v0.9.5

The Norseman

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Extras, Limitations and Known Issues

GPS, Aircraft options

Our Norseman is equipped with a top-of-the-line device, the Combined Remote Territory Technical Visualiser (or CRT-TV for short). The CRT-TV combines all necessary items for trips in remote areas, from pre-flight to post-flight tie-down. Through it, you gain access to various aircraft options.

You also have access to a GPS unit, should you become lost with seemingly no way back to civilisation. It is located above your head on the roof and is stowed by default. You can flip the screen down to use the GPS and stow it once you are ready to return to more classical means of navigation.

NOTAM

This software is an artistic representation of the subject matter.

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Introduction

Thank you for purchasing The Norseman. This manual will guide through everything you need to know to take your classic Canadian bush plane on the adventures of your dreams!

Installation

Copy the contents of the ZIP file to your community folder. The default locations are

Windows Store:
C:\Users\[YOUR USERNAME]\AppData\Local\Packages\Microsoft.FlightSimulator_[RANDOM LETTERS]\LocalCache\Packages\Community

Steam:
C:\Users\[YOUR USERNAME]\AppData\Roaming\Microsoft Flight Simulator\Packages\Community
Or
C:\Users\[YOUR USERNAME]\AppData\Local\Packages\Microsoft.FlightDashboard_[RANDOM LETTERS]\LocalCache\Packages\Community

History of The Norseman

The Noorduyn UC-64A Norseman is a single-engine aircraft designed for operation in the most challenging conditions encountered in remote territories of Canada. Its sturdy high-wing configuration gives the pilot exceptional downward visibility.

Noorduyn Aviation Ltd. manufactured this aircraft in Montreal, Canada, from 1935 to around 1945. Then, the rights to the airframe were purchased by Canadian Car & Foundry, which continued production until 1959. Our Norseman is powered by a nine cylinder Pratt & Whitney R-1340 Wasp engine, producing 450 shaft horsepower.

With ultimate versatility in mind, this aircraft can be equipped with regular or bush wheels, skis and floats. It was rugged enough to survive the harsh conditions prevalent in arctic territories. For this purpose, special shutters could be fitted to prevent overcooling of the engine.

Its versatility did not go unnoticed, it was ordered by the RCAF during World War II as a training aircraft. Primarily used as a radio and navigational trainer, it soon was introduced into a series of additional roles, including logistical services and air ambulance flights. The Norseman also served on an arctic staging route during that time.

Non-military aviation saw the Norseman employed in a variety of purposes, from flying tourists or supplies out to areas completely inaccessible by road, to firefighting efforts, where it was used as a water bomber.

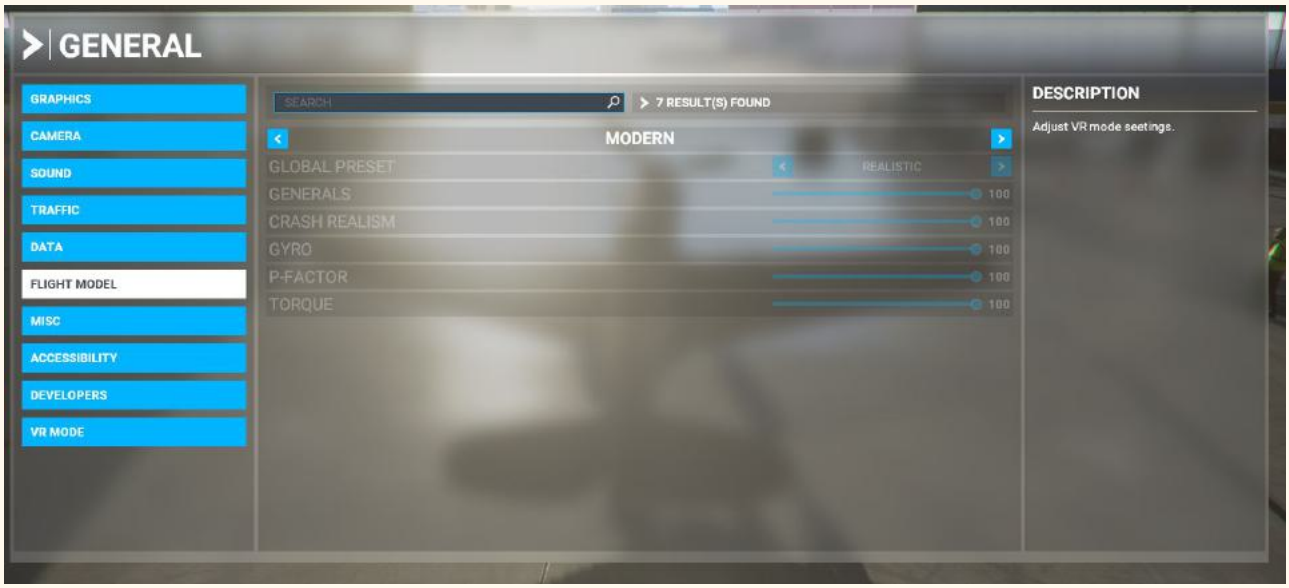
Nowadays, Red Lake, Ontario is referred to as the “Norseman Capital of the World”, with most Norseman aircraft still flying registered there. From there, to this day, the Norseman continues to serve as a supply aircraft for out-of-the-way communities further North.

Recommended Specs & Settings

The Norseman has been modeled with good frame rates in mind, which means you should not notice a significant drop in performance when using it.

Please use the same graphics settings you are used to.

The flight model has been specifically designed to feel best when following settings are used.



The Norseman will fly on any difficulty levels you set - but if you are experiencing greater mishaps than normal on takeoff and landings, please feel free to turn down some of these settings. Or practice taildragger takeoff and landing more 😉

Practice makes progress!

Quick Start Guide

If you are just too eager to fly, and you don't care about real world procedures, please follow these tips and tricks to get you up in no time.

Center of Gravity

The empty Center of Gravity (CG) value in MSFS can be changed by the user and is reset upon loading any plane. We have fixed the CG for our Norseman, but it is good practice to check before the flight. Please make sure the CG is at 26.9% MAC (± 1%), otherwise you may have an uncontrollable plane.

STARTUP

Simply use the default keybind Ctrl+E to start your engine and electrical systems. If the engine stops, check your throttle is about ¼" open.

TAXI

The nose-high attitude and the large, bulky engine and cowl make taxiing The Norseman a feat on its own. Keep it slow to avoid mishaps, especially when braking. While the aircraft is rather stable when braking from higher speed, it is easy to nose over during low speed braking. And make sure to crank down the side windows to look cool.

TAKE OFF

Apply power swiftly but smoothly to achieve take off power (36 " MAP) . The tail should come up and level on its own. Since The Norseman is a taildragger, so you can expect the usual rudder dance to keep the nose pointed down the runway! The plane should lift off at around 110 - 120 MPH. Passing 500 ft, reduce power (32,5 ") and RPM (Between 2.000 and 2.200 RPM are a good place to be).

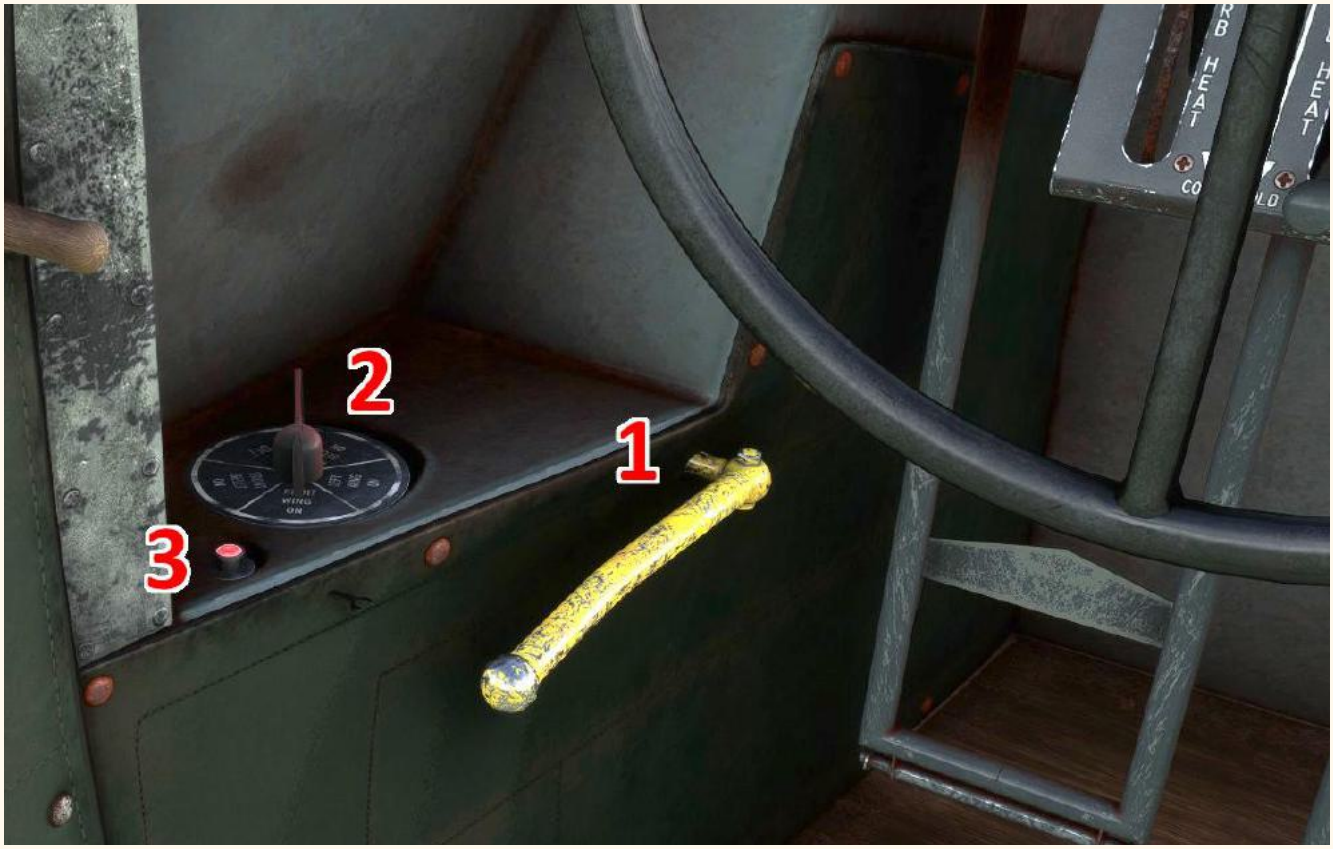
CRUISE

A power setting of about around 29 " MAP and between 1.900 and 2.000 RPM will give you a decent cruise speed with good range.

LANDING

Slow down and lower your flaps step by step. Aim for an approach speed of around 100 MPH and a touchdown speed of about 85 - 90 MPH. With flaps your approach should be relatively steep. Upon touchdown, get ready to dance yet again while the aircraft slows down!

Port Layout

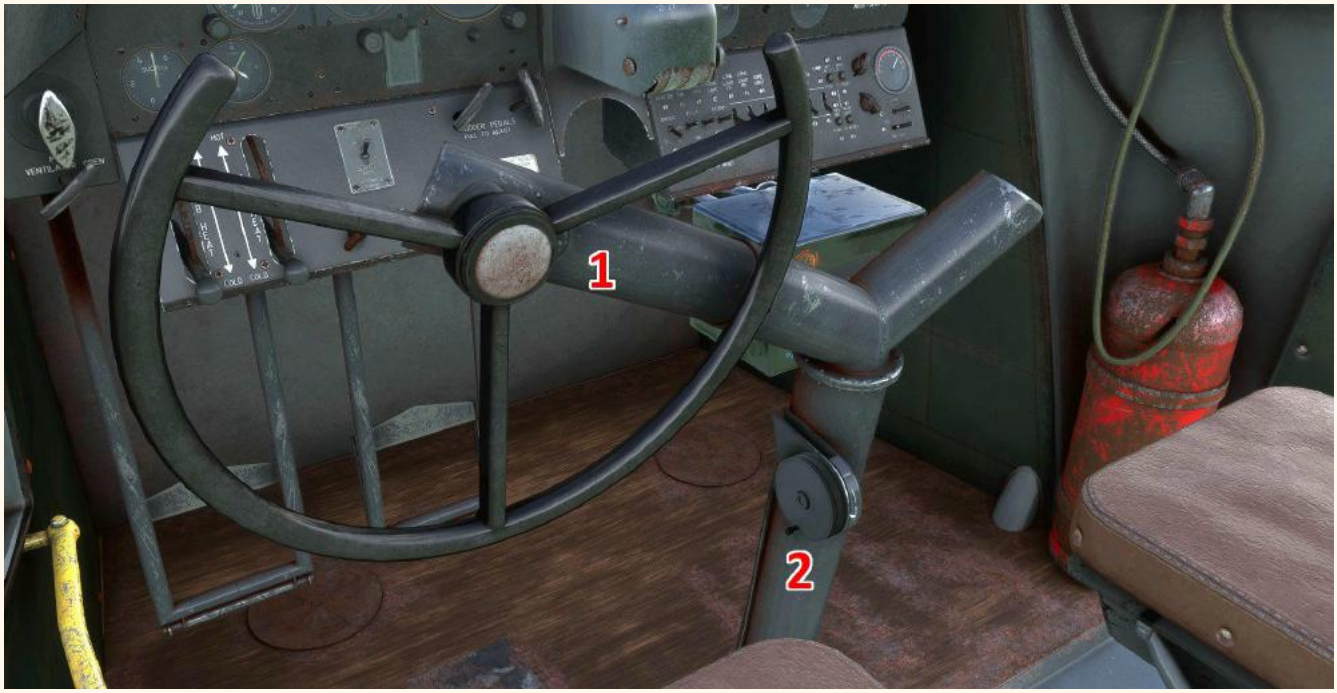


1 - Fuel Hand Pump
2 - Fuel Selector Valve
3 - Water Rudder Switch (Floats only)

Panel Layout

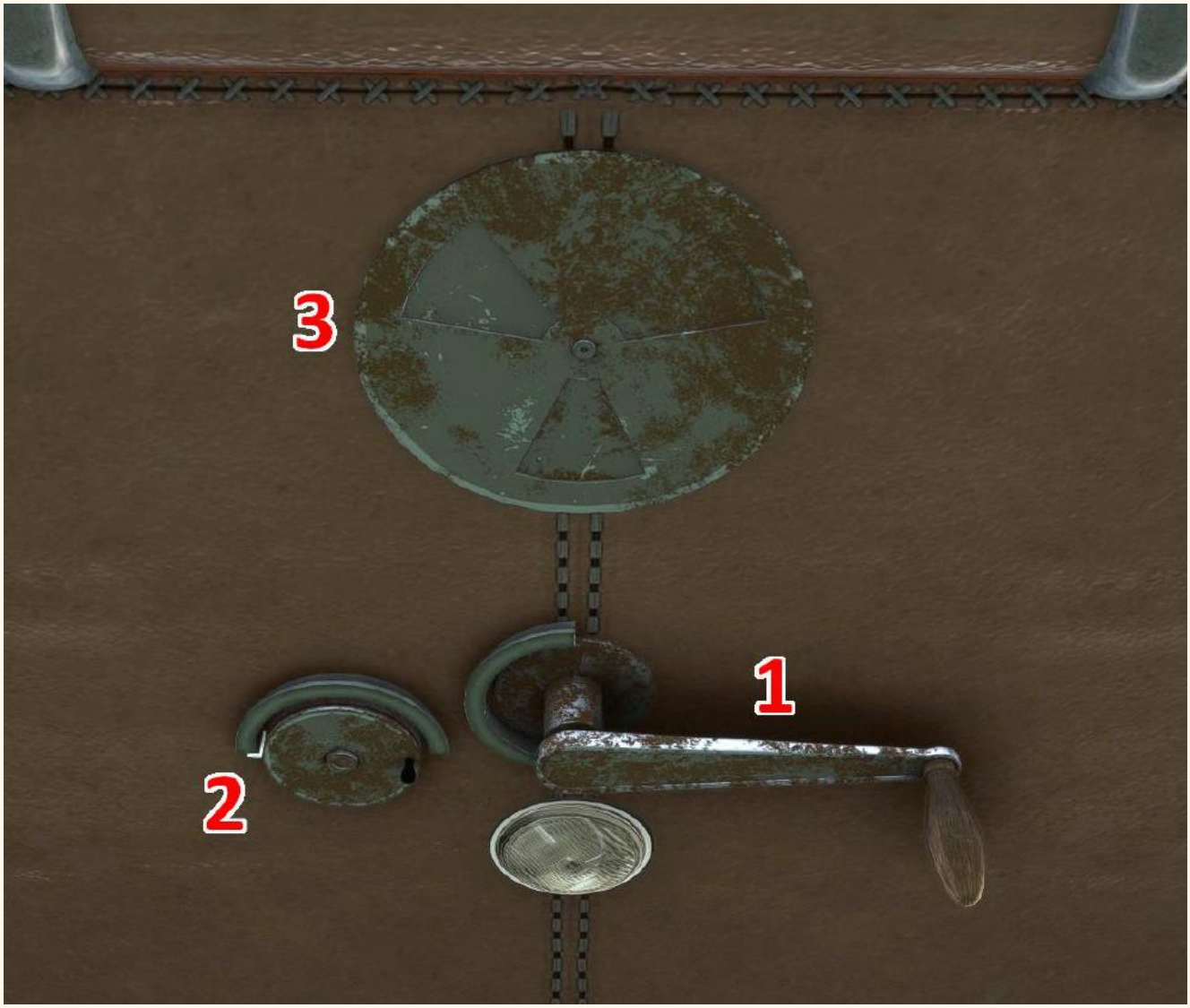
1 - Main Instrument Cluster
2 - Engine Instrument Cluster
3 - Electricity Panel
4 - Engine Primer and Cabin Air
5 - Ignition Selector
6 - De-Icing Controls (Carb Heat, Oil Heat, Pitot Blowout)
7 - Brake Line Lock (Parking Brake)
8 - Throttle Quadrant
9 - CRT-TV

Control Column



1 - Pilot’s Yoke
2 - Elevator Trim Control

Overhead Layout



1 - Flaps Crank
2 - Rudder Trim Control
3 - Cabin Vent (INOP, mechanic says it smells bad)

What the hell is it?
What the hell does it do?

Magnetic Compass: Indicates your magnetic heading in a unique way. The dial is fixed North up, the wide needle points North. The thin needle points towards South.

Artificial Horizon: Indicate your current pitch and bank angle.The horizon index can be calibrated via the knob below the instrument

Airspeed Indicator: Shows your Indicated Air Speed (IAS). The outer ring shows up to 190 knots. The inner ring ranges from 200 to 440 knots (emergency use only, at that speed your wings might not be part of the aircraft anymore).

Turn Coordinator: Helps you coordinate your turn to avoid side slipping.

Magnetic Compass: This shows where your nose is pointing. Magnetic heading is showing up in the center.

Vertical Speed Indicator: Indicates your vertical speed in thousands of feet per minute.

Altimeter: Measures sea level altitude in hundreds (big hand) and thousands (small hand) of feet. The knob changes the pressure the altimeter is calibrated to, measured in inch Hg.

Clock: You know what a clock is, don't you?

These are all the gauges needed to hop in and just #FlyTheDamnPlane

Want to dive into more realistic procedures? The gauges on the Co-Pilot's panel are what you're looking for. They keep you informed about everything the engine is doing as well as outside temperatures.

Electricity Panel: Here you can find all the electricity controls and circuit breakers. The switches control internal and external (DIM - DOWN, BRIGHT - UP, OFF - CENTRE) lighting, oil dilution as well as the engine starter.

Cockpit Light Dimmers: When the internal lights are on, use these rheostats to dim the lights.

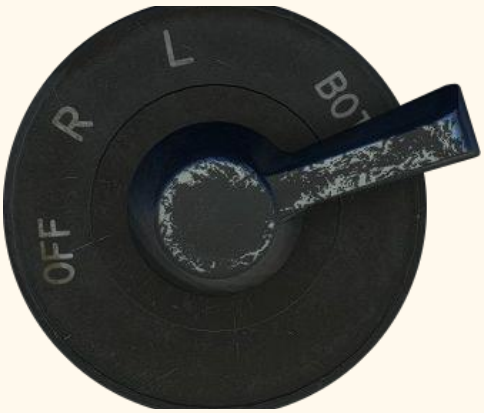
Parking Brakes: This valve acts as a line lock, closing the brake lines with brake pressure applied to stop the aircraft from rolling without having to keep the toe brakes applied.

Fuel gauge: Shows the remaining capacity of a fuel tank in percent. There are 2 fuel levels shown, the front and rear belly tanks.

Vacuum: This indicates the pressure difference in inches Hg between the vacuum tube and the ambient air pressure.

Engine Manifold Pressure: This indicates the manifold pressure (MAP in short) in inch Hg.

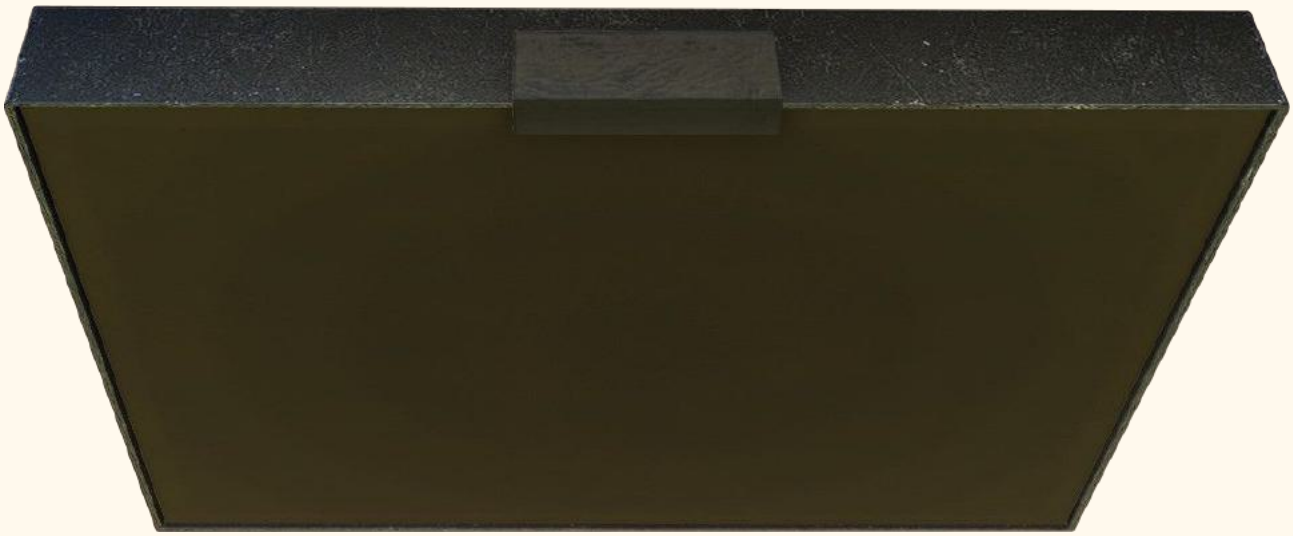
RPM Gauge: This shows the revolutions of the propeller in hundreds per minute.



Ignition Controls: The "Magnetos" (self-contained generators) power the spark plugs. Depending on switch position either none, left, right or both banks of plugs are powered.

Voltmeter and Electricity Controls: Shows the battery current in Volts.

The switches control the generator and main battery.



Stowed GPS Unit: A GPS unit that can help you if you cannot find your way back home. It can be stowed out of sight into its metal container in the ceiling of the pilot compartment.

Cylinder Head Temperature: Shows the engine's cylinder head temperature in degrees Celsius.

Carburettor Temperature: Shows the temperature inside the carburettor body in degrees Celsius.

Outside Air Temperature: This gauge tells you the outside air temperature in degrees Celsius.

Oil Temperature, Oil Pressure and Fuel Pressure Gauge: This gauge shows oil temperature in °C on the top arc, oil pressure on the bottom left and fuel pressure on the bottom right.

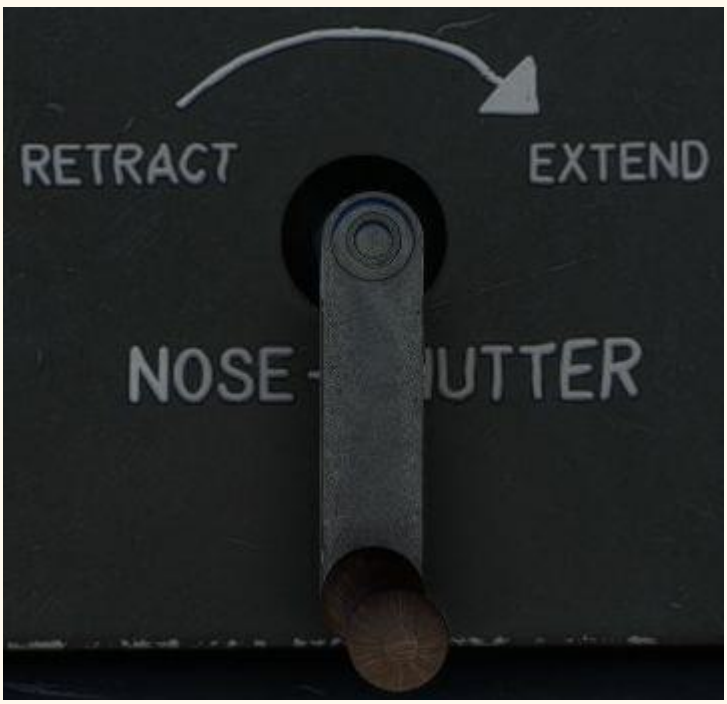
Air to Fuel Ratio Gauge: This gauge shows you, how much fuel in relation to air enters the engine's cylinders. It is helpful for setting the mixture appropriately.

Throttle Quadrant: Here you can find Throttle, Mixture and Prop levers. The black throttle lever controls engine power output by changing how much of the air-fuel mix goes into the engines.

The red Mixture lever changes the air-fuel mix by decreasing the amount of fuel passing through the carburettor.

The blue Prop lever allows you to change prop RPM by increasing or decreasing the prop blade pitch angle.

Flaps Hand Crank: Use this crank to set the flaps angle.



Shutter Hand Crank: Use this crank to extend or retract the nose shutter. Insert the crank to mount the shutter.

Carburettor and Oil Heat Levers: If the carburettor air temperature drops close to or below 0 degrees, you can use Carb Heat to prevent icing. Keep in mind that this will also lower your maximum power output.

Carburettor icing is not exclusive to low ambient temperatures, as intake air is flowing through a choke point. This can lower air temperature significantly.

When flying in particularly cold weather, you will need to use the oil heating system, because the oil will become too thick, preventing it from properly lubricating the engine.

Manual Fuel Pump: Operate this pump lever to force fuel from the tank into the fuel lines for start-up.

Fuel Selector Valve: Turn this valve handle so the short end points at the tank you want to use. Note that there is no position for using both wing tanks or all tanks at the same time.

If you are using the wing tanks, we recommend switching between left and right tank every 15 to 20 minutes to keep the aircraft balanced.

Auxiliary Fuel Valve: Found on the auxiliary tank, this valve allows fuel to flown down into the belly tank.

The auxiliary tank is a valuable addition when you plan on flying long trips, especially in remote areas where there are no opportunities for refuelling along the way.

Primer: The large handle is the engine primer. Pull it to inject fuel for starting the engine.

Elevator Trim: Turning this crank will adjust the elevator trim tabs, allowing you to trim the aircraft for your current airspeed.

Rudder Trim: Turning this crank will adjust the rudder trim tab, allowing you to change the rudder's centre.

Pitot Blowout: The Norseman has a pitot heat system. But if your pitot tube ices up and your airspeed indicator stops working, you can use the pitot blowout controls. Pressurised air is forced into the pitot tube, blowing out any ice accumulated inside.

Static Pressure Source Selector: If The Norseman's primary static port fails, causing the airspeed indicator, altimeter and VSI to stop working, you can select the alternate static source by flicking this switch down.

CRT-TV: Last, but certainly not least: The Combined Remote Territory Technical Visualiser, or CRT-TV, is your best friend out in the wild. It combines everything you need for trips to remote territories.

If you land in cold places, we recommend adding pitot and engine covers before stepping away from your Norseman. The CRT-TV lets you do all that.*

* Warranty void if you try actually using it for TV reception

Flying Tips and Tricks

This section covers advanced tips and tricks or flying techniques to get the most out of your Norseman (and to maybe even push it past some of its official limitations - but shhh, you didn't get that from us). Whether you want to avoid nasty surprises or dive into challenging bush adventures, we've got your back!

Short Takeoff:

If you want to take off in the shortest distance possible, first make sure your takeoff heading is as close as possible to where the wind is coming from. On runways there is not much wiggle room. When taking off from open spaces, you can be more tactical about it. Leave the flaps retracted to minimise drag during takeoff roll. Once you're ready, hold the brakes and pull the yoke all the way back.

Increase throttle to 36 " MAP and wait for the engine to reach full power before releasing the brakes. Due to its weight, The Norseman is unlikely to dip the nose when running at high throttle while holding the brakes. But you should still keep the yoke pulled firmly back. If the nose dips, release the brakes immediately and commence your takeoff roll. Otherwise release your brakes once you are ready to go.

If you have a good feel for the P-factor, you can push the yoke forward a little bit to force the tail up, thusly minimising your wing's Angle of Attack and therefore drag. This way you can squeeze out the last bit of acceleration. Just be ready on the rudder, The Norseman likes to kick around when forcing the tail up. Wait until roughly 70 MPH - or a bit less, if the plane is nearly empty - and drop one notch of flaps. Then wait a second before swiftly pulling back on the yoke to force the aircraft off the ground. You are still at or below stall speed but ground effect lets you stay in the air.

Level out and fly straight ahead, very close to the ground, to accelerate. At 90 MPH, you can pull up and climb out for a few seconds. Then level out and retract your flaps once you reach 100 - 110 MPH. This will provide sufficient altitude to clear any obstacles at the end of the runway.

Using this technique and getting the timing just right, you can take off from runways shorter than 1 000 ft. It is going to be a close shave, but you will make it. Just keep in mind that The Norseman, while rugged, is not necessarily meant to take off from extremely short fields.

You can safely practise this technique on short grass fields of around 2 000 to 2 500 ft length before going for the really tough strips around the world.

Crosswind Takeoff:
When facing relatively strong crosswind on takeoff, a taildragger's weathervaning tendency will be a significant challenge. This might end your flight before it even starts if the wind is strong enough. In a single engine aircraft, your rudder is the only way to show the weather who's boss.

It's simple enough, however. Crosswind from your left will require more right rudder than usual, while crosswind from your right will lower the amount of right rudder needed or even call for left rudder input.

When there is a strong crosswind component and not much head- or tailwind, you should think about taking off with the wind coming from your right, even if it means a slight tailwind. This will give you more wiggle room with rudder authority.

When you get up to speed, make sure to turn the yoke towards where the wind is coming from. Otherwise, your windward wing will be picked up. This can quickly end your flight with the leeward wing striking the ground.

Either way, the rudder dance in The Norseman is a significant endeavour. Practice with just a slight crosswind, so you can get a feel for how much rudder is needed. Without wind, this will generally be a slight input to the right, along with some dancing around that spot. With increasing wind speed, the required input also increases.

Canyon Turn:
In the mountains, it is easy to take a wrong turn and end up in a narrow valley with a faceful of mountain in front of you. The terrain ahead of you is rising faster than you could climb and the valley is too narrow to simply turn around. Especially in The Norseman, because it feels rather heavy and is more suitable for shallow climbs.

Fear not, the Canyon Turn is the technique that will save your life in this situation. First of all, don't panic! While cars turn in a set radius, you are flying an aeroplane. And during flight, planes speak degrees per second. The slower you go, the smaller the distance covered per second. This means tighter turns at lower speeds.

So obviously you want to slow down before running out of valley. Swiftly reduce throttle and keep your altitude to slow down. Or do a shallow climb to slow down even quicker, this is up to you and, more importantly, up to how much space you have left ahead of you. Do not slow down too much in The Norseman, fly just slow enough for full flaps (i. E. 100 MPH). When your flaps are all the way out, adjust throttle to stay at about 95 - 100 MPH. Fly as close as possible to the side of the valley facing the wind to maximise space and to avoid downdrafts. Then enter a 30 - 40 degree bank and turn the aircraft around. The Norseman will require a good deal of back pressure on the yoke to maintain altitude.

Why not slower? Because at 100 MPH your wings themselves provide plenty of lift. Your flaps further increase the amount of lift you have. And since lift pulls you towards the inside of your turn this maximises degrees per second. At slower speed your wings do not provide enough lift without the help of flaps, keeping you from achieving maximum possible turn speed.

Curved approach by feel:

There are many numbers involved in flying. But it also requires a lot of feel for what the aircraft is doing. To nail the approach you have to feel it, even if it does not quite match the numbers. And the big engine cowling drastically reduces forward visibility, so you need to be a bit creative on approach.

Sometimes you should do what feels best to you. Start by reducing throttle, as usual. At the same time, increase RPM to maximum. But instead of strictly following the numbers, just try to feel what The Norseman is doing. How it responds to throttle changes, how it slows down and how the controls become more sluggish as you decelerate. Feel how anything below about 110 MPH seems like you are close to stall territory, but do not let that fool you. You still have wiggle room. Stalls develop slowly, but you will get that sinking gut feeling long before a stall starts to develop, thanks to the heavy controls. If you want to land, it is best to start in a pattern with a 180 degree turn required to get to your desired runway. “Look where you want to go” plays a big role in flying, so lower your head a bit and look at a point before the runway threshold. Slowly descend and keep looking at your focus point. When you pass the runway threshold, start a turn for a curved approach and keep looking at your focus point. You will need to get a feel for this part as well, because you want to touch down the exact moment you end the turn. If you feel your turn is too tight or too shallow or leads you too far away from the threshold, you can modulate the turn as required. Throughout the entire manoeuvre, try to adjust your throttle and controls to match up your glide path with the point you are aiming for. Keep in mind that you will reach the point you focused on just before the turn ends, since touch-down is always past the point you aim for. Therefore, always aim for a point before the threshold.

After doing this for a while, you will develop a good feel for how much throttle you need if you want to maintain a specific approach angle. And you will notice that you barely have to look at the airspeed indicator during approach. Different airports and airfields require different approach angles, depending on whether there are obstacles near the threshold or whether there is difficult terrain around the runway.

Pick a couple runways with different lengths and different terrain around them, then try various approach angles and see how they work. This way you will develop a good feel for how shallow or steep to approach, just by looking at the terrain on and around your landing zone.

Ultimately the feel for power setting, controls and optimal approach angle will combine and you can intuitively judge when to start decelerating, what angle to fly and what power setting you will need, just going by what “feels right”. When you reach this point, you will notice that you consistently end up with the perfect airspeed just as you reach the point you were aiming for.

Developing this kind of feel for your aircraft and for your approach is an invaluable tool in case you have to perform an emergency landing. Especially when you lose your engine, a go-around might prove a little bit difficult. Being able to feel out the approach for a landing site and nailing it on your first try will make the difference between repairing the engine and rebuilding the whole aircraft.

Short Landing:
If you want the shortest landing distance possible, there is a special technique involved. It's not that hard but requires you to be comfortable on the verge of stall speed. Thusly it is recommended you practise slow flight first.

To set up for a short landing you follow the same procedure as for a normal landing. Your approach and touchdown speeds will be lower however. The aircraft will stall at around 65 MPH in landing configuration with full flaps. This means that you ideally aim for an approach speed of just over 65 MPH. Be very cautious when flying that slow, a pull on the yoke will cause you to stall and shall therefore always be preceded by a throttle increase.

Your approach, apart from the lower speed, will be just like a normal approach. Pull the yoke back just before touchdown for a gentle flare. What makes this relatively difficult is the necessity for flying a curved approach. Do not exceed roughly 15 degrees of bank angle when flying that slow. If done exactly right, the aircraft will settle nicely in a three-point attitude just as you roll out of the turn.

Immediately upon touchdown you should retract your flaps fully. This increases the weight on your wheels, giving you an increase in rolling resistance as well as grip. Now fully pull back on the yoke. You can now apply full brakes without skidding. Keep holding full brakes to rapidly slow down The Norseman. When you notice your tail lifting, release the brakes right away. Then reapply them. As your speed decreases you will have to transition from brakes fully applied to intermittent braking. With practice you will get a feel for it and develop the muscle memory to keep your nose from dipping down while not sacrificing your braking distance.

Sideslip Landing
This is the most difficult of the bunch because it requires crossing your controls very close to stall speed. Being able to perform a sideslip approach and landing is going to be very helpful in the most remote unprepared airstrips however. Sometimes you encounter groups of trees or a hill directly at the runway threshold, but no obstacles towards the side of the threshold. That's when a sideslip landing is your best option. This is the only time when you can drop the curved approach, since you can see your focus point before the threshold during the entire slip.

To perform this maneuver, you will have to apply opposite aileron and rudder inputs, forcing The Norseman to crab sideways. Choose the runway you want to land on, then imagine another parallel runway, roughly 50 - 100 metres (or around 150 - 300 ft) next to it. Now approach the imaginary runway in a straight approach. You are now on a glideslope, flying parallel to your runway of choice but off its side. Once you can see the runway threshold ahead, 45 degrees off to either side, you will have to start crabbing sideways towards it.

To do this you need to add a little bit of throttle, use ailerons to bank TOWARDS the runway and apply opposite rudder, AWAY FROM the runway. You are now flying sideways, approaching your runway threshold diagonally. Your nose is pointed parallel to the runway all the time. Just before reaching the threshold, smoothly level your wings and bring your rudder back to neutral. This will stop the crabbing and, without your Norseman turning either direction, line you up for landing. Now touch down and come to a stop as usual.

Water Turning:

Moving around on water is quite different from taxiing on solid ground. Wind will carry you away, The Norseman wants to point the nose into the wind and you have nothing except water resistance to provide lateral stability. But The Norseman has water rudders, so turning should not be an issue.

If you want to turn, taxi slowly!

To turn, apply full rudder into the turn and increase throttle just a little bit, if necessary. The water rudder makes this fairly simple, but do keep in mind that you will not be able to turn on the spot. Any thrust the prop generates - even at idle - will carry you forward, more so when you increase throttle.

If you want a tighter turn radius, you can add aileron input towards the inside. This will push the inside float further into the water, increasing drag on that side and therefore making your turn radius smaller.

None of this will let you turn like you would on land. Keep this in mind when planning where to land. It is advisable to give yourself plenty of room to manoeuvre on water if the area permits.

Step Taxi:

The advantage of landing on water, besides the freedom of having 70 % of Earth's surface available as a runway, is that you can quickly move around. Much quicker, in fact, that on land.

If you want to cover ground, do a Step Taxi!

This is simple to do. Increase power to about 15 - 18 " MAP to accelerate and pull back on your yoke, about halfway. Keep an eye on your airspeed indicator. When you feel The Norseman rise out of the water, modulate back pressure on the yoke as well as throttle to keep her slightly nose high. You're now "on the step", the float's main hull rises and only the step and lower portion of the keel will be in the water. The result is drastically decreased drag, requiring very little power to keep your speed. And you are fast enough for the rudder to be effective. Just don't make any sharp inputs to keep yourself out of trouble.

Bush Trip “Gibbes Sepik Airways Check Ride”

Welcome to Gibbes Sepik Airways! We are the first air service to operate regularly here in the beautiful wilds of Papua New Guinea. Founded by legendary Australian fighter ace Bobby Gibbes, we are at the forefront of aviation here in PNG after the end of the Second World War.

You’ve come to us with a fair bit of flight experience, but today that is going to be put to the test by one of our lead pilots as she checks you out in one of our venerable Norsemans’. The Norseman is ideally suited for the mountainous and at times very short strips that we fly out of here in PNG. We move a lot of vital cargo to remote villages and major centres throughout the island.

Today, you will be flying one of our regular supply routes, bringing supplies and passengers to a series of villages. The terrain is rugged, and the weather can change in an instant, so you will need all your wits about you. Your co-pilot has helped you prepare your flight with the visual cues you’ll need for your route, because there isn’t any radio navigation out here! She will also be keeping an eye on your performance!

The weather is pretty good today considering the time of year, with light winds and a cloud deck that isn’t touching the mountain tops. Remember though, this can change at any time!

You will go from the shores of the Pacific Ocean up into the New Guinea Highlands today and get a chance to see places where history was written not that long ago. Lean into your experience and knowledge of mountain flying to show the experienced team here what you can do!

Bush Trip “Antarctic Gateway”

Welcome to BR Air Services. This air charter service is based in Canada and is one of the few that operate the legendary Noorduyn Norseman.

A pilot of ours was tasked with flying a team of four researchers from the Canadian border to the airport outside Puerto Williams, Chile. This the port of entry for any flights to the Antarctic and is also known as the Antarctic Gateway.

But the pilot got an urgent call on the way there, so she is trusting you with the aircraft and the research team. She already completed most of the distance, but you have to cover the remaining 1 000 km from Villa O’Higgins all the way to Puerto Williams.

The passengers are no strangers to tough airfields, so they can stomach a firm touch-down. Which is excellent, because there are short runways for you to land on during this trip.

Weather and visibility are good, just make sure you stay below the low-hanging clouds. And you might want to use the nose shutters, because the air temperature is low.

Our pilot left her box of notes in the cockpit for you. They will be your primary means of navigation, containing short written instructions on where to turn and landmarks to identify where you are.

The route is diverse and challenging, ranging from flat ground and rolling hills to valleys, mountain ridges and large bodies of water. But you are a capable pilot, so we trust you to bring the researchers to their destination in one piece.

Aircraft Checks

Before starting up, make sure to have received a weather report, especially temperature. Also check you have sufficient fuel on board unless you want to fly a glider.

1. FLIGHT RESTRICTIONS.
a. Intentional spinning is prohibited.
b. All acrobatic maneuvers are prohibited.
c. Maximum permissible diving speed is 200 m.p.h. indicated air speed.
d. Do not exceed overspeed dive of 2800 r.p.m. (maximum duration 30 seconds).
e. Do not exceed 2200 r.p.m. in level flight.
f. Do not lower wing flaps above 120 m.p.h. indicated air speed.
g. Do not extend landing lights above 120 m.p.h. indicated air speed.

2. BEFORE ENTERING PILOT'S COMPARTMENT
a. Check Form 1 and 1A.
b. WEIGHT AND BALANCE
Check Form F, Weight and Balance Clearance (AN-01-1-40).
c. INSTRUCTIONS FOR FLIGHT PLANNING.
See Section III, paragraph 1.
d. INITIAL ENTRANCE TO AIRPLANE-
Initial entrance to airplane is gained through the left cabin door. The door is provided with standard automobile key lock; the cockpit doors are locked from the inside by means of a small latch.

NOTE: Before entry, check the red disc on the pressure fire extinguisher to ascertain it is intact.

3. ON ENTERING THE PILOT'S COMPARTMENT.
a. CHECK FOR ALL FLIGHTS.
(1) Remove surface control lock.
(2) Ignition switch "OFF".
(3) Parking brakes "ON".
(4) Controls free.
(5) Turn battery disconnect switch "ON". I
(6) Test operate fuel pressure warning light.
(7) Set fuel selector valve handle on fullest wing tank.
(8) Generator switch "ON".
(9) Compass switch "ON".
(10) Propeller control in full "LOW" r.p.m. position.
(11) Throttle "CLOSED".
(12) Mixture control full "RICH".
(13) Carburetor air heat control full "COLD".
(14) Oil temperature regulator shutter as re -quired.
(15) Nose shutter closed, if installed for cold weather operation.
b. SPECIAL CHECK FOR NIGHT FLYING. .
(1) Tum instrument lights "ON".
(2) Test operate landing lights, navigation lights and recognition lights.

WARNING: Do not operate landing lights on the ground for more than 30 seconds, and recognition lights for more than 10 seconds.

c. CHECK OF COMMUNICATION SYSTEM.
(1) Test operate radio receivers for satisfactory operation on all bands.
(2) Test o~erate radio transmitters for proper operation on assigned frequencies.

Engine Start & Warmup

4. STARTING ENGINE.

NOTE: On all occasions when starting up engine, a qualified operator equipped with a fire extinguisher must be standing by the airplane.

a . COLD ENGINE. With ignition switch "OFF", pull propeller through about three revolutions.
b. Turn ignition switch "BOTH".
c. With mixture control at full "RICH" and throttle cracked slightly open, operate hand fuel pump to fill carburetor bowl and priming system.
d. Prime engine 6 to 10 strokes and lock primer in "OFF" position.
e. Energize and engage starter.

NOTE: Before energizing starter, pull switch to "ENGAGE" and release; this will insure that motor brushes are resting on commutator.

f. When engine fires and oil pressure appears, move propeller control to full "HIGH" r.p.m. position.
g. Use carburetor air heat as required to prevent engine from backfiring until warm.
h. Set throttle to maintain engine speed between 800- 1000 r.p.m.

WARNING: Stop the engine if the oil pressure does not register within 30 seconds after starting.

5. ENGINE WARM-UP.
a. Warm up engine between 800-1000 r.p.m. until engine fires regularly.
b. Return carburetor air heat to full "COLD", if used.

CAUTION: Do not attempt take-off with carburetor heat control in "HOT" position.

c. Continue engine run until following conditions are reached at 1000-1200 r.p.m.
(1) Normal oil pressure of 70-90 pounds per square inch.
(2) Minimum oil temperature.of 40" C (104°F).
(3) FUEL PRESSURE of 3 to 4 lbs. sq. in.
(4) Maximum allowable cylinder head temperature is 260° C (500°F). See Specific Engine Flight Chart.

NOTE: Normal oil temperature is 50°C-70° C, max. 95° C (122°F-158° F , max. 203°F). Fuel pressure is 3 to 4 pounds per square inch.

6. ENGINE AND ACCESSORIES GROUND TEST.
a . Check functioning of engine on each magneto at 2000 r.p.m., 26 inches Hg.

WARNING: Minimum oil temperature of 40° C (104°F) to be reached before opening throttle. This test should never exceed 15 seconds on each magneto. Avoid prolonged ground running.

b . Check functioning of propeller control.

Taxi, Takeoff, After Takeoff

7. TAXIING INSTRUCTIONS.
a . Adjust pilot's seat and rudder pedals to com-fortable position.
b . Release parking brakes. (See Section I , paragraph 4., c ., (3)).
c . Oil shutter as required.
d . Nose shutter as required, if installed for cold weather operation.
e . Check brakes individually· and become familiar with their characteristics.

8. BEFORE TAKE-OFF.
a . Fuel selector on fullest wing tank.
b. Controls free.
c. Elevator trim tab "NEUTRAL" or slightly nose down depending on load carried.
d . Rudder trim tab "NEUTRAL" or slightly to the right, to counteract yawing to the left during climb.
e. Set flaps "TAKE-OFF".

NOTE: It is not essential to place flaps in "TAKE-OFF" position under normal load and take-off conditions with airplane on wheels; flaps are beneficial for all take-offs on floats and skis.

f. Mixture control full "RICH".
g. Propeller max. "HIGH" r.p.m. 2250.
h. Oil pressure 70-90 pounds per square inch.
i. Fuel pressure 3 to 4 pounds.
j. Oil temperature 40° C min., 95°C max. (104°F min., 203° F max.) .

9. TAKE-OFF.
a. Manifold pressure 36 inches Hg., r .p .m. 2250.
b. Reduce manifold pressure to 32.S inches Hg. as soon as all obstacles are cleared.
c. Reduce r.p.m. to 2200 and continue to 500 feet altitude.
d. Return flaps slowly to "ZERO" if used. e. Reset elevator trim.

NOTE: Refer to flight operation chart for continuous climb.

10. ENGINE FAILURE DURING TAKE-OFF.
a. Mixture control to idle cut-off.
b. Ignition switch "OFF".
c . Battery disconnect switch "OFF".
d. Fuel selector "OFF".

NOTE: Continue straight ahead and maintain minimum safe flying speed 85-90 I.A.S

Climb & Cruise

11. FLIGHT OPERATION.
a. During flight use fuel tanks as instructed in Section I, paragraph 4., b., (5).
b. For cruising and similar conditions of continuous operation, the manifold pressure and r.p.m. should be reduced in accordance with the following table.

I.A.S.	Condition	Max. man. press. (in. Hg.)	Max. R.P.M.	Min fuel air ratio	Fuel Cons. gal-hr (Approx.)
	Take-off	36.0	2,250	full RICH	
105- 100	Climb	32.5	2,200	.091 (Max)	
	Level Flight	32.5	2,200	.091 (Max)	
At 5,000 ft.	Cruising (Max)	29	1,925	.080	34
	Cruising (1) Desired	27	1,925	.075	31
	-or (2)	25.5	1,850	.072	27

c. Maintain a carburetor mixture temperature of 2 ° C to 5°C (35.6°Fto 41°F).

NOTE: Refer to flight operation data Section III for additional instructions.

12. GENERAL FLYING CHARACTERISTICS.
a. STABILITY-Under recommended loading conditions, the airplane is stable.
b. TRIM.
(1) Slight differences in longitudinal trim with flaps raised or lowered, can be counteracted with elevator tab adjustments.
(2) Directional trim can be set for any condition of flight as required.
(3) The airplane yaws to the left during climb. Directional trim may be set to counteract this condition.

Emergencies

13. ENGINE FAILURE DURING FLIGHT.
a. Drop nose of airplane sufficiently to maintain a glide of approximately 85-90 I.A.S.
b . Ignition switch "OFF".
c . Battery disconnect switch "OFF".
d . Fuel selector "OFF".
e. Lower flaps as circumstances require; final approach and landing will be slower with full (40°) flaps down.

14, STALLS.
a . Stalling Speeds-Fully loaded.
Flaps fully down-68 I.A.S.
Flaps neutral-75 I.A.S.
b . Stalls develop slowly and the airplane tends to "mush"; there is no tendency to drop a wing or go into a spin. A minimum gliding speed of 85 I.A.S. should be maintained with the airplane fully loaded; this may be reduced to 80 I.A.S. if the airplane is lightly loaded.

15. EMERGENCY EXITS.
a. IN FLIGHT-Release emergency handle at pilot's, co-pilot's and left side cabin doors; this will jettison the entire door. Withdraw draw bolts from right side freight panel and panel will drop.
b . EMERGENCY LANDING ON WATER.-Rip open emergency hatch in cabin roof to gain access to top of fuselage and wing.

16. TAKE-OFF AND LANDING IN CROSS WIND.
With a high wing monoplane, cross wind take-offs and landings should only be attempted with discretion and are not recommended.

Landing & Final Checks

17. LANDING.
a. PRELIMINARY APPROACH.

WARNING: Check that parking brakes are in unlocked "UP" position.

(1) Fuel selector on fullest wing tank.
(2) Mixture control full "RICH".
(3) Propeller control "MAX. CRUISE" r.p.m. position.
(4) Carburetor air heat full "COLD", unless ice conditions prevail.
(5) Reduce speed to 100 I.A.S.
(6) Flaps down as desired.

NOTE: Flaps should not be depressed more than 30° unless 150 lbs. ballast or equivalent load is carried in the rear of cabin.

b. FINAL APPROACH.
(1) Final approach speed 85-90 I.A.S. if airplane heavily loaded; this may be reduced to 80 I.A.S., if the airplane is lightly loaded.
(2) It is preferable to make tail down landings.

NOTE: Brakes should be used delicately if rolling at high speed and tail not on ground.

c . EMERGENCY TAKE-OFF IF LANDING IS NOT COMPLETED.
(1) Open throttle but not beyond 36 inches manifold pressure.
(2) Hold wheel forward to prevent climbing and until elevator tab can be reset.
(3) Reduce flap setting slowly.

NOTE: The airplane in emergency, or for slow flying purposes, may be flown flaps full "DOWN" providing 90 I.A.S. is not exceeded.

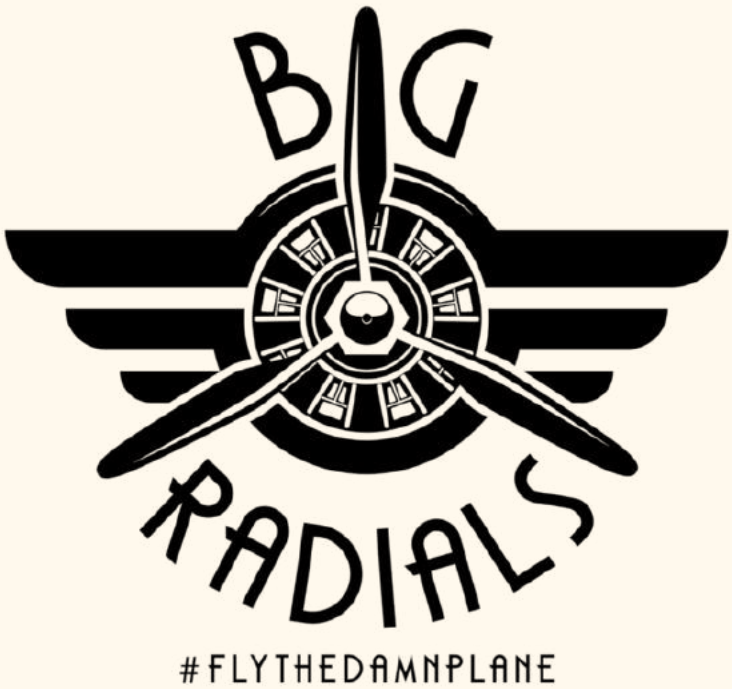
18. AFTER LANDING.
a. Flaps up.
b. Set propeller control to full "LOW" r .p .m. position.
c. Set parking brakes, see Section I, paragraph 4., c., (3).
d. Run up engine sufficiently to insure full "LOW" r .p .m . of propeller.
e. Close throttle.
f. Move mixture control to idle cut-off.
g. If a cold weather start is anticipated;
use oil dilution procedure outlined in paragraph 6b In Appendix III.
h. Turn all switches to "OFF".
i. Install surface control lock.
j. Main wheels chocked , if possible

Shutdown

18. Shutdown

a. Flaps up.
b. Set propeller control to full "LOW" r .p .m. position.
c. Set parking brakes, see Section I, paragraph 4., c., (3).
d. Run up engine sufficiently to insure full "LOW" r .p .m . of propeller.
e. Close throttle.
f. Move mixture control to idle cut-off.
g. If a cold weather start is anticipated;
use oil dilution procedure outlined in paragraph 6b In Appendix III.
h. Turn all switches to "OFF".
i. Install surface control lock.
j. Main wheels chocked , if possible

Come Talk To Us



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