Mooney 9351M systems

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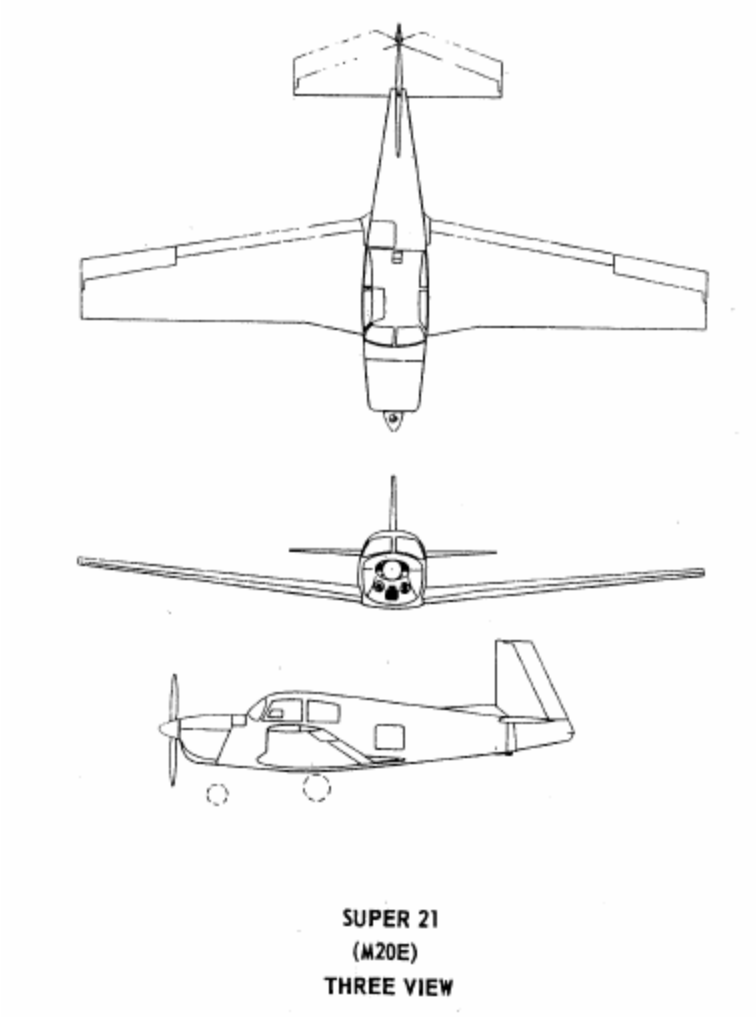
http://williams.best.vwh.net/m20e/

Thank you Bob Keller, Scott Burkhart, Evan Reed, Steve Radcliffe and others for their help/comments.

The information herein is believed to be correct, but the POH/AFM is the ultimate arbiter…

N9351M is a 1966 Mooney M20E “Super 21”



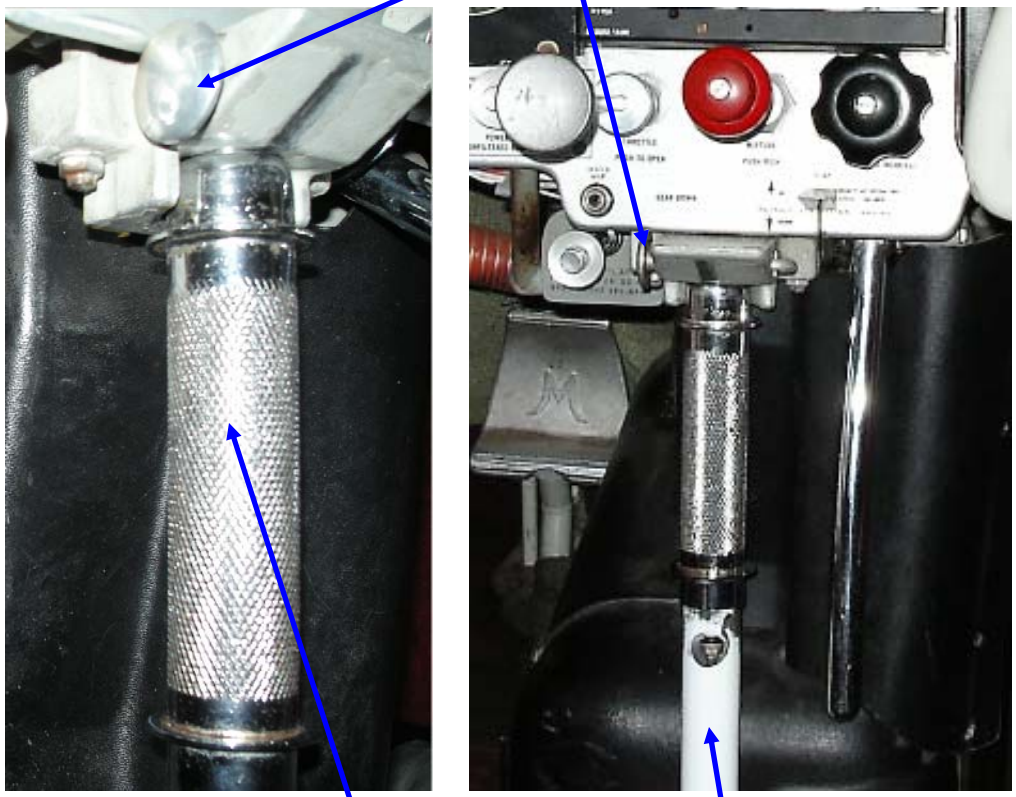
- Single engine, low wing 4-place retractable
- 74” Hartzell constant-speed prop
- Lycoming IO-360-A1A fuel-injected 4-cylinder, 200HP engine
- Max gross weight 2575 lb, Cabin load with full (52 gal) fuel and oil is 570 lb.
- Cruise 145+ KTAS
- IFR: Dual Navcoms, HSI, 2 GS, ADF, TXP, MB, STEC A/P with altitude hold.

Leap tall buildings – faster than a speeding bullet…

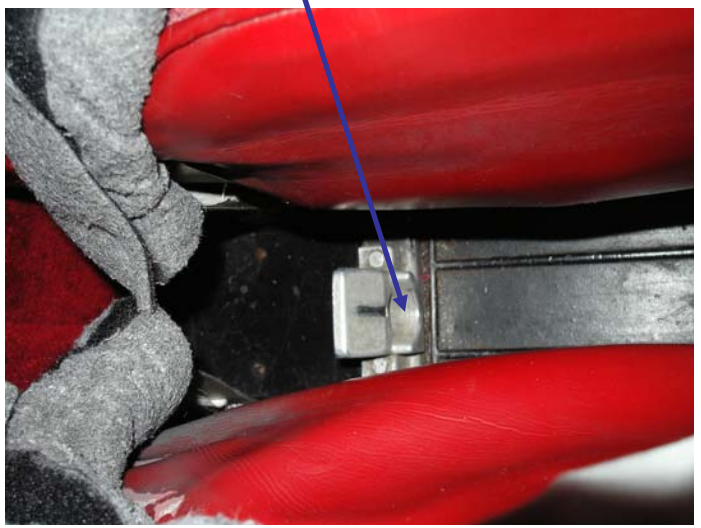
Departing Aspen…

Moving along…

Gear



Up-lock socket.



To retract the gear, depress the safety latch(*) and slide the gear handle downward out of the down-lock socket. Swing the Johnson bar rapidly to the floor and snap the gear handle into the up-lock socket.
Max speed is 120 mph, but the gear retracts much more easily at lower speeds.

To lower the gear, slide the gear handle out of the up-lock socket and swing the Johnson bar rapidly up the instrument panel. Snap the gear handle into the down-lock socket. Verify that it is mechanically locked by pulling down on the gear handle *without* pressing the safety latch.

(*) The latch will depress more easily if you momentarily push the gear handle towards the panel.

Gear indications.

The position of the gear is indicated by the lights on the panel above the airspeed indicator. These lights may be dimmed by rotating the lens housing to prevent glare at night. Press the lens housing to test the bulbs. The red indicator light will come on if the Johnson bar is not sufficiently engaged in the down and locked position, indicating an unsafe-to-land condition. The green light indicates that the handle is properly engaged in the gear down position, and that the gear is in the landing configuration. The thumb-operated safety latch on the down socket prevents unlocking of the gear unless it is deliberately released.

Gear down and locked:

(1) The green “gear down” light on the panel is illuminated. (Don’t trust this 100%)

(2) The gear horn will not sound if the throttle is idled.

(3) Pulling down on the gear handle (without disengaging the safety) does not unlock the gear.

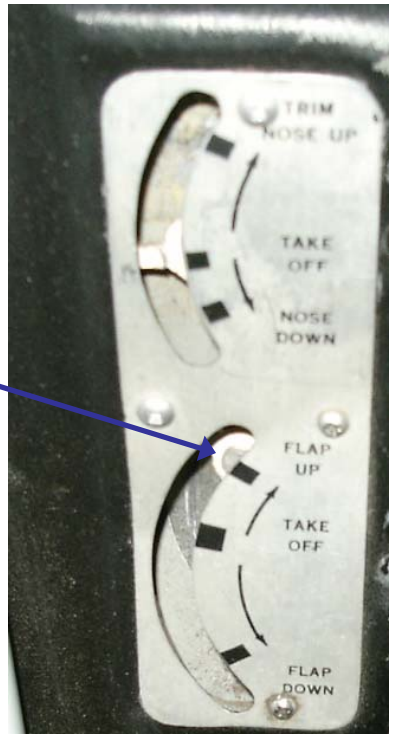
Note: There is no “emergency” extension procedure. It’s all manual.

Flaps

Flap pressure release lever

Flap position indicator

Flap hydraulic pump handle.



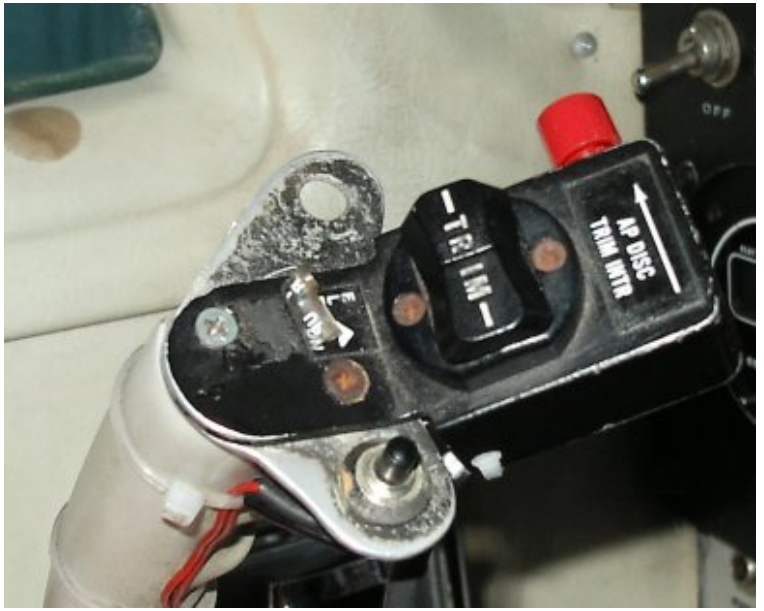
The flaps are hydraulically controlled by a hand-operated pump which actuates a hydraulic cylinder. A relief valve is provided which releases the flaps slowly as the springs (or air pressure) raises them. The hydraulic fluid reservoir is shared with the brakes and is mounted on the aft side of the firewall. To lower the flaps, depress the pressure release lever and pump the flap handle. (Two strokes for takeoff; four and one half strokes for full flaps.) To raise the flaps, lift the pressure release lever.

CAUTION. Do not leave the flaps full down when the aircraft is parked. Solar heating can expand the trapped hydraulic fluid and cause damage to the system.

Mooneys pitch DOWN with flap extension!

Trim

The Mooney's have no elevator trim tabs. The aircraft is trimmed by pivoting the entire empennage.

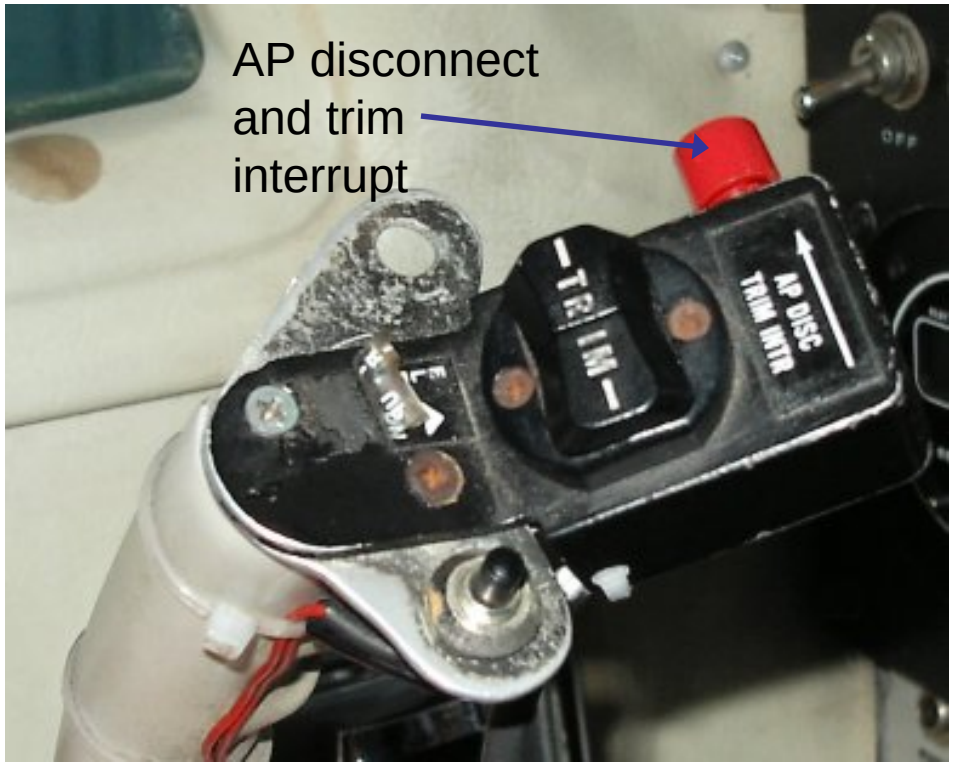


In addition to a manual trim wheel, N9351M has electric trim actuated by pulling or pushing on *both* sides of the split trim switch.

Three ways to de-power the electric trim…

Electric trim master switch

Electric trim CB.



Electric trim malfunctions:

EMERGENCY OPERATING PROCEDURES

In the event of a trim system malfunction or anytime the trim does not operate as expected, do not attempt to identify the system problem. Immediately depress and hold the trim interrupt switch on the pilot's control wheel. This will stop all trim action. Move the trim master switch on the instrument panel to the off position and manually retrim as necessary. Conduct the following-procedure:

Item	Action
1. Trim Master Switch	OFF
2. Manually retrim aircraft	
3. Trim circuit breaker	PULL
4. Release the interrupt switch	

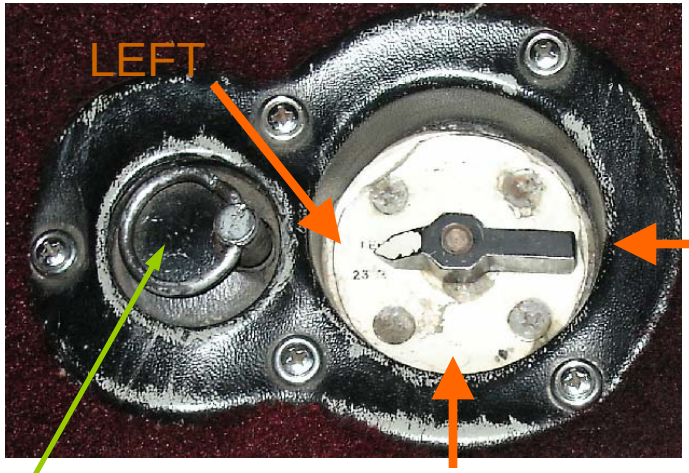
Do not operate electric trim system until the problem has been identified and corrected.

Electric trim preflight:

Item	Action
1. Check circuit breaker	IN
2. Master Trim Switch	ON
3. Trim Control Switch	1. Push forward for nose down trim. Pull aft for nose up trim. Observe normal operation. 2. Actuate each half of split trim switch individually - trim should-not operate unless both switch sections are operated together.
4. Interrupt Switch	With trim operating up or down, depress interrupt switch and observe trim operation stops while depressed.
5. Overpower Check	With trim operating electrically, grasp the manual trim wheel and overpower the electric trim to stop trim motion.

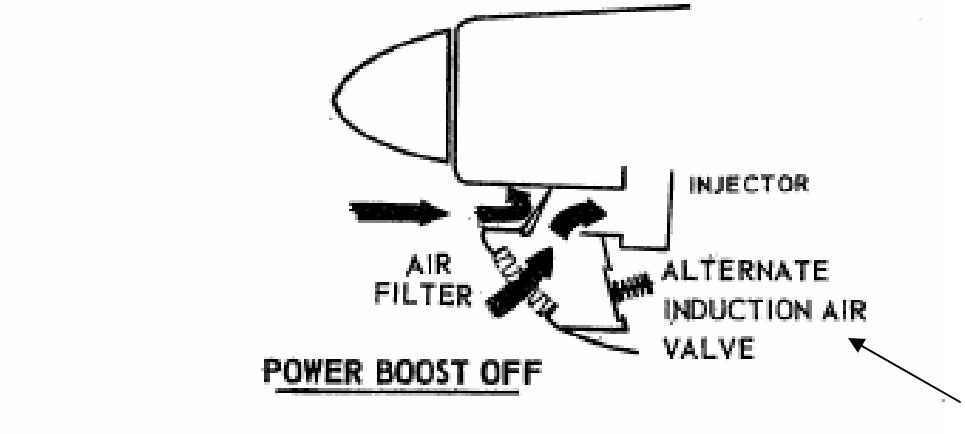
If the electric trim system fails any element of the above preflight procedure do not operate the electric trim system in flight until the problem is corrected:

Fuel System



- Two 26 gallon tanks – all useable – 100LL
- Switched Left-Off-Right on the floor in front of the pilot.
- Drain each tank sump at the fuel selector and at the tank drains.
- An electric fuel pump is used
  - For priming during engine starts
  - For takeoff and landing, to backup the engine-driven pump
  - If the engine-driven pump malfunctions

The Lycoming engine is fuel-injected.



Spring-loaded valve opens if air filter is blocked

- More even fuel distribution between cylinders
- No carburetor to ice up
- Automatic alternate air if the air filter is blocked by impact icing (don’t use “power boost!)
- Starting/priming procedures differ.
- Hot starts can be tricky…

Normal (cold) starting procedure.

- Mixture - Rich
- Prop - High RPM
- Throttle - Open ¼”
- Fuel pump - On 3-5 sec to prime engine (*)
- Mixture – Idle cutoff
- Starter – Engage
- Mixture – Rich as engine starts

(*) Longer prime in colder weather

Hot starts

- The engine can be tricky to start when hot. It helps to open the oil filler door when you anticipate restarting soon. Idle at 1000 RPM just prior to shutdown and then leave the throttle alone.
- There's almost as many techniques as CFIs. This one is recommended by MAPA.

- Fuel pump – OFF
- Prop - High RPM
- Throttle – Open ~1/4" (per 1000 RPM shutdown)
- Mixture –Idle cutoff
- Starter – Crank (may take 15-20 blades)
- Mixture – Smoothly rich as the engine starts.

The idea is to avoid flooding the engine and to eventually provide cold fuel via the engine driven pump.

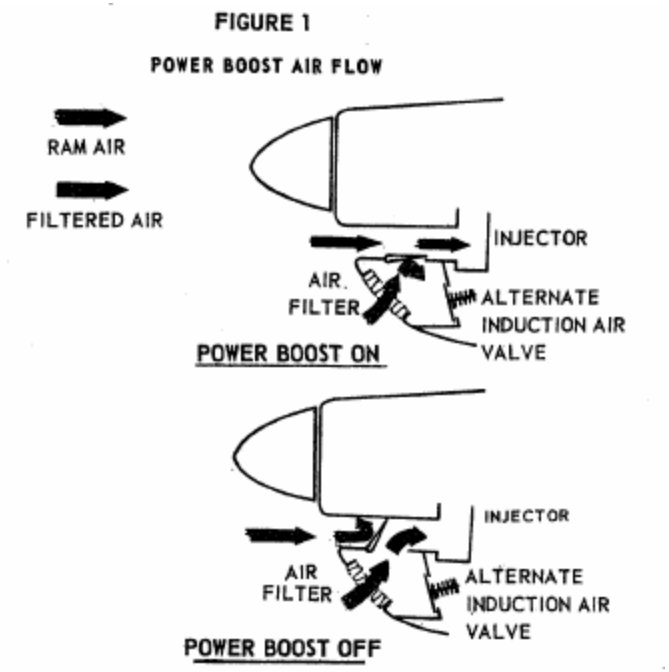
If this somehow fails deliberately flood the engine and try a flooded start….

Flooded starts

- Prop – High RPM
- Throttle – wide open
- Mixture – Rich
- Fuel Pump – ON for 3 sec *(just making sure we are flooded!)*
- Mixture – Idle Cutoff
- Starter - Crank
- Throttle – Slowly pull back towards idle as you crank
- When the engine fires smoothly increase the mixture to full rich

The idea here is at full throttle we are too lean to fire. As we pull the throttle back the mixture richens and we find the magic mixture…

Mooney's "Power Boost"



Turning on the "power boost" provides an increase in full throttle manifold pressure. Because the ram air is unfiltered, this should only be used at altitude in clean, dust-free air.

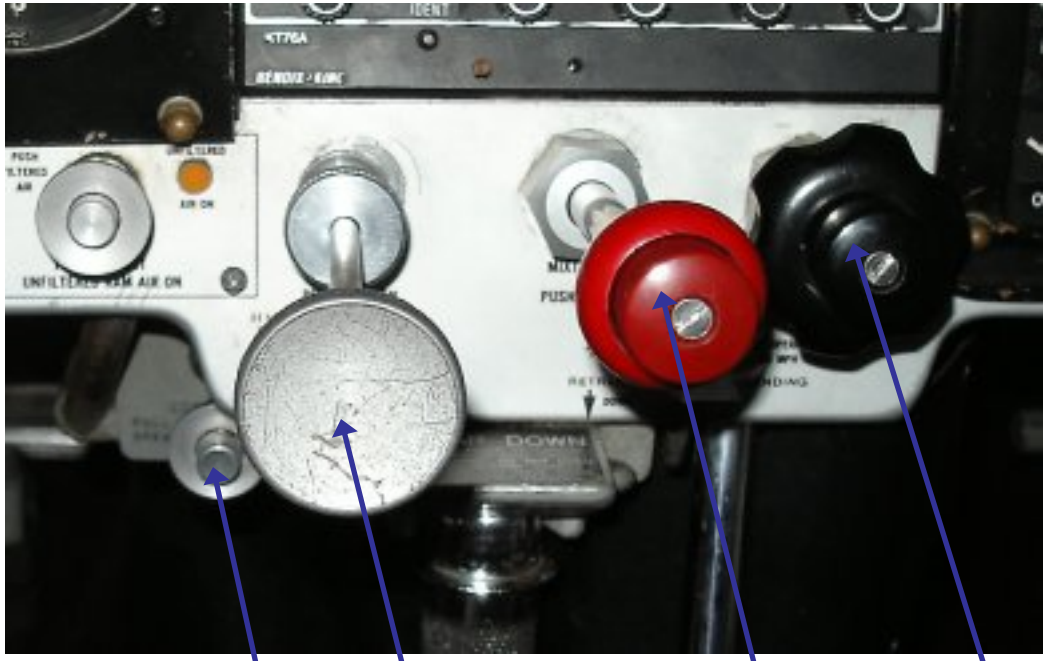
The power boost control is just to the left of the throttle.

Power boost ON warning light.

WARNING Turn “power boost” OFF in conditions where impact icing is possible.

Using unfiltered air when flying in snow or other IFR conditions can be hazardous. Snow can accumulate and/or moisture can freeze in the air intake and cause a loss of power. It is imperative power boost not be used when flying in sleet, snow, rain or moisture laden air in near freezing conditions. Under these conditions ice can form in the inlet duct or fuel injector unit even though no visible moisture is apparent on the airframe.

Cowl flaps should be open on the ground and during climb.



Prop control

Mixture

Throttle

Cowl flaps – pull open. Do not open above 160 MPH

(Scott Burkhart has found that 51M is actually somewhat faster in cruise with the cowl flaps ~1/3 open.)

The propeller is red-lined from 2100-2350 RPM

To avoid a vibrational resonance that can damage the engine and/or prop…
06M had a different prop/engine that removed this limitation.

Long range cruise is 1950 RPM/17” MP.
Normal cruise power settings have RPM in the 2350-2700 range.

Mooneys have relative low prop ground clearance. Be careful taxiing if it’s bumpy!

Vacuum system

The attitude indicator (and the step) are vacuum driven.

The panel has a suction gauge and low/high vacuum warning lights.

The HSI has a remote (KG-102) electric gyro.

51M has a King KI-525A HSI

King KI-525A HSI.

The slaving meter indicates the difference between the displayed heading and the magnetic heading. Right deflection indicates a clockwise error of the compass card. Left deflection indicates a counterclockwise error of the compass card. Whenever the aircraft is in a turn and the card rotates, this meter will show a full defection to one side or the other. *Note: During level flight it is normal for the meter needle to continuously move from side to side and to be fully deflected during a turn. tf the needle stays fully deflected, left or right, during level flight, the Free Gyro mode can be used to center it.*
To use free gyro mode, set the slaving switch to “free” and center the slaving meter with the CW/CCW drive switch.

King KA-51B Slaving meter/Compensator.

The heading is stabilized by a remote electric gyro slaved to a remote compass in the tail section.

Adjusts indicated heading CW/CCW in free gyro mode.

Slave/Free switch – set to “slave” if working OK.

Slaving meter – shows difference between indicated and flux-gate heading

and an STEC autopilot…

A/P master and test switch.

Annunciator window

Trim lights indicat the need for UP/ DOWN trim

Enable STB (roll) mode

Push to toggle STB/HDG modes
Turn knob.

Toggle altitude hold

A/P disconnect button on yoke.

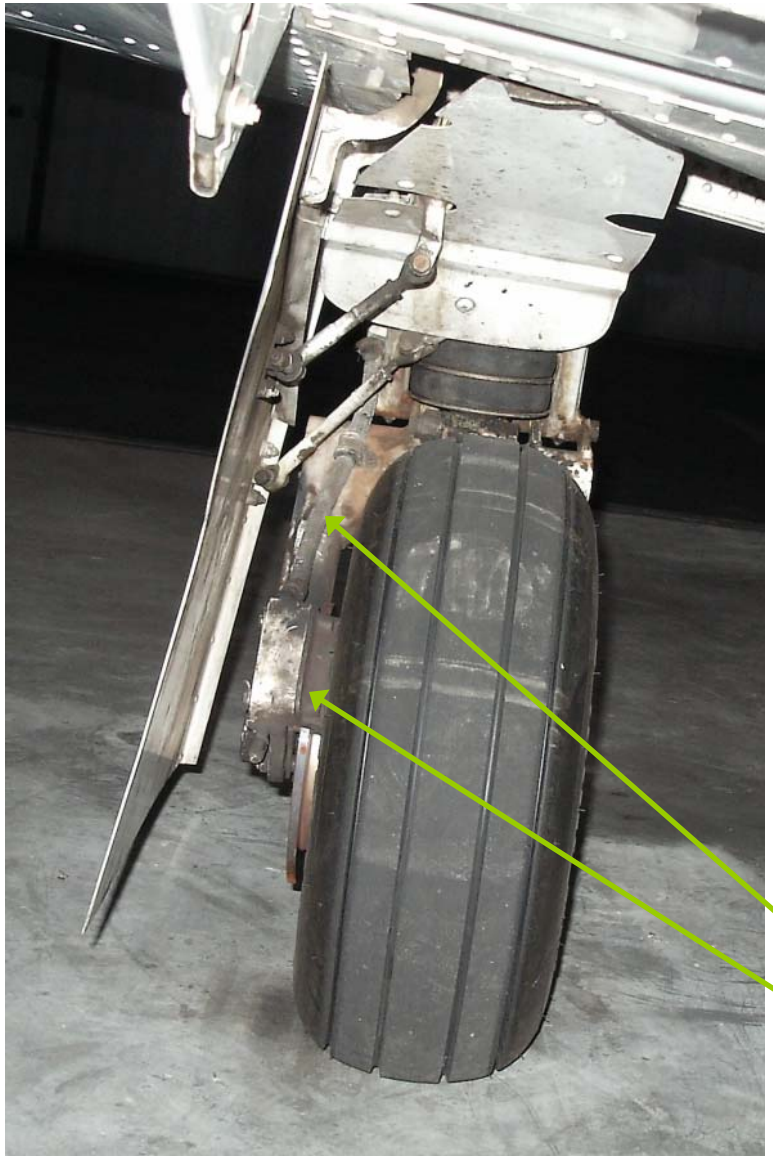
Engage VOR track

Engage APR track

Engage reverse APR track (LOC BC)

Read the manual!: http://williams.best.vwh.net/m20e/sys4050poh.pdf

Brakes



N9351M is equipped with hydraulic toe brakes on the pilot side only.

The parking brake is set by depressing the toe brakes and pulling the parking brake lock valve.

(Don't leave the plane parked this way – a temperature rise could over-pressure the hydraulic system. Use chocks!)

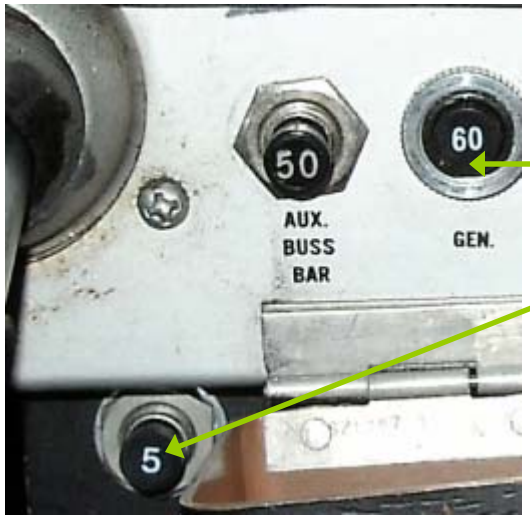
Keep your heels on the floor when landing. It's easy to land with the brakes on and scrub the tires.

Hydraulic line

Calipers

N9351M Electrical system

- N9351M has been retrofitted with an Interav belt-driven 60 Amp alternator.



Alternator

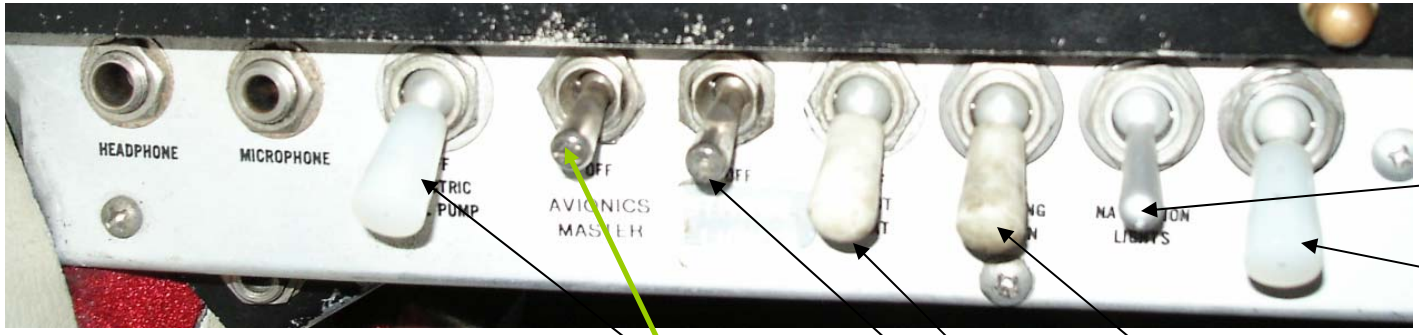
Alternator field?

- In addition to the factory ammeter, there is an Electronics International VA-1 volt/ammeter.

EI: With the master on and engine off, the discharge light will be on, the voltage should be 11.9-12.5V, and the ammeter will show -2.0 to -10.0A depending on the load.
With the master on and engine running, the discharge light should be off, the voltage 13.2-14.8V, and the ammeter will show the battery charging current of 5.0-15.0A and reducing rapidly. Adding load should not change the ammeter reading. (The “factory ammeter” is a load meter. The EI measures charging current.)

If the over-voltage relay trips, causing the discharge light to go on, cycle the master switch?

N9351M electrical - continued



Nav. Lights

Landing light

Electric Fuel Pump

Pitot heat

Rot. Beacon

Strobes

Don't run the pitot heat on the ground too long. It'll over-heat

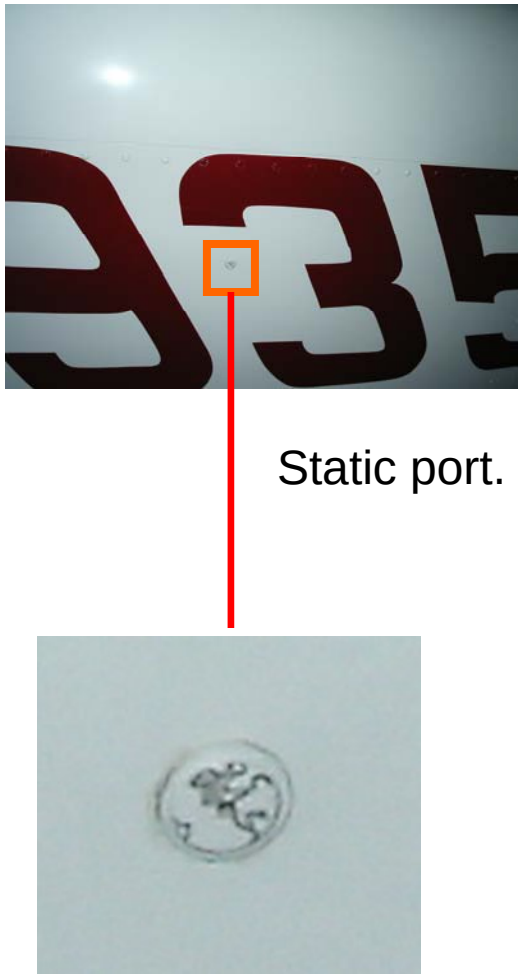
There are two paralleled avionics master switches for redundancy.

CBs are on the copilot side.

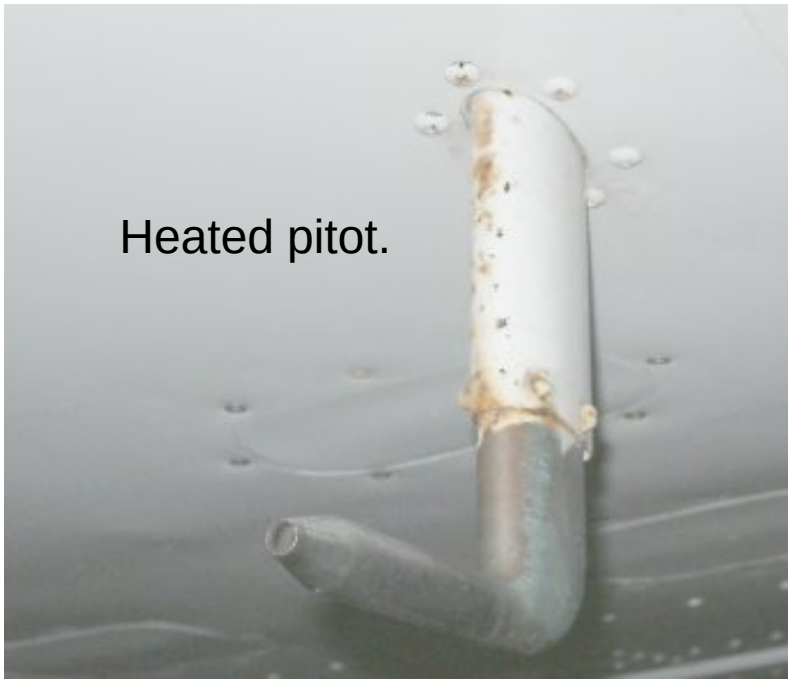
It’s very easy to do expensive damage to the nose gear truss by towing the airplane with a mechanical tug.

Caused by over-steering when towed by a tug with a solid tow-bar.
A dent of 1/32” (or more) is grounds for determining the truss un-airworthy.
Look where the tubing on the gear truss contacts the stop.

Pitot-Static system.



Static port.



Heated pitot.

No alternate static source… If you are desperate, break the glass on the VSI.