Mooney 201 Members Handbook
G-BJHB

Introduction

This Members Handbook has been written to bring together the historic Handling Notes, relevant Operational Notices, and the Avionics Guide developed when the G5/GFC500 installation was performed.

It gives a basic introduction to the Mooney 201 for members converting on to type, and acts as a revision aid for those members already qualified.

In the event of any confliction with the aircraft Flight Manual, the Flight Manual (including latest supplements) is the overriding document.

Version History

Version	Date	Author	Notes
0.1	23/04/2025	Steven French	Initial OCR of prior doc, format, and update
0.2	17/12/2025	Steven French	Updated Altimeter information

Table of Contents

General Specification

CLASSIFICATION

The Mooney 201 is an all metal, single engine, low wing land plane with retractable undercarriage.

DIMENSIONS

Wing Span	35 ft
Length	24 ft 8 ins
Height	8 ft 4 ins
Propeller Clearance	Approximately 12 ins (with MT 3 Blade Propeller)

UNDERCARRIAGE

Electrically operated retractable tricycle gear with rubber shock discs, steerable nose wheel and hydraulic brakes.

Wheel Base	5 ft 9.5 ins
Wheel Track	9 ft 0.75 ins
Turning Radius (No brakes)	41 ft
Tyre Pressure: Main	30 psi
Nose	49 psi

ENGINE

Lycoming IO-360 four cylinder, horizontally opposed, air cooled and fuel injected engine, with wet sump lubrication. Producing 200 BHP at 2700 RPM at Sea Level.

PROPELLER

MT Propeller 3-blade constant speed, hydraulically controlled propeller (MTV-12-B/180-59b)

FLAPS

Trailing edge Fowler flaps, electrically operated, infinitely variable between 0 and 33 degrees.

Take Off	15
Landing	33

MAXIMUM CERTIFICATED WEIGHTS

Max all up weight	2740 lbs
Empty weight (inc oil)	1857 lbs
Useful load	883 lbs

FUEL AND OIL

Total fuel capacity	66.5 US Gal (252 litres)
Total usable fuel	64 US Gal (242 litres / 384lb)
Grade	100 LL
Oil quantity	8 US Qts (6 Qts min, avoid over-filling beyond 7 Qts)
Grade	W100

Note:Fuel gauges are in lbs with direct reading gauges in the top surface of the fuel tanks in US Gal. Filler neck indicator (tab) = 25 US Gal usable. For reference 6lb per US Gal should be used for conversion. The direct reading gauges are NOT guaranteed accurate other than when the aircraft is sitting on the ground.

Performance

Figures are for the aircraft flown at max weight at sea level in still air temp + 10 C

Published figures are for a new aircraft flown by a professional test pilot. Pilots are advised to add a suitable safety margin, particularly when operating at or near MTOW, in above ISA-temperatures or at high-altitude airports. The Aircraft is fitted with a non-standard MT 3 blade propellor which may provide improved static thrust and climb performance as well as greater aerodynamic braking on landing but this is not guaranteed nor stated in the Supplemental Type Certificate (STC).

Take of run 15 Flap short dry grass Take off distance	1055 ft
Take off run 15 Flap paved dry surface Take off distance	1870 ft
Take off speed 15 Flap	63 KIAS
Initial climb speed 15 Flap	71 KIAS
Best rate of climb speed 0 Flap S.L. Best Rate of Climb S.L.	88 KIAS
Best Angle of Climb speed 15 Flap	1100 ft/min
Ceiling	20,000 ft
Max speed V.N.E.	198 KIAS
Max continuous speed V.N.O.	176 KIAS
Max range 75% power at 4,000 ft	831 NM
Max range 55% power at 4,000 ft	1003 NM
Stall speed clean	63 KIAS
Stall speed gear down 33 flap	55 KIAS
Best Glide speed (2740 lbs)	91 KIAS
Landing run 33 flap short dry grass	1311 ft
Landing distance	2408 ft
Landing run 33 flap paved dry surface	865 ft
Landing distance	1962 ft
Landing speed normal 33 flap	71 KIAS
Landing speed performance 33 flap	66 KIAS
Rough Air Penetration speed	120 KIAS

[all figures to be checked and updated if necessary]

Limitations

FLIGHT LOAD

Flaps up	+ 3.8g to -1.52g
Flaps down	+ 2.0g to-0.0 g

OPERATIONAL LIMITATIONS

Day or night V.F.R. / I.F.R.

Do not operate into known icing conditions

ENGINE LIMITATIONS

Max power		200 BHP
Max RPM		2700
Max cylinder head temperature		475 F (246 C)
Max oil temperature		245 F (118 C)
Oil pressure	Max	100 psi
	Min	25 psi
Fuel pressure	Max	30 psi
	Min	14 psi

Note: For engine longevity, the group specify a maximum cruise CHT of 400 F, around 2/3 of the green arc, in accordance with Lycoming published recommendations

PROPELLER LIMITATIONS

None (MT 3-Blade)

Propellor is NOT field serviceable, any nicks or dents cannot be “filed out” as with a conventional metal propellor.

UNDERCARRIAGE

Max speed for retraction	108 Kts
Max speed for extension	133 Kts

FLAPS

Max speed for lowering	115 Kts

RAM AIR CONTROL

Do not use unless in clear air, i.e. above the haze layer and clear of cloud. Only worth using once already at full throttle for 75% power, which is about 5,500 ft. Remember to close this before reducing throttle on descent. The ram-air must be closed when operating in cloud, rain, or visible haze.

MIXTURE

Only lean at power settings of 75% or less.
Lean mixture until temperature peaks on E.G.T. gauge.
Then economy cruise: Enrich mixture until E.G.T. drops 25 F or more below peak. Best Power mixture is 100 F below peak – consult performance charts.

SPINNING

The aircraft is not approved for spinning.

AUTO PILOT

Not to be engaged below 800 ft unless coupled to the ILS or GPS in approach mode with the aircraft in the landing configuration (max 15 flap) and then not below 200 ft A.G.L.

The GFC500 autopilot is a sophisticated piece of equipment, integrated with the G5 PFD and HSI, and offers underspeed, overspeed, and envelope protection even when not engaged. Please ensure that you fully read and understand the supplementary information on the operation of these systems provided as Annex-A to this document.

ALTIMETERS

The aircraft is fitted with 3 altimeters, 2 mechanical altimeters and the altimeter tape on the G5 PFD.

It is important to realise that the G5 altimeter tape is NOT PRIMARY CERTIFIED and should be considered as “reference only”. Accordingly the mechanical altimeters are the certified primary reference for IFR flight and should be checked and evaluated for accuracy and agreement in accordance with the regulations pertaining to your flight.

Note that the knob for setting the subscale on the 2 mechanical altimeters operate in opposite directions. There is a risk of a error when adjusting to the QNH that it is very easy to turn them both (for example)1 hPa in the same direction, which results in the altimeters being 2 hPa apart.

Visual and Audible Warnings

ANNUNCIATOR PANEL WARNING LIGHTS

Gear Down	Landing gear is down and locked.
Gear unsafe	Landing gear is not fully extended or not fully retracted.
Left or Right low fuel	Approx 2.5 to 3 US Gal remaining in respective tank.
VAC (Flashing)	Inoperative (Vacuum system removed).
Volts (Flashing)	Low voltage.
Volts (Steady)	Over voltage or the voltage relay has tripped.
Ram Air	Ram air is open when the landing gear is fully extended.
Area Nav	Inoperative.

INSTRUMENT PANEL

[This section requires update since removal of old autopilot & avionics upgrade]

Trim Warning	[does this still exist, is it now a GFC warning?]
Starter Engaged	Shows starter running – confirm out after start

AUDIBLE WARNINGS

Continuous Horn	Stall Warning
Intermittent Horn	Gear unsafe with low manifold pressure or airspeed below 57 Kts.
High Pitched Whistle	Electric trim failure.
“Dee Dah Dee Dah”	GFC-500 Autopilot disengage
Long Single Beep	GFC-500 various alerts including: 1000 ft to target altitude 200 ft from target altitude
Voice Call-Outs	GFC-500 envelope protection

Please refer to Annex-A and the G5 and GFC-500 user manuals for full explanation and understanding of all audible warnings from the new avionics, including underspeed and overspeed warnings and the behaviour of the units in these situations.

Panel Diagrams

[need an updated panel layout diagram – maybe AI can create one from a photo?]

Normal Operation

BRAKES

Toe brakes are fitted to the left hand rudder pedals only. They can be used independently for differential braking.

PARKING BRAKE

TO APPLY:	Depress toe brakes firmly then pull parking brake knob then release toe brakes. This will lock the applied brake pressure in the system.
TO RELEASE:	Push park brake knob in.
WARNING	Park brake will not be applied if parking brake knob is pulled without first applying toe brakes. When parking for an extended period release bakes after chocking the aircraft to relieve pressure in the system.

FLAPS

Electrically operated by a switch on the right hand side of the centre console, next to the flap and trim indicators. The switch has 3 position. Up, centre Off and Down. The switch is spring loaded from the Down position to Off.

TO LOWER FLAPS:	Depress switch and hold until flaps reach the required position, then release switch.
TO RAISE FLAPS:	Place switch to the up position, the flaps will run fully up. If an intermediate position is required place the switch to the off position when the required setting is reached.

COWL FLAPS

These are used to control the cylinder head temperature by changing the amount of cooling air flowing around the engine. When closed the airflow is reduced. At low speed and high power they should be open to increase cooling flow. There is a half-open position which can be used once in cruise climb or for use in the circuit – continue to monitor cylinder head temperatures aiming to keep them below 400F (around 2/3 of the green arc) other than takeoff & initial climb.

Select half-open cowl flaps on final, it's one less thing to worry about if a go-around is required.

NORMAL OPERATION

Cowl flaps are normally closed during start and warm up, they should be opened fully once the oil temperature is in the green range, and MUST be opened prior to take off.

They should be left open during low speed climb, once a cruise climb is established they can usually be selected to half open.

When established in the cruise they can normally be closed, subject to ambient conditions. They will then only normally require opening again due to further climb, or after landing.

In warm conditions, it may be necessary to trail half open cowl-flaps to maintain CHT and Oil temperature within the mid-arc range. This is more satisfactory than overly enrichening the mixture at lowering both temperatures and allows optimum leaning for predictable fuel-burn.

In the event of a go around they should be opened to at least the half open position as soon as safely possible.
For circuit work they can normally be left half open without risk of exceeding the cylinder head temperature.

ENGINE CONTROLS

There are three engine controls, throttle, mixture, and propeller. They are of the plunger type.

The mixture and propeller have vernier adjusters, for fine adjustment they can be rotated, clock wise to increase and anti clock wise to decrease. For coarse adjustment a plunger in the end of the knob can be depressed and the control pushed in or pulled out.

Engine controls should be operated with a steady continuous movement, avoid rapid and overly forceful movement of any of the controls. The MT composite propeller is considerably lighter with lower inertia than a metal prop, and spins up very quickly so caution should be used to avoid overspeed conditions through excessively rapid throttle up.

PROPELLER

The propeller is variable pitch, controlled by a governor, set via the pitch control in the aircraft.

PITCH CONTROL

FULLY FORWARD	The propeller goes to the fully fine position (max RPM)
FULLY AFT	The propeller goes to the fully coarse position (min RPM)

The control is infinitely variable between the two positions.

SETTING ENGINE POWER

Because the engine is fitted with a variable pitch prop, the engine power is set by a combination of Manifold Pressure and RPM.

The manifold pressure is set by the throttle and the RPM is set by the pitch control.

INCREASING POWER	Set RPM first and then set manifold pressure.
DECREASING POWER	Set manifold pressure first and then set RPM.

A way of remembering this is to remember increasing power REV UP i.e set RPM first.
Decreasing power THROTTLE BACK i.e. set manifold pressure first.

Consult the power setting tables in the aircraft Flight Manual for permitted combinations of MP and RPM at various altitudes, however it is convenient to remember 25”/2500 RPM is approximately 75% power and 24”/2400RPM is approximately 65% power. Generally it is good practice to keep MP no higher than RPM although other valid settings are available as set out in the Flight Manual.

ENGINE STARTING

The engine is fuel injected and therefore requires a specific technique for starting.

COLD START

Set pitch control fully forward. Set throttle 1/8" open. Mixture fully rich.
Switch fuel pump on and establish fuel pressure for a full 5 seconds, fuel pump should then be switched off and the mixture set to lean. The starter should then be engaged and when the engine starts the mixture should be pushed smoothly to fully rich.

WARM START

The engine does not need priming therefore set pitch fully forward, throttle 1/8" open and mixture fully lean. Engage starter, when engine starts smoothly push mixture fully forward.

FLOODED ENGINE

Set throttle fully open, mixture fully lean and pitch fully forward. When engine starts smoothly close throttle, and then smoothly push mixture fully forward.

The mixture should leaned for taxi and ground operations (other than power checks) to avoid fouling the spark plugs. Leaning until EGT is observed to begin to rise is a good starting point. Remember to reset full rich mixture before conducting power checks.

POWER CHECKS

The power checks are normal, but with the addition of the function check on the variable pitch propeller. While the engine is running at 2,000 RPM pull the pitch control fully aft and check the RPM decays. As the engine speed decays to 1500 RPM push the pitch control fully forward. This should be carried out twice on a cold engine, to ensure warm oil is circulated to the prop, but only once on a warm engine. Avoid allowing the RPM to decay below 1500 as this puts considerable strain on the constant-speed unit.

Then set the engine to 1500 RPM and again pull the pitch control fully aft. As the RPM decays to 1200 push the pitch control fully forward. This needs only be carried out once on a cold engine.

TAKE OFF

Take off technique is normal all engine controls should be fully forward. Rotate the aircraft at 63 Kts and then allow to accelerate to 71 Kts. Once a positive rate of climb has been established, depress toe brakes to stop the wheels spinning and then select the undercarriage up.

CLIMB

Once above 250 ft or any obstacle with the speed accelerating toward 90 Kts, select the flap to 0. Once the flaps have reached 0 climb power can be set 25" HG 2500 RPM (75% power). This is done by slowly pulling the throttle aft, until 25" HG is indicated on the manifold pressure. Then rotate the pitch control anti clockwise until 2500 RPM is indicated.

The engine mixture can then be leaned at 75% power or less.

At high ambient temperatures with max weight 26" HG 2600 RPM can be used for initial climb. But do not lean until power is reduced to 75%.

Re adjust manifold pressure every 1,000 ft in the climb

CRUISE

Select power for required performance, 75% or less. Check cylinder head temperature and close cowl flaps.

Fine tune mixture for best economy cruise.

DESCENT

RPM can be left in selected cruise position. Retard throttle as required to give desired rate of descent and airspeed. Enrich mixture as necessary to maintain Rich of Peak EGT during the descent. Close RAM AIR before beginning to retard throttle.

At the end of descent select required power and re lean mixture.

THE CIRCUIT

Set power to give a speed compatible with circuit traffic, allow some time for the aircraft to slow down. Unlike lower performance aircraft, the Mooney has low drag and will take considerably longer to slow, especially if high descent speeds have been used.

DOWN WIND

Additional items: Check speed is below 133 Kts and select gear down, check the green light is on. Check RAM AIR closed. Late down wind check speed below 115 Kts and select flap to 15. As you run flap down select nose up trim at the same time, this will keep the aircraft in trim

BASE LEG

Reduce power and then select mixture fully rich and pitch fully fine

FINAL

Select full flap, final gear check, aiming for 75 Kts over the threshold.

GO AROUND

Full throttle accelerate to 75 Kts, when positive climb is established select gear up. Accelerating to 90 Kts select flaps to 0 and open cowl flaps to at least half.

Note: After landing select cowl flaps fully open.

Shut down checks are normal. Complete the pre shut-down checklist, making sure the radios are switched off by using the radio master switch prior to setting 1,000 RPM and pulling mixture fully lean.

POWER SETTINGS

There are many different combinations of manifold pressure and RPM for a particular power setting listed in the aircraft Flight Manual.

Some useful rules of thumb are as follows:

75% power	25" HG 2500 RPM	Normal climb and max cruise this will be good up to about 5,500 ft.
65% power	24" HG 2400 RPM	
55% power	22" HG 2200 RPM	A good initial setting for the circuit at max weight

Avionics

The aircraft is fitted with a significantly modernised avionics navigation and autopilot suite which takes time and practice to utilise fully and with confidence. Care should be taken to read the manuals and practice with simulators where available (the GTN750 has an excellent iPad simulator available for example) before depending upon them in-flight.

[Things we might want to consider highlighting here specifically:

- G5 failover event / battery backup
- Autopilot basics (IAS for climb, VS for descent etc)
- Alerts and alarms
- Incorporate Alan's manual for the G5/GFC500 upgrade as Annex-A with a tidy up]

Mass and Balance

USEFUL LOAD

The useful load for our Mooney is 883 lbs (including 2.5 US Gal unusable fuel). If we fill the fuel tanks they will take 64 US Gal usable. On an average day this will weigh 384 lbs, when this is subtracted this from the useful load it will leave 499 lbs that can be made up of people and baggage.

As you can see it is very important to keep an eye on the aircraft load. For this reason it is planned to always leave the aircraft with a part fuel load of 40 US Gal, i.e. 20 US Gal per side. There are fuel gauges in each wing next to the fuel filler port for this purpose.

40 US Gal equals 37.5 US Gal of usable fuel. This will weigh 225 lbs and will leave 658 lbs for occupants and baggage.

This for example would allow 2 @ 12 st (76.2kg) and 2 @ 10 st (63.5kg)+ 42 lbs (19kg) of baggage.

Note: The standard onboard equipment (eg: spare oil, spark plug kit, external power cable, tiedown rachets, ground anchors, logs, paper towel etc) and optional items (Raft, life jackets etc) must be factored into the useful load (ie: added as luggage or on a seat). An Excel spreadsheet containing the weights is provided, and a copy appendixed to this document.

C of G POSITION

To calculate the C of G position it is necessary not only to calculate the all-up weight but also the total moment.

To calculate the moments you can either enter the loading computation graph and extract the moment for the particular position and weight.

Or calculate by multiplying a particular weight by the Station where it is acting. i.e. basic weight 1857 x STN No 47.32 = 87.87 x 10^3. This is carried out for each seat, fuel and baggage, the moments are then added together.

You can then enter the graph of aircraft weight verses total moment to check that the C of G falls in the shaded area.

If you wish to calculate the C of G position in inches AFT of the datum you have to divide the total moment by the total weight.

You can then check that it is between the forward and aft limits, on the C of G limits envelope.

To make life easy the fuel gauges on the instrument panel are calculated in lbs

STATION POSITION

Basic weight	46.10 @ 1,857 Lbs
Front seats fully forward	32.75
Front seats fully aft	39.00
Rear seats	70.70
Fuel	48.43
Baggage area (120 lbs max)	95.50
Hat rack (10 lbs max)	119.00

Note: The calculations in this section have been based on the following SG:

OIL	7.58 Lbs/US Gal = 1.9 Lbs/US Qt.
FUEL	6 Lbs/US Gal.

The Basic Weight of the aircraft assumes the engine sump contains 8 US Qts. It is the Group's policy to operate with a maximum of 7 Qts due to engine breathing.

This allows you to increase the useful load by 1.9 Lbs.

Note: The basic weight and moment of the aircraft includes 2.5 US Gal of unusable fuel. Remember to subtract the unusable fuel from your total fuel on board when calculating the weight and index of fuel.

The current basic weight of the aircraft is 1857 Lbs.
The current basic moment of the aircraft is 85,607 lb-inch or 85.61 lb-inch/1000 as used in the Mass and Balance calculation.

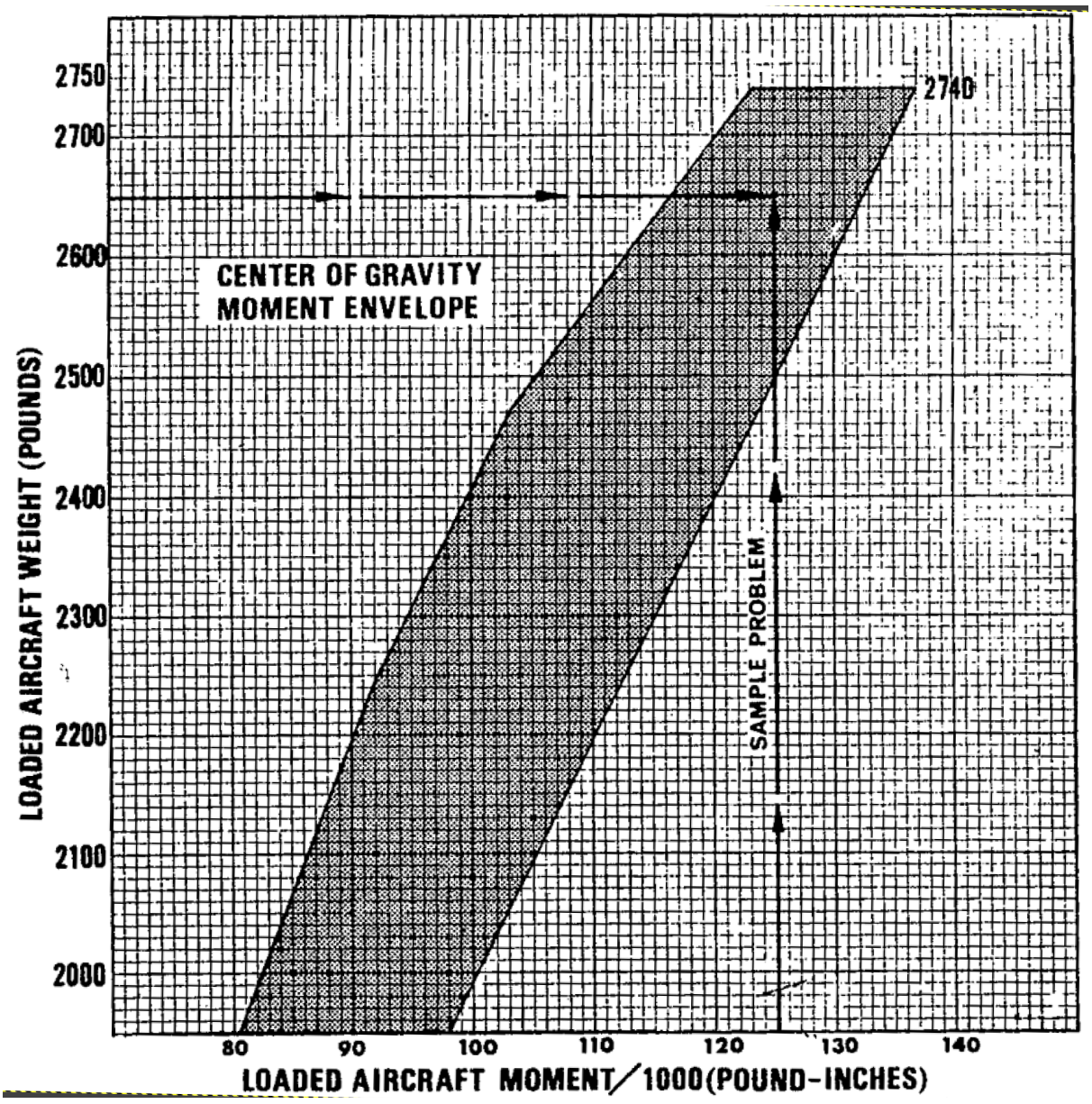
If you have time it is more accurate to calculate it the long way

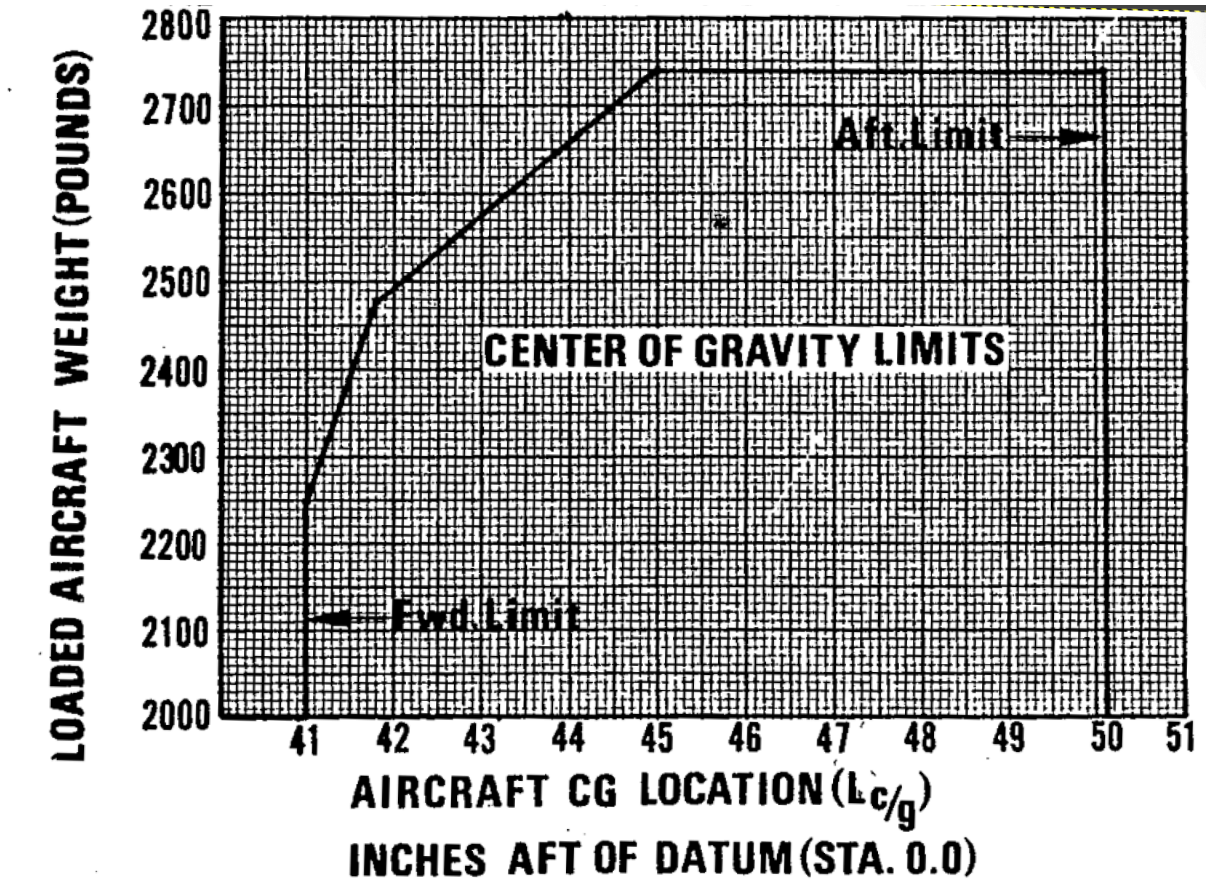
Sample Mass & Balance Form

Step	Item		Sample Problem		Your Problem	
			Pilot & Two Pass			
		Arm	Weight (lbs)	Moment (lb-inch/100)	Weight (lbs)	Moment (lb-inch/100)
1	Aircraft Basic Empty Weight, Includes Full Oil, & 2.5 USG unusable fuel.	46.10	1,857.00	85.61		
2	Pilot Seat (Arm 32.75 fwd - 39.00 full aft - 6 stops)	33.00	200.00	6.60		
3	Copilot Seat (Arm 32.75 fwd - 39.00 full aft - 6 stops)	34.00	200.00	6.80		
4	Left Rear Seat	70.70	25.00	1.77		
5	Right Rear Seat	70.70	170.00	12.02		
6	Baggage (Max 120lb)	95.50	40.00	3.82		
7	Hat Rack (Max 10lb)	110.00	6.00	0.66		
8	**Zero Fuel Weight**		**2,498.00**	**117.27**		
9	Fuel (Max Usable 64 USG @ 6lb/USG (384lb)	48.43	240.00	11.62		
10	**Takeoff Weight**		**2,738.00**	**128.90**		

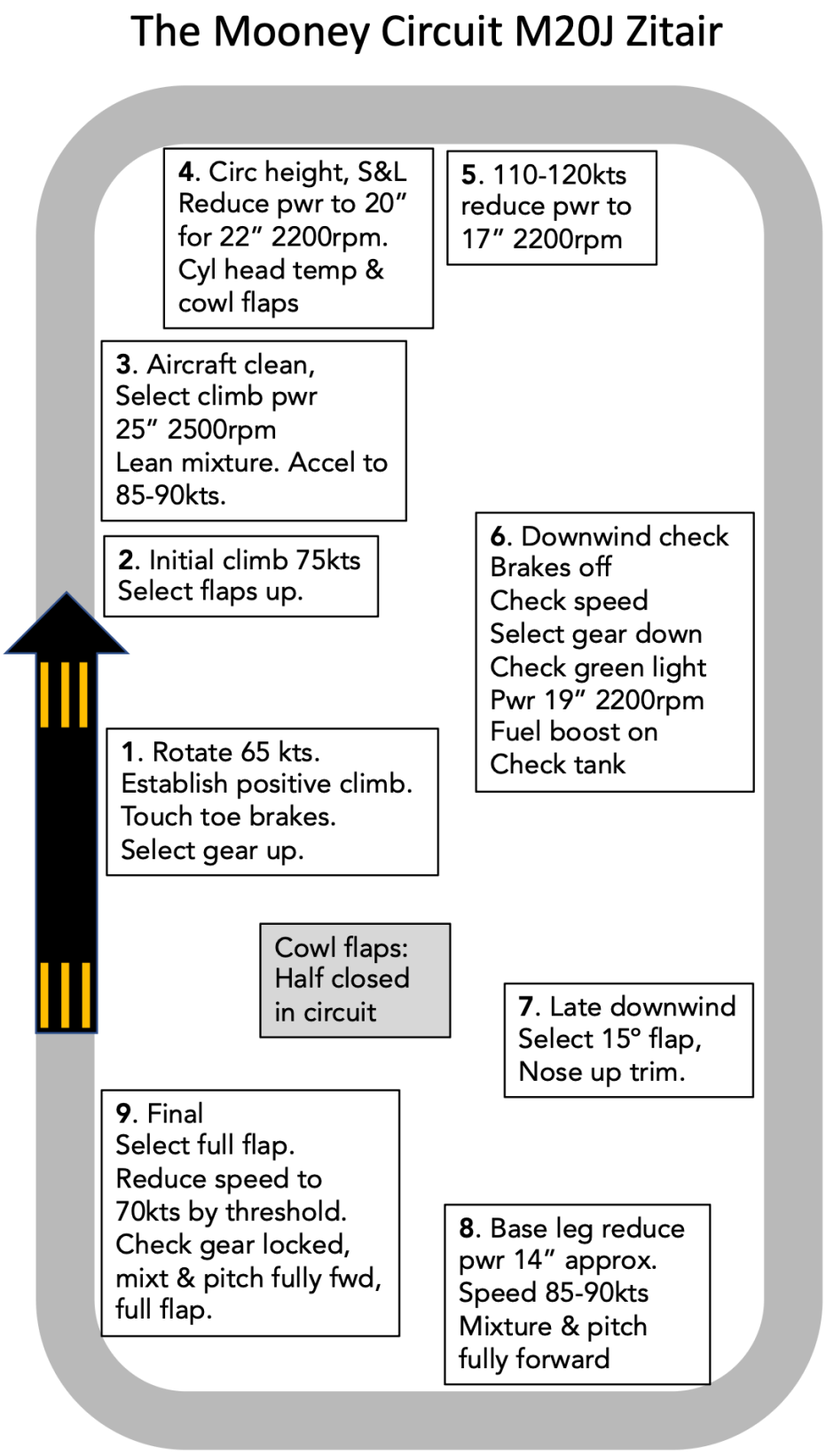
Refer to page 126 (Section 6-8) of the Pilots Operating Handbook to confirm that the Takeoff Weight/Moment and Zero Fuel Weight/Moment are within the envelope shown below

POH Mass & Balance Graphs




LOADED AIRCRAFT WEIGHT (POUNDS)
2800
2700
2600
2500
2400
2300
2200
2100
2000
Aft. Limit
CENTER OF GRAVITY LIMITS
Fwd. Limit
41
42
43
44
45
46
47
48
49
50
51
AIRCRAFT CG LOCATION ($L_{c/g}$)
INCHES AFT OF DATUM (STA. 0.0)

The Mooney Circuit



Equipment in Baggage Compartment

A useful calculator in Excel form is available on the website showing all the standard weights for the onboard equipment, including qty and location.

G-BJHB Mooney M20 Baggage Weight Calculator

Baggage Items	Baggage Weight (kg)	Baggage Weight (lb)	Include on Trip?	Position	Number	Flight Weight (kg	Flight Weight (lb)
Document Folder and POH	2.665	5.863	Yes	Hat Shelf	1	2.6650	5.8630
PLB	0.370	0.814	Yes	Rear Seat	1	0.3700	0.8140
First Aid Kit	0.925	2.035	Yes	Rear Seat	1	0.9250	2.0350
Crate (with 1 engine oil bottle)	2.213	4.869	Yes	Cargo	1	2.2130	4.8686
Additional Engine Oil Bottles (full)	0.898	1.976	Yes	Cargo	3	2.6940	5.9268
Blue Paper Roll (new)	0.374	0.823	Yes	Hat Shelf	1	0.3740	0.8228
Tow Bar	0.752	1.654	Yes	Cargo	1	0.7520	1.6544
Jump Leads	3.354	7.379	Yes	Cargo	1	3.3540	7.3788
Spark Plug Change Kit	1.841	4.050	Yes	Cargo	1	1.8410	4.0502
EAA Ground Stakes (each)	0.345	0.759	Yes	Cargo	3	1.0350	2.2770
EAA Rachet Strap (each)	0.420	0.924	Yes	Cargo	3	1.2600	2.7720
Spare Head Sets x2	1.426	3.137	No	Hat Shelf	1	-	-
Sundries (screen shield, leather gloves, 4 x hi viz)	0.774	1.703	Yes	Hat Shelf	1	0.7740	1.7028
Sundries (rear seat pockets)	0.775	1.705	Yes	Rear Seat	1	0.7750	1.7050
Liferaft	11.300	24.860	Yes	Rear Seat	1	11.3000	24.8600
Air Compressor	0.653	1.437	Yes	Cargo	1	0.6530	1.4366
Life Jacket, large x1	0.894	1.967	Yes	Front Seats	2	1.7880	3.9336
Life Jacket, compact x1	0.574	1.263	No	Front Seats	2	-	-
		Total Flight Weight				**32.7730**	**72.1006**
		Weights for Weight & Balance				**KG**	**LB**
		Hat Shelf				3.8130	8.3886
		Cargo				13.8020	30.3644
		Rear Seat				13.3700	29.4140
		Front Seats				1.7880	3.9336

The above equipment is generally in the aircraft, with the exception of life raft and life jackets which are stored in the locker. Be conscious that some of these items are per *each*, eg: there are 3 ground stakes and 3 rachet straps, the weight is per each.

Due to the significant weight of some of these items, consider them when performing your mass and balance calculations.

If necessary remove and stow unnecessary equipment in the locker at Wycombe, while ensuring you are not at risk with a lack of extra oil for example.

General Notes, Guidelines, and Warnings

Remember to take your feet off the brakes on final. Landing with a bit of brake applied risks flat-spotting the tires which are expensive to replace. On one occasion a tyre has burst on landing for this reason.

Use extreme caution when considering a landing on unpaved runways. The ground clearance with the MT propeller is better than the standard aircraft, but is still relatively limited, meaning the risk of a prop-strike is significant on a poor surface. A prop-strike will likely entail an engine teardown at very significant cost. The group generally recommend not landing on unpaved surfaces where avoidable, and not until well experienced with the aircraft in any case.

Firmly resist any ATC, AFISO or Radio service directions to taxi over unknown grass surfaces for the reasons above, particularly at Wycombe where the grass area is in poor condition. If absolutely necessary use extreme caution, low speed, and full aft elevator.

Exercise caution when crossing grass/pavement junctions, there can often be a “step” which creates a prop-strike risk. A good example of this is Denham (EGLD) where there can be a height difference of 1-2 inches between the grass area and the paved runway. It is good technique if possible to cross such junctions at a 45 degree angle to give you maximum prop clearance.

Mooney’s speed comes primarily from low-drag, not an abundance of power. Care should be used to plan descents well in advance as it can take some time to bleed off airspeed once level. Mooneys do not carry ice well, and even a small amount of ice has a very significant impact to the aircraft’s ability to maintain altitude. Ice encounters should result in an immediate action to descend (safely, not below MSA) or reverse course out of icing conditions.

In descent it may be necessary to reduce power to avoid overspeed, particularly in turbulent air, the Mooney will very quickly reach the top of the green arc with cruise power set if you just command a 500 fpm descent on the autopilot. Avoid shock cooling the engine with rapid power reductions and long low power descent. Plan ahead and gradually reduce manifold pressure throughout the descent. Pulling back 1” every 30 seconds or so works well. Plan to arrive at your target altitude a mile or two early to give speed time to bleed off.

Ensure when towing or steering the aircraft on the ground with the towbar that the nosewheel turn-radius limits are observed – these are indicated on the front of the nose-gear. Turning the nosewheel past these limits with the towbar will result in significant (expensive) damage to the internal mechanism. Be especially vigilant when others such as ramp-staff or passengers are assisting with ground handling.

There is little purpose filling the oil beyond 7 quarts, as it is quickly vented overboard through the engine breather and all over the belly. Generally a half-quart more frequently when the level gets close to 6 quarts is better than a large top up. 6 quarts is the departure requirement, not the arrival requirement. Give the engine at least 30 minutes for oil to return to the crankcase after flying before measuring the oil level. It can take several hours for oil to fully drip down from the top of the engine to the sump. Experience with W100 oil has shown that the oil reading can increase by up to ½ a quart overnight due to the higher viscosity of this oil over multigrade taking a long time to fully drip down into the oil pan.

Ensure the aircraft log is completed fully and accurately after each flight, and any defects noted. If in doubt contact the committee in the event of any defects being found so that appropriate action can be taken.

Ensure the engine-oil is wiped from the nosewheel gear doors and belly area after each flight. Paper towel is in the aircraft for this purpose.

Spend the time to wash at least the leading edges, prop, and cowling front if you've been flying in warmer weather and insects are present. It's a lot easier to get the insects off with some soap and water while they're fresh than weeks later. The insects contain enzymes that eat into the paintwork over time. Buckets, sponges, suitable soap, insect remover and hose are all present in the locker. There are several taps located near the hangar on the airfield which can be used.

Only use the Perspex cleaner and clean microfibre towels supplied for cleaning any of the windows and the windscreen. Do NOT use paper towel, as it will scratch the windows. Additional microfibre towels are stored in the locker, you are encouraged to swap out dirty ones before or after flying.

Please leave the aircraft as you would wish to find it. Remove rubbish, ensure it's properly configured (all switches off, fuel off, brakes as necessary, seatbelts tidied, etc).

Return the Raft and Lifejackets to the locker after flight, unless agreed with the next user.

Refuel to 20 USG per side, as indicated by the wing gauges, this ensures that a subsequent user should have sufficient useful load remaining for most normal flights.

If you have used oil on your trip, discard any empty bottles, and replenish the supply in the aircraft from the locker. If supplies are getting low, advise the committee.

Annex-1 G5 and GFC500 avionics detailed instructions

Introduction

This section is a highly condensed set of key relevant information for pilots. All pilots should fully read the operating manuals for the G5, GTN750, and GFC500 autopilot systems before operating the aircraft. This section contains key information for initial training or refresher purposes. The current Garmin Manuals, Flight Manual and Supplements take precedence over this document at all times.

The group recommend that everyone become fully familiar with the equipment and able to use the equipment confidently and instinctively in day VFR before undertaking flight at night or in IFR conditions.

System Diagram

The following diagram is a useful reference in understanding the the overall avionics installation and also useful in the event of needing to troubleshoot problems or errors.

Key Principles for EFIS

- Distraction is the number one threat to pilots converting to Electronic Flight Instrument Systems (EFIS).

  New features can focus our attention and consume mental capacity at the expense of lookout and situational awareness. Much of the group's flying is VFR outside controlled airspace and we should be "head up" and "eyes out" most of the time.

- It is still the same aeroplane and flies the same.

  Displaying heading, airspeed and altitude to a greater level of precision can lead to a desire to fly the aircraft more accurately and even greater fixation on the instruments. More accurate isn't always better, especially if it leads to a mid-air collision.

- When using the autopilot, understand the Flight Mode Annunciator (FMA)

  Pressing a button on the autopilot controller does not guarantee the desired mode is engaged. The only way to confirm the modes in use is to check the Flight Mode Annunciator (FMA).

  When you do something here **Confirm the desired mode here**

- If the autopilot isn't doing what you want it to, or you don't know what is happening, disengage it! There are several ways to disengage the autopilot but the yoke mounted button should always be the primary method.

- If you are flying manually with the flight directors displayed and are not following them, switch them off. Irrelevant information can be confused with other indications and presents a distraction.

Is Differences Training Required?

Pilots converting to an EFIS equipped aircraft for the first time within the SEP class are required to complete differences training with an appropriately qualified instructor unless they can provide logbook evidence of operating such aircraft as PIC prior to 9th September 2010.

The G5 replacing the legacy AI falls within the definition of an Electronic Flight Instrumentation System (EFIS) requiring differences training. Unless pilots have previously completed EFIS differences training within the SEP class or have the above logbook evidence, they must obtain differences training prior to flying HB post upgrade. EFIS experience within other class or type ratings does not satisfy this requirement.

> *CAP 804 Section 5, part H, subpart 1: "For the purposes of this requirement, an EFIS display requiring differences training is an electronic presentation of the primary flight instruments that presents gyroscopic instrument, pressure instrument and navigation information that is used by the pilot as a primary reference for control of the aircraft in flight."*

What Training is Required?

Pilots requiring differences training have two options:

- Differences training sign-off by Alan Bamford:
  - For VFR operations only
    - Self-study of relevant manuals
    - Briefing and ground familiarisation
  - For VFR+IFR operations:
    - Self-study of relevant manuals
    - A training flight to include IFR navigation and an instrument approach.

  Pilots can opt to complete the VFR training first, followed by the IFR training when convenient. For IR(R) holders, an instrument approach flown during the IFR training flight could count towards revalidation or renewal within five years of expiry.

- Obtain differences training with another instructor or ATO.

As explained below, the scope of differences training is at the discretion of the instructor delivering it. Other instructors may insist on additional training above and beyond what is suggested above.

How have these requirements been determined?

One might expect the CAA to produce a document listing common avionics installations and clearly identifying any training required.

Sadly, this is not the case. Instead, they have provided guidance in two documents, an AIC dated 09/2010 and CAP804, which has been published “for reference only” since 2016.

Besides being outdated, these documents are open to interpretation and force the reader to juggle several conflicting requirements. Therefore, I have sought advice from other instructors and devised a solution that satisfies the intent of the regulations without being too onerous for the members.

What training is recommended?

A familiarisation flight with an instructor, covering both EFIS and autopilot operation, is recommended for all pilots. Whilst no differences training is required for autopilots, this is arguably more important than EFIS training as the GFC500 includes flight envelope protection.

For new members this will be included in the checkout process to ensure a new pilot is fully familiar with the systems onboard.

Detailed System Description

General

Both G5 units are physically identical. The knob in the lower right corner performs different functions depending on whether the unit is configured as a Primary Flight Display (PFD) or Horizontal Situation Indicator (HIS).

Summary of features

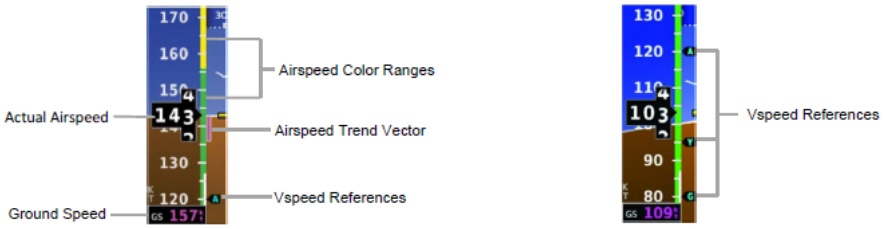
1. AI replaced by PFD
2. Altitude pre-select and alerting
3. HSI and bearing pointers
4. TAS and wind vector display
5. GPS steering
6. Back-up battery
7. Removal of vacuum system
8. Changes to ADF operation
9. Autopilot modes
10. Autopilot speed protection
11. ESP (flight envelope protection)
12. Yaw servo and yaw damper
13. Limitations

AI replaced by Primary Flight Display (PFD)

The most significant difference is the replacement of the AI with a Primary Flight Display (PFD). Whilst we are retaining the conventional ASI, altimeter, VSI and turn co-ordinator, the G5 PFD displays all this information.

Airspeed and altitude are displayed on moving vertical tapes. The airspeed tape has the following features:

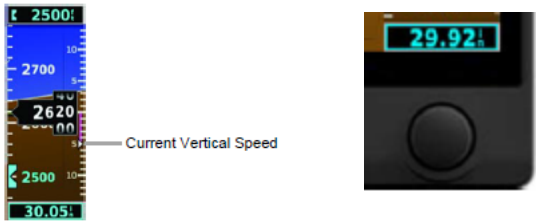
- 60kt of airspeed viewable at any time (current speed ± 30kt).
- Standard white, green, amber and red colour coding[2].
- VS0, VS1, VX, VY, VG (best glide speed), VA, VNO, VNE2.
- A trend vector showing the predicted airspeed in 6 seconds if the current acceleration is maintained.



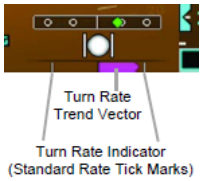
[2] Colour coding and V-speed references are entered from the POH during installation. Many of these speeds vary with weight; values for MTOW (1243kg/2740lbs) are programmed.

The altimeter tape has the following features:

- 400ft of altitude viewable at any time (current altitude ± 200ft).
- Barometric setting (in hPa) is displayed at the bottom of the tape and is adjusted by turning the knob on the bezel.
- Vertical speed displayed as a magenta bar on the right hand side.



Slip, skid and turn rate are also displayed. A rate one turn is indicated when the turn rate trend vector touches the standard rate tick marks:



Heading, track and altitude bugs are displayed, and when the appropriate autopilot/flight director (AP/FD) mode is engaged, these become the target. AP/FD modes are displayed on the FMA at the top of the PFD:

Modes and targets are colour coded as follows:

- Active AP/FD modes are GREEN.
- Armed AP/FD modes are WHITE.
- Most targets (selected altitude, heading, IAS and VS) are BLUE.
- If TRACK mode is used, the selected track is MAGENTA.

Some navigational data is also displayed on the PFD. This will be discussed in the HSI section.

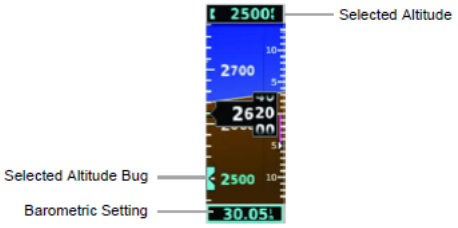
Altitude Pre-Select and Alerting

An altitude can be pre-selected by turning the ALT SEL knob on the autopilot controller[3]. Pressing the ALT SEL knob synchronises the selected altitude to the current altitude.

This enables two functions:

- The autopilot will level off at the selected altitude if an appropriate vertical mode is engaged.

- Visual alerts and an aural tone are provided when approaching the selected altitude, or when deviating from it after it has been reached.



The altitude alerting function is active at all times and could be particularly useful when flying manually in proximity to controlled airspace. A deviation alert is provided when ±200ft from the selected altitude, so flying at least 300ft below the base of controlled airspace and selecting or synchronising this altitude would provide a warning before infringement.

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[3]The selected altitude can also be modified or synchronised by pressing the knob on the bezel and selecting the "altitude" sub menu. It is usually more convenient to use the Altitude & Heading knobs on the GFC500 Autopilot Controller

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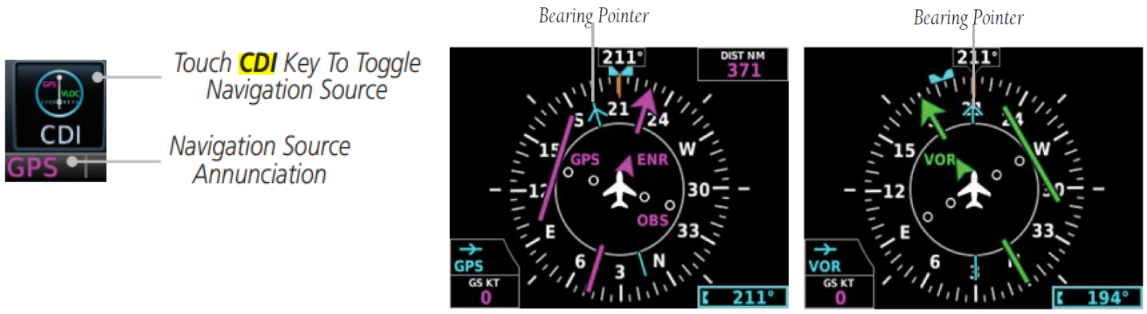
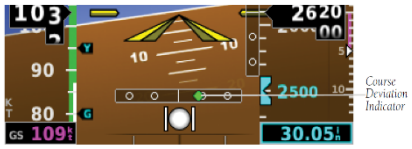
HSI Display and Bearing Pointers

The HSI displays navigation data from the GTN750. As before, the navigation source can be toggled between GPS and VLOC by pressing the CDI key on the GTN750. The colour of the CDI bar indicates the selected navigation source: MAGENTA for GPS or GREEN for VOR/Localiser (VLOC).



The CDI display is also repeated on the PFD:



When GPS is selected, the CDI bar is automatically set to the desired track (DTK) for the current flight plan leg. There is no need to manually adjust the CDI bar.

When VLOC is selected, the CDI must be manually set to the desired course. This is achieved by pressing the knob on the HSI bezel to display the menu, then selecting course:

Up to two single needle bearing pointers can be displayed on the HSI. These are also selected from the menu. The options are GPS1, VOR1 (NAV1) and VOR2 (NAV2). It is not possible to display ADF data, but displaying the GPS1 bearing pointer and routing direct to an NDB on the GTN750 would provide a similar presentation.

When a localiser frequency is selected or an RNAV approach is active, a glidepath indication is displayed on both the HSI and PFD. Loss of vertical guidance is indicated by “NO GS” (ILS) or “NO GP” (RNAV).

TAS and Wind Vector Display

Outside air temperature (OAT), true airspeed (TAS) and a wind vector are displayed in various places on both G5s. This information is derived from a new OAT probe (mounting location TBC).

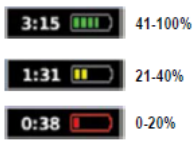
GPS Steering (GPSS)

The G5/GFC500 combination supports GPS autopilot roll steering. When the navigation source is selected to GPS, the CDI bar automatically changes on reaching a waypoint. The system anticipates turns and can smoothly fly procedure turns and holding patterns.

Backup Battery

Both G5 units are fitted with a back-up battery that lasts up to 4 hours. During normal operations when the PFD is powered from the aircraft electrical bus, the battery status is not displayed. If aircraft power is lost, the unit automatically transitions to battery power.

The battery status indicator appears automatically after one minute on battery power. The estimated battery power remaining is shown in hours and minutes:



Removal of Vacuum System

Following the upgrade, HB has no vacuum driven instruments. The whole vacuum system including the pump has been removed and high/low VAC light on the annunciator panel have been deactivated.

As well as improving reliability and redundancy, there is a modest weight saving and increase in useful load.

Changes to ADF Operation

The G5 cannot interface with an ADF in any way, either to receive data or provide heading synchronisation to an RMI. In many installations, this would require the replacement or removal of the RMI. Fortunately, the KI227 fitted in HB is not really an RMI; it is an RBI with an optional synchronisation function. After the upgrade, we will lose this function and will have to manually rotate the compass card to match the aircraft's heading.

Autopilot / Flight Director Modes

The default modes are pitch and roll hold. The following modes are selectable:

- Lateral:
  - HDG (Heading)
  - TRK (track select)
  - APR (approach)
  - GA (take-off or go-around)

- Vertical:
  - ALT (Altitude)
  - ALTS (Altitude Select – "Altitude Capture")
  - VS (Vertical Speed)
  - IAS (Indicated Airspeed)
  - APR (Approach)
  - VNAV (Vertical Navigation)
  - GA (Go Around)

ALT mode indicates the system is holding the altitude at the time the button was pressed, whilst ALTS indicates the capture of the preselected altitude.

It is highly recommended to use IAS for Climb, and VS for Descent. Using VS for climbs to high altitude may result in airspeed decaying below safe levels and the underspeed protection activating.

The VNAV mode would allow the autopilot to follow the vertical profile in the VNAV page on the GTN750. However, this mode is not activated in our installation.

The GA mode is activated by pressing the go-around button above the throttle quadrant and can be used for take-off and go-around. When GA mode is activated:

- If the autopilot is engaged, it will not disengage. If an automatic go-around is performed, full power must be selected manually.
- The flight director will command wings level and 7° nose up. This is an arbitrary pitch attitude and does not guarantee an appropriate speed and/or climb rate. If insufficient performance is available to follow these commands, the autopilot will enter underspeed protection at the minimum airspeed.
- ALTS mode is automatically armed so the pre-selected altitude is capture. Appropriate vertical (IAS) and lateral modes (HDG/NAV) should be selected when workload permits.
- To use NAV mode to fly a missed approach procedure, you must also select "activate GPS missed approach" on the GTN750. Otherwise, the aircraft will continue straight ahead after passing the missed approach point.

Autopilot Speed Protection

When the autopilot is engaged, underspeed and overspeed protection is provided:

- When the minimum airspeed of 80kt is reached, a visual MINSPD message will appear above the airspeed tape and the autopilot will lower the nose to maintain 80 KIAS. An aural “AIRSPEED, AIRSPEED” voice alert will sound. Underspeed protection is exited automatically when airspeed reduces below 85kt.

- When the maximum airspeed of 185kt is reached, visual MAXSPD message will appear above the airspeed tape and the autopilot will raise the nose of the aircraft to avoid exceeding the maximum configured airspeed. An aural “AIRSPEED, AIRSPEED” voice alert will sound. Overspeed protection is exited automatically when airspeed is reduced below 180kt.

Electronic Stability Protection (ESP) and “LVL” Mode

Electronic Stability and Protection uses the autopilot servos to assist the pilot in maintaining the airplane in a safe flight condition within the airplane’s normal pitch, roll and airspeed envelopes during manual flight.

According to the STC, ESP is activated when one or more of the following limits is exceeded:

- Pitch attitude above 20° or below -15°
- Bank angle in excessive of 45°
- Airspeed above 196kt or below 65kt.

ESP is disabled automatically when the aircraft is below 200ft AGL based on GPS altitude.

When ESP is activated, the autopilot servos apply a force to bring the aircraft back into the normal flight envelope. This can be overridden by the pilot, but if the deviation continues the applied force will increase until it reaches the maximum level.

When the above limits have been exceeded for more than 10 seconds, ESP Level mode (LVL) is activated. Level mode engages the autopilot to bring the airplane back into straight and level flight. An aural “ENGAGING AUTOPILOT” alert sounds and the FMA will indicate LVL for both vertical and lateral modes.

LVL mode can also be manually selected on the autopilot controller. This could be used by the pilot in the event of disorientation or loss of control, or by a suitably briefed passenger in the event of pilot incapacitation.

ESP can be temporarily disabled by pressing and holding the yoke mounted autopilot disconnect button. Releasing the button will allow ESP to function.

ESP can also be disabled for the whole flight via a menu accessed via the PFD bezel mounted button. This would be appropriate for intentional practice of steep turns and stalling during training. It is not necessary in normal operations as experience has shown the ESP system operates transparently and without nuisance activation. The only reported activations of the low speed protections have occurred below 60kt during stall training.

When ESP is deactivated in this way, it is automatically re-enabled at the next power cycle.

Yaw Servo and Yaw Damper

The new autopilot includes a yaw servo. Yaw control and damping is automatically provided when the autopilot is engaged. When flying manually, the yaw damper can be engaged separately to maintain balance. The yaw damper must be disengaged for take-off and landing.

There is no rudder trim so pilots should be prepared for an out of trim force when disengaging the autopilot and/or yaw damper, especially at low airspeeds and high power settings.

Limitations

The following limitations apply, with most being similar to the KFC200 system:

- The Garmin G5 Electronic Flight Instrument Pilot's Guide for Certified Aircraft, part number 190-01112-12 Rev C (or later approved revisions), must be immediately available to the flight crew.
- A pilot must be seated in the left pilot's seat, with seatbelt fastened, during all autopilot operations.
- Do not use autopilot or yaw damper during take-off and landing.
- The GFC 500 AFCS pre-flight test must complete successfully prior to use of the autopilot or flight director. This test occurs automatically on power-up.
- The maximum fuel imbalance with the autopilot engaged is 15 gallons.
- Autopilot maximum engagement speed is 185 KIAS.

- Autopilot minimum engagement speed is 80 KIAS.
- The autopilot must be disengaged below 200 feet AGL during approach operations.
- The autopilot must be disengaged below 800 feet AGL for all operations other than approach operations.
- The GFC 500 autopilot is approved for Category 1 precision approaches and non-precision approaches only.