

Henley Aviation

BE-76 Beechcraft Duchess

The Problem of Asymmetric Thrust

When a Multi-engine aircraft with engines not mounted on the longitudinal axis loses an engine, there will be unbalanced forces and turning moments about the center of gravity. The following directional control and performance problems will result:

Pitch Down

The loss of induced airflow over the horizontal stabilizer results in less negative lift from the tail and causes the nose to pitch down. To compensate for this pitch down, additional back pressure is required.

Roll toward the Dead Engine

The loss of airflow created by the propeller (accelerated slip stream) over the dead engine wing results in a loss of lift on that wing. This loss of lift causes a roll toward the dead engine and will require additional aileron deflection into the operating engine.

Yaw toward the Dead Engine

The loss of one engine will result in asymmetric thrust being produced. This will cause the aircraft to yaw toward the dead engine and will require additional rudder pressure on the working side. "Dead-Foot, Dead-Engine"

Engine Inoperative 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 the climb. When an engine is lost, we must maximize thrust (full power) and minimize drag (flaps and gear up, prop feathered, etc.) in order to achieve optimum single - engine climb performance.

Drag Factors on the Beechcraft Duchess

Full Flaps:	-400FPM approx.
Windmilling Prop:	-400FPM approx.
Gear Extended:	-150 FPM approx.

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Terms and Definitions

Single Engine Service Ceiling

The maximum density altitude at which the single engine best rate of climb airspeed (V_{yse}) will produce a 50 FPM rate of climb with the critical engine inoperative.

Single Engine Absolute Ceiling

The maximum density altitude that an aircraft can attain or maintain with the critical engine inoperative. V_{yse} and V_{xse} are equal at this altitude.

Sideslip Versus Zero Sideslip

During flight with one engine inoperative, pilot technique is important to maximize aircraft performance. An important technique is to establish a Zero Sideslip Condition.

Sideslip Condition

When an engine failure occurs, thrust from the operating engine yaws the aircraft. To maintain aircraft heading with the wings level, rudder must be applied toward the operating engine. This rudder force results in the sideslip condition by moving the nose of the aircraft in a direction resulting in the misalignment of the fuselage and the relative wind. This condition usually allows the pilot to maintain aircraft heading; however, it produces a high drag condition, which will significantly reduce aircraft performance.

Zero Sideslip Condition

The solution to maintaining aircraft heading and reducing drag to improve performance is the Zero Sideslip Condition. When the aircraft is banked into the operating engine (usually 2-5 degrees), the dihedral of the wing will create horizontal component of lift. The horizontal component of lift opposes the force produced by the rudder, aligning the longitudinal axis of the aircraft to the relative wind. In addition to banking into the operating engine, the appropriate amount of rudder required is indicated by the inclinometer ball being "split" towards the operating engine side. The Zero Sideslip Condition must be flown for optimum aircraft performance.

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Critical Engine

The critical engine is the engine whose failure will most adversely affect the performance and handling qualities of the airplane. On most light twin engine aircraft, both propellers rotate to the right, making the left engine critical. The contributing factors that make the left engine critical are:

P	Factor
A	Accelerated Slipstream
S	Spiraling Slipstream
T	Torque

P-Factor (Yaw)

Both propellers turn clockwise as viewed from the cockpit. The descending blade produces more thrust than the ascending blade due to its increased angle of attack. Though both propellers produce the same overall thrust, the descending blade on the right engine has a longer moment arm to the C.G. (or greater leverage) than the descending blade on the left engine. The yaw produced by the loss of the left engine will be greater than the yaw produced by the loss of the right engine, making the left engine critical.

Accelerated Slipstream (Roll and Pitch)

P Factor causes more thrust to be produced on the right side of the propeller. This yields a center line of lift that is closer to the center of gravity on the left and further from the center of gravity on the right and also results in less negative lift on the tail. Because of this, the roll produced by the loss of the left engine will be greater than the roll produced by the loss of the right engine, making the left engine critical.

Spiraling Slipstream (Yaw)

A spiraling slipstream from the left engine hits the vertical stabilizer from the left, helping to counteract the yaw produced by the loss of the right engine. However, with a left engine failure, slipstream from the right engine does not counteract the yaw toward the dead engine because spirals away from the tail, making the left engine critical.

Torque (Roll)

For every action, there is an equal and opposite reaction. Since the propellers rotate clockwise, the aircraft will tend to roll counterclockwise. When the right engine is lost, the aircraft will roll to the right. The right rolling tendency, however, is reduced by the torque created by the left engine. When the left engine is lost, the aircraft will roll to the left, and the torque produced by the right engine will add to the left rolling tendency requiring more aileron input, which increases drag, making the left engine critical.

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Vmc

The minimum airspeed at which directional control can be maintained with the critical engine inoperative. The FAA sets the guidelines, which the aircraft manufacturers must follow when determining Vmc speed. These guidelines are governed under FAR Part 23. Vmc speed is marked on the airspeed indicator by a red radial line. The guidelines are:

1. Standard day conditions at sea level (Max engine power)
2. Maximum power on the operating engine (Max yaw)
3. Critical engine windmilling (Max drag)
4. Flaps takeoff position, landing gear up (Least stability)
5. Maximum takeoff weight
6. Up to 5 degrees of bank into the operating engine
7. Aft legal center of gravity (Least rudder effectiveness)
8. Full rudder on operative engine side

Note: Any change to the above criteria could result in a significant change in Vmc, although recovery procedures should be maintained within the guidelines of the POH and FAA Flight Training handbook. The following summarizes how Vmc may be affected by the above criteria, although each aircraft is different and may be subject to different handling qualities considering the conditions.

1. Standard Day Sea Level

Standard conditions yield high air density that allows the engine to develop maximum power. An increase in altitude or temperature (a decrease in air density) will result in reduced performance and prop efficiency. This decreases the adverse yaw effect. Vmc speed decreases as altitude is increased.

2. Maximum Power On The Operating Engine

When the operating engine develops maximum power, adverse yaw is increased toward the inoperative engine. The pilot must overcome this yaw to maintain directional control; any condition that increases power on the operating engine will increase the Vmc speed. Any condition that decreases power on the operating engine (such as power reduction by the pilot, an increase in altitude, temperature, low density, or aging engine) will decrease Vmc speed.

3. Critical Engine Windmilling

When the propeller is in a low pitch (unfeathered), it presents a large area of resistance to the relative wind. This resistance causes the engine to "windmill". The windmilling creates a large amount of drag and results in a yawing moment into the dead engine. When the propeller is "feathered", the blades are in a high pitch position, which aligns them with the relative wind, minimizing drag. A feathered prop will decrease drag and lower Vmc.

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4. Gear Up and Flaps in Takeoff Position

When the gear is extended, the gear and gear doors act like rudders, reducing the yawing tendency and decreasing the V_{mc} speed. Extended flaps have a stabilizing effect that may reduce V_{mc} speed.

5. Maximum Takeoff Weight at Sea Level

During straight and level flight, the aircraft weight will not affect V_{mc} . However, in a given bank, the heavier the aircraft the greater the horizontal component of lift and the less rudder is required. As weight is increased, V_{MC} is decreased.

6. Aft Legal Center of Gravity

As the center of gravity moves aft, the moment arm between the rudder and the CG is shortened, reducing the leverage of the rudder. This reduced leverage reduces the rudder's effectiveness and results in a higher V_{mc} speed.

7. Up To 5 Degrees Bank Into the Operating Engine

When the wings are level; only the rudder is used to stop the yaw produced by the good engine (sideslip condition). Banking into the good engine creates a horizontal component of lift. With this horizontal component of lift, less rudder deflection is required to overcome yaw. V_{mc} decreases we bank into the good engine by a factor of 3 knots per degree of bank angle.

8. Maximum Rudder Travel Toward Operative Engine

To maintain directional control full rudder travel is required.

Summary

This aircraft is equipped with a counter-rotating propeller on the right engine. This results in equal performance loss and equal handling qualities loss with either engine's failure. This is why This aircraft does not have a critical engine by definition.

When critical engine loss occurs, both directional control and performance will suffer. When discussing directional control problems, the focus is on V_{mc} . When discussing performance, the focus is on V_{xse} and V_{yse} (climb performance). It is important to keep these concepts separate and fully understand them.

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Aircraft Systems and Procedures

Engines

- L.... Lycoming
- H.... Horizontally opposed
- A.... Air-cooled
- N.... Normally aspirated
- D.... Direct drive

The Beechcraft Duchess is equipped with two Lycoming, 4 cylinder O-360 (opposed, 360 cubic inch) engines rated at 180 horsepower at 2700 RPM. The right engine is designated as a LO-360 due to the fact that it rotates to the left. The engines are direct drive (crankshaft connected directly to the propeller) horizontally opposed (pistons oppose each other) piston driven, carbureted and normally aspirated (no turbo or supercharging). The oil capacity in each engine is 6 quarts, and the minimum is 4 quarts. Engine ignition is provided through the use of engine-driven magnetos, which are independent of the aircraft electrical systems and each other.

Propellers

The Duchess is equipped with Hartzell two bladed, controllable pitch, constant speed, full feathering metal propellers. The Duchess also has unfeathering prop accumulators which are used to unfeather the propeller blades for engine restart.

Controllable Pitch

Controllable pitch is the ability to control engine RPM by varying the pitch of the propeller blades. When the propeller control is moved forward, positive oil pressure, regulated by a propeller governor, drives a piston, which rotates the blades to a low pitch high RPM (unfeathered) position. When the propeller control is moved aft, oil pressure is reduced by the propeller governor. This allows a nitrogen charged cylinder with a large spring on the opposite side of the piston to drive the blades to a high pitch low RPM (feathered) position.

Constant Speed

After RPM setting is selected with the propeller control, the propeller governor will automatically vary oil pressure inside the propeller hub. This is accomplished to change the propeller blade pitch to maintain a constant engine RPM. Because of this, changes in power setting (manifold pressure) and flight attitude will not cause a change in engine RPM.

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Full Feathering

When the propeller blades are in alignment with the relative wind, they are feathered. Feathered propeller blades reduce the drag caused by the blade area exposed to the relative wind. Feathering the propeller blades on the Duchess is accomplished by the pilot moving the propeller control to the full aft position. The propeller takes approximately six seconds to feather. Before feathering the propeller, the mixture should be placed to cutoff to stop engine combustion and power production.

The Duchess is equipped with a centrifugal stop pin on the prop itself that prevents engine feathering below 950 RPM. The purpose of this is to allow the propeller blades to remain in a low pitch upon engine shutdown. This will prevent excessive loads on the engine starter during the next engine start.

Note: Regardless of the Prop Lever position, when oil pressure is lost, the propeller will feather if the RPM is above 950 RPM. Typically, RPM will be above 950 in flight and on takeoff roll and landing roll due to airflow over the propeller.

Propeller Overspeed

Propeller over-speed is usually caused by a malfunction in the propeller governor which allows the propeller blades to rotate to full low pitch. If propeller over-speed should occur, retard the throttle. The propeller control should be moved to full "DECREASE RPM" and then set if any control is available. Airspeed should be reduced and throttle used to maintain 2700 RPM.

The Prop governor primary function is to regulate oil pressure to and from the prop.

Flight Controls

The control surfaces are bearing supported and operated through conventional cable systems and push rods terminating in bell cranks.

Trim controls

Trim tabs on the rudder and elevator are adjustable with the controls located on the lower center console. The trim tabs and controls are connected through closed cable systems. Mechanical position indicators for each of the trim tabs are integrated with their respective controls. Elevator trim is accomplished through either the electric or manual pitch trim system.

Manual Elevator Trim

The manual elevator trim is actuated by a handwheel located between the pilot seats. An elevator tab position indicator is located adjacent to the trim control handwheel.

Electric Elevator Trim

The electric elevator trim system is controlled by the on-off circuit breaker type switch located on the left sub panel and a thumb switch located on the pilots control wheel. An

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emergency disconnect button located on the pilots control grip will disengage the trim motor while depressed only, allowing time to turn off the trim circuit breaker switch.

Aileron Trim

The aileron trim control located on the lower center console, is provided to displace the ailerons for trimming purposes through cable tension only. No Tabs

Wing Flaps

The wing flaps are controlled by a three position switch, Up, Off, and Down, located on the right sub panel. The switch must be pulled out of detent before it can be repositioned, A dial type indicator, located adjacent to the flap switch, has position markings for Up, 10, 20, and down(35).

Limit switches automatically interrupt power to the electric motor when the flaps reach the extremes of travel. When the flaps are positioned beyond 16 degrees the landing gear horn will sound regardless of throttle(s) position if the landing gear is not down and locked.

Fuel System

The Duchess is designed for operation on grade 100 (green) or 100 low lead avgas (blue). The fuel system is an On-Crossfeed-Off arrangement and controlled by the fuel selectors located on the lower center floor panel. Total capacity is 51.5 gallons per wing tank with 50 gallons is unusable in each tank. Each wing fuel tank has a visual measuring tab with markings for 30 (28.5 useable), 40 (38.5 useable) and full at tank top. There are two engine-driven and two electrically driven fuel pumps. The electric fuel pumps are used for engine start, takeoff, landing, and fuel selector changes. The fuel selector remains in the on position during normal operations, with each tank feeding its respective engine. Fuel cannot be transferred from tank to tank; however, either tank may feed both engines in crossfeed mode. Crossfeed operation is limited to straight and level flight only. The correct procedure for crossfeed operations to supply the left engine with fuel from the right tank is:

1. Left engine electric boost pump on.
2. Left fuel selector selected to crossfeed.
3. Check left fuel pressure.
4. Left engine electric boost pump off.
5. Check fuel pressure.

A minimum of 9 gallons of fuel is required in each wing tank prior to flight.

Engine Priming

The magneto / start switches incorporate a PUSH TO PRIME function to aid in engine starting. To prime the master switch and the respective side aux fuel boost pump must be on. The prime will occur with the magneto switch in either the both or start position and the switch is being pushed in.

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Electrical System

The Duchess is equipped with a 28 volt electrical system which utilizes push-pull type circuit breakers; two 12 volt, 25 amp hour battery and two 55 amp, engine-driven alternators. The alternators maintain equal load through the use of a voltage regulator. An annunciator light and a zero indication on the ammeter indicate loss of one alternator. The remaining alternator will normally provide adequate electrical power. Over-voltage protection is provided if system if voltage exceeds 31.5 volts. The battery is used as a source of emergency electrical power and for engine starts. High drain items include the lights, vent fan, heater, gear hydraulic pump, and radios. The electrical system is a split bus system with each alternator powering the respective bus. Each bus can be isolated from the battery bus through two isolation bus circuit breakers

Note: If an electrical problem arises, always check circuit breakers and refer to the checklist.

Landing Gear

The Duchess is equipped with hydraulically actuated, fully retractable tricycle type landing gear. Hydraulic pressure for the gear is provided by an electrically powered, reversible hydraulic pump with two associated circuit breakers, one for the pump and the other for the control circuit, located on the right side sub panel. The gear is held in the up position solely by hydraulic pressure and remains locked in the down position by over-center brace & spring. The system is equipped with a gear warning system, which is activated under any of the following conditions:

1. The gear not down and locked or the throttle lever positioned below approximately 16" of manifold pressure (MP) on one or both engines.
2. The gear is not down and locked with wing flaps selected to 16 degrees or more.
3. The gear handle is in the up position on the ground. (Tested only by authorized maintenance personnel).

Landing gear retraction operation is protected by a time delay relay which will disengage electrical power to the pump after 30 seconds of continuous pump operation.

Inadvertent gear retraction on the ground is protected by a safety pressure switch installed in the pitot system to deactivate the pump circuit when impact pressure is below 59 – 63 knots.

In the event of a hydraulic malfunction, the landing gear may be extended by turning the hydraulic pressure bypass valve 90 degrees counterclockwise. The valve is located under the access door on the floor in front of the pilots seat. Follow the manufactures emergency checklist. Emergency gear extension is limited to 100 knots. As with any emergency / abnormality, always refer to the appropriate checklist.

Note: If hydraulic pressure is lost with gear retracted, the gear will free-fall.

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Brakes

The Duchess is equipped with hydraulically actuated disk brakes on both main landing gears. The hydraulic system for the brakes is independent of that for the landing gear. Depressing the tops of the rudder pedals activates brake actuation. To set the parking brake, pressure must be applied to the tops of the rudder pedals while the parking brake knob is pulled. The brake fluid reservoir is located in the left side of the nose compartment

Vacuum Pumps

The Duchess is equipped with two engine driven pressure pumps. The pressure pumps operate the attitude gyro and the directional gyro. Suction limits are 4.8 minimum to 5.2 maximum inches of mercury. The failure of a vacuum pump is indicated by a red pump inoperative indicator on the vacuum gauge. The failure of one pump alone will not cause the loss of any instruments because the remaining pump will, in most circumstances, handle the entire vacuum demand.

Pitot Static

The left wing houses the heated pitot tube and static port. An alternate static source is located inside the cabin for use in the event of static port blockage. When using the alternate static source, the storm window must be closed, and the heater must be turned on. This will reduce the pressure differential between the cockpit and the atmosphere, reducing pitot static error. The pitot static instruments are the airspeed indicator, altimeter, and the VSI.

Stall Warning

The Duchess is equipped with two electric stall detectors, one located on each wing. The left stall indicator provides warning when the flaps are positioned from 0 – 16 degrees of travel and the right stall vane when flaps are more than 16 degrees.

When the Battery and Alternators switches are in the off position stall warning is inoperative.

Heating

A Janitrol gas combustion heater in the nose compartment supplies heat to the cabin. Air from the heater is distributed by a manifold to the ducts along the cabin floor to outlets at each seat and to the defroster outlet. Operation of the heater is controlled by a three-position switch located on the instrument panel and labeled "FAN, OFF, AND HEATER". An overheat switch located in the heater unit acts as a safety device to render the heater inoperative a malfunction occur. Should the switch deactivate the heater, the heat light on the instrument panel will illuminate. The overheat reset button is located on the heater shroud in the nose cone compartment. To prevent activation of the overheat switch upon normal heater shutdown during ground select FAN on the switch with the air intake lever full open for two minutes. During flight, leave the air intake lever open for fifteen seconds. Fuel is supplied to the heater at a rate of 2/3 gallon per hour from the right fuel tank.

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Limitations

V Speeds (In knots indicated airspeed)

V _{so}	60	Stall Speed with full flaps (Bottom of white arc)
V _{mc}	65	Minimum Controllable Airspeed (Red Radial Line)
V _s	70	Stall Speed with zero flaps (Bottom of green arc)
V _r	71	Rotation Speed
V _{sse}	71	Safe speed for intentional engine failure
V _x	71	Best angle of climb
V _{xse}	80	Best angle of climb single engine
V _y	100	Best rate of climb (Cruise Climb)
V _{yse}	85	Best rate of climb single engine (Blue radial)
V _{ner}	85	Single engine enroute climb speed
V _{fe}	110	Maximum flap extension speed (Top of white arc)
V _{io}	112	Maximum gear retraction speed
V _{le}	140	Maximum gear extension speed
V _{io}	140	Maximum speed with gear extended
V _{no}	154	Maximum structural speed (Yellow arc)
V _{ne}	194	Never exceed speed (Red radial)
V _a	132	Maneuvering speed
	140	Emergency descent
	25	Maximum demonstrated crosswind
	95	Max glide

All engine landing

87	Flaps Up
76	Flaps Down

Single engine landing

90	maneuvering to final
85	final approach flaps down

Limit Flaps to 20 degrees on single engine approach

Powerplant Limitations

180hp @ 2700 rpm and standard conditions	
T/O & Max continuous	Full Throttle & 2700 rpm
Max. Oil temperature	245° F
Max. Cylinder Head Temperature	500° F
Min. Oil Pressure @ idle	25psi
Max. Oil Pressure	100psi
Min. Fuel Pressure	0.5psi
Max. Fuel Pressure	8.0psi

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Fuel

Aviation Gasoline, Grade 100 (green) or Grade 100ll (Blue)	
Total Capacity	103 Gallons
Useable	100 Gallons
Yellow Arc	E to 9 Gallons
Min. for Takeoff	9 Gallons per side

Instrument Pressure

Normal Operating Range	4.3 to 5.9 in. Hg
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Weight Limits

Max. Ramp Limit	3916
Max. Takeoff Weight	3900
Max. Landing Limit	3900
Zero Fuel Weight	3500
Max. Baggage Compartment Load	200

Maneuvers

This is a normal category airplane. Acrobatic maneuvers, including spins, are prohibited.

Max. slip duration	30 seconds
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Flight Load Factors

Positive maneuvering load factors.

Flaps Up	3.8 G
Flaps Down	2.0 G

Negative maneuvering load factors.

Flaps Up	1.52 G
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Minimum Flight Crew

One Pilot

Kinds of Operation

VFR day & night

IFR day & night

Far 91 operations when all pertinent limitations and performance considerations are complied with.

Warning **Flight in icing conditions prohibited**

Structural Life

Wing structure 20,000 flight hours provided mandatory inspection accomplished.

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Memories Items

Engine Failure

Prior to Vr	Abort
After Vr	If sufficient runway remains land Else maintain control and secure dead engine and airspeed no less than Vyse to a safe altitude, then appropriate checklist.

Engine Fire on Ground

- Mixtures to cutoff
- Continue cranking engine
- Fuel selectors off
- Battery & Alternators off
- Extinguish fire if possible

Engine Fire in Flight(Affected Engine)

- Fuel selector off
- Mixture to cutoff
- Propeller feather
- Aux fuel pump off
- Magneto switch off
- Alternator off
- Appropriate checklist
- Land as soon as possible

Emergency Descent

- Props 2700 rpm
- Throttle idle
- Airspeed 140 kts.
- Landing gear down

Max Glide Configuration

- Props feather
- Flaps up
- Landing gear up
- Cowl flaps closed
- Airspeed 95 kts.

Landing Gear Emergencies

Refer to appropriate checklist

Single Engine Go Around Do not attempt once flaps have been fully extended

- Max Power
- Gear up
- Flaps up

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Airspeed 85 kts. Minimum

Electrical Smoke and or Fire

Battery & Alternators	Off
All electrical switches	Off
Battery & Alternators	On
Essential equipment	On one at a time
Checklist	

Complete Loss of Electrical Power

Both alternators	Off
Battery switch	Off
Both BUS-ISO CB's	Pull
Remove all electrical loads	
Both alternators	On
Essential equipment	On
Checklist	

Unscheduled Electric Elevator Trim

Maintain aircraft control
Elevator trim thumb switch depress and move in opposite direction
Elevator trim switch on sub panel off
Retrim using manual trim wheel

Spin (Simultaneously apply following)

Neutralize ailerons
Full forward on control column
Rudder opposite direction of rotation
Power to idle on both engines

These are **MEMORY Items Only** and do not encompass all the emergency procedures listed in the POH. Any other emergencies or non normal events require you to refer to the POH.

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General Flight Procedures

Approach Speed

Minimum approach speed of 100 KIAS in the Duchess allow for better synchronization with other aircraft in the ATC system. The 100 KIAS approach speed, however, is not the approach and landing speed of the aircraft. All aircraft are essentially designed for a stabilized final approach speed of 1.3 V_{so}. In the Duchess this speed is about 90 KIAS whether the flaps are used or not. Therefore the pilot must transition the aircraft to this slower speed between the Decision Altitude and the runway on precision approaches, and between the point at which the decision to land has been made and the runway on non-precision approaches. It is a good idea to reduce to 90 KIAS as you cross the "fence" on final approach. This may also be termed as the V_{ref} speed. Short field landings use 76 KIAS crossing the numbers. Sink rate should never exceed 600fpm below 500 feet AGL.

Holding Speed

Hold at 100 knots

Max speed for reciprocating engines is 175

Slow to holding speed 3 minutes prior

Circling Approaches

Approach Category B is used during circle-to-land approaches due to the 100 kt approach speed.

This ensures terrain clearance up to 1.5 miles from the approach end of the runway at MDA.

Note: Category B speed range: 91 To 120 KIAS

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Flight Profiles

Select an altitude no lower than 3000 feet AGL or recommended by the POH, whichever is higher.

Take-Off Departure Stall (Power On)

Two 90 degree clearing turns, maintaining altitude:

1st turn, reduce power to 15" manifold pressure

2nd turn, G.U.M.P. with gear down (below 140 kts.)

2. Slow to 80 knots.

3. At 80 knots, increase throttles to 20" manifold pressure.

4. Increase pitch 10-12 degrees up until stall horn activates.

5. Recover, full power, and decrease critical angle of attack while maintaining altitude.

Accelerate to VX-80 kts

Initiate climb.

After positive rate, accelerate to Vy - 85 kts. and climb.

Approach To Landing Stall (Power Off)

Two 90 degree clearing turns, maintaining altitude

1st turn, reduce power to 15" manifold pressure

2nd turn G.U.M.P. with gear down below 140 kts.

2. Below Vfe, extend flaps to full

3. Maintain altitude while airspeed decreases, at 80 KIAS stabilize descent.

4. Throttles to idle and increase pitch.

4. Recover, full power, and place the nose 5 degrees up while slowly retracting the flaps.

5. Establish a positive rate of climb, then gear up

6. Climb at Vy speed 85 kts

(for slow flight MCA, at step 3, above add power to 20" to maintain 80 kts).

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Vmc Demonstration:

Two 90 degree clearing turns, maintaining altitude

1st turn, reduce power to 15" manifold pressure

2nd turn, G.U.M.P. with gear up

2. At 100 knots, close the left throttle (maintain heading and altitude)

3. Right throttle, full power and bank 5 degrees to the right

4. Increase pitch 1 degree per second

5. Recover, simultaneously reduce power on the operating (right) engine and lower the nose as necessary to regain speed and directional control within 20° and a minimum loss of altitude. As control is regained, slowly increase power on the operating (right) engine and climb at Vyse (85 knots).

Note: Recovery is to be initiated at the first indication of any of the following:

Loss of direction control, Full rudder travel, or the stall horn

Drag Demonstration

Two 90 degree clearing turns, maintaining altitude

1st turn, reduce power to 15" manifold pressure

2nd turn, G.U.M.P. with gear up

2. At 100 knots, left throttle to 11" manifold pressure simulated feather

3. Right throttle full power

4. One by one perform the following and note VSI for each:

Maintain 85 knots

Extend landing gear

Raise landing gear

Extend flaps to 35 degrees

Raise flaps to 0 degrees

Left throttle to idle

5. Recover, full power, nose to the horizon, and above Vyse, perform the cruise check.

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Steep Turns

Cruise power 23"/2300:RPM

Two constant altitude turns maintaining 45 degrees bank angle

Recover, at entry altitude and heading, perform cruise check.

Approach / Holding Power Settings At 100 Kts.

	2 Engine	1 Engine
ILS	15"	20"
Non Precision	13"	15" (750 FPM minimum descent – 1000 FPM)
Level at MDA	20"	Full or as necessary
Holding	17	Full or as necessary
Traffic Pattern	17	Full or as necessary

Gear Extension

The landing gear is extended at glide slope intercept or at the FAF.

A before-landing check is completed when the gear is extended (G.U.M.P.)

Gas:	fuel selectors and pumps on
Undercarriage:	gear down with three green lights
Mixtures:	full rich
Propellers:	full forward

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Aircraft Requirements & Performance:

List required inspections for us to fly on this check ride.

Taxi light found inoperative during pre flight

Conditions:

200 nm trip	
Day VFR	
My weight	150 lbs.
Cruise altitude	6500
Surface wind	270 @ 17 gusting to 25
Runway	18 / 36
Surface temperature	+30c
Field elevation	Sea Level

1. Accelerate stop distance
2. Accelerate Go distance
3. Takeoff distance no obstacle
4. Normal Landing distance
5. SE Absolute Ceiling
6. SE service ceiling
7. ME Absolute Ceiling
8. SE Absolute Ceiling
9. Weight and Balance

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General:

1. What are the EMPHASIS ITEMS for this check ride
2. What is the difference between memory items and the emergency check list?
3. Which check lists are required to be used?
4. What documents are required to be on the aircraft?
5. What is the DECIDE MODEL?
6. When does runway incursion planning begin?
7. Under what conditions may you accept a LAHSO clearance?
8. May you as a pilot make an entry in an aircraft logbook?

Stall Spin Awareness:

1. What is the difference between a STALL/ SPIN and a DESCENDING SPIRAL
2. What two things must occur for the aircraft to enter into a stall/spin?
3. What is the proper procedure for a stall spin recovery?
4. What is the proper procedure for a descending spiral?
5. How do you tell the difference between the two above, using flight instruments only?

Engine System:

1. How many cylinders are on the engine?
2. Who is the manufacturer of the engine?
3. What is the engine horsepower
4. How many fuel pumps are there?
5. If your fuel pressure is fluctuating, what do you do?
6. Does altitude and or temperature affect fuel flow?
7. How do you do a flood start?
8. In cruise flight, with the lost of an engine driven fuel pump will the engine continue to operate normally?
9. If the primer were left unlocked what would happen?
10. How long after starting should you see oil pressure?
11. Are the engines turbo-charged or normally aspirated
12. Why is the right engine labeled LO-360
13. How are the cylinders arranged?
14. How is ignition provided for the engine
15. Should there be no drop in RPM during the magneto check is this acceptable?
16. What is the maximum permissible drop when checking magnetos?
17. How would you clear a rough running magneto?
18. Is the ignition system dependent on the electrical system?
19. What are the minimum and maximum oil capacities?
20. What type oil does this engine use?
21. How do you identify carburetor ice?

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Propeller & Governor System

1. Who makes the propellers?
2. What are the two functions of the propeller governors?
3. What does oil pressure do to the propeller?
4. Which lever manipulates the oil pressure to the propeller?
5. Which unit regulates oil pressure to the propeller?
6. What is the function of the nitrogen charged?
7. What purpose does the spring serve?
8. Define constant speed.
9. What unit adjusts the propeller to maintain a constant RPM and how does it do it?
10. Will the propellers feather without manually putting the propeller control in the feather detent?
11. What is the maximum drop when doing the feather cycles?
12. What are you checking when you do the governor checks?
13. Will the propeller always feather?
14. What are centrifugal stops pins?
15. What is the true purpose of the centrifugal stop pins?
16. What is the correct action for a propeller over-speed?
17. Will the propeller feather below 950 RPM. Why or why not?

Aircraft Fuel System:

1. Explain how to cross feed fuel.
2. Where are the fuel tanks located?
3. What is the total fuel capacity?
4. What is the fuel burn for this aircraft?
5. Is the FAA required fuel reserve different between IFR Day or Night?
6. How many gallons are unusable?
7. What grades of fuel is approved for use in the aircraft?
8. May you mix approved different grades of fuel?
9. How do you tell the difference between jet fuel and water contamination?
10. What happens to the fuel color when you mix any two types of fuel?
11. Where are the fuel selectors located?
12. What are the various positions on the fuel selectors?

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Electrical System

1. What are the indications of a failed alternator?
2. Will the engines continue to run with the alternator and battery master switches turned off?
3. Is it ok to reset the alternator circuit breaker (60 Amp) in flight, if so what should you do?
4. What are the two purposes of the battery?
5. In the event of dual alternator failures, how long will the battery provide power?
6. Does it matter whether you start the left or right engine first?
7. What is the maximum load on the alternator after starting an engine and for how long?

Landing Gear & Brake Systems:

1. How is the landing gear actuated?
2. What keeps the gear in the up position?
3. What keeps the gear in the down position?
4. If hydraulic pressure is suddenly lost in flight what indication, if any, would you have
5. In what three situations will the landing gear horn activate?
6. What unit will not allow the gear to be retracted on the ground?
7. What is the procedure to extend the gear manually (Emergency Gear Extension)?
8. What airspeed, is of importance during manual gear extension?
9. Are the brake and landing gear hydraulics interconnected?
10. If you lose gear hydraulics, will you still have brakes?
11. What type of braking system is this?
12. Where is the brake fluid serviced?

Flap System:

1. What type of flaps does the aircraft have?
2. What are the flap settings?
3. Are there any limitations on the use of flaps?

Pressure System:

1. Which instruments are pressure operated?
2. What are the normal pressure operating limits?
3. How many vacuum pumps are there
4. What indications would occur in the event of a vacuum pump failure?
5. Why are there two stall warning vanes

Weight & Balance:

1. What are the maximum taxi, takeoff, and landing weights?
2. What is the maximum baggage capacity?

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Pitot-Static System:

1. Where does the aircraft receive ram pressure and static pressure?
2. Does the aircraft have an alternate static source? If so, how is it activated and what actions are necessary to acquire the most accurate reading?
3. What instruments are pitot static?
4. What device or anti icing equipment do you have?

Environmental System:

1. How do you prevent a heater overheat?
2. Where does the heater receive fuel from and at what rate?
3. How do you cut off fuel to the heater?

Engine-Out Dynamics:

1. What are the drag factors on light twins?
2. Who determines V_{mc} for a particular aircraft?
3. Why is an aft CG used in determining V_{mc} ?
4. What are the factors in determining V_{mc} ?
5. Define critical engine and list the factors to determine it
6. What causes an aircraft to sideslip with the loss of an engine?
7. What action is required to correct for sideslip?
8. Should you maintain a zero side slip while executing an instrument approach?
9. How much climb performance is lost when an engine fails?
10. What is drift down?
11. What is the procedure for encountering severe wind shear or a downdraft?
12. Does this procedure change if you are single engine?
13. What are your approach speeds single and multi engine?
14. When should you lower your flaps and gear on a single engine approach?
15. When should you lower your flaps and gear on a multi engine approach?
16. If after extending flaps you notice a strong roll, what could it be? What would you do?
17. What is the maximum rate of descent below 500 feet AGL.
18. Does it make any difference whether single or multi engine approach?
19. Define absolute and service ceiling.

Emergency Procedures:

1. Describe the emergency descent procedure.
2. How would you handle an engine fire?
3. How would you handle a severe cabin fire?
4. What is the procedure for landing with the nose gear stuck in the up position?