ACCELERATED MULTI-ENGINE GROUND SCHOOL
CHECK-RIDE PREP

SKYVIEW
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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.

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“Preparation = Success” - Challenge

Preparation = Success!

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We are willing to invest in each student, but this is an ACCELERATED COURSE. This means you MUST be prepared prior to your arrival.

Take our 10 Point challenge before attending your 3-Day Multi Course!

Give Yourself a Point for each Affirmative “Yes” Answer Below:

	Have you studied the entire course packet and can answer our mock check-ride questions?
	Did you complete our Sporty’s online Multi-Engine Course and submit your completion certificate?
	Do you know the POH for the BE95A and D95A and understand these?
	If you have an emergency, how will you respond?
	Can you recite the v-speeds for the Travel Air BE95 and D95A?
	If asked to chair-fly the maneuvers, can you do that now or will you be prepared on Day 1?
	Do you understand the new terms and ceilings, and various performance charts?
	Have you flown a complex airplane and are you able to manage the added complexity and speed?
	Are you proficient at hand-flying IFR approaches and can you step up to the challenge of flying one-engine inoperative approaches?
	Do you have the work ethic and study habits to assure your success in an accelerated course?
	Total Score

Name: ____________________________ Date: ______________

Signature: ____

Most Students who Complete the Accelerated 3-Day Multi Course say it is one of the most challenging things they have completed in their aviation journey.

The most successful students are the ones who study and prepare prior to arrival. These are also the students who excel in their knowledge and piloting skills.

Join our best graduates who go on to get the best jobs, front-line interviews, and improve safety records because of all their effort, added preparation, study habits, and attention to detail.

Accept the Preparation = Success Challenge

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4 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)
    - **Allow for bank processing limitations (daily limits)**
    - Credit Cards are welcome with processing fee
  - DPE Fee ($800-1,000+) Depends on DPE and Location of Checkride **NO CHECKS PLEASE**

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Training Schedule

This is a sample schedule of normal training activities (not always in this order)

Day 1	Day 2	Day 3
Sign-in, TSA, Payments	Pre-flight Briefing	Pre-flight Briefing
Course & Pre-flight Brief	Pre-flight	Pre-flight
Pre-flight Training	Multi-maneuvers & OEI	Check-ride Prep
Intro to BE95 Flight	OEI Rnav	XC to Check-ride & Training
Maneuvers & OEI Intro	Mock Check-ride	Check-ride
Ground Training	Ground Training	Certs, Photos, Billing (if any)

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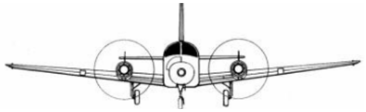
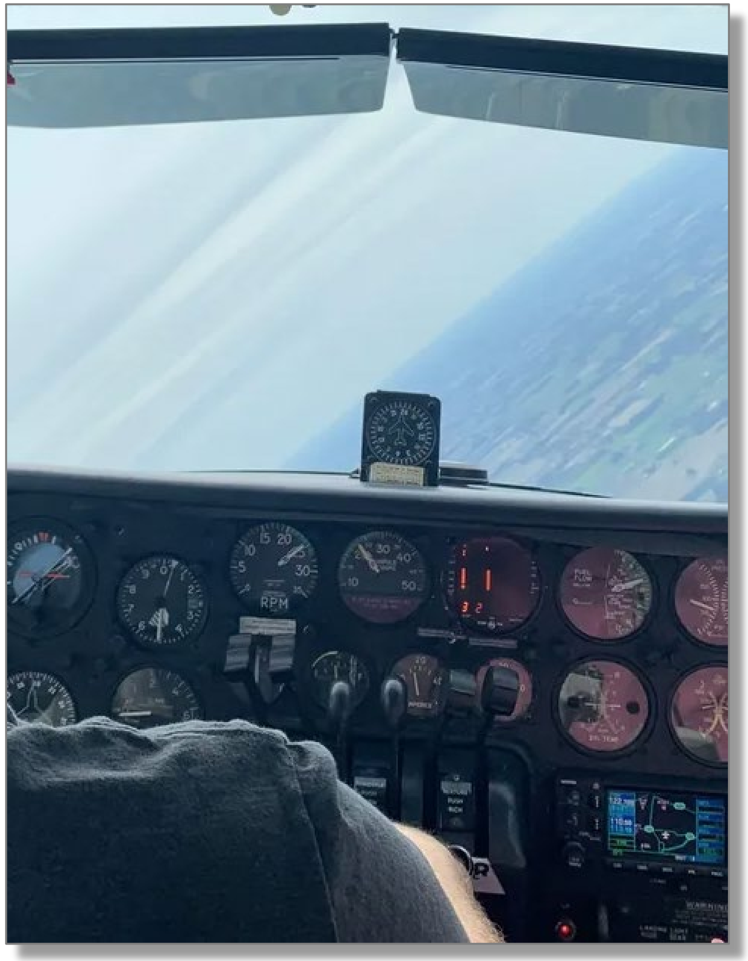
Multi-Maneuvers



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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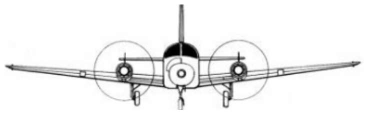
Flying Light Twins



- 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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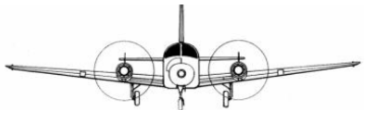
Multi-Engine Terms and definitions



- **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.
- **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.
- **Single Engine Absolute 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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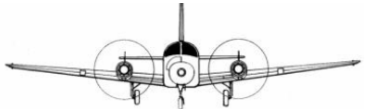
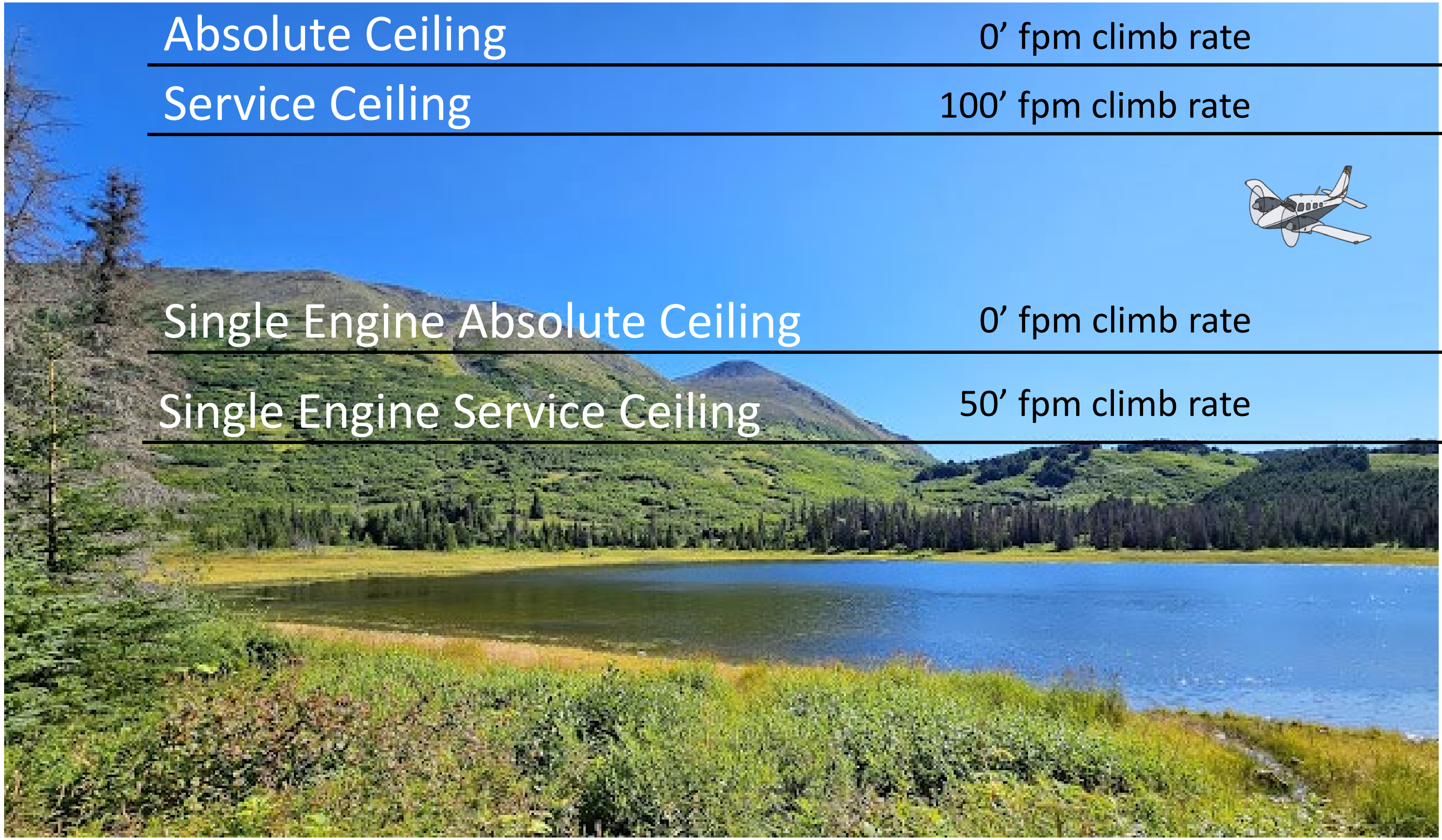
Absolute and Service Ceilings

Travel Air examples





Absolute Ceiling	0’ fpm climb rate	19,800’ Density Altitude
Service Ceiling	100’ fpm climb rate	18,100’ Density Altitude
Single Engine Absolute Ceiling	0’ fpm climb rate	5,850’ Density Altitude
Single Engine Service Ceiling	50’ fpm climb rate	4,400’ Density Altitude

Drift-down occurs with engine loss

Have a flight plan option away from terrain and obstacles after engine loss. Plan ahead!

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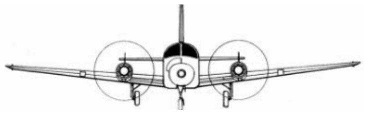
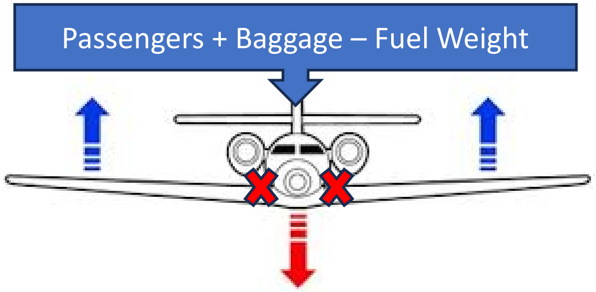
Multi-Engine Terms and definitions, continued



- **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 (none for Travel Air so we use Vyse 108 mph)
- **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 can withstand before structural damage occurs



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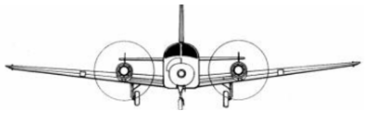
Single Engine Aerodynamics



- 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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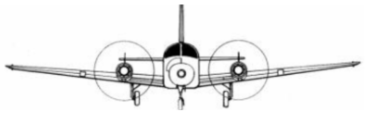
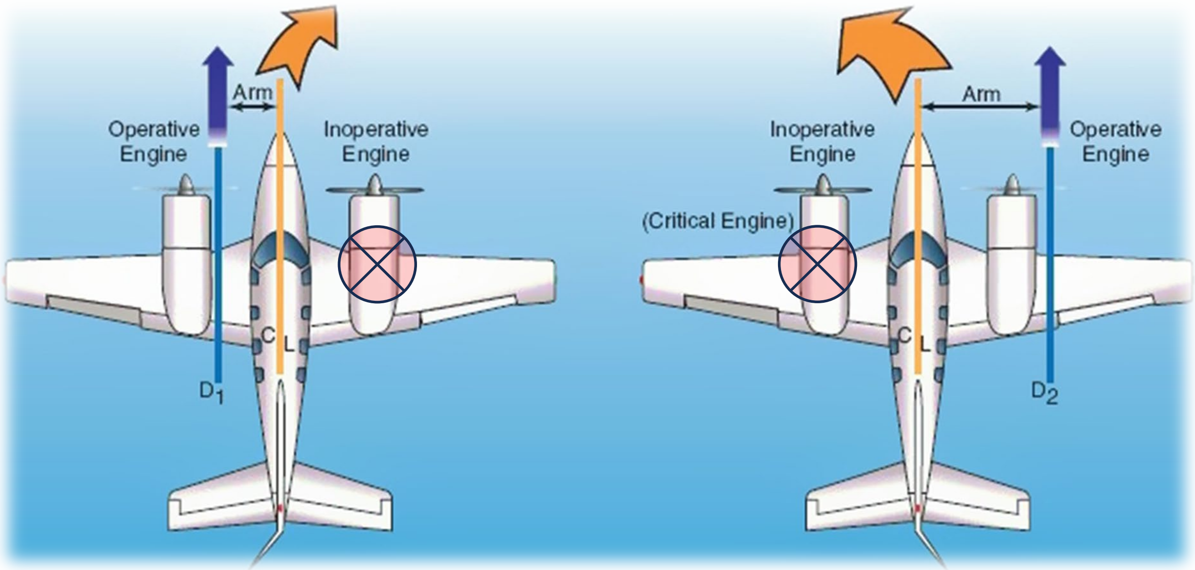
What is a “Critical Engine”



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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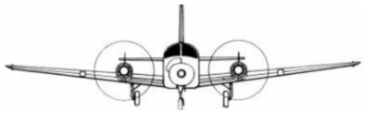
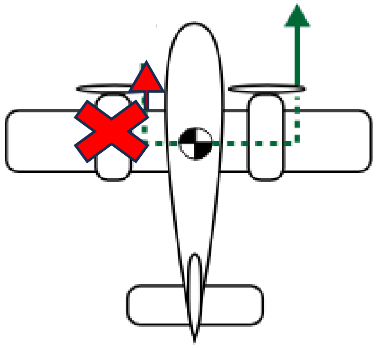
Factors used in determining the critical engine



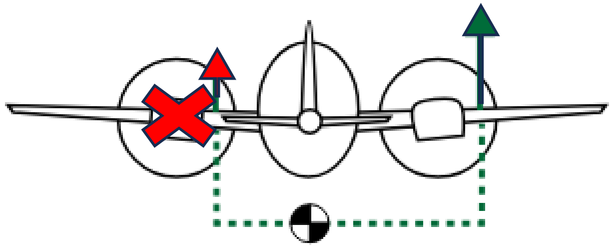
Factor	Explained
P-Factor	Right propeller blade (farther away) is producing more thrust (yawing moment)
Accelerated Slipstream	The air being forced over the wing by the operating engine creates extra lift (rolling moment)
Spiraling Slipstream	Loss of air from the left engine (out) impact rudder control (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



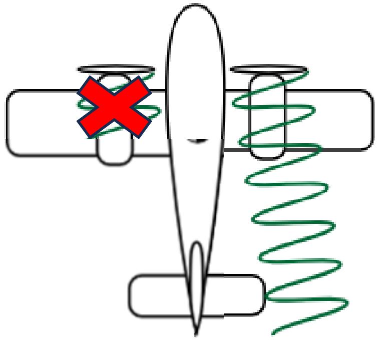
YAW

Accelerated Slipstream



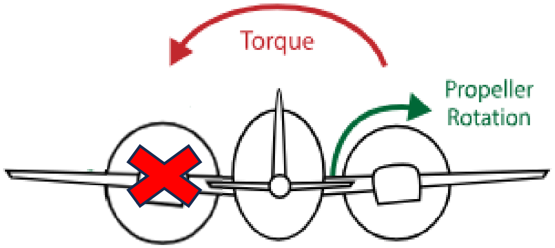
Roll

Spiraling Slipstream



YAW

Torque



Roll

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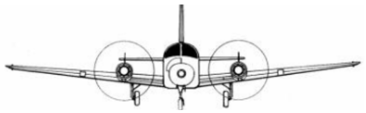
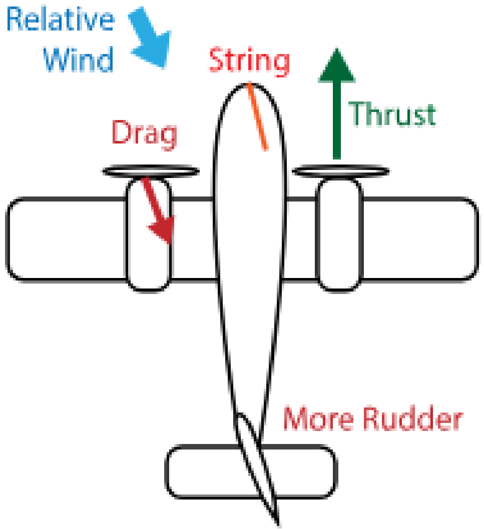
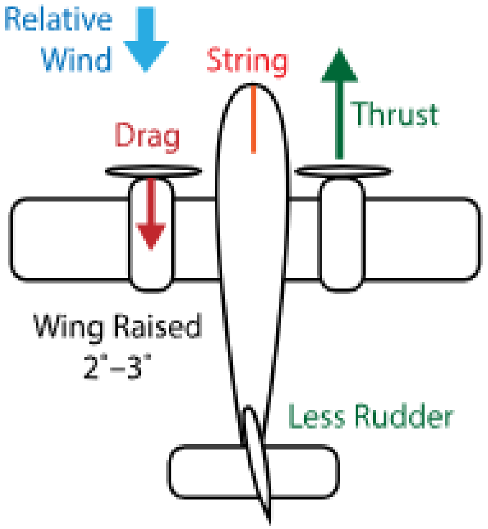
Counter-acting the "dead engine" - Zero Side-Slip



- 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.

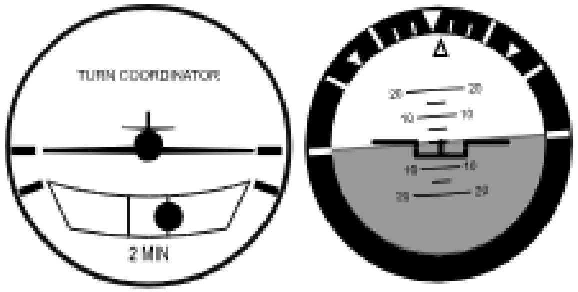


Wings Level with OEI



Zero Sideslip Condition

"Raise the Dead Engine"



Instrument Indications of a Zero Sideslip Condition

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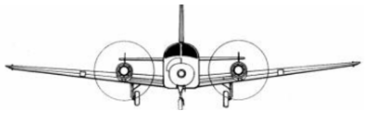
Determining Vmc



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 (when indicated). Vmc guarantees directional control only!! Vmc Changes with various factors – see the next page.

Traditionally: 14 CFR 23.149 - “critical engine is suddenly made inoperative“
Currently: 14 CFR 23.2135(c) – “following the sudden critical loss of thrust”

VMC —currently defined in 14 CFR part 23, section 23.2135(c) as the calibrated airspeed at which, following the sudden critical loss of thrust, it is possible to maintain control of the airplane. VMC is typically marked with a red radial line on most airspeed indicators [Figure 13-1]. VMC was previously defined in 14 CFR part 23, section 23.149 as the calibrated airspeed at which, when the critical engine is suddenly made inoperative, it is possible to maintain control of the airplane with that engine still inoperative and thereafter maintain straight flight at the same speed with an angle of bank of not more than 5 degrees. This definition still applies to airplanes certified under that regulation. There is no requirement under either determination that the airplane be capable of climbing at this airspeed. VMC only addresses directional control.

Source: FAA AFH chapter 13

How does the manufacturer determine Vmc?

C- Critical engine failed and windmilling
O- Operating engine at maximum takeoff power
M- Most Unfavorable 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)

Image for training use only

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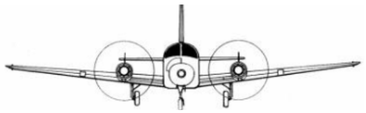
Factors that influence Vmc



	Cause	Effect
Performance	Increase Power in Good Engine	↑ Vmc ↑ Performance
Drag Factor	Windmilling Propeller	↑ Vmc ↓ Performance
Drag Factor	Feathered Propeller	↓ Vmc ↑ Performance
Performance	Flaps Down	↓ Vmc + Lift + Drag
Performance	Gear Down	↓ Vmc ↓ Performance
Performance	Max Takeoff Weight	↓ Vmc ↓ Performance
Performance	Aft CG	↑ Vmc ↑ Performance
Performance	High Temperature	↓ Vmc ↓ Performance
Performance	Low Pressure	↓ Vmc ↓ Performance
Drag Factor	Bank of 5° into Good Engine	↓ Vmc ↑ Performance
Drag Factor	Split Ball	↓ Vmc ↑ Performance
Performance	High Altitude	↓ Vmc ↓ Performance
Drag Factor	Ground Effect	↓ Vmc ↑ Performance

Drag factors – VMC follows Drag
Performance factors – VMC follows Performance

- When considering the factors that influence Vmc, start with drag factors (think side-slip or zero side-slip) or is the question about ground-effect.
- For the (3) drag related factors (propeller, bank, and ground effect), Vmc follows Drag (so if you decrease drag Vmc goes down (decreases), if you increase drag, Vmc goes up.
- Other factors follow Performance, so if performance goes up, Vmc goes up. If performance goes down, Vmc goes down.

Scenario Question:

You are flying a family from Destin Florida (KDTS) 23’ MSL to Denver Colorado (KDEN) 5,434’ MSL

Would you expect your Vmc speed to be higher at Destin or at Denver? Why

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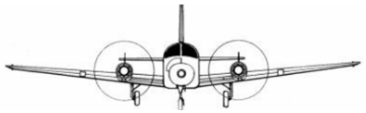
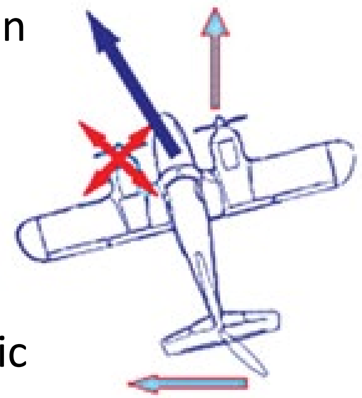
Recognizing & Recovering from Vmc



Warning signs you are getting close to Vmc: FIRST OF ANY OF THESE

- 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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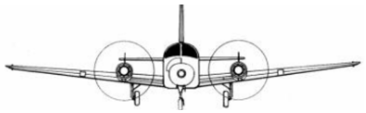
Vmc versus Stalls



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**.

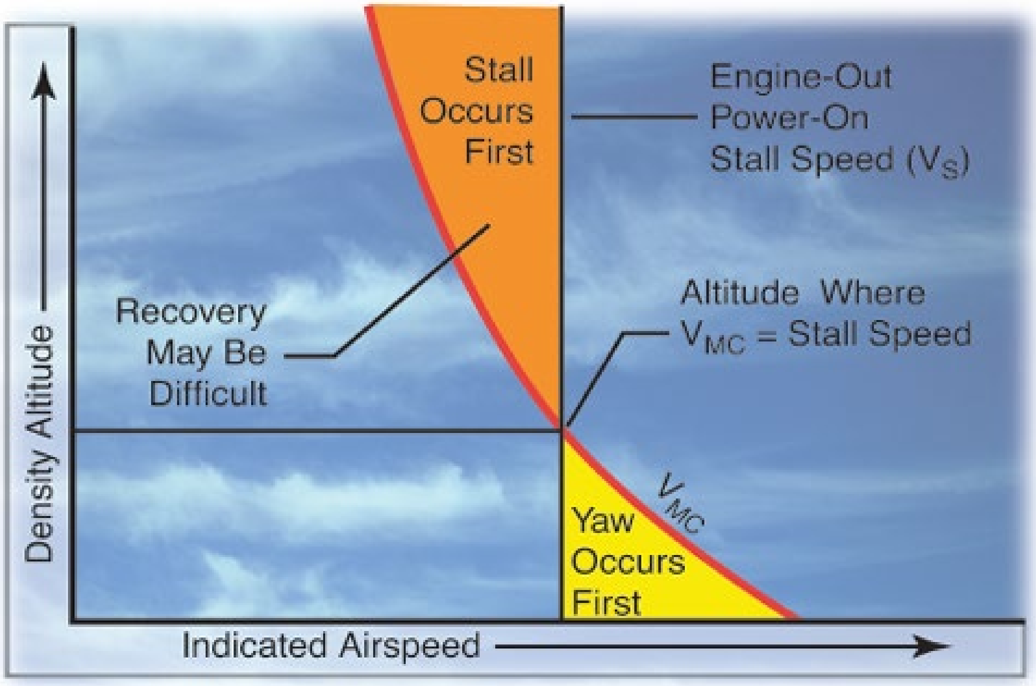


Figure 13-14. *Graph depicting relationship of V_{MC} to V_S.*

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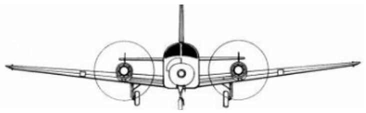
Risks of Stalls in Multi-Engine Airplanes



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**)

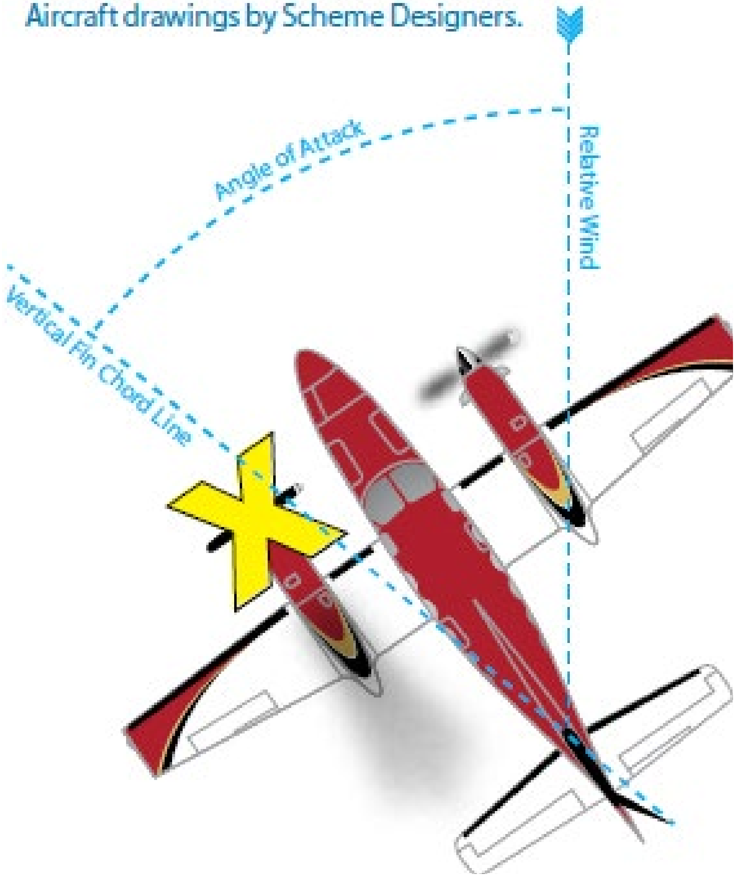
•During a mishandled **go around** (**Aircraft management and Flying Skills**)

•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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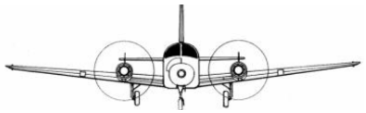
Memorize These Steps!



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!

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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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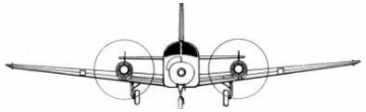
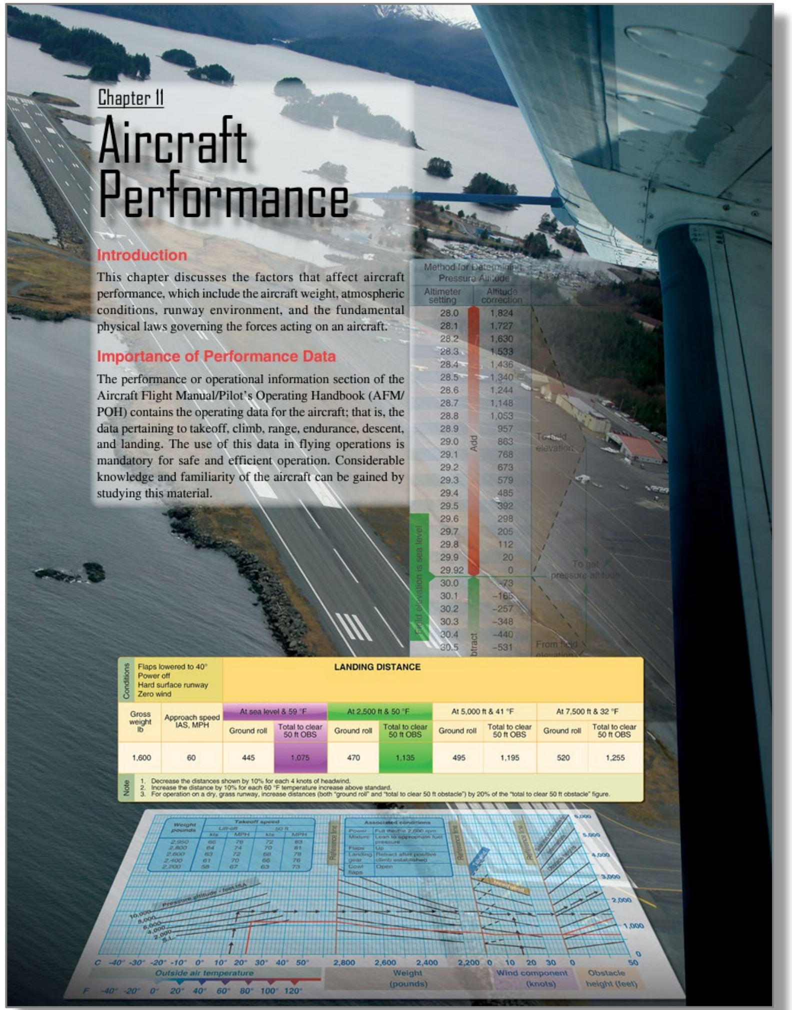
Performance Charts



Always Understand Performance
Accelerate Stop Distance
Accelerate Go Distance (won't apply to the Travel Air)
Normal Take-Off (including Ground Roll Distance)
Normal Landing (including Ground Roll Distance)
Short-Field Take-Off (including Ground Roll Distance
Short-Field Landing (including Ground Roll Distance
Single Engine Climb Rate
Two Engine Climb Rate
Single Engine Absolute Ceiling 5,850' DA
Single Engine Service Ceiling 4,400 DA



Chapter 11

Aircraft Performance

Introduction

This chapter discusses the factors that affect aircraft performance, which include the aircraft weight, atmospheric conditions, runway environment, and the fundamental physical laws governing the forces acting on an aircraft.

Importance of Performance Data

The performance or operational information section of the Aircraft Flight Manual/Pilot's Operating Handbook (AFM/POH) contains the operating data for the aircraft; that is, the data pertaining to takeoff, climb, range, endurance, descent, and landing. The use of this data in flying operations is mandatory for safe and efficient operation. Considerable knowledge and familiarity of the aircraft can be gained by studying this material.

Altimeter setting	Altitude correction
28.0	1,824
28.1	1,727
28.2	1,630
28.3	1,533
28.4	1,436
28.5	1,340
28.6	1,244
28.7	1,148
28.8	1,053
28.9	957
29.0	863
29.1	768
29.2	673
29.3	579
29.4	485
29.5	392
29.6	298
29.7	205
29.8	112
29.9	20
29.92	0
30.0	-73
30.1	-165
30.2	-257
30.3	-348
30.4	-440
30.5	-531

LANDING DISTANCE

Conditions: Flaps lowered to 40°, Power off, Hard surface runway, Zero wind

Gross weight lb	Approach speed IAS, MPH	At sea level & 59 °F		At 2,500 ft & 50 °F		At 5,000 ft & 41 °F		At 7,500 ft & 32 °F	
		Ground roll	Total to clear 50 ft OBS	Ground roll	Total to clear 50 ft OBS	Ground roll	Total to clear 50 ft OBS	Ground roll	Total to clear 50 ft OBS
1,600	60	445	1,075	470	1,135	495	1,195	520	1,255

Note
1. Decrease the distances shown by 10% for each 4 knots of headwind.
2. Increase the distance by 10% for each 60 °F temperature increase above standard.
3. For operation on a dry, grass runway, increase distances (both "ground roll" and "total to clear 50 ft obstacle") by 20% of the "total to clear 50 ft obstacle" figure.

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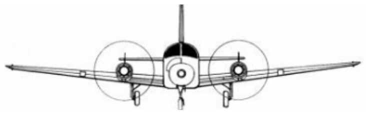
Accelerate Stop & Go Distance



Performance and Limitations

Discussion of performance and limitations requires the definition of the following terms.

- Accelerate-stop distance is the runway length required to accelerate to a specified speed (either V_R or V_{LOF}, as specified by the manufacturer), experience an engine failure, and bring the airplane to a complete stop. *[Figure 13-5A]*

- Accelerate-go distance is the horizontal distance required to continue the takeoff and climb to 50 feet, assuming an engine failure at V_R or V_{LOF}, as specified by the manufacturer. *[Figure 13-5A]*

- Climb gradient is a slope most frequently expressed in terms of altitude gain per 100 feet of horizontal distance, whereupon it is stated as a percentage. A 1.5 percent climb gradient is an altitude gain of one and one-half feet per 100 feet of horizontal travel. Climb gradient may also be expressed as a function of altitude gain per nautical mile (NM), or as a ratio of the horizontal distance to the vertical distance (10:1, for example). *[Figure 13-5B]* Unlike rate of climb, climb gradient is affected by wind. Climb gradient is improved with a headwind component and reduced with a tailwind component.

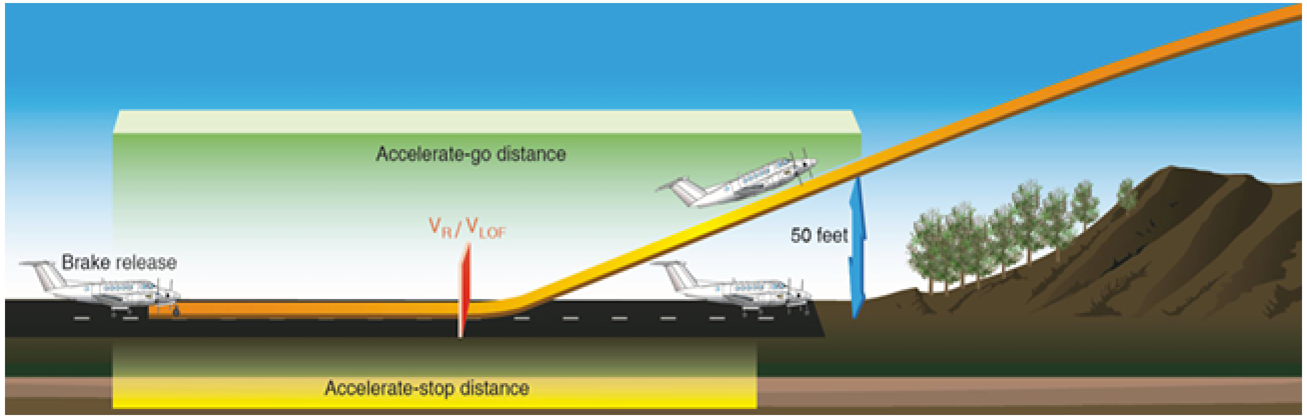


Figure 13-5A. *Accelerate-stop distance and accelerate-go distance.*

Note: Accelerate Go Distance won't apply to the Travel Air

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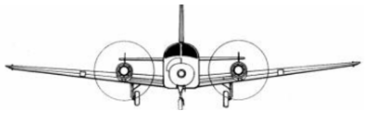
Weight & Balance for the Travel Air



Load Manifest for N6033F (BE95)
N6033F

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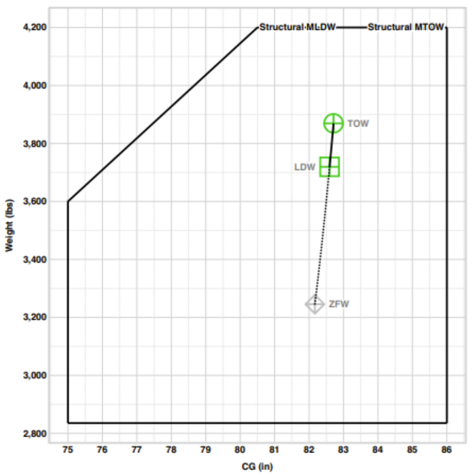

Item Description		Weight (lbs)
Souls on board	2	
People		
Front Seats / Pilot		200
Pilot		
Front Seats / Co-pilot		190
DPE		
Back Seats / Seat 1		0
Back Seats / Seat 2		0
Cargo		
Nose Compartment		0
Reat Cargo		20

	Weight (lbs)	Limit (lbs)	CG (in)	FWD / AFT Limits (in)
BEW	2,835	-	81.3	75.0 / 86.0
Payload	410	1,365	-	-
Zero Fuel Weight	3,245	4,200	82.2	75.0 / 86.0
Aux Fuel	372	372	-	-
Main Fuel	264	264	-	-
Ramp Weight	3,881	4,200	82.7	77.6 / 86.0
Taxi Fuel	12	-	-	-
Takeoff Weight	3,869	4,200	82.7	77.5 / 86.0
Fuel To Destination	150	-	-	-
Landing Weight	3,719	4,200	82.6	76.1 / 86.0

PILOT SIGNATURE

PILOT NAME

DATE

Sample W&B is shown here for N6033F (1965 D95A)

For your check-ride, we will work together to develop the weight & balance for the following:

- Your weight
- DPE weight
- Baggage
- Tools, service items (prist, oil, etc)
- Main & Aux fuel tanks full (25/22 gal main, 31 gal aux)

- Understand the W&B overall
- What happens as you use fuel (where does the CG move)?
- What if your total Gross Ramp weight was out of the envelope?
- What if your CG is AFT (would Vmc increase or decrease)? Why
- Consider your total fuel used, any zero fuel weight limitations (none for the Travel Air), your required reserves

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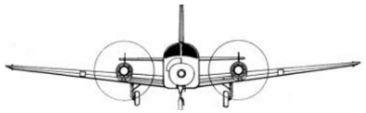
Aircraft Systems – MUST KNOW THESE

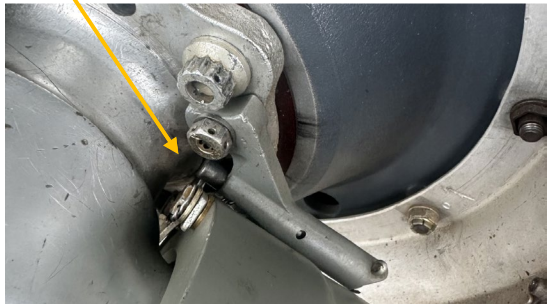


Engines

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.



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

Brakes are hydraulic. No other systems on the Travel Air are hydraulic

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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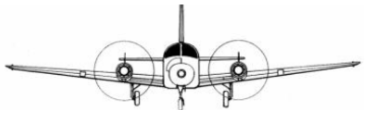
Travel Air Landing Gear System



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.

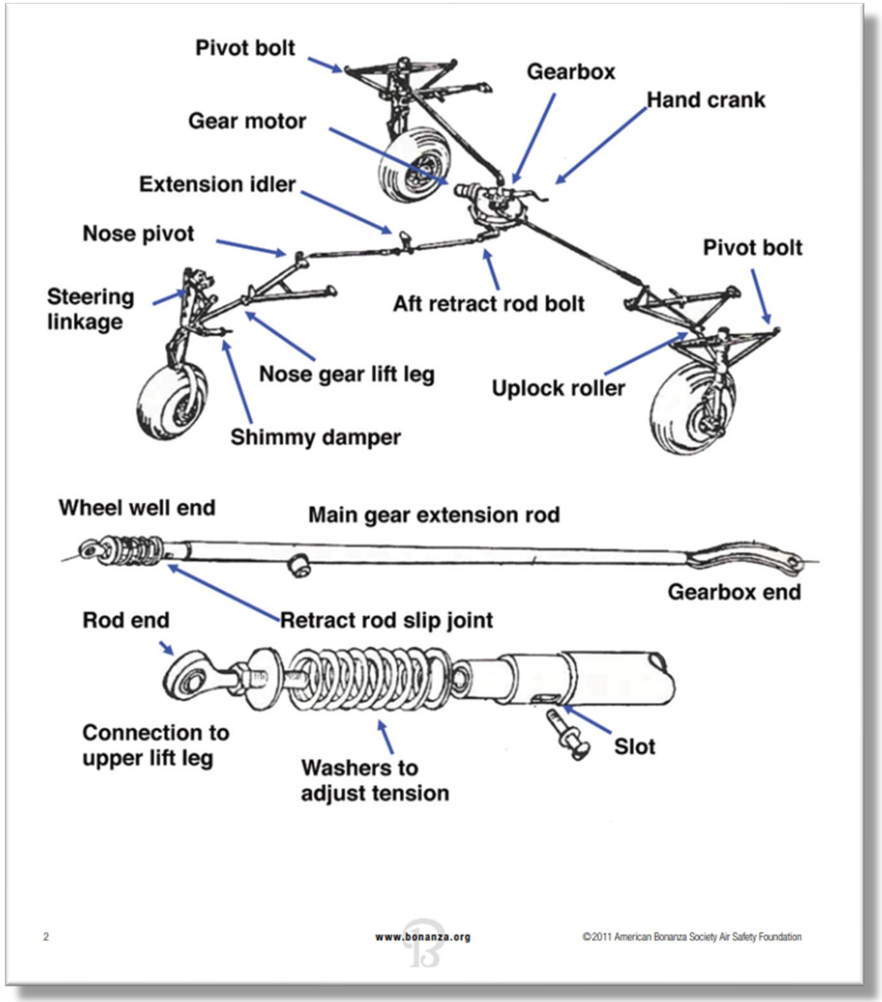
This system has a Squat switch on the left Main Gear. This prevents the gear from retracting on ground.

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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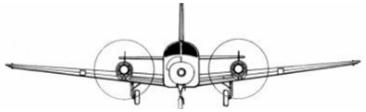
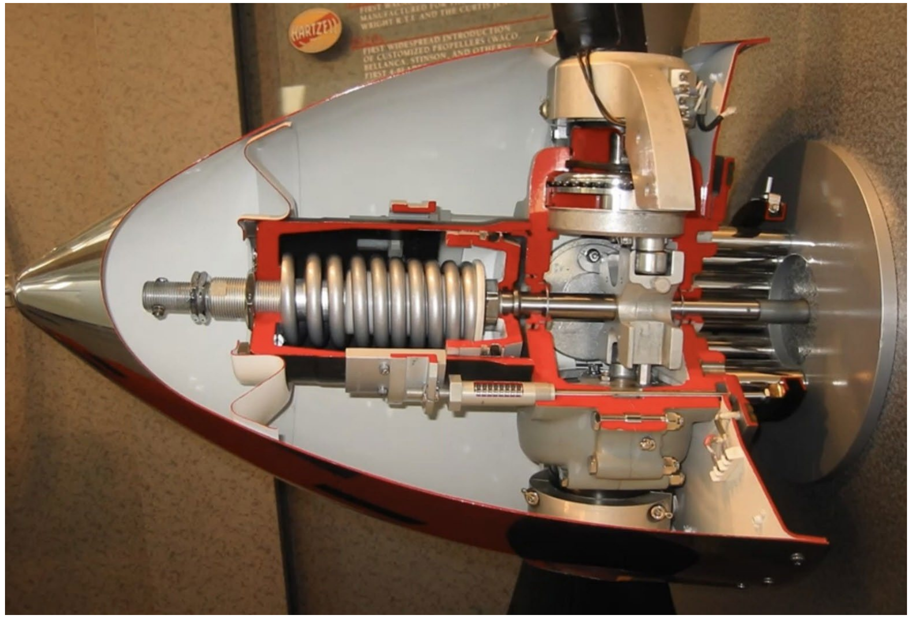
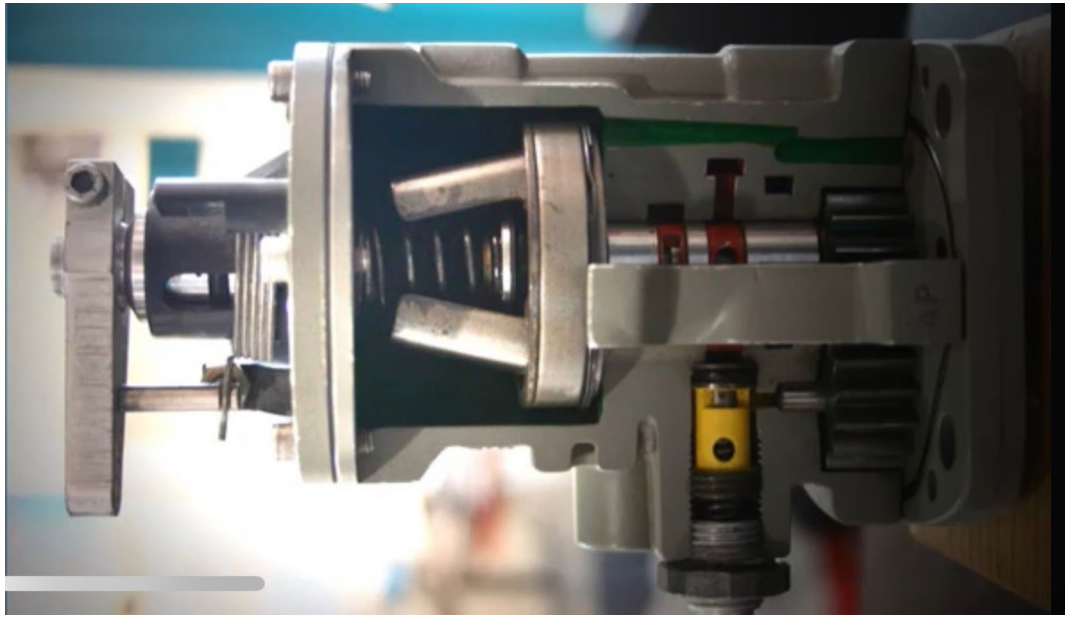
Travel Air Full Feathering Props



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.



Full-Feathering Propeller – cutaway view



Prop Governor (flyweights, speeder spring, pilot valve) cutaway view

Unfeathering Accumulator
135psi +/- 5 psi Nitrogen

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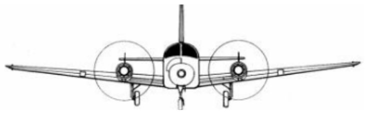
Travel Air Cross-Feed Selection

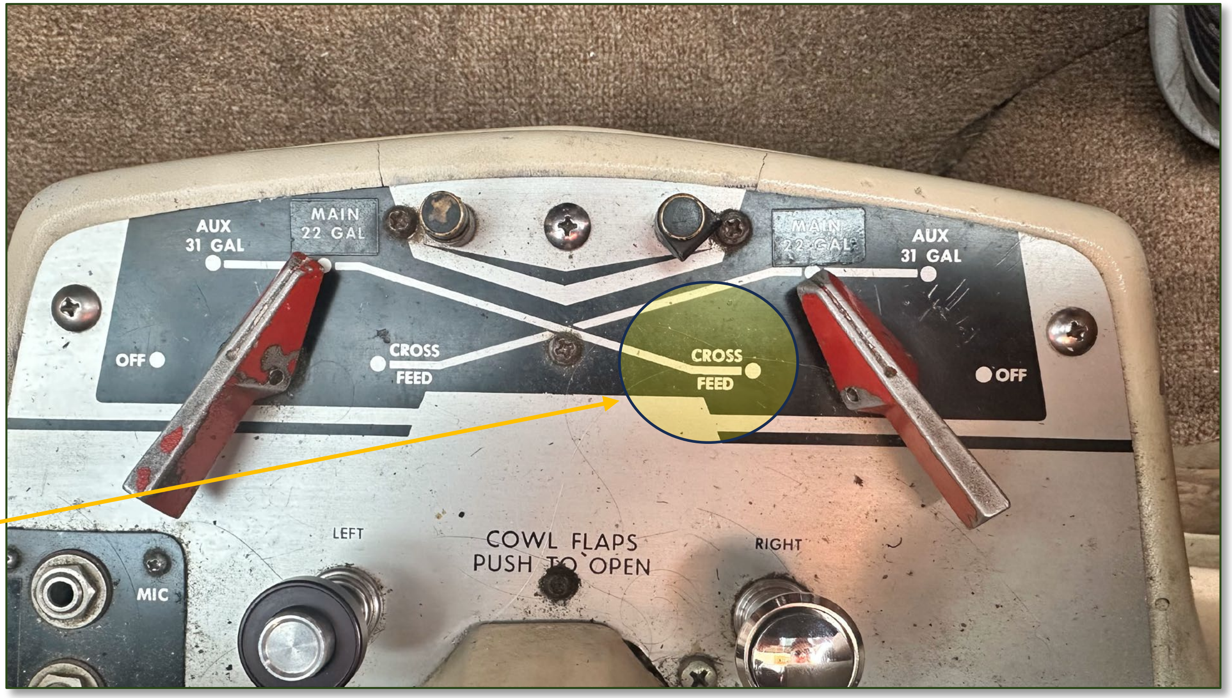


Fuel System on the Travel Air includes selectors for "Cross-Feed" – see the pic below.

When operating the Travel Air and when an engine is inoperative you may need to use fuel from the tank(s) on the in-operative side of the aircraft. Remember the saying "Cross-Feed is GOOD"

Scenario: You have lost your left engine and wish to use the fuel from your Main or Aux tank in the left wing…

1. Place your in-operative engine side tank selector on the tank you wish to use (Aux or Main)
2. Place your operating engine fuel selector in the "Cross-feed" position
3. Monitor fuel flow during the procedure and set your tank gauge switch to the proper position
4. Note the time of the switch and monitor your fuel level and make changes as necessary



1965 D95A model shown

Note that some models may not include detents to assure selectors are NOT both on the cross-feed position and (this would result in both engines having fuel starvation).

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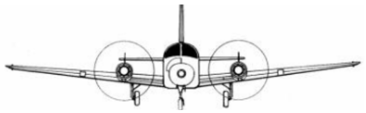
BOOM… You just lost an engine!!!!



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 Use the checklist!

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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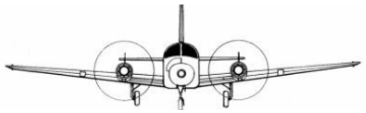
Emergency Procedures



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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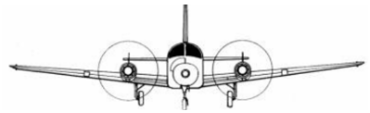
Multi-Engine Maneuvers – quick reference



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

It is critical to your success to study these maneuvers and commit them to memory:

Commercial / Private Add-On
1. Engine Failure on Runway
2. Slow Flight
3. Stalls + (accelerated for Comm)
4. Steep Turns
5. Vmc Demonstration
6. Engine Failure in Flight
7. OEI Cruise
8. Engine Shutdown & Restart
9. Emergency Descent
10. RNAV OEI Approach

CFI – MEI Add-On
1. Drag Demo (add for MEI)

Always consult the Pilot Operating Handbook

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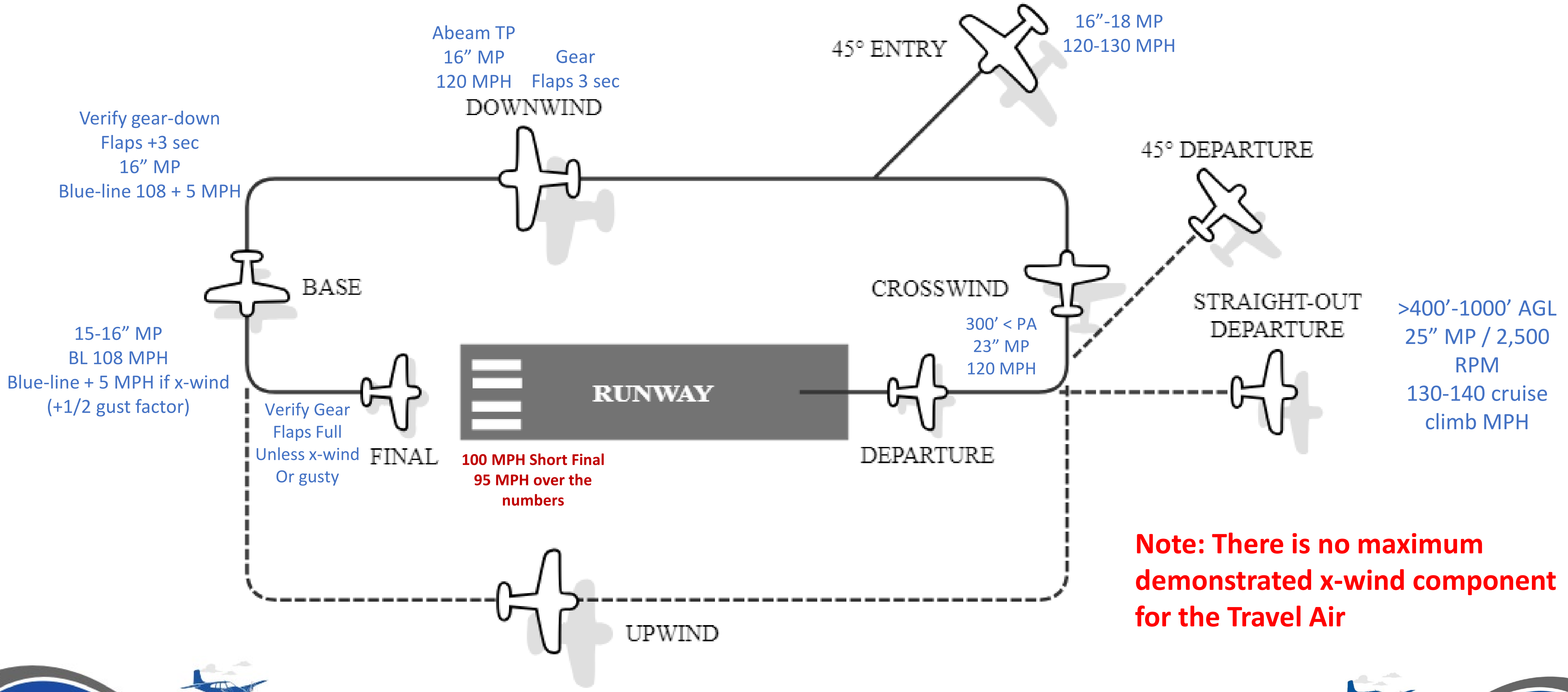
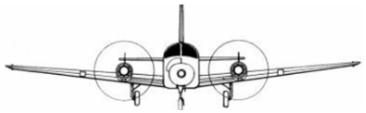
Multi-Engine Maneuvers – Traffic Pattern Reference

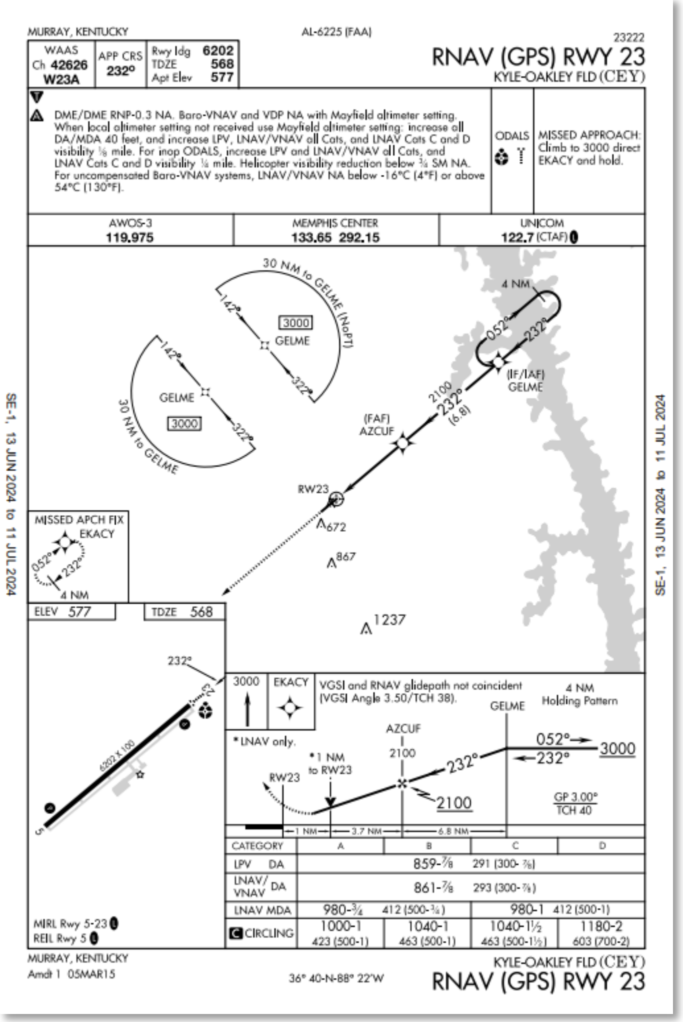


Note: There is no maximum demonstrated x-wind component for the Travel Air

Always consult the Pilot Operating Handbook

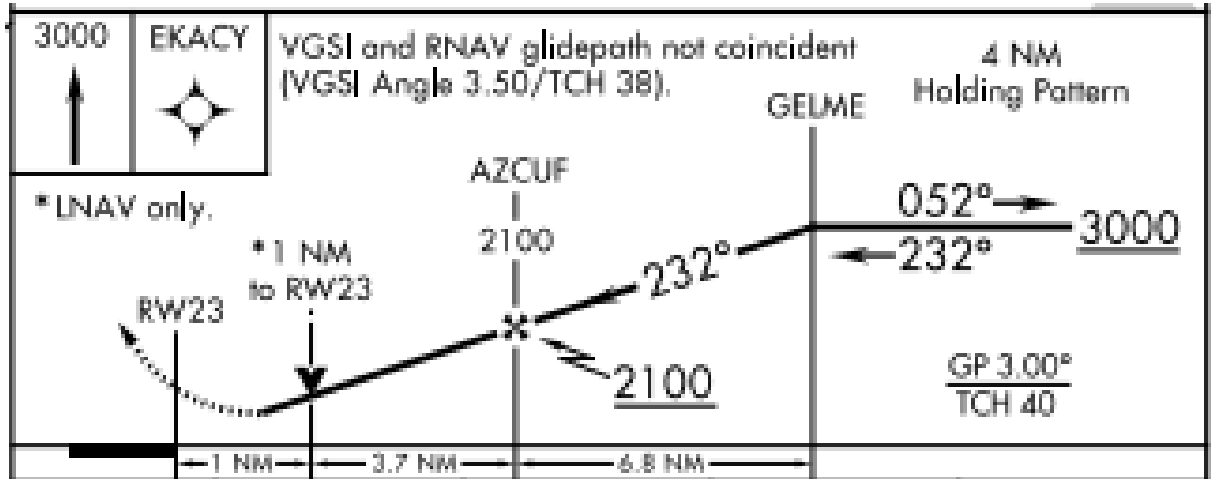
Multi-Engine Maneuvers – RNAV reference





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
Blue-line 108
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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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

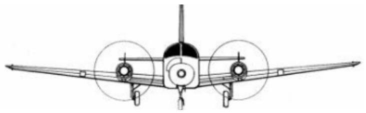
Complete your weight & balance!
Be able to use the charts and graphs in the POH.
Explain zero fuel weight.

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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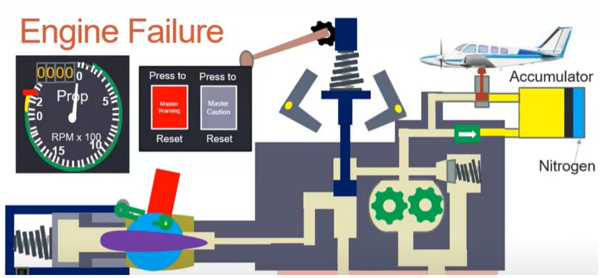
Multi-Engine Ground School
Martin Pauly & Doug Rozendaal

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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