with the engine still inoperative.
- Maintain straight flight at the same speed with an angle of bank not more than 5 degrees.

As airspeed decreases the rudder becomes less effective, eventually an airspeed will be reached where full rudder deflection will be required to maintain directional control. This airspeed is Vmc. Any further reduction in airspeed will result in loss of directional control. Published Vmc is defined by the red radial on the airspeed indicator.

Vmc guarantees directional control only!!


Image for training use only

## How does the manufacturer determine Vmc?

C- Critical engine failed and windmilling

O- Operating engine at maximum takeoff power

M- Maximum gross weight

B- Bank of no more than 5 degrees

A- Aft center of gravity

T- Takeoff configuration (gear up, flaps up)

S- Standard temperature (15°C) and pressure (29.92” Hg)

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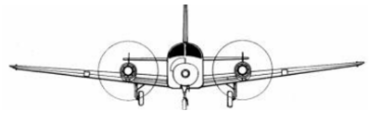
# Factors which influence Vmc




Vmc is defined using a very specific set of conditions. Published Vmc and actual Vmc can be two very different numbers. Vmc only addresses directional control and is not related to aircraft performance.

While controllability is important, single engine performance is just as important.

You must be able to balance both controllability and performance to keep a serious situation from getting out of control. In some cases, an element that provides an increase in controllability can actually hurt performance.

| Condition | $V_{MC}$ | Performance |
|---|---|---|
| Below Maximum Weight | Increases | Increases |
| Maximum Weight | Decreases | Decreases |
| Landing Gear Up | Increases | Increases |
| Landing Gear Down | Decreases | Decreases |
| Wing Flaps Retracted | Increases | Increases |
| Wing Flaps Extended | Decreases | Decreases |
| Forward CG | Decreases | Decreases |
| Aft CG | Increases | Increases |
| Cowl Flaps Open | Decreases | Decreases |
| Cowl Flaps Closed | Increases | Increases |
| Windmilling Propeller | Increases | Decreases |
| Feathered Propeller | Decreases | Increases |
| Above Standard Temperature | Decreases | Decreases |
| Below Standard Temperature | Increases | Increases |
| 1° to 5° Bank | Decreases | Increases |
| No Bank | Increases | Decreases |
| > 5° Bank | Decreases | Decreases |
| Out of Ground Effect | Increases | Decreases |
| In Ground Effect | Decreases | Increases |

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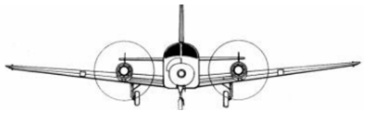
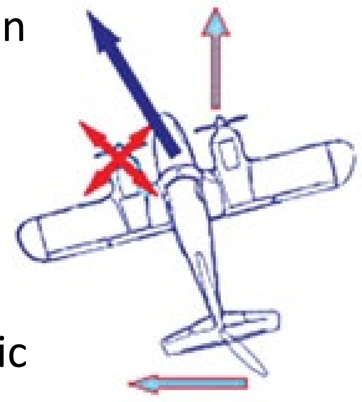
# Recognizing & Recovering from Vmc




## Warning signs you are getting close to Vmc:

- Loss of directional control - The rudder pedal is depressed to its fullest travel and the airplane is still yawing or rolling toward the inoperative engine.
- Stall warning horn or buffeting of the controls- A single engine stall is very dangerous and could result in a spin. Light twins are not known for good stall/spin recovery.
- A rapid decay of control effectiveness- This could lead to the loss of control of the aircraft.



## To recover from Vmc, you must simultaneously:

- Reduce power on the operating engine- Reduce power on the operating engine reduces the asymmetric air flow.
- Pitch down- Lowering the nose of the aircraft will get the air flowing again over the control surfaces and allow you to regain directional control.

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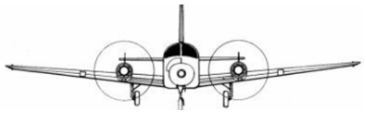
# Vmc versus Stalls




Normally aspirated engines lose efficiency as density altitude increases. Since the operating engine is not producing as much thrust as at sea level, asymmetrical airflow will be reduced, which will lower Vmc. We must remember, though, that stall speed is an indicated airspeed that will remain constant as altitude increases or decreases. Eventually, the two speeds will be at the same point.

**There exists an altitude where each of the following exists:**

- VMC is less than VS (stall occurs first)
- VMC is the same as VS (stall and yaw coincide)
- VMC is greater than VS (yaw occurs first)

Here, the airplane will "stall and yaw" simultaneously under a condition of asymmetrical thrust. The airplane could experience an abrupt change in attitude or enter into a spin.

The density altitude where VMC and VS are equal is called the **critical density altitude**.

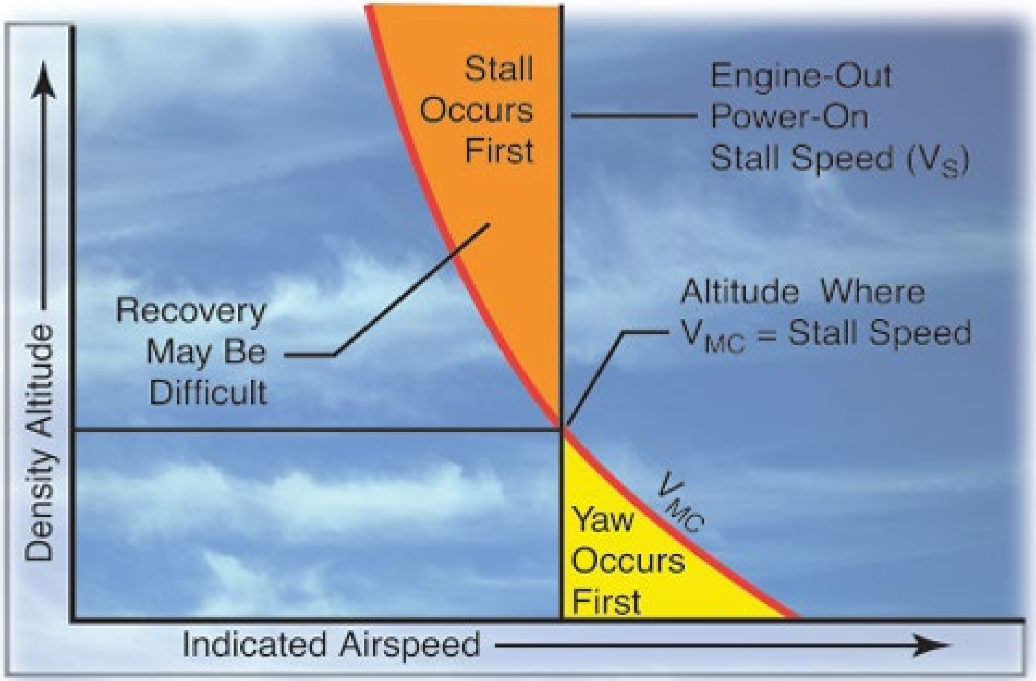



**Figure 13-14.** *Graph depicting relationship of $V_{MC}$ to $V_S$.*

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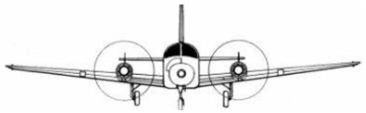
# Risks of Stalls in Multi-Engine Airplanes




### When Stalls Most Often Occur

Accident and incident reports show that most full or near-full stalls of transport aircraft occur in one of the following situations and usually in **IMC** or where there is no natural visual horizon:

•During inappropriate response to an un-commanded **autopilot** disconnect at high altitudes. (**Un-commanded AP Disconnect due to malfunction of other systems**)

•At low altitudes when the indicated airspeed is unintentionally allowed to deviate significantly from the intended and necessary target (**Airspeed Awareness**)

•At low altitudes in the presence of frozen deposits on the wings (**Airframe Icing**)

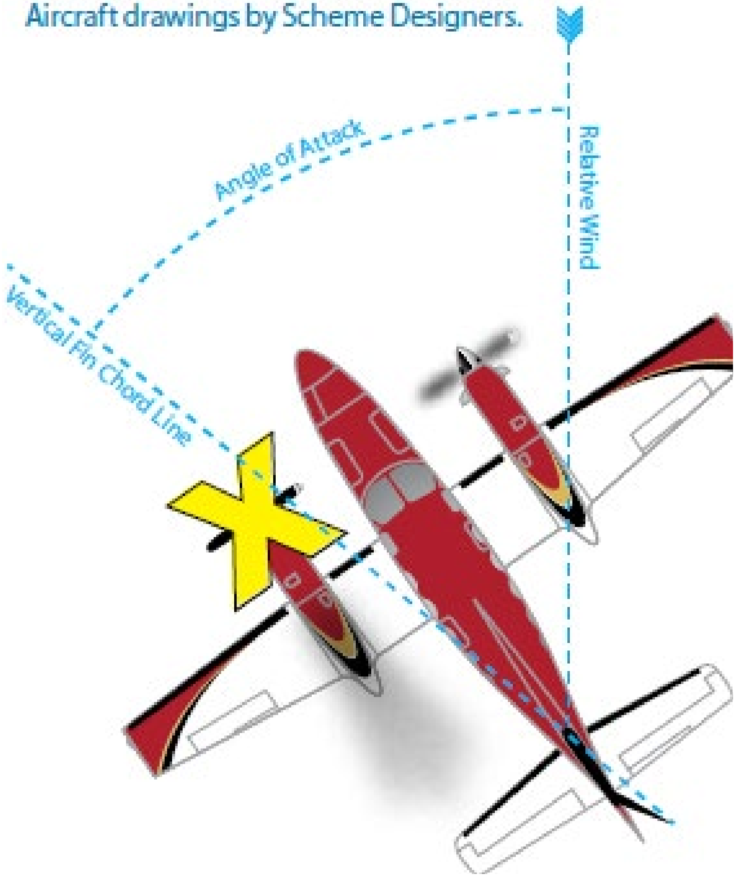
•During a mishandled **go around** (**Aircraft management and Flying Skills**)

•Because of **insufficient understanding of automation** as it affects flight envelope protection systems.

•Improper **slats/flaps** configuration (**Aircraft Configuration**)

•When exceeding **VMC** in multi-engine aircraft

•When operating **One Engine Inoperative** in Multi-engine aircraft

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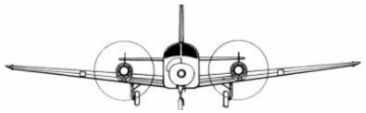
# Memorize These Steps!




Action when an engine fails:

1. Maintain Directional Control & Pitch for Blueline
2. POWER UP- right – left - center: mixtures full, props full, throttles full
3. CLEAN UP- flaps up, gear up
4. IDENTIFY- Dead foot, Dead engine
5. VERIFY- cautiously retard throttle to idle

**If Below 3,000' AGL**

6. SECURE- feather the prop Mixture to idle cut-off

**If Above 3,000' AGL**

1. 1-5 Above then…
2. RECTIFY- Floor to the door:
   - A. Fuel, Fuel, Fuel (mixture, boost pumps, fuel selectors)
   - B. Ignition (check mags)
   - C. Air (alternate air)
3. SECURE- feather the prop Mixture to idle cut-off Use the checklist!

Why can't we rely on engine gauges to identity the inoperative engine?

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# V Speeds for normal operations

| | | |
|---|---|---|
| Vr | Rotation Speed | 85mph |
| Vx | Best Angle of Climb | 90mph |
| Vy | Best Rate of Climb | 110mph |
| Vxse | Best Angle 1 Engine | 98mph |
| Vyse | Best Rate 1 Engine | 108mph |
| Vso | Stall w/ Flaps down | 70mph |
| Vmc | Min Control 1 Engine | 80mph |
| Va | Maneuvering (Max Gross) | 160mph |
| Vno | Max Structural Cruise | 185mph |
| Vne | Never Exceed | 240mph |
| Vle/Vlo | Max Gear Speeds | 150mph |
| Vfe | Flap Extension | 130mph |
| Best Glide | Max Gross | 120mph |

Certain items in the are lower and noted as “at 5,000’” Skyview uses a higher limit for an added margin of safety

NOTE: THE D95A Vle is 165 mph and the BE95A is 150 mph. We will train using a 150 mph Vle to reduce the likelihood of gear or gear door damage.

## Basic Single Engine Procedures


**#1 Cardinal Rule – Maintain control and airspeed at all times**

Apply max power to operating engine

Reduce drag to an absolute minimum

Secure failed engine and related sub-systems

## Sample Take-off Briefing

1. We’ll be using runway _____ and conditions are ________
2. Any loss of directional control we will reduce power to idle, use rudder to control the aircraft, and brake to stop.
3. Any loss of power prior to rotation, or if not reaching 70% of rotation speed by 50% of the runway, we will reduce power to idle, use rudder to control the aircraft, and brake to stop.
4. After rotation, gear still down, runway remaining, we will reduce power to idle, use rudder to control the aircraft, land, and brake to stop.
5. After rotation, and below 400’ AGL, we will pitch for blueline and land straight ahead +/- 30 degrees. (NOTE: if conditions permit – see #6)
6. After rotation, gear up and above 400’AGL, we will pitch for blueline, maintain directional control, run the drill (mixtures, props, throttles, flaps up, gear up, identify, verify, feather), continue the climb to pattern and return and land.

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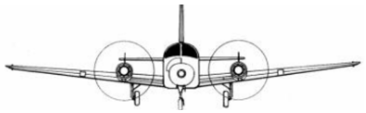
# BOOM, Engine Died!!!




Action when an engine fails:

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**If Below 3,000' AGL**

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1. 1-5 Above then…
2. RECTIFY- Floor to the door:
   - A. Fuel, Fuel, Fuel (mixture, boost pumps, fuel selectors)
   - B. Ignition (check mags)
   - C. Air (alternate air)

3. SECURE- feather the prop Mixture to idle cut-off Use the checklist!

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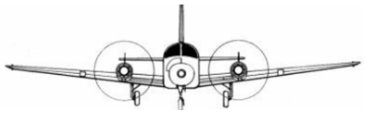
# Performance Charts




**<u>Know your performance!!</u>** Your CFI will cover the performance charts with you, but it's good to have a basic understanding of several of them before you start your flight training. Refer to the POH for these numbers.

## Accelerate-Stop Distance

Accelerate-Stop distance is the distance required to accelerate to liftoff speed and, assuming failureof an engine at the instant liftoff speed is attained, bringing throttles to idle and stopping the airplane.

## Accelerate-Go Distance

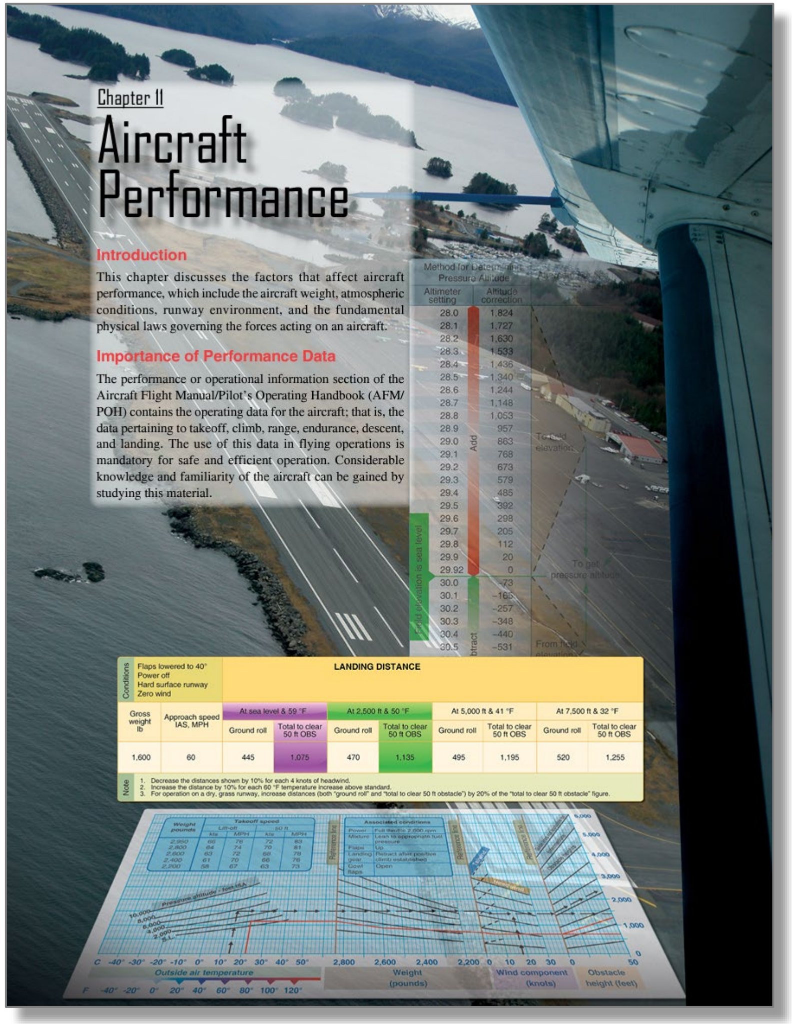
**Note: won't apply to the Travel Air**

Accelerate-Go distance is the distance required to accelerate to liftoff speed and, assuming failureof an engine at the instant liftoff speed is attained, continuing the takeoff and climbing to 50'. Know before you try to takeoff whether you can maintain control and climbout if you lose an engine with the gear still down!

## Takeoff Weight To Achieve A Positive Single Engine Rate Of Climb at Liftoff

This chart is for exactly what the title implies. Plug in your weight from the weight & balance to determine if you will be able to climb at liftoff, period. If you can't, then you are committed to pulling throttles to idle and stopping the airplane. Accelerate-Go would be impossible in this case.

**<u>Remember</u>**, These charts were printed many years ago when the airplanes were new. Always assume that your airplane will not live up to the performance stated in the charts. Always plan for worst case scenario andalways give yourself an out. Always fly under the assumption "what if".

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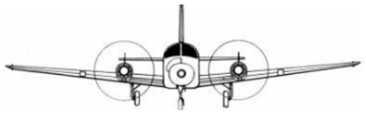
# Oral Exam Guide

It is important to understand and be able to demonstrate your knowledge in these areas for your oral exam.




**Vmc**

A thorough knowledge of Vmc is probably the most important subject on the oral exam.

1. Be able to define Vmc.
2. How does the manufacturer determine Vmc speed?
3. What happens to Vmc if the aircraft is loaded aft of the CG limit?

**How is Vmc Determined?**

**COMBATS**

Critical engine failed and windmilling
Operating engine at max t/o power
Max gross weight
Bank up to 5° into the good engine
Aft CG
Takeoff configuration
Standard day, 29.92" Hg, 15°C

Know the factors that affect Vmc

**Lowers Vmc (good)**

Add power to the critical engine
Reduce drag
Reduce power on the good engine
Forward CG
Gear down
Lower pressure
Higher altitude
Higher temperature

**Increases Vmc (bad)**

Reducing bank
Higher pressure
Lower temperature
Lower altitude

How will these affect your performance?

**Critical Engine**

Be able to define critical engine.
How is it determined?
Why do some airplanes have a critical engine and some don't?
Does the Travel Air have a critical engine?

**Performance Charts**

Know your performance!!

1. Takeoff distance
2. Accelerate-stop distance
3. Accelerate-go distance
4. Takeoff weight to achieve single engine climb
5. Climb performance: 2 engine, 1 engine
6. Cruise chart: TAS, fuel flow, range
7. Single engine service ceiling
8. Landing distance: flaps up, flaps down

**Weight and Balance**

Complete your weight & balance!
Be able to use the charts and graphs in the POH.
Explain zero fuel weight.

**Aircraft Systems**

Know your systems!
Fuel system
Landing gear
Electrical system
Constant speed, full feathering props
Heater system
Pressure system
Fuel cross feed

**Airspeeds**

Red line
Blue line
Vy, Vx, Vyse, Vxse, Vmc, Va, Vlo, Vle, Vso, Vs1, Vsse, Vno, Vne

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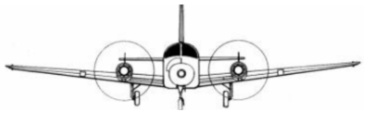
# Aircraft Systems




## Engines

**Specs:** 2 x Lycoming IO-360 B1B
4-cyl horizontally opposed, fuel-injected, air cooled, naturally aspirated, Max 28.5"
2 x 180 hp each = Total 360 hp
**Oil capacity:** 6-8 qts per engine (5 qt min)
**Fuel burn:** 10 gals / hr per side

## Propellers

**Specs:** Two-bladed Hartzell constant speed, full feathering props. Maximum 2700 RPM
**Maintains constant RPM:** With oil pressure through the prop governor (speeder springs / flyweights / pilot valve)
**Nitrogen unfeathering accumulator:** Brings prop out of feather **Why use Nitrogen?**
**Locking pins:** Prevents props from feathering when engine is < 800 RPM. Saves wear and tear on starters.

## ALTITUDE LIMITATIONS AT 4,200 lbs

| Two Engine Service Ceiling | Single Engine Service Ceiling |
|---|---|
| 18,100' (100 fpm) | 4,400' (50 fpm) |

## Fuel System

**Fuel Capacity:** 112 total (106 useable)
**4 Tanks: Two MAIN:** 25 gal ea (22 usable)
**Two AUX:** 31 gal ea (all usable)
**4 fuel pumps:** 2 eng drive & 2 elec boost*
**8 fuel sumps:** 4 ea wing
**Fuel grade:** 100LL (blue dyed & 6 lbs/gal)
**X-Feed:** Emergency Only
**Fuel Limitations:**
1. ALWAYS T/O & LAND on MAINS.
2. NEVER T/O with < 10 gals (yellow arc).
3. WAIT 30s before t/o after high-speed taxi.

## Electrical

**28V system:** 2 x 12V battery (series)
2 x 28V alternators – 60 amps
**Circuit breakers:** Protects the system
**Voltage regulator:** Parallels Loads
**Gear and Flaps System:** 100% electrical

## Starter Limitations

**10 Seconds on, 20 Seconds Off**
**(limit to 6 attempts) – wait 30 minutes**

## Landing Gear

**Sungear system:** Uses a torque motor to rotate a circular disk, which is connected to push pull rods attached to the landing gear. The push pull rods push the gear and doors out and pulls them in.
**'WOW' or Squat switch:** On L Main Gear. Prevents the gear from retracting on ground.
**Other safety systems:** Gear warning horn, nose gear indicator and nose gear mirror
**Gear hand crank:** For emergency use (roughly 50 turns counterclockwise)
**Landing checks:** "Down & Green" (verified twice and one in the mirror)
**Locks:** Mechanical Up-Locks, and over-center linkage w/ spring locks gear down

## Heater

**Janitrol 35,000 BTU Combustion Heater:** Located in the nose compartment. Self-contained system. **Has its own fuel pump.***
Draws fuel from left main tank and ignites in the nose. Blower then circulates hot air throughout the cabin.

**When should you get a gear warning?**

1. Gear up with low MP
2. Full flaps, gear up
3. Gear selector up on ground

**Always verify flaps and gear when using.**

**Nose Gear Indicator light**
**Nose Gear in the mirror**
**Flaps up or down (visually)**

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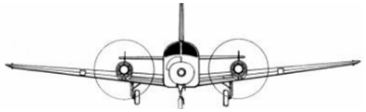
# Travel Air Landing Gear System




The Travel Air has a Sun Gear system which uses a torque motor to rotate a circular disk, which is connected to push pull rods attached to the landing gear.

The push pull rods push the gear and doors out and pulls them in.

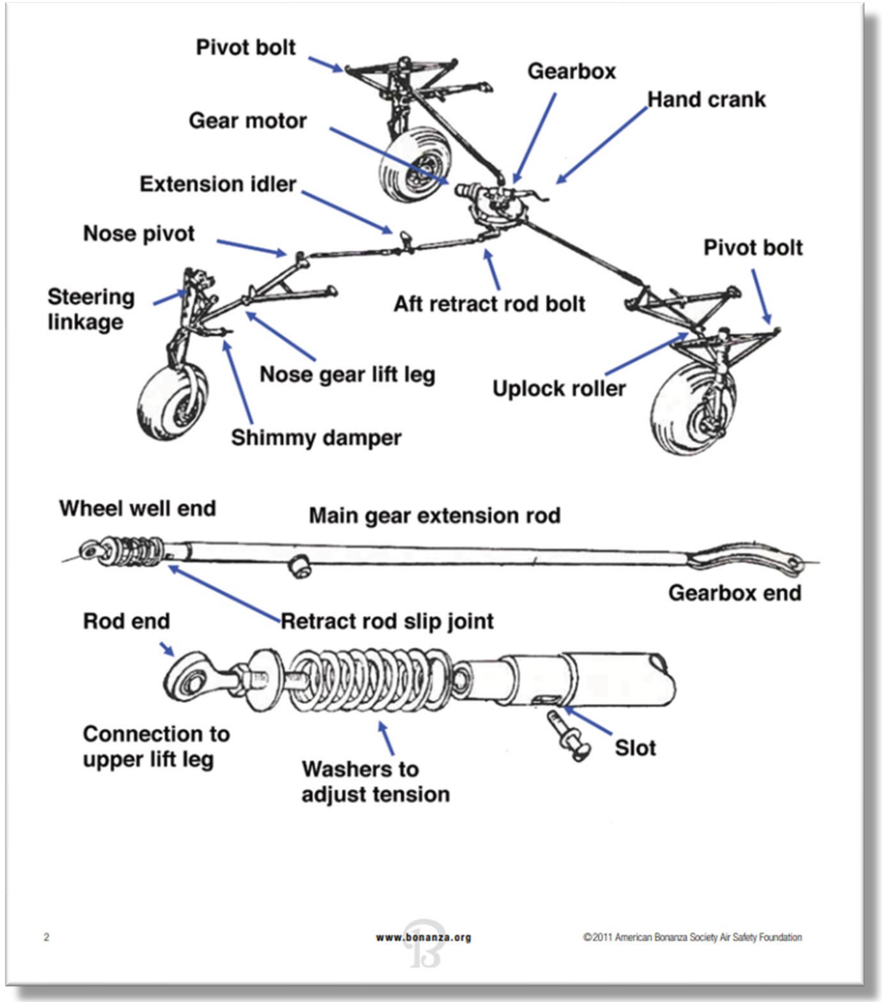
This system has a Squat switch on the left Main Gear. This prevents the gear from retracting on ground.

Other safety systems: Gear warning horn, nose gear indicator, and nose gear mirror.

Gear hand crank: For emergency use (roughly 50 turns counterclockwise)

Landing checks: “Down & Green” (verified twice and one in the mirror)

Locks: Mechanical Up-Locks, and over-center linkage w/ spring locks gear down

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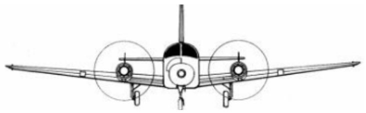
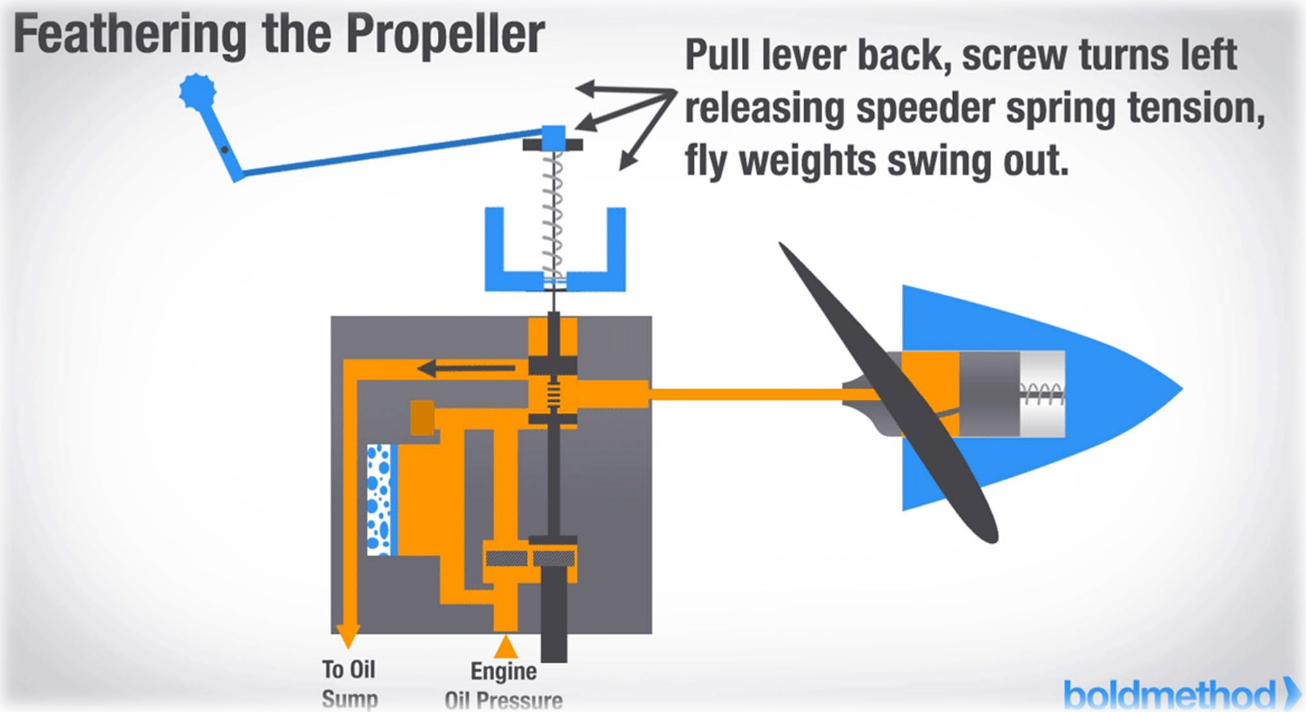
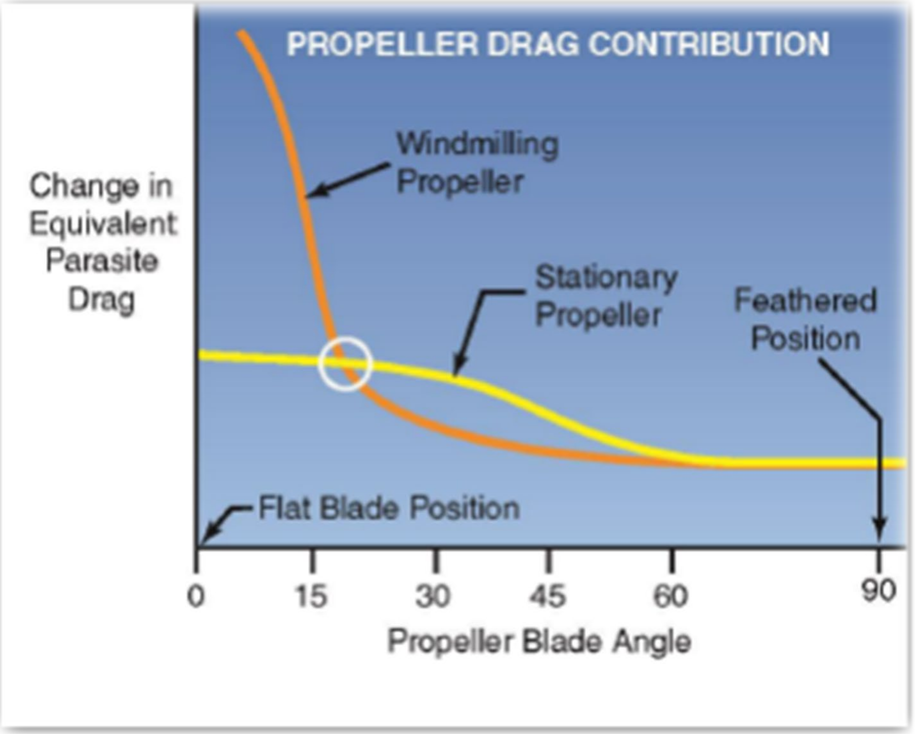
# Travel Air Full Feathering Props



The Travel air has full feathering propellers and the system includes unfeathering accumulators to aid in unfeathering the propeller after an engine re-start. The propeller system is a constant speed propeller system similar to that shown below. Locking pins keep the propeller from feathering at shut-down at low RPM below 800 RPM. Note the drag caused by a windmilling propeller as compared to a feathered propeller.




Watch this video by Seth Lake, DPE about the unfeathering accumulators on the Travel Air.

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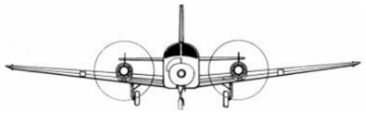
# Emergency Procedures




**ENGINE FIRE ON-GROUND**
1. Starter .... Continue Cranking
- Observe Starter Limitations (10 Seconds On)
- If Engine Doesn't Start and/or Fire Persists
2. Evacuation .................................. Initiate

**EVACUATION**
1. Mixtures .................................. Cut-Off
2. Throttles ......................................... Idle
3. Magnetos ....................................... Off
4. Battery & Alternators..................... Off
5. Fuel Selectors ................................ Off
6. Evacuation ................................ Initiate

**ENGINE FAILURE ON RUNWAY**
1. **"Abort-Abort-Abort"**
2. Chop - power idle
3. Stop - apply brakes
4. Maintain directional control on runway

**EMERGENCY DESCENT**
1. Autopilot .......................................... Off
2. Throttles ......................................... Idle
3. Props .............................................. Full
4. Landing Gear ....... Down (Max 150 MPH)
5. Airspeed ......................... Max 150 MPH
6. Altitude .... As Required; note MEA/MSA

**Note:** In the event of a dual engine failure the best glide speed (Vg) is 120 MPH, with both props feathered and landing gear / flaps retracted. The glide ratio is 2.5 Miles for every 1,000' of ALT.

**SQUAWK 7700 – 121.5 (MAYDAY)**

**ENGINE FAILURE / FIRE IN-FLIGHT**
1. Power ............................... Max Available
   a. Mixture
   b. Prop
   c. Throttle
2. Landing Gear ....................................... Up
3. Flaps ................................................... Up
4. Identify ....................... Malfunction L or R
5. Throttle Lever ....................... Verify L or R
6. Prop Lever .......................... Feather L or R
7. Affected Engine Mixture Lever ...... Cut-Off
8. Fuel Selector ....................................... Off
9. Cowl Flap ...................................... Closed
10. Boost Pump .........................................Off
11. Alternator .............................................Off
12. Magnetos .............................................Off

Land as soon as possible - If flight time on single engine is to exceed 30 minutes: CROSSFEED (One Engine Inoperative) checklist

**ENGINE RESTART**

**Caution:** The reason for engine failure should be determined before attempting an air start.
1. Complete the ENGINE FAILURE checklist
2. Airspeed .................................. 120 MPH
3. Magnetos ........................................... On
4. Alternator........................................... On
5. Cowl Flap ..................................... Closed
6. Fuel Selector .......................... Aux / Main
7. Throttle Lever ................................... Idle
8. Mixture Lever ................................. Rich
9. Prop Lever ....................................... Full
10. Starter .................. Engage / As Required
11. Warm-Up ................. 15" MP, 2000 RPM

## MANUAL GEAR EXTENSION

**Warning:** Keep cranking until the physical limit of the handle is reached. DO NOT rely on the green indicator light, as the gear may be down but not fully locked in this condition.

**Warning:** If the gear is manually extended in an actual emergency situation, DO NOT move any landing gear controls or reset any circuit breakers until the aircraft is on jacks, as the failure may be in the gear-up circuit. This could cause the gear to retract on the ground .

**Caution:** The manual extension system is designed only to lower the landing gear. DO NOT attempt to retract the landing gear manually.

- Landing Gear Relay C/B ........................................ Pull
- Landing Gear Handle ........................................ Down
- Handcrank ........................................ Engage / Turn CC

**Note:** Pull Handcrank out to engage manual extension and turn the crank counter-clockwise about 50 turns; verify with mechanical indicator.

## LANDING GEAR RETRACTION
### (AFTER PRACTICE MANUAL EXTENSION)

- Handcrank ........................................ Stowed
- Landing Gear Relay C/B ........................................ In
- Landing Gear Handle ........................................ Up

**Caution:** DO NOT operate the landing gear electrically with the Handcrank engaged, damage to the mechanism could occur rendering the manual gear extension system inoperative. 7.3

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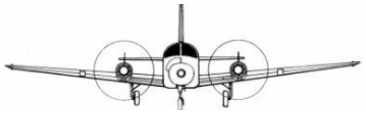
# Multi-Engine Maneuvers – quick reference



**Steep Turns (4,000 MSL min)**
- CLEAR THE AREA
- Locate a suitable outside reference
- Set heading and bug
- Power 20" @ 2400rpm
- 45 or 50 degrees of bank +/- 5 degrees
- Two 360 degree turns, as directed

**Slow Flight (4,000 MSL min)**
- CLEAR THE AREA
- Power 16"
- Mixture/Prop Forward
- Gear down below 150mph
- Flaps down below 130mph (incrementally)
- At 105mph, Power 19"-20" (hold altitude)
- Airspeed 95mph (min 90mph)
- Remember: pitch for IAS, power ALT

**Slow Flight Recovery**
- Add Power as needed
- Maintain Altitude
- Pitch for Blue Line
- Clean Up - Flaps, Gear, Flaps

**Power Off Stall (4,000 MSL min)**
- CLEAR THE AREA
- Power 16"
- Gear down below 150mph
- Flaps down below 130mph (incrementally)
- Mixture/Prop Forward below 110mph
- Establish a stabilized descent
- Power to idle at 100 mph
- Pitch attitude for landing
- Recover at 1st indication

**Power Off Stall Recovery**
- Pitch - nose just below the horizon
- Power – Smoothly apply Full Power
- Drag – FLAPS-GEAR-FLAPS
- Climb - Blue Line

**Power On Stall (minimum 4,000 MSL)**
- CLEAR THE AREA
- Clean configuration
- Power 16" MP Slow Down to 120
- Mixture/Prop Forward below 110mph
- Power 20" MP (simulated power on)
- Attitude - nose just above the horizon
- Recover at first indication

**Power On Stall Recovery**
- Pitch - nose just below the horizon
- Power – Smoothly apply Full Power
- Climb - Blue Line

**Accelerated Stall (4,000 MSL min)**
- CLEAR THE AREA
- Locate a suitable outside reference
- Set heading and bug
- Power idle or 16" @ 2400rpm
- At 120 mph, 45 degree bank and apply back pressure smoothly to stall then recover
- Pitch – nose just below horizon, wings level, smoothly apply Full Power

(3,000 AGL minimum Alt
SKYVIEW at 4,000 AGL for safety.)



**Vmc Demonstration (minimum 4,000' AGL)**
- CLEAR THE AREA
- Reduce to 16"
- Flaps up, Gear up
- Critical engine – idle (guard the good)
- Right Engine – Max Power
- Slow to initial loss of control (1 MPH / sec)

(First Indication – stall light, warning, roll, yaw)
- Reduce Power - idle on the good (< Rudder)
- Pitch - blue line (108MPH)
- Full Power SMOOTHLY Right Eng at blue line
- Maintain airspeed & direction w/rudder

**Drag Demo - for MEI Check-ride only (minimum 4,000' AGL)**
- CLEAR THE AREA
- Power - full (smoothly)
- Mixture Prop Throttle - full (smoothly)
- Critical engine - idle "guard the good"
- Maintain airspeed & directional control
- Gear down below 150mph
- Flaps down below 130mph (incrementally)
- Maintain blue line - Note VSI
- Gear Up - Blue Line - Note VSI
- Flaps Up - Blue Line - Note VSI
- Sim Feather - 12" - Blue Line - Note VSI

**Emergency Descent (Recover per DPE)**
- CLEAR THE AREA
- Prop - full forward (Mixture, rich)
- Reduce both throttles to idle
- Drop - gear down (Below 150 MPH)
- Pitch for 130-140mph (don't overspeed)
- Bank away from the affected engine, 30-45 degrees

NOTE: Vle 150 BE95A, 165 D95A
NOTE: Va at Max Gross 160mph
Va at lower speeds will be less than 160mph



| Vspeeds MPH | | | |
|---|---|---|---|
| Vr | 85 | Vmc | 80 |
| Vx * | 90 | Vxse | 98 |
| Vy * | 110 | Vyse | 108 |
| Va | 160 | Vsse | 108 |
| Vne | 240 | Vle | 150 |
| Vno | 185 | Vfe | 130 |
| Vso | 70 | *Increased from POH | |

NOTE:
Vle 150 mph BE95A
Vle 165 D95A
(use 150 mph in training)

**Engine Failure in Flight**
- Maintain Directional Control
- Pitch for Blue-Line
- Mixtures, Props, Throttle (max)
- Flaps UP – Gear UP
- Identify (Dead Foot – Dead Engine)
- Verify (Cautiously Retard Dead)
- Feather dead engine prop

Secure if below 3,000 AGL
- Mixture

If above 3,000 AGL - Rectify
- Mixture, Fuel Pumps, Fuel Sel
- Ignition (Magnetos)
- Alternate Air
- Secure the Engine
- Checklist

**Engine Failure on Runway**
- "Abort - Abort - Abort"
- Chop - power idle
- Maintain directional control
- Stop - apply brakes
- Complete stop on runway

Always consult the Pilot Operating Handbook

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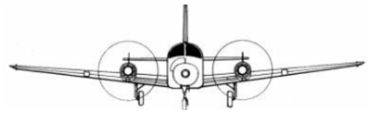
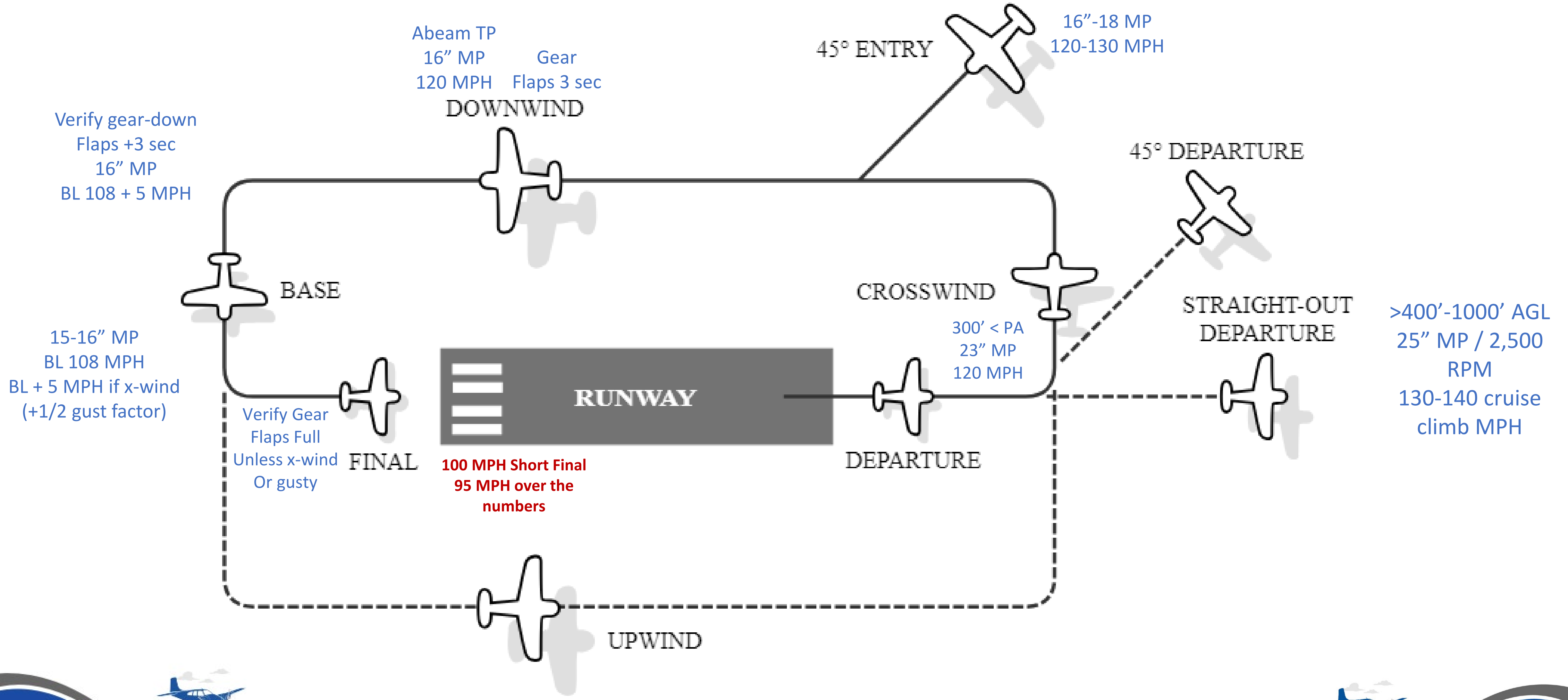
# Multi-Engine Maneuvers – Traffic Pattern Reference



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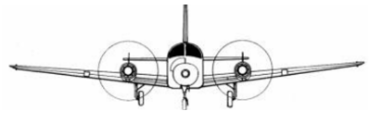
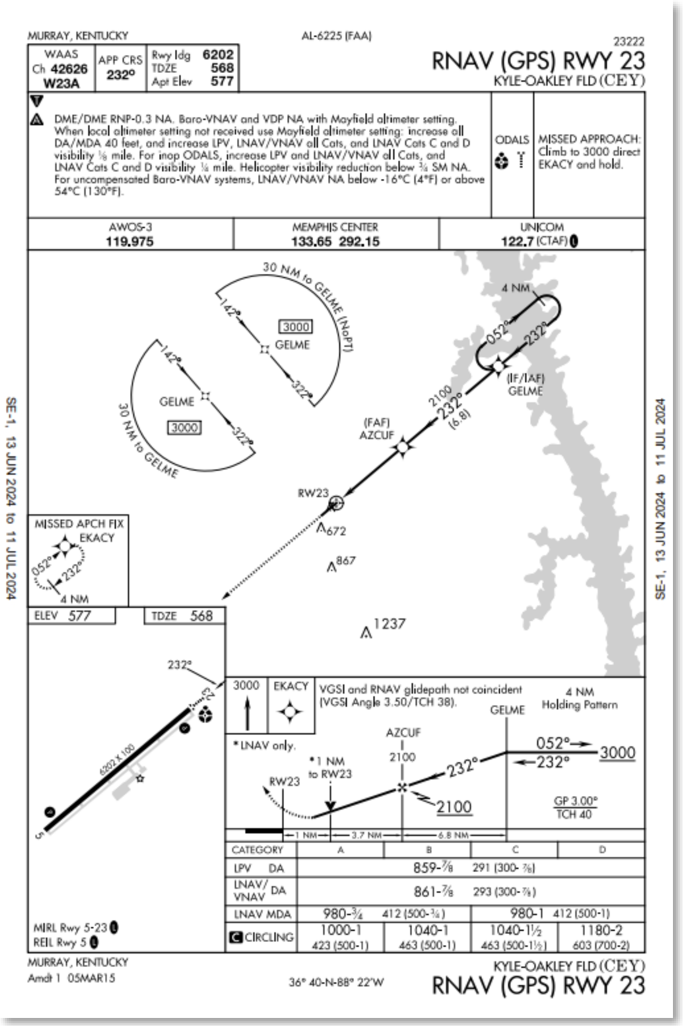
# Multi-Engine Maneuvers – RNAV reference

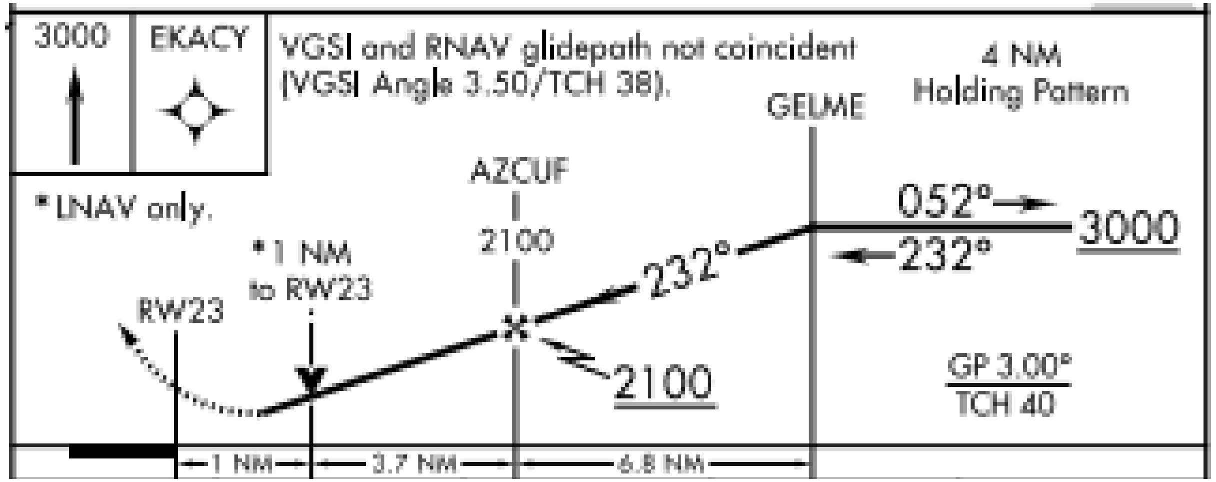







Heading reference example only

GUMPS
Check gear speed < 150MPH
Gear-down (check indicators)
@(1) dot GP / GS
@ GP / GS – check flap speed then, (3 sec) flaps
Set MP to 16" – 2 eng or 18" 1 eng




15-16" MP
BL MPH
BL + 5 MPH if x-wind
(+1/2 gust factor)

Glide Path
16" – MP (2-eng) – 18"
(1 engine)
Pitch for 120 MPH

17"-18" MP
130-140 MPH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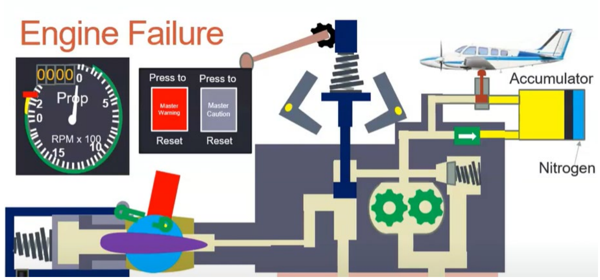
# Multi-Engine Ground School
## Martin Pauly & Doug Rozendaal


## Beechcraft Landing Gear

## Unfeathering Accumulators

## Full-Feathering Propellers




## Flaps for Take-off (risks)

# Other links and resources


https://3daymulti.com/study-materials

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