EXECUTIVE 21

MODEL M20F

OWNERS MANUAL

OPERATE THIS AIRCRAFT ONLY – ❶ after reading owners manual ❷ with owners manual on board ❸ after you are fully qualified & understand all of the aircraft operating characteristics & limitations

1967

MOONEY AIRCRAFT, INC.

EXECUTIVE 21

OWNERS MANUAL

YEAR	MODEL	SERIAL NUMBERS
1967	M20F	660003 & 660004
		670001 & ON

Issued September 1966

Revised March 1967

Welcome...

aboard your new Executive 21. Enjoy the greater utility of the long, roomy cabin. The far-ranging fuel capacity of the Executive 21 now makes possible one-stop transcontinental flights.

The same high performance and low operating cost which make its sister ships, the Mark 21 and Super 21, the world's leading sellers in the retractable-geared class, are bred into the Executive 21.

Read this manual carefully, it is prepared to help you enjoy fully the remarkable performance and economy characteristics the Executive 21 is prepared to deliver.

MOONEY AIRCRAFT, INC.

KERRVILLE, TEXAS

Note . . .

This manual contains Federal Aviation Agency – Delegation Option Authority approved limitations and must be carried in the Executive 21 at all times.

EXECUTIVE 21

OWNER'S MANUAL

TABLE OF CONTENTS

PART I DESCRIPTION AND OPERATION OF COMPONENTS

PART II FLIGHT PROCEDURES

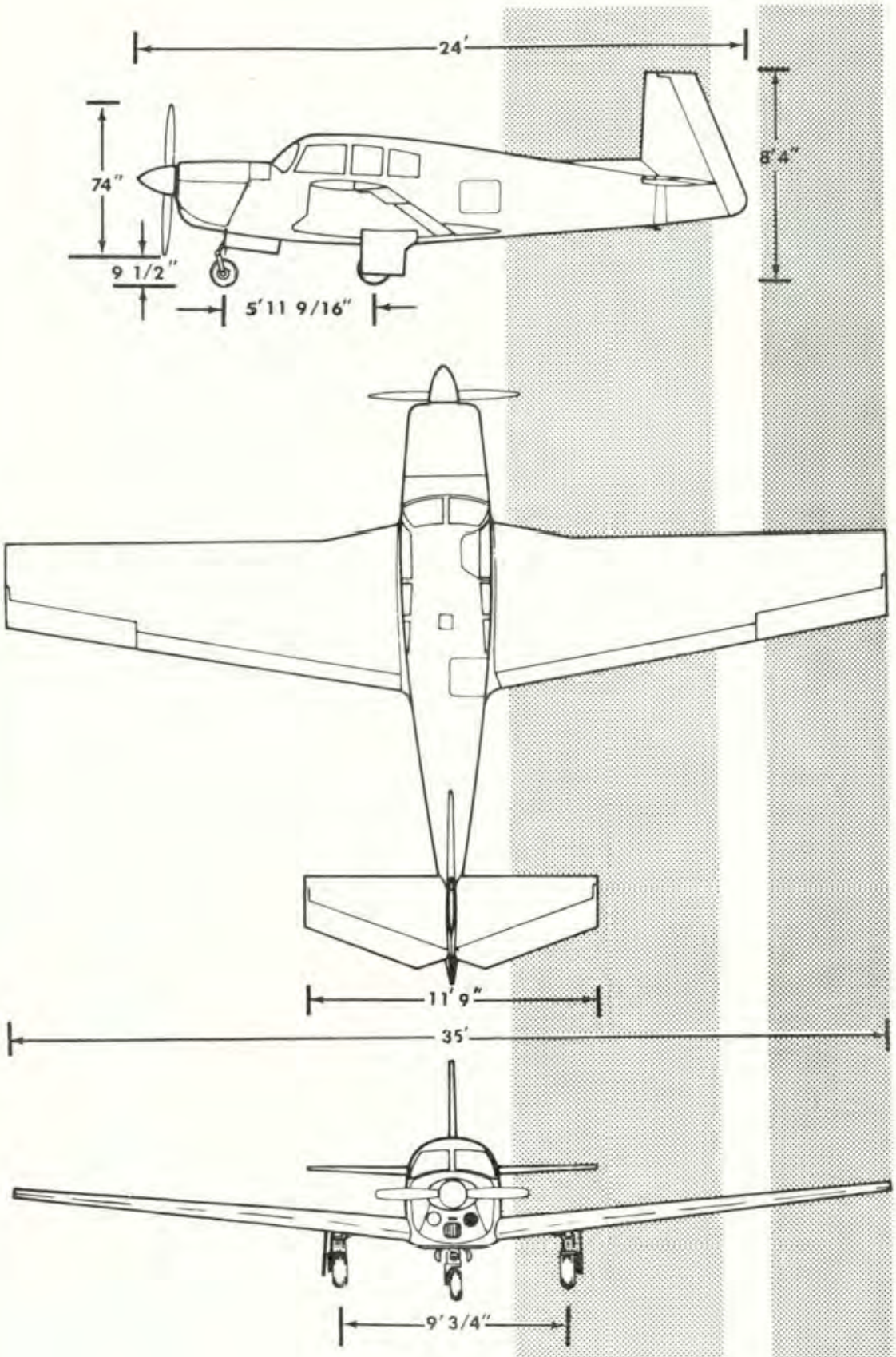
PART III SERVICE AND MAINTENANCE

PART IV PERFORMANCE DATA

PART V OPERATING LIMITATIONS

FAA/DOA APPROVED MOONEY M20F

Revised March 1967


24'
8'4"
74"
9 1/2"
5'11 9/16"
11'9"
35'
9'3/4"

PART I
DESCRIPTION AND OPERATION OF COMPONENTS

GENERAL

The Executive 21 is a single engine four-place low wing, retractable tricycle landing gear airplane. The design and operation of this aircraft are conventional with few exceptions. This section will describe some of the components of the aircraft and operating details.

PROPELLER

The Executive 21 uses an aluminum alloy constant speed propeller of 74 inch diameter. The pitch of the blades is controlled by engine oil pressure which acts to increase blade angle of attack and thereby control engine speed. The propeller control in the cabin operates the propeller governor which controls the oil pressure provided to the propeller hub. The governor setting functions to maintain the engine at a constant speed by actuating blade angle of attack. In essence then, the function of the propeller control in the cabin is to regulate and maintain the rotational speed of the engine at a desired setting.

ENGINE

100LL

The Executive 21 is powered by the Lycoming 200 hp IO-360-A1A four cylinder engine. This engine uses 100/~~130~~ octane fuel. Four rubber bushings on the aft side of the engine provide mounting and vibration isolation. Engine manifold pressure is regulated by the push-pull throttle control on the panel.

POWER BOOST

A unique Power Boost feature of the Executive 21 provides increased manifold pressure when operating at full throttle. This is accomplished by pulling the Power Boost control out, which causes induction air to by-pass the engine air filter to permit the engine to operate on direct ram air. Because the engine will be operating on unfiltered air when the Power Boost is used, it should be operated only in clean, dust free

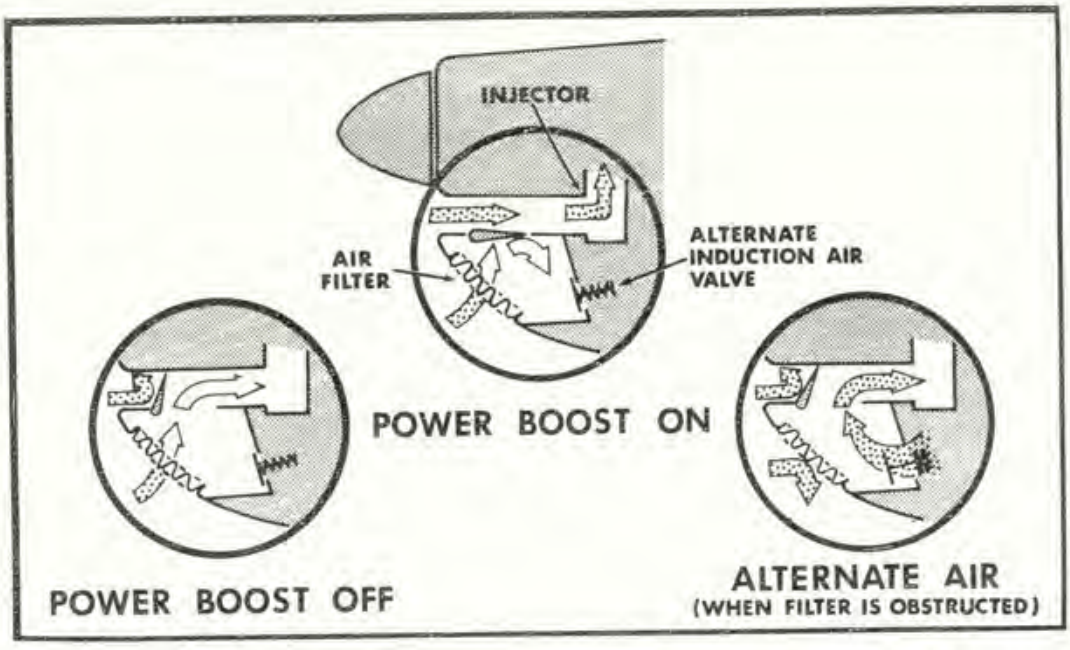
air at altitude, and turned off for take-off and landing. Because the Power Boost is effective only when the throttle is in the fully opened position, its advantages generally will be realized at altitudes above 5,000 feet where flight is often with full throttle. A light is provided on the panel by the Power Boost control to remind the pilot to push the control in (to filtered air) before landing. This light will come on when the gear is lowered while Power Boost is on.

WARNING

Do not fly this aircraft in icing conditions.

Turn Power Boost off when icing conditions are inadvertently encountered. Icing conditions prevail any time the temperature and moisture conditions combine to produce the possibility of impact ice.

Using unfiltered induction air when flying in snow or other IFR conditions can be hazardous. Snow can accumulate in the fuel injector impact tubes or moisture can freeze in the passages under icing conditions and cause loss of power. Therefore it is imperative that the Power Boost not be used when flying in sleet, snow, rain, or moisture-laden air near freezing temperatures. Under these conditions ice can form in the inlet duct or fuel injector unit even though no visible moisture is apparent on the airframe.



FUEL—AIR MIXTURE

The fuel injector unit of the IO-360 engine has provisions for adjusting the fuel-to-air ratio as required at different altitudes. The fuel-to-air ratio (mixture) is regulated by the hexagon shaped push-pull control located between the throttle and propeller controls in the cabin. This control has a vernier adjustment feature for obtaining precise mixture settings. An exhaust gas temperature gage is provided to indicate the optimum mixture setting.

ENGINE COOLING

The engine baffling directs air flow over the cylinders for cooling in flight. Cowl flaps are provided on the lower cowling to allow more free air flow on the ground and during low speed, high power conditions (i.e., climb conditions). Cowl flaps should always be open on the ground, and prolonged engine operation on the ground should be avoided to prevent engine overheating. A push-pull control is provided below the instrument panel and to the right of the pilot for operation of the cowl flaps.

ENGINE LUBRICATION

The engine has a pressure-type wet-sump lubrication system. It has an eight quart capacity; however, as a general rule, when the oil level drops below six quarts, one quart is added. This will maintain the oil level between the six and seven quart level. See Part III for type of oil used and time between oil changes.

An oil temperature thermostat, located in the oil reservoir, is set for 180° F. to assure adequate operating engine oil temperatures. The oil cooler is mounted on the lower left side of the cowling. An oil filter is available as optional equipment.

ENGINE IGNITION

The ignition system has the following features:

1. Two Bendix magnetos, the left magneto being equipped with a set of retard breaker points.
2. A starting vibrator, located on the upper firewall, which furnishes a shower of sparks for starting.
3. A switch which combines both ignition and starting functions.
4. Shielded spark plugs and ignition harness to suppress radio noises.

When the push-type starter switch is activated in the "start" position, the starter vibrator sends an interrupted current through the retard-breaker points while the right magneto is grounded out. The left magneto then provides a fixed retard and a long duration, boosted spark for starting.

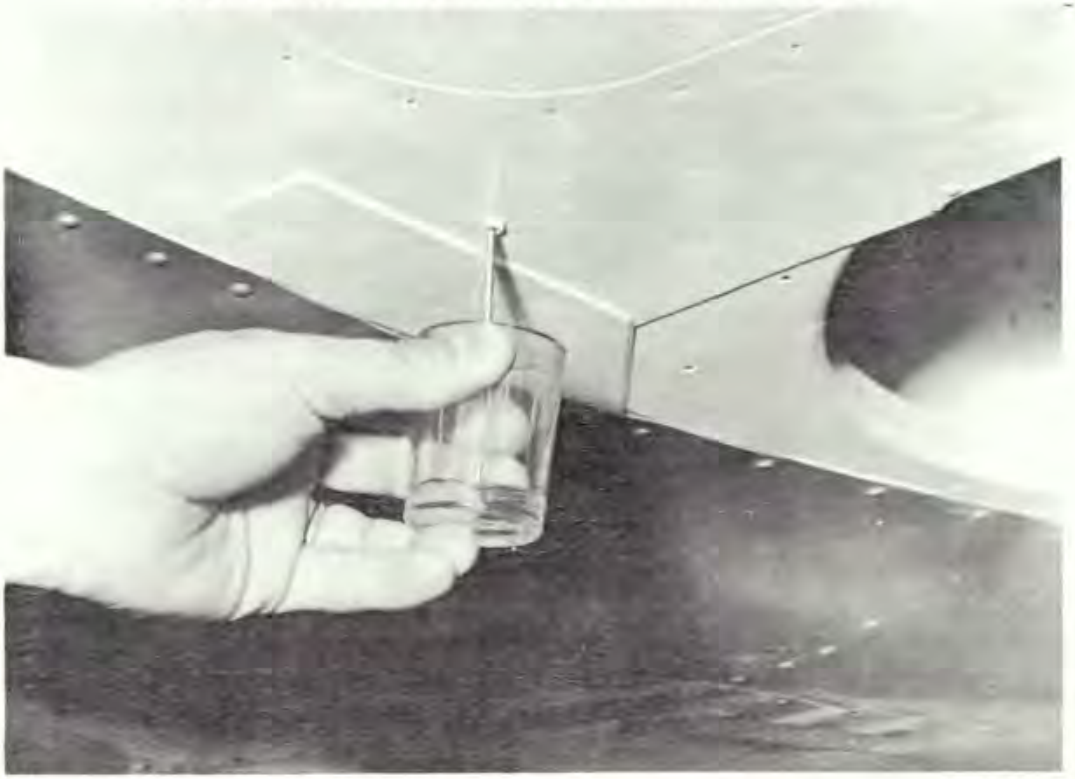
FUEL SYSTEM

Fuel bladders have been installed on this aircraft, see supplement. This has reduced the fuel capacity to 27.4 gallons of usable fuel in each tank and 54.8 gallons total. The bladders had a history of letting in water, so an AD was issued. See last page of Operating Limits for required pre-flight requirements.

~~mark on the indicator.~~ Tank vents allow ventilation as fuel is depleted and overflow when fuel expands in hot weather. The fuel tanks each have a sump drain under the wing from which fuel may be sampled to check for water or sediment contamination. A small plastic cup with anactuator prong is provided to obtain fuel samples. If water is present in the fuel, a distinct line separating the water from the gasoline may be seen through the plastic cup. Water, being heavier, will be on the bottom of the cup, and the light green colored fuel will be on top.

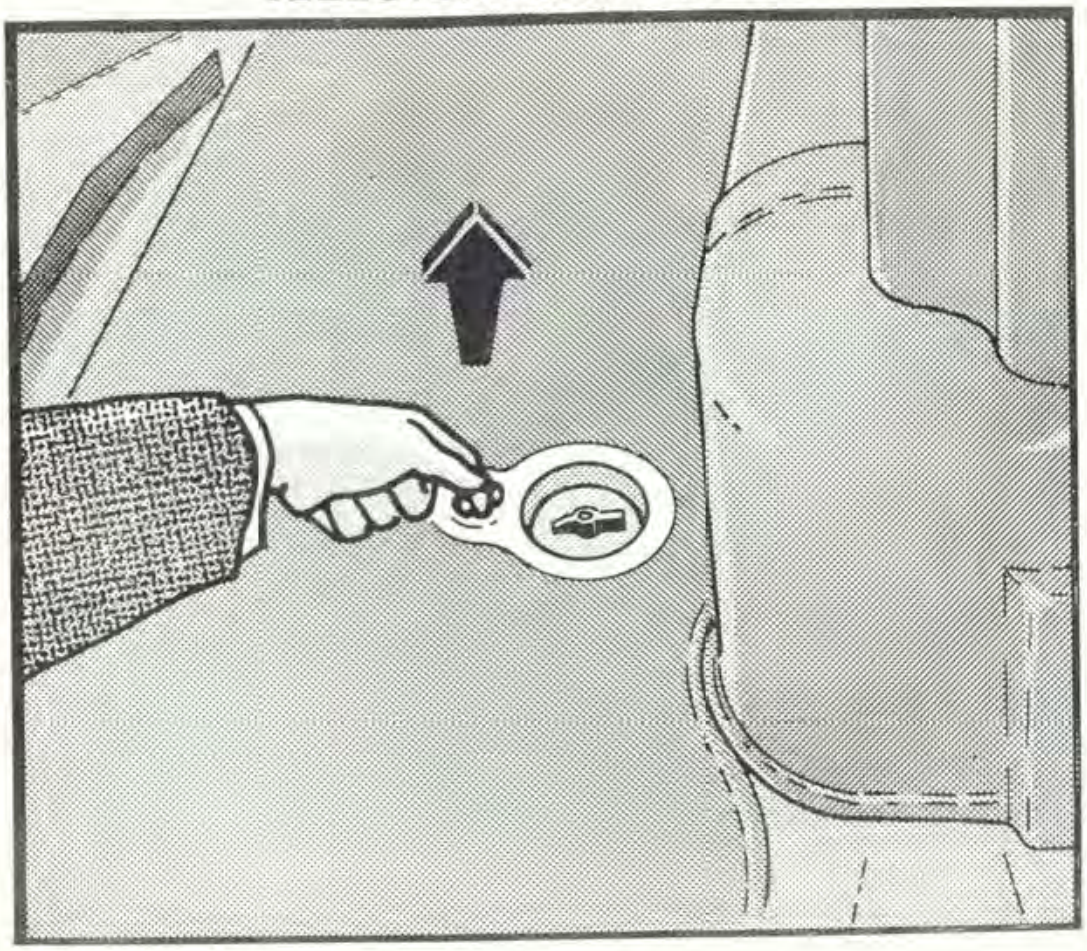
or blue

SAMPLING FUEL FROM MAIN TANKS



Aluminum fuel lines feed the fuel from the tank to a two-way, positive-setting selector valve on the floor ahead of the pilot's seat. The selector valve feeds fuel from one of the tanks at a time, and also has an "off" position for extended periods of storage or for emergency use. The selector valve also contains a sump drain which is actuated by pulling the ring adjacent to the fuel valve handle. Switch the selector valve handle to the right and left tanks to drain the respective lines. Be sure sump drain returns to normal closed position after releasing the ring. Fuel is fed from the selector valve through the electric boost pump, then to the engine driven pump and into the fuel injector unit. The electric boost pump is turned on for take-off and landing to provide fuel pressure if the engine driven pump malfunctions.

SELECTOR DRAIN VALVE



WARNING

Under no circumstances should aviation fuel of a lower grade than 100/130 octane or 100LL be used. Aviation fuels may be distinguished by their color: 80 octane is red, ~~91 octane~~ 100LL is blue, and 100 octane is green.

ELECTRICAL SYSTEM

The electrical system is provided with a 50-amp., 12-volt generator and a 35 amp-hour battery which is located aft of the baggage compartment. All electrical systems can be turned off by the master switch which actuates a relay located at the battery. The master switch for the electrical system is located

at the left-hand side of the flight panel. The electrical system operates all the electrical accessories listed below:

1. Radios
2. Engine starter
3. Starter vibrator
4. Navigation lights and interior lights
5. Landing light
6. Rotating beacon (if installed)
7. Heated pitot (if installed)
8. Turn coordinator
9. Cigarette lighter
10. Electric landing gear (if installed)
11. Fuel gages
12. Electric fuel pump
13. Stall warning horn
14. Landing gear warning horn and warning lights

NOTE: The engine has its own separate electrical system and will continue to run, even though the master switch has been turned off, or even though the accessory electrical system should malfunction.

15. Electric flaps
16. Electric DG

Interior Lights

Panel illumination is provided by two adjustable spot lights mounted on the headliner and individual post lights for the instrument panel. These lights are controlled by a rheostat. The fuel selector valve is illuminated by a small light mounted under the panel on the left side. The intensity of this light is controlled by rotating the lens housing.

Ammeter

The ammeter in the engine instrument cluster will indicate if the battery is charging or discharging. A malfunction in the generator or voltage regulator will be shown as an ammeter discharge at flight power settings. A low battery will cause a high charge indication.

Electrical Panel

The electrical panel is divided into two parts:

a. The electrical toggle switches, on the lower left side of the pilot's panel, act in combination both as on-off switches and as breaker switches. Should any of these circuits be overloaded, the switch automatically turns to the "off" position.

   These switches are, from left to right:

   1. The electrical fuel pump
   2. An optional equipment switch ~~(Marker beacon)~~ Elec. DG
   3. An optional equipment switch ~~(Glide slope)~~ Strobe
   4. An optional equipment switch (Pitot heat)
   5. An optional equipment switch (Rotating beacon)
   6. The navigation lights
   7. The landing light

b. The breaker switches which are located on the lower right side of the copilot's panel, are covered by a special breaker switch cover. These switches are of the push-to-reset type.

AIRFRAME

The structure of the Executive 21 is of conventional all-metal design. The cabin section consists of tubular steel structure covered with aluminum sheet metal. The center windshield post and the firewall are stainless steel.

The wing, stabilizer, and fin have a main spar design and an auxiliary spar with stressed skin to carry torsional loads. The tail cone is a conventional semi-monocoque design. The seat design features contoured construction. The front seats are adjustable fore and aft and have adjustable three-position backs. The rear seat back may be removed for additional cargo space.

The entire empennage pivots around two attachment points to the tail cone to provide stabilizer trim. A screw mechanism actuates the empennage movement at the rear bulkhead when the trim control wheel is operated.

LANDING GEAR

Electric System installed instead. See next page.

Manual System

The landing gear is unique in that it is manually retracted by the pilot by means of a lever in the cabin. The system is operated by direct mechanical linkage and has proven to be one of the most reliable and maintenance-free retraction systems available. An electrically powered landing gear retraction system is also available at extra cost and is described in the following section.

The manual system is aided by bungee type springs in the fuselage and assist springs in the wing, which balance the weight of the gear. Rubber discs are used for shock absorption in the welded steel tube gear structure. Grease fittings are provided at certain important lubrication points on the landing gear.

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

To retract the gear, depress the safety latch button and slide the gear handle from the down-lock socket. Move the handle rapidly to the floor between the seats. Slide the gear handle into the up-lock socket, and the operation is complete. The more rapid the movement of the handle, the easier it is to retract the gear. The gear retracts easiest at low airspeeds.

To lower the gear, slide the gear handle from the up-lock socket and move the handle forward to the instrument panel. Slide the gear handle into the down-lock socket and check the gear warning light for a gear-down indication (a green light).

Electrical Gear System ~~(optional)~~ Installed

The optional electrical landing gear retraction system is operated by the wheel-shaped switch on the upper portion of the flight panel. To raise the gear, the knob is pulled out and the switch moved up to its upper detent. An "airspeed switch" is incorporated in the electrical circuit which prevents landing gear retraction until a safe airspeed is attained.

CAUTION

Never rely on the airspeed safety switch to keep the gear extended while taxiing, taking off or landing. Always check the gear switch for the down position.

A limit switch will stop the gear in its retracted position; the gear-up light will come on, and the gear switch will require no further attention until landing. To lower the landing gear, the knob is pulled out, moved down, and placed in the lower detent. A limit switch will stop the gear system when the proper locking force has been exerted to hold the gear down, and the green gear-down-light will come on.

WARNING

A discharged storage battery may prevent the landing gear from fully extending.

There are three ways to check that the gear is completely down and locked:

1. The green "safe-to-land" indicator light (on the left panel) will come on.
2. The ~~black~~ red indicator marks, as seen through the glass in the floorboard, will be aligned.
3. Retard throttle fully, and if no warning horn is heard the gear should be down and locked. The gear warning horn emits an interrupted sound of a different pitch than the stall warning horn.

When these conditions are fulfilled, the aircraft may be landed with no further attention to the landing gear system.

If the gear does not come down due to electrical malfunction. etc., the system may be operated manually as described below:

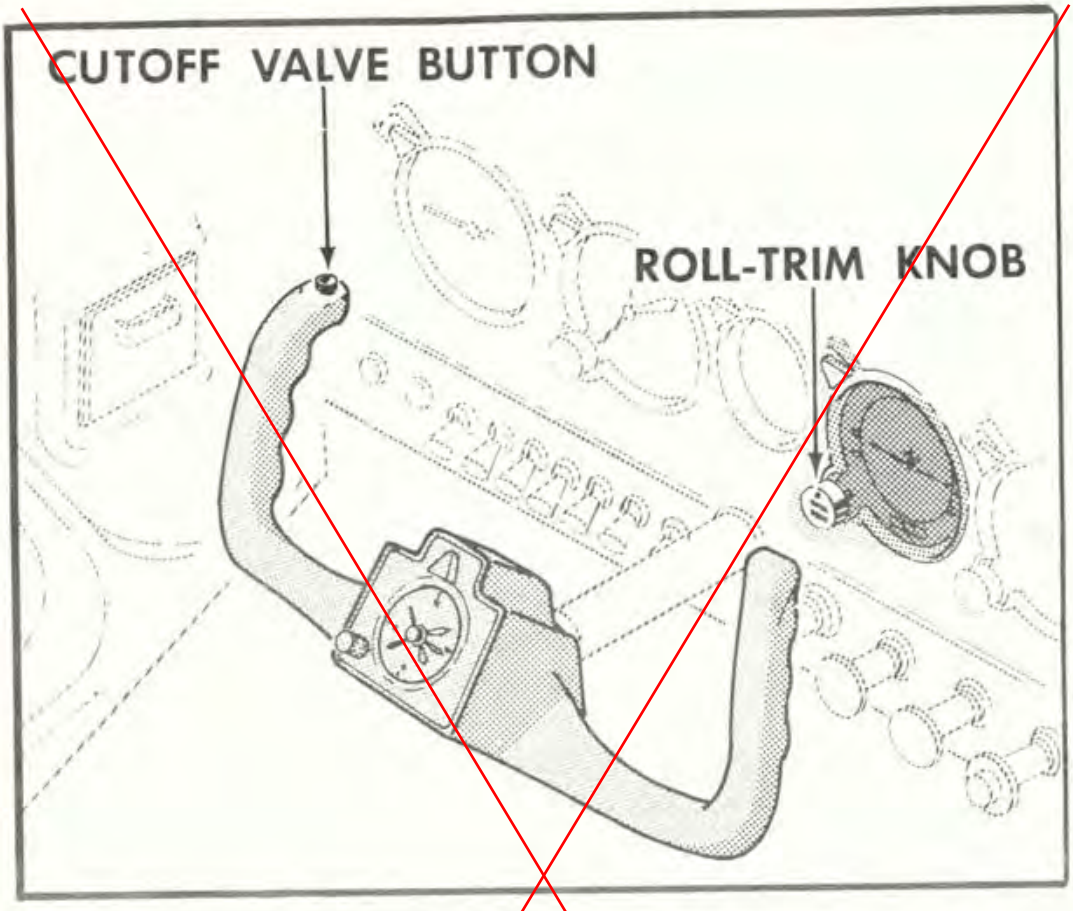
1. Pull landing gear circuit breaker to OFF position.
2. Put gear switch in the gear down position.
3. Push crank engage knob forward.
4. Crank clockwise approximately fifty (50) turns to lower the gear.
5. Gear is down when green gear light is on. If a total electrical malfunction occurs, check gear visual indicator.
   DO NOT RETRACT GEAR IN FLIGHT WITH MANUAL HAND CRANK.

FLIGHT CONTROLS

The ailerons, elevators, and rudder operate conventionally. Push-pull tubes with self-aligning rod end bearings actuate these control surfaces. The ailerons have a differential linkage (i.e., up travel is greater than down travel) to minimize adverse yaw when they are deflected. Gap strips on the hinge line minimize air spillage from the high to the low pressure side of the control surfaces. The ailerons have beveled trailing edges to lower pilot control force.

POSITIVE CONTROL SYSTEM

Replaced with S-TEC System 30, see supplement.



right; counterclockwise rotation trims to the left. In the event of malfunction, the pilot can easily override the system at any time. Complete disengagement may be accomplished by depressing the cut-off valve. In the event of complete loss of vacuum (indicated by a red light above the gyro horizon), the PC system will automatically become inoperative. Excluding malfunction of the vacuum system, PC will continue to operate even after a complete engine power loss as long as the propeller is windmilling at approximately 1000 rpm or above.

The turn coordinator operates on both vacuum and electrical power, thereby providing fail-safe turn coordinator operation.

This aircraft is not approved for spins. In the event that the pilot inadvertently approaches or enters a spin, the Positive Control system can be overpowered from either the pilot's or copilot's side and the controls used for normal spin recovery techniques. The pilot should use the cut-off valve located in the pilot's left control wheel handle to cut off the PC system when employing spin recovery control procedures.

WARNING

While taxiing before take off. the PC system should be checked for proper functioning by noting movements of the flight controls in taxi turns. When PC is functioning properly, the control wheel will tend to rotate in the opposite direction of the taxi turn. The absence of flight control movement during taxi turns, or extreme control movement in either direction without prompt return to neutral, indicates a PC malfunction that should be corrected before flight.

The pilot must become familiar with the flight characteristics of the airplane with the PC system inoperative. This is accomplished simply by holding down the cut-off valve button while making turns and maneuvers. Frequently check the PC system during flight to see that it is functioning properly, particularly if IFR conditions are anticipated. To check for a malfunction while in flight, first establish a moderate bank. Then release the controls to see if the aircraft will return promptly to straight wings-level flight as shown by the artificial horizon. Repeat the procedure with a turn in the opposite direction. Sluggish, erratic, or incomplete bank recovery warns of a malfunction in the PC system. PC is installed to help alleviate pilot fatigue, but the system should be monitored frequently to check for proper functioning like any other system in the aircraft.

TRIM SYSTEM

A small control wheel on the floor between the front seats actuates the adjustable stabilizer via a gear reduction and torque tube linkage which actuates the empennage jack screw. A friction lock is provided on the pilot side of the trim control pedestal. Rotating the friction screw clockwise increases trim friction. The position of the stabilizer is indicated by a pointer on the aft side of the nose wheel well. The intermediate mark in the pointer range is the normal take-off setting of the trim control. The trim system also changes the setting of the trim bungees connected to the elevator horns to obtain trim assist from the elevators.

FLAPS

The wide span flaps were originally operated by a factory installed manual hand lever. That has since been replaced by an electric motor operated by the switch in the middle lower console under the throttle/prop/mixture levers (see image below). The motor switch has an 'up', 'off', and 'down' position. The 'down' position is spring loaded to return to off but 'up' is not spring To lower the flaps, place the switch in the 'down' position and then release the switch once the flaps reach the desired extension. To retract the flaps, place the switch in the 'up' position and return it to the 'off' position once the desired retraction is met.

CAUTION

Do not leave the flaps in the full down position while the aircraft is parked. Trapped fluid in the system can be expanded by solar heat causing damage to the system.

VACUUM SYSTEM

An engine-driven vacuum pump powers the gyroscopic instruments (artificial horizon & directional gyro), the Mooney Positive Control System, and the automatic retractable step. Vacuum pump output is governed by a regulator. HI-LO indicator lights on the instrument panel will show when vacuum is above or below limits. Test the warning lights by pressing forward the lens housing of each light; if operative the light will show red. To dim these lights during night flight, turn the lens housings clockwise.

When the engine is started and sufficient vacuum is produced, a vacuum servo will raise the cabin entry step to the stowed position. A spring will pull the step down when the engine is stopped and vacuum is relieved.

There is a standby system as well in this A/C. See supplement.

BRAKES

The Executive 21 is equipped with hydraulic disc brakes on the main gear which are operated independently by toe pressure on the rudder pedals. The brakes may be set for parking by depressing the toe pedals and pulling out the lock valve control which is located on the panel to the right of the pilot's control column. Hydraulic fluid for the brake and flap systems is stored in a reservoir on the top aft side of the firewall. Co-pilots brakes are available as optional equipment.

HEATING AND VENTILATION SYSTEMS

Lower Heat and Vent System

Cabin heat is obtained from a muff which surrounds the engine exhaust muffler. From this muff, a flexible duct transmits

heated air to a junction box on the aft side of the firewall on the copilot's side. Cool air is also ducted to this junction box from the flush air scoop on the right side of the airplane. The warm and cool air entering the junction box can be individually controlled to provide the combination required for the desired temperature. From the junction box, air is ducted to the pilot and co-pilot's feet, to the rear cabin, and to the windshield defrosters. Pilot and co-pilot heating and ventilating outlets have individual controls.

Defroster System

In order to obtain the maximum flow of heated air through the windshield defroster outlets, the rear cabin, pilot, and co-pilot airflow valves should be closed. With these valves in the closed position, the airflow is forced through the defroster outlets.

CAUTION

When using maximum defrost airflow, the cabin vent control should be in the open position (full aft) to prevent excessively hot air from being directed through the system to the windshield, which could cause windshield deterioriation.

WARNING

In case of engine fire, turn the cabin heater "Off".

The Upper Ventilation System

The upper ventilation system consists of a retractable air scoop on top of the cabin section which supplies four individually controlled ceiling outlets. The scoop control knob, located above the pilot, is turned counterclockwise to open (extend) the scoop to obtain ram air. To minimize drag and prevent air buffeting in the cabin at higher airspeeds, open the overhead air scoop only enough to obtain sufficient air supply to the outlets. The outlets can be controlled individually by turning the inner knob to adjust the air volume and rotating the deflector to obtain air flow in the desired direction.

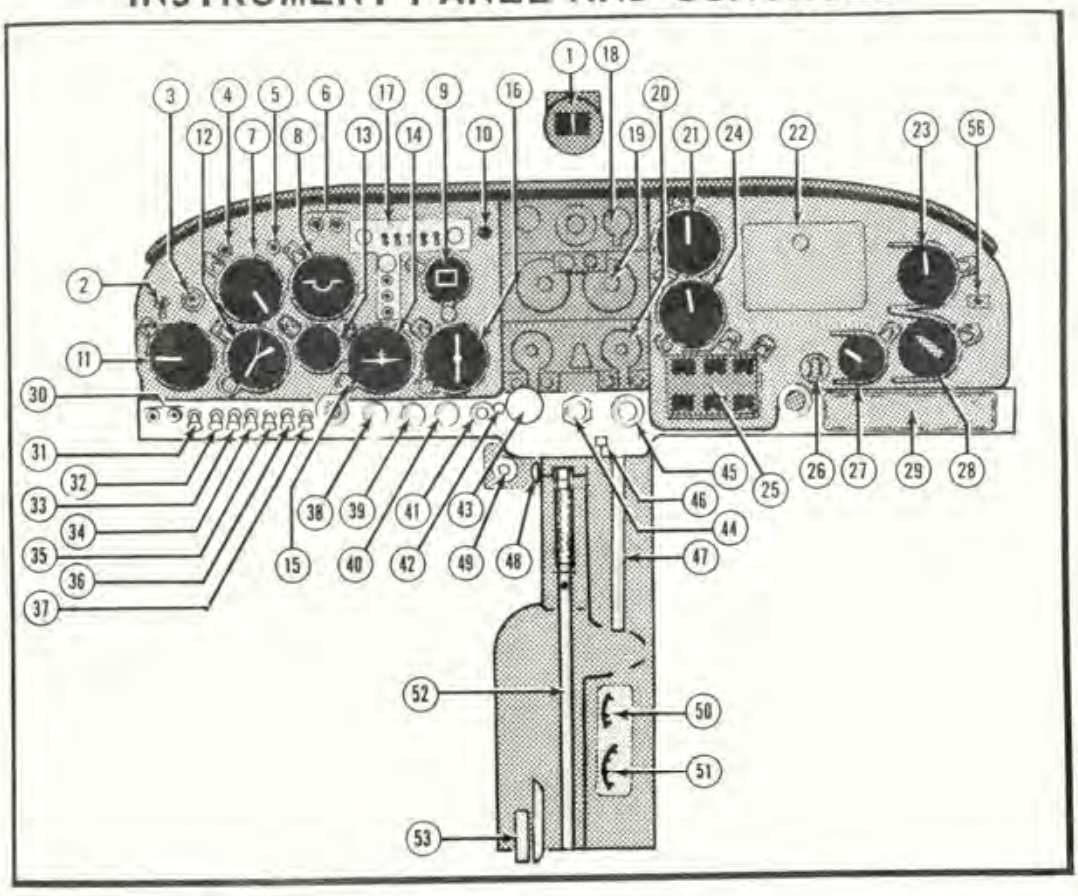
Left Side Air Scoop

The left side air scoop has one outlet which has a volume control and can be adjusted directionally. This scoop also has two outlets behind the upholstery panel which provide an additional source of air for radio cooling.

Radio Cooling Outlet

In addition to the outlets on the left scoop for radio cooling tubes, the right side flush air scoop provides air for the radio vent grill which is mounted on the firewall, directly forward of the center radio panel. This grill directs air aft to insure sufficient air flow to prevent multiple radio installations from overheating. The tube supplying the grill has a control valve near the scoop to decrease air flow in extremely cold weather.

INSTRUMENT PANEL AND CONTROLS



WINDSHIELD CENTER POST

1. Magnetic Compass

LEFT PANEL

2. Master Switch
3. Ignition-Starter Switch
4. Gear-Up Signal Light
5. Gear-Down Signal Light
6. HI-LO Vacuum Warning Lights
7. Airspeed Indicator
8. Artificial Horizon
9. Directional Gyro
10. Electric Gear Retraction Switch (optional)
11. Rate-of-Climb Indicator
12. Altimeter
13. Optional Equipment
14. Turn Coordinator
15. PC Roll-Trim Knob
16. Radio Equipment
17. Communications Controls (optional)

RADIO PANEL

18. Radio Equipment or Autopilot (optional)
19. Radio Equipment (optional)
20. Radio Equipment (optional)

RIGHT PANEL

21. Tachometer
22. Glove Box or Radio Equipment (optional)
23. Manifold Pressure/Fuel Pressure Gage (or optional radio equipment)
24. Manifold Pressure/Fuel Pressure Gage (or optional radio equipment)
25. Engine Cluster Gage:
    - Fuel Quantity Gage (L tank)
    - Fuel Quantity Gage (R tank)
    - Ammeter
    - Oil Pressure Gage
    - Oil Temperature Gage
    - Cylinder Head Temperature Gage
26. Cigarette Lighter
27. Exhaust Gas Temperature Gage
28. Manifold Pressure & Fuel Pressure Gage
29. Main Circuit Breaker Panel Cover

SUBPANEL

30. Headset & Microphone Jacks (optional)
31. Electric Fuel Pump Switch
32. Marker Beacon Switch (optional)
33. Glide Slope Switch (optional)
34. Pitot Heat Switch (optional)
35. Rotating Beacon Switch (optional)
36. Navigation Lights Switch
37. Landing Light Switch
38. Parking Brake Control
39. Cabin Heater Control
40. Cabin Vent Control
41. Power Boost Control
42. Unfiltered Air Warning Light

ENGINE CONTROLS

43. Throttle Control
44. Mixture Control
45. Propeller Control
46. Wing Flap Control Knob
47. Wing Flap Hydraulic Pump Handle
48. Gear Lever Safety Latch
49. Cowl Flap Control

WHEEL WELL

50. Stabilizer Trim Position Indicator
51. Wing Flap Position Indicator
52. Gear Retracting Lever

CABIN FLOOR

53. Stabilizer Trim Control Wheel
54. Fuel Tank Selector Valve Drain
55. Fuel Tank Selector Knob
56. Overvoltage Warning Light (optional)

PART II

FLIGHT PROCEDURES

GENERAL

This section will describe recommended flight procedures necessary for the proper operation of your Executive 21. The aircraft is normally flown from the left seat. However, when equipped with optional dual brakes, a copilot or instructor has full control of the aircraft and access to all instruments and controls. The copilot can override the Mooney PC system easily without depressing the cut-off valve located on the left control wheel.

WEIGHT & BALANCE

The aircraft weight and center of gravity location can be determined from the information and examples shown in the Weight & Balance Record provided with the airplane.

The maximum allowable take-off weight of the Executive 21, including fuel, oil, baggage, and passengers is 2740 pounds. If there is doubt concerning the weight or C.G. location of a proposed loading, that loading should be checked per the weight and balance data.

The hat rack compartment, aft of the main baggage compartment, is to be used only for the storage of light, soft items.

WARNING

The hat rack area is limited to ten pounds weight for balance purposes.

PRE-FLIGHT INSPECTION

The following pre-flight inspection is recommended:

1. Check all switches off.
2. Remove tiedowns or wheel blocks, check tires and prop clear of rocks, holes, etc.

3. Check wings and control surfaces clear of ice, snow, or frost.
4. Check the propeller blades for nicks or cracks.
5. Check the oil level to six quarts or above. (Full for extended flight.)
6. Inspect the cowling for loose attachments.
7. Inspect the tires for proper inflation.
8. Inspect the air filters for cleanliness.
9. Check the left tank for fuel level and drain sump.
10. Check the left aileron for freedom of travel.
11. Inspect the left flap.
12. Inspect the elevator and rudder for freedom of travel. (Rudder travel will be limited by nose gear steering mechanism.)
13. Inspect the right flap.
14. Inspect the right aileron for freedom of travel.
15. Check the right fuel tank for fuel level and drain sump.
16. Check lights if flight is at night.

ENTERING THE AIRPLANE

After entering the cabin, close the door by pulling on the pull strap and rotating the handle forward to the latched position. DO NOT SLAM THE DOOR. Check that the gear retraction handle (or electric gear switch) is in the gear down and locked position. Drain the fuel selector valve on the floorboard and turn the selector to the proper tank. Be sure the drain returns to "OFF" position and that the pull ring is properly positioned in the cavity provided. If the flight is at night, check to assure a flashlight is on board.

STARTING THE ENGINE

The following starting procedures are recommended; however, the starting characteristics of each engine may vary slightly which could necessitate some variation from these recommendations.

1. Tank selector on fullest tank.
2. All radio switches and electrical switches off.
3. Brakes on.

4. Power Boost control in filtered air (OFF) position.
5. Cowl flaps open.
6. Check throttle for unlocked position – 1/8" open.
7. Mixture control full aft (idle cut-off).
8. Propeller control full forward (high rpm).
9. Master switch on (green gear indicator light, "Low Vacuum" warning light, and the electric turn coordinator should come on).
10. Turn boost pump on and note fuel pressure indication.
11. Move mixture to full rich (forward) position for three seconds and return to idle cut-off (aft). Do not keep the mixture control in the full rich position more than a few seconds with the boost pump on to avoid flooding the engine.
12. Turn ignition switch to "Start" and press in.
13. When engine fires, hold start switch on for another second, then allow the spring loaded switch to return to "Both."
14. Move mixture control to "Full Rich" (forward) slowly.

NOTE: Flooded engine–throttle full open, mixture control in "idle cut-off," boost pump off. When engine starts, retard throttle, move mixture to "Full Rich" and turn on boost pump.

COLD WEATHER AND MANUAL STARTING

In extremely cold weather it may be necessary to provide additional fuel priming to the engine by holding the mixture control in the full rich position a few seconds longer than usual. It may be necessary to preheat the engine and engine oil prior to starting.

NOTE: If oil pressure is not indicated on the oil pressure gauge within 30 seconds, stop the engine immediately and determine the cause.

In the event that it becomes necessary to start the engine with a low battery and no external battery source is available, use the following procedure:

1. As the engine is "hand propped," hold the magneto switch in the "start" position to operate the starter vibrator and furnish a retarded spark to the engine.

WARNING

When "hand propping" the engine, stand clear of the propeller until the starter vibrator is energized. Do not push the magneto switch forward as this will engage the starter.

2. When the engine starts, release the switch to the "Both" position.

TAXIING AND GROUND OPERATION

The nose gear is linked directly to the rudder pedals to provide steering. The brakes may be applied independently to assist steering for sharper turns.

Caution should be used when operating on rough terrain. It is recommended that minimum power be used for starting to taxi on sod or gravel fields. Too much power will cause the propeller to suck up stones and thus nick the blades. Excessive speed over rough ground should be avoided to preclude pitch down of the nose.

The engine is air-pressure cooled and depends on the forward speed of the airplane to maintain proper cooling. It is recommended that the following precautions be observed for proper engine cooling:

1. When stopped, head the airplane into the wind.
2. Open the cowl flaps (control full aft).
3. Operate the engine on the ground only with the propeller in high rpm setting (control forward).
4. Keep mixture "Full Rich" (control forward).
5. Do not overheat engine by prolonged ground running. Monitor the cylinder head temperature gauge.

PRE TAKE-OFF CHECK

When operating on gravel fields, it is recommended that the run-up be made while taxiing to avoid nicking the propeller. Warm up the engine at 1000 to 1200 rpm. Avoid prolonged idling at low engine speeds as this practice may result in fouled spark plugs. The engine is warm enough for take-off when it can develop full rpm and the throttle can be opened without backfiring or skipping of the engine or the throttle can be opened without a reduction in oil pressure.

Check the following items before take-off:

1. Check flight controls for travel and smoothness of operation.
2. Check fuel quantity indicator, selector valve, and fuel pressure.
3. Check instruments:
   a. Set altimeter to field elevation.
   b. Check oil pressure and temperature.
   c. Check ammeter for indication.
   d. Check cylinder head temperature.
   e. Set clock.
   f. Check manifold pressure gauge and tachometer for readings proportional to engine power.
   g. Check rate of climb, airspeed, and turn coordinator for zero readings.
   h. Check artificial horizon and directional gyros for proper orientation.
   i. Test gear indicator lights and vacuum warning lights.
4. Set trim to take-off setting (check indicator).
5. Check cowl flaps open.
6. Set wing flaps to take-off setting (check indicator).
7. Turn on boost pump.
8. Check magnetos at 1700 RPM for smooth operation and maximum drop of 125 RPM with variation of 50 RPM maximum between magnetos.
9. Exercise the propeller at 1800-2000 RPM by pulling the propeller control to the "full-out" position. After the tachometer has shown a drop-off of 100 RPM, push the propeller control to the "full-in" position.

10. Check mixture rich (full forward).
11. Check lights if flight is at night.
12. Check all seat belts.
13. Close door and pilot window and latch shut.
14. Clear floor for retraction handle clearance.

WARNING

Do not fly this aircraft in icing conditions.

TAKE-OFF AND CLIMB

When applying power for take-off, move the throttle to the full open position slowly to avoid picking up loose stones, etc., with the propeller. Apply back pressure to the control wheel at about 65-75 mph airspeed. When the aircraft breaks ground, it will tend to "rock" into a nose-high attitude. To compensate for this tendency, relax some of the elevator back pressure as the nose-wheel leaves the ground. For best results and a smoother take-off, do not allow the nose of the aircraft to lift above the horizon during take-off. After some practice, you will find that you can make your smoothest take-offs by applying elevator back pressure as flying speed is approached and then slowly reducing the back pressure as you feel the nose wheel lifting from the ground. This will allow the aircraft to fly smoothly from the runway without any abrupt change in pitch attitude.

As soon as the airplane is airborne and under good control, perform the following procedures:

1. Apply brakes to stop wheel rotation.
2. Retract the gear.
3. Reduce the propeller rpm to 2550-2600.
4. Retract the flaps.
5. Establish climb-out attitude.
6. Turn electric fuel pump to the "off" position.
   (Note fuel pressure indication to verify that the engine driven fuel pump will provide fuel pressure.)

An enroute climb speed of 115-120 MPH IAS is recommended for improved cooling and good visibility. The speed for maximum rate of climb is a straight line variation from 113 MPH IAS at sea level (decreasing approximately one MPH IAS per 1000 FT.) to 102 MPH IAS at 10,000 FT. The speed for maximum angle of climb (obstacle clearance) at Full Power, Gear and Flaps UP, is about 94 MPH IAS. Recommended power setting for normal climb is 2600 RPM and 26 inches manifold pressure.

POWER CHANGES

The following sequence is recommended for increasing or decreasing power settings.

To Increase Power

First, increase engine speed (rpm) by means of the propeller control.
Second, increase manifold pressure by means of the throttle.

When operating at full throttle and additional power is desired, the Power Boost control may be pulled out, provided the atmosphere is free of visible dust. This will allow the engine air flow to by-pass the filter and provide approximately one inch Hg additional manifold pressure. Do not use Power Boost on Take-off or landing.

To Decrease Power

First, reduce manifold pressure by means of the throttle.
Second, decrease engine speed (rpm) by means of the propeller control.

CRUISE PROCEDURES

When the desired altitude is reached, use the following procedures:

1. Close cowl flaps.
2. Trim nose down to level flight.
3. Reduce manifold pressure and rpm to desired setting. See performance charts in Section IV.

4. Set the mixture control for the fuel/air ratio desired. This is accomplished by use of the exhaust gas temperature indicator on the right side of the panel. For best economy, lean the mixture by turning the control counterclockwise until the indicator shows a peak (maximum) temperature and starts to decrease. Then enrich the mixture (turn control clockwise) until the temperature drops 25° F. minimum (one mark on the gage) from the peak.

   To obtain a best power (maximum airspeed) setting, lean to peak temperature and then enrich the mixture (turn control clockwise) until the indicator shows a 100 F. drop (four marks on the gauge) from the peak temperature.

   Do not lean the mixture at power settings above 75% rated power.

   Operation of the mixture control should be slow enough to allow for the slight lag in the EGT instrument.

WARNING

With the new prop, the placard for RPM limits reads:
Continuous operation is prohibited above 24" MP between 2350 and 2550 RPM. The bottom red line on the tachometer is no longer applicable. For more information, see supplement.

INDICATED AIRSPEED

The superior aerodynamic efficiency of your airplane manifests itself in the normal indicated cruise speeds. Your airspeed indicator is marked with a green arc to 175 mph and a yellow arc starting at 175 mph and ending at 200 mph. At lower altitudes, it is possible to cruise at indicated airspeeds above 175 mph and in the yellow cautionary arc. The yellow arc indicates speeds at which the pilot must exercise caution when encountering rough air or severe gusts. Rough air is considered to be a condition uncomfortable to pilot and passengers. Therefore, under these conditions, do not operate at airspeeds within the yellow arc.

WARNING

This airplane must be operated as a normal category airplane in compliance with the operating limitations stated in the form of placards, markings, and manuals. No acrobatic maneuvers, including spins, are approved. Maximum speed landing gear extended, 120 mph. Maximum speed for operation of gear, 120 mph. Maximum maneuvering flight load factor: flaps up +3.8 −1.5; flaps down +2.0.

FUEL MANAGEMENT

The following method is useful for monitoring remaining fuel. After take-off with both tanks full, use one tank only until one hour of fuel is depleted from it. Then switch to the second tank and record the time of switch-over on the elapsed time indicator on the clock. Use all the fuel in the second tank. Then, the time of fuel remaining in the first tank is the time it took to deplete the second tank, less one hour. However, this will be correct only if the cruise altitude and power setting remain unchanged. If a tank runs dry and the engine loses power, retard the throttle before restarting. Restarting with advanced throttle may cause engine over-speeding and can lead to mechanical malfunction.

LET-DOWN PROCEDURES

It is recommended that power let-downs be made in order to keep the engine from cooling too rapidly. By reducing the manifold pressure to some figure below cruise setting and then retaining cruise speed, a let-down can be made without excessive cooling of the engine. Do not open the cowl flaps for let-down.

LANDING PROCEDURES

Use the following check list before landing:

1. Fuel selector on fuller tank.
2. Boost pump on.
3. Mixture full rich (control forward).
4. Power Boost OFF (control full forward).
   NOTE: Warning light adjacent to Power Boost control will be on if gear is down and Power Boost is not off.
5. Landing gear down (lower at 120 mph or less).
   NOTE: The low frequency Warning Horn will sound intermittently (beep) if gear is not down and locked and throttle is retarded. Check for green "down and locked" light. If green light is not working, it can be screwed out and replaced in flight with the red "Gear Up" light to verify the locked position.
6. Propeller high rpm (control forward).
7. Seat belts fastened.

It is recommended that the base leg be flown at 90 mph. Upon turning final, or sooner if necessary, extend the desired amount of flaps. Flap speed is 105 mph. As the flaps are extended, the aircraft will become nose heavy. Roll the trim back so that the aircraft will glide hands-off at approximately 80 mph. The addition of a slight amount of power will flatten out the glide considerably. The high frequency stall warning horn will blow continuously if airspeed is reduced to within 5 to 10 mph of stalling speed.

NORMAL LANDING

Begin your flare-out for landing closer to the ground than you ordinarily would. This is done for two reasons:

1. The Executive 21 sits lower to the ground than most aircraft.
2. The Executive 21 requires very little altitude to make a transition from a glide to a landing attitude. A slight addition of back pressure is sufficient to stop the rate of descent.

it is recommended that full flaps be used on normal landings, because of the added visibility over the nose that it affords. However, the use of full flaps tends to make an aircraft nose-heavy,

and it is therefore necessary to roll the trim well back to make a good landing.

In a normal final landing approach, the aircraft should be trimmed for hands-off flight to the point of flare-out.

CAUTION

Under no circumstances should the aircraft be allowed to touch down in a nose-low attitude or at too high an airspeed. Either of these conditions will allow the nose wheel to contact the runway first, which may cause the aircraft to porpoise and damage the gear.

A good landing has been made when the main gear gently touches down before the nose wheel is allowed to make contact with the runway. This is the conventional and safest landing procedure for tricycle-gear aircraft.

After leaving the runway:

1. Open cowl flaps.
2. Retract wing flaps.
3. Taxi at 1000 to 1200 RPM for uniform engine cooling.
4. Set trim for TAKE-OFF.
5. Turn boost pump off.

STOPPING THE ENGINE

Stop the engine in the following manner:

1. Idle the engine at 1000 to 1200 RPM.
2. Pull the mixture control to the "idle cutoff" position.
3. As the engine stops firing, retard the throttle all the way out to reduce engine vibration.
4. When the propeller stops, turn the magneto and master switches to the "off" position.

PART III

SERVICE AND MAINTENANCE

GENERAL

This section will present service and maintenance information that is of a general or routine nature only. For more detailed information concerning maintenance that is more extensive, see the appropriate Mooney Service and Maintenance Manual. In the back of the Service and Maintenance Manual is a series of inspection guides covering recommended twenty-five, fifty and one-hundred hour inspections. It is recommended that you have these inspections and other maintenance performed at the nearest Mooney Service Center where factory trained mechanics are available.

If it becomes necessary to consult the Mooney factory concerning a specific problem, contact the Customer Service Department, Mooney Aircraft, Inc., Box 72, Kerrville, Texas 78028. Phone Area Code 512, 257-4043.

GROUND HANDLING

A small hand tow bar is provided with the aircraft which fits into the nose gear lower structure to facilitate maneuvering the

WING TIEDOWN RING

HAND TOW BAR

airplane by hand. When towing the airplane do not exceed the maximum turning angle indicated on the nose wheel turn indicator. Towing by means of a tractor or other vehicle is not recommended, as damage to the nose gear structure can result if the nose wheel is turned beyond the limit in either direction.

Removable tiedown rings are provided for the wing which screw into an attachment marked "Hoist Point" outboard of each main gear. The bearing points provided for jacking or hoisting the airplane also fit into these attachments. The tail tiedown ring is located under the tail skid.

PROPELLER

Before each flight the propeller blades should be checked for any nicks, cracks, or signs of other damage. Nicks cause high stress concentrations in the blades which could start a crack. Have a mechanic remove any nicks as soon as possible. It is not unusual for the propeller to have a certain amount of end-play. This is a result of manufacturing tolerances in the parts. Small differences at the blade root are magnified many times at the tip. This end-play has no adverse effect on the performance or operation of the propeller. As soon as the propeller begins to rotate, the centrifugal force of the blades seats them positively and rigidly against the bearing.

Sometimes it may be noted that the tachometer needle wavers in straight and level flight. If it is excessive, it may be further checked to determine if the problem lies in the propeller governor system or in the tachometer by doing the following:

1. Move the propeller control to the "high RPM" position. The RPM should increase to 2700.
2. Reduce the manifold pressure until the RPM is below 2700. At this time, the propeller will be in fixed pitch.

If the tachometer needle continues to waver, the problem lies in the tachometer and cable system itself. If the tachometer needle stabilizes, then the problem lies in the governor and propeller system. To eliminate this condition, have your mechanic purge or clean the propeller system.

If surging of the propeller occurs during take-off or climb out, it may be caused by air in the system or foreign matter in the governor passages.

ENGINE

or 100LL per Lycoming manual

Use 100/~~130~~ octane aviation fuel only. The wing sumps are drained with the plastic cup by inserting the center prong into the drain hole to release the valve.

Overflow vents are incorporated in each fuel tank to allow for overflow of the tank and ventilation as fuel is depleted.

The Power Boost ram air scoop located above the engine air filter should be closed off when the aircraft is on the ground. The scoop door should be checked frequently to insure that the door is closed and sealed properly.

The air filter should be removed and cleaned every 25 hours or more often if unusually dusty conditions are encountered. Refer to Lycoming Service Instruction No. 1014 (latest revision) for engine oil type recommendations and replacement intervals. Oil capacity is eight quarts – six minimum for take-off.

BATTERY

The battery should be checked every 25 hours of flight or every 30 days (whichever comes first) for proper fluid level. The battery is located aft of the baggage compartment and is easily accessible through the large access panel on the left side of the airplane.

CARE OF INTERIOR

Normal cleaning methods may be used for routine cleaning of the aircraft interior. The fabric on the seats and side panels may be cleaned with any spray-on type dry cleaner. The side panels and headliner may be cleaned with a damp cloth or an aircraft detergent and water solution. Do not use alcohol on interior plastics. Draftsman's dry cleaning pad can be used for removing light soil from the cloth headliner.

CARE OF EXTERIOR

The acrylic enamel paint used on the exterior does not require waxing. However, if you desire to wax the exterior, a period of 90 days since the airplane was painted should be allowed before waxing to insure proper curing of the paint. When washing the exterior use only mild aircraft detergents. Do not use a combination cleaner and wax on the exterior.

WINDOWS

The Plexiglas windows should be kept clean and waxed. Remove dirt or mud with your hand while flushing with water. Do not rub the windows with a cloth or chamois while cleaning. After cleaning, rinse and dry with a moist chamois. Remove oil or grease with a cloth soaked in kerosene. Do not use solvents other than kerosene on Plexiglas. After cleaning, polishing wax may be applied and rubbed lightly with a soft dry cloth. Do not use a power buffer as the heat generated by it may soften the surface of the windows.

LANDING GEAR

The landing gear retraction system should be rigged only by a mechanic familiar with the gear rigging procedures of the aircraft. The landing gear should be kept free of mud or ice to prevent interference when retracted. If you notice an unusual force when operating the manual retraction system, return the lever to the down and locked position and have the gear checked after landing. The gear warning horn may be checked in flight by retarding the throttle with the gear up. The horn should sound at about ten inches Hg manifold pressure.

Main gear tire pressure should be maintained at 30 PSI, while the nose gear tire should be kept at 49 PSI.

VACUUM OPERATED STEP

The operation of the step may be checked easily on the ground by starting the engine and maintaining sufficient engine speed to turn off the "Low Vacuum" light while an observer checks the step retraction. The step should retract slowly and smoothly into the fuselage. If there is evidence of binding as the step retracts, the support blocks should be examined for alignment. The step strut should be kept clean and a silicone-spray lubricant should be applied occasionally.

REQUIRED DATA

The following items must be carried with the aircraft at all times:

1. Aircraft Airworthiness Certificate (displayed)
2. Aircraft Registration Certificate (displayed)
3. Radio Station License (if transmitter is installed)
4. Weight & Balance Record (including equipment list)
5. Aircraft and Engine Log Books
6. Owners Manual (or sheet showing operating limitations).

SERVICE BULLETINS AND INSTRUCTIONS

Service Bulletins and Instructions are available from Mooney Distributors. It is recommended that all owners maintain contact with authorized service operators listed in the Mooney Service Directory to be assured of factory recommended service.

PART IV

PERFORMANCE DATA

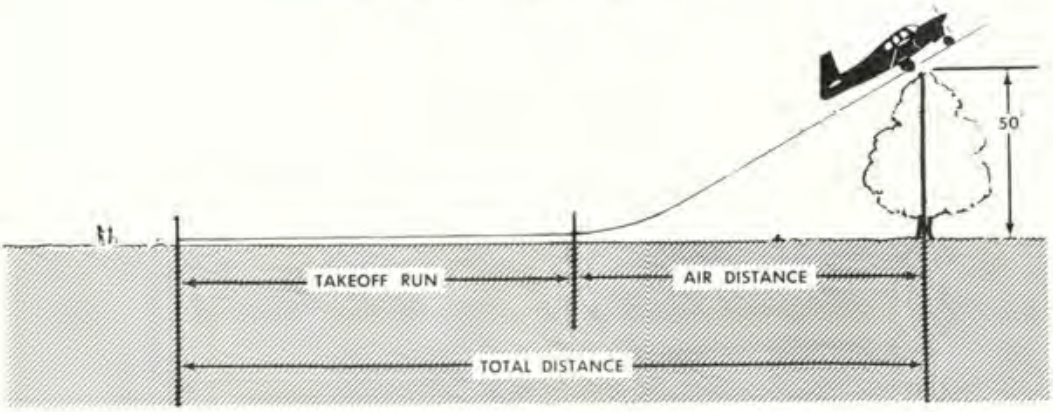


FIGURE 1

TAKE OFF & CLIMB DATA

		TAKE OFF WEIGHT 2300 LBS.				TAKE OFF WEIGHT 2740 LBS.			
Alt. Feet	Temp. °F. Feet*	Ground Run to Clear	Total Dist. to Clear 50'*	Max. R/C Ft/Min	Best R/C Speed IAS	Ground Run Feet*	Total Dist. to Clear 50'*	Max. R/C Ft/Min	Best R/C Speed IAS
SEA LEVEL	100°	730	1240	1230	109	1075	1675	935	109
	59°	595	1020	1370	113	880	1385	1075	113
	20°	545	950	1515	116	700	1105	1220	116
2500'	90°	860	1440	1100	107	1270	1960	805	107
	50°	730	1235	1235	110	1085	1650	940	110
	10°	615	1055	1380	113	905	1425	1085	113
5000'	80°	1095	1825	970	105	1560	2395	675	105
	41°	900	1515	1100	108	1320	2050	805	108
	0°	750	1285	1250	111	1105	1735	955	111

TAKE OFF CONFIGURATION:

* Gear down, full rich mixture, 15° (take off position) flaps
Wind calm—hard surface runway

CLIMB CONFIGURATION:

Gear Up – Best Power Mixture – Cowl Flaps Open – Flaps Up

FIGURE 2

EXECUTIVE 21 CLIMB PERFORMANCE

CONFIGURATION: GEAR UP, BEST POWER MIXTURE
FLAPS UP, FULL THROTTLE,
2700 RPM, COWL FLAPS OPEN

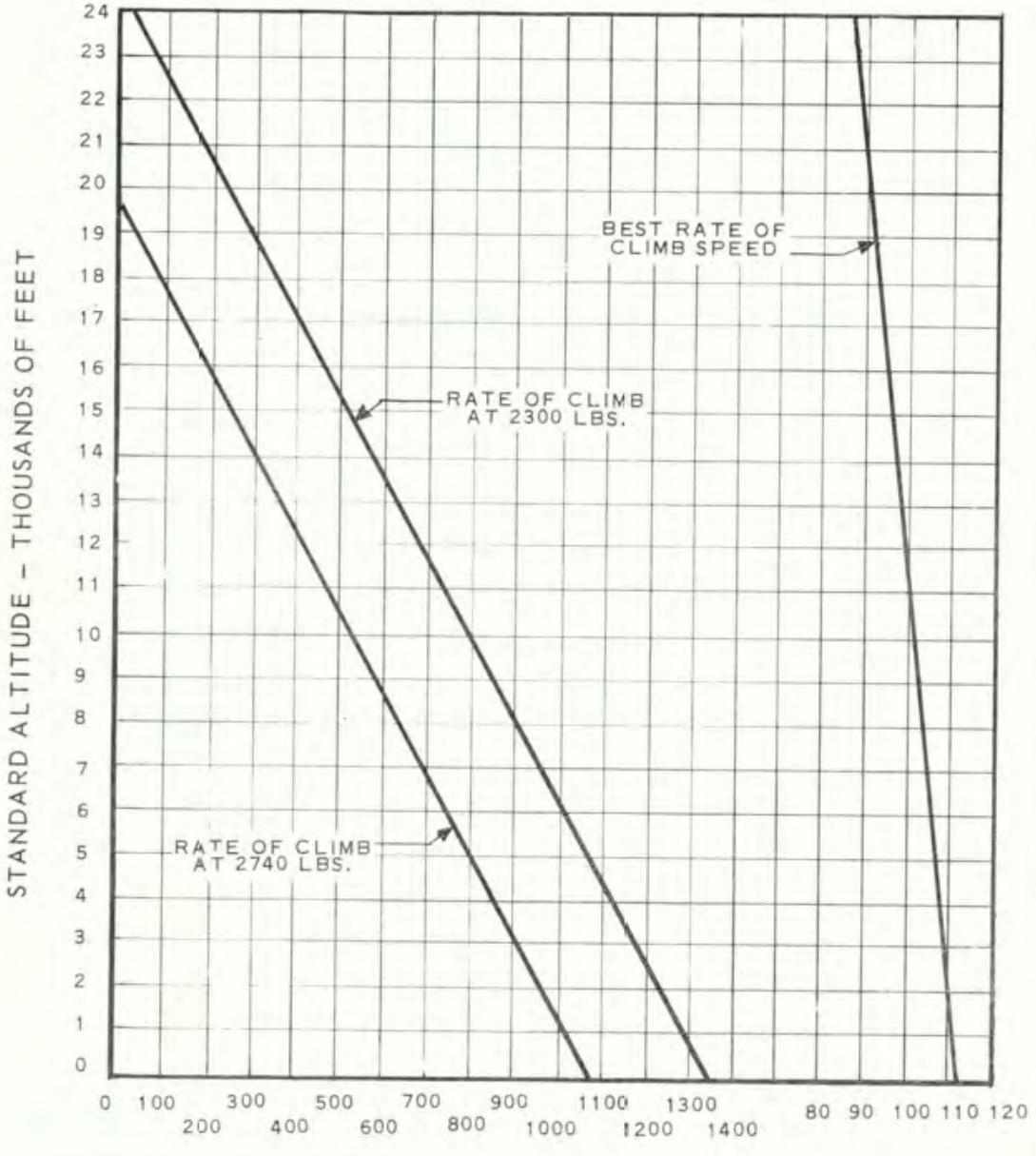


FIGURE 3

54.8 Gallons with bladders

CRUISE & RANGE DATA

2300 LBS. & 2740 LBS.: BEST POWER MIXTURE
~~64 GAL.~~ USABLE FUEL; NO RESERVE FOR RANGE CALCULATIONS
STANDARD ATMOSPHERE

ALTITUDE 2500 FT. MSL

Altitude 2,500ft M.S.L - Revised for fuel bladders

			%	Gal.	TAS (MPH)		TAS (KTS)		*Endurance		*Range NM	
RPM	M.P.	B.H.P	B.H.P.	Hour	2740lb	2300lb	2740lb	2300lb	Hrs.	HR:MIN	2740lb	2300lb
2700	27.5	193.0	97.0	13.8	191	197	166	171	3.97	3:58	659.1	679.8
	26.0	181.0	91.0	12.8	185	191	161	166	4.28	4:16	688.3	710.6
	25.0	170.0	85.0	12.3	182	188	158	163	4.46	4:27	704.6	727.9
	24.0	162.0	81.0	11.8	178	184	155	160	4.64	4:38	718.4	742.6
2600	26.0	173.0	87.0	12.2	181	187	157	163	4.49	4:29	706.5	729.9
	25.0	164.0	82.0	11.6	178	184	155	160	4.72	4:43	730.7	755.4
	25.0	156.0	78.0	11.2	175	181	152	157	4.89	4:53	744.1	769.6
	23.0	148.0	74.0	10.8	171	177	149	154	5.07	5:04	754.0	780.5
2500	25.0	Not allowed on this prop for continuous operations										
	24.0	149.0	75.0	10.8	168	174	146	151	5.07	5:04	740.8	767.2
	23.0	142.0	71.0	10.3	165	171	143	149	5.32	5:19	762.9	790.6
	22.0	133.0	67.0	9.8	160	166	139	144	5.59	5:35	777.5	806.6
2400	24.0	142.0	71.0	10.1	163	169	142	147	5.43	5:25	768.5	796.8
	23.0	134.0	67.0	9.8	159	165	138	143	5.59	5:35	772.6	801.8
	22.0	127.0	64.0	9.3	154	160	134	139	5.89	5:53	788.6	819.3
	21.0	119.0	60.0	8.9	149	155	129	135	6.16	6:09	797.3	829.4
2350	23.0	128.0	64.0	9.3	157	163	136	142	5.89	5:53	803.9	834.7
	22.0	119.0	60.0	8.8	152	158	132	137	6.23	6:13	822.5	855.0
	21.0	112.0	56.0	8.4	147	153	128	133	6.52	6:31	833.4	867.4
	20.0	105.0	53.0	8.0	143	149	124	129	6.85	6:51	851.2	886.9
1950	17.3	67.0	34.0	5.6	112	119	97	103	9.79	9:47	952.4	1012.0
	=optimum engine setting											

ACCURACY OF DATA IS ± 3%
EACH 100 LBS. CHANGE IN AIRPLANE WEIGHT WILL AFFECT T.A.S. BY 1.1 MPH

FIGURE 3A

54.8 Gallons with bladders

CRUISE & RANGE DATA

2300 LBS. & 2740 LBS.: BEST POWER MIXTURE
~~64 GAL.~~ USABLE FUEL; NO RESERVE FOR RANGE CALCULATIONS
STANDARD ATMOSPHERE

ALTITUDE 5000 FT. MSL

Altitude 5,000ft M.S.L - Revised for fuel bladders

RPM	M.P. HG.	B.H.P	% B.H.P.	Gal. Hour	TAS (MPH) 2740lb	TAS (MPH) 2300lb	TAS (KTS) 2740lb	TAS (KTS) 2300lb	*Endurance Hrs.	*Endurance HR:MIN	*Range NM 2740lb	*Range NM 2300lb
2700	25.0	176.0	91.0	12.6	191	197	166	171	4.35	4:20	721.9	744.6
	24.0	167.0	83.0	12.0	188	194	163	169	4.57	4:34	746.1	769.9
	23.0	158.0	79.0	11.5	183	189	159	164	4.77	4:45	757.8	782.6
	22.0	151.0	75.0	11.2	174	180	151	156	4.89	4:53	739.8	765.3
2600	25.0	170.0	85.0	12.0	189	195	164	169	4.57	4:34	750.0	773.8
	24.0	161.0	81.0	11.5	184	190	160	165	4.77	4:45	761.9	786.8
	23.0	154.0	77.0	11.1	181	187	157	163	4.94	4:56	776.5	802.3
	22.0	145.0	73.0	10.7	176	182	153	158	5.12	5:07	783.3	810.0
2500	25.0	Not allowed on this prop for continuous operations										
	24.0	154.0	77.0	11.0	181	187	157	163	4.98	4:58	783.6	809.6
	23.0	146.0	73.0	10.5	177	183	154	159	5.22	5:13	802.8	830.0
	22.0	139.0	70.0	10.1	173	179	150	156	5.43	5:25	815.7	844.0
2400	25.0	Not allowed on this prop for continuous operations										
	24.0	146.0	73.0	10.4	178	184	155	160	5.27	5:16	815.1	842.5
	23.0	138.0	69.0	9.9	175	181	152	157	5.54	5:32	841.8	870.7
	22.0	132.0	66.0	9.7	171	177	149	154	5.65	5:38	839.5	869.0
2350	24.0	139.0	70.0	9.8	175	181	152	157	5.59	5:35	850.4	879.5
	23.0	132.0	66.0	9.5	171	177	149	154	5.77	5:46	857.2	887.3
	22.0	125.0	63.0	9.1	166	172	144	149	6.02	6:01	868.7	900.1
	21.0	117.0	59.0	8.6	162	168	141	146	6.37	6:22	897.1	930.3
1950	17.0	69.0	35.0	5.7	116	122	101	106	9.61	9:36	969.1	1019.3

=optimum engine setting

ACCURACY OF DATA IS ± 3%
EACH 100 LBS. CHANGE IN AIRPLANE WEIGHT WILL AFFECT T.A.S. BY 1.1 MPH

FIGURE 3B

CRUISE & RANGE DATA

54.8 Gallons with bladders

2740 LBS. & 2300 LBS.; BEST POWER MIXTURE
~~64 GAL.~~ USABLE FUEL; NO RESERVE FOR RANGE CALCULATIONS
STANDARD ATMOSPHERE

ALTITUDE 7500 FT. MSL

Altitude 7,500ft M.S.L - Revised for fuel bladders

			%	Gal.	TAS (MPH)		TAS (KTS)		*Endurance		*Range NM	
RPM	M.P.	B.H.P	B.H.P.	Hour	2740lb	2300lb	2740lb	2300lb	Hrs.	HR:MIN	2740lb	2300lb
2700	23.0	162.0	81.0	11.8	188	194	163	169	4.64	4:38	758.7	782.9
	22.0	155.0	78.0	11.3	185	191	161	166	4.85	4:50	779.6	804.9
	21.0	146.0	73.0	10.8	180	186	156	162	5.07	5:04	793.7	820.1
	20.0	136.0	68.0	10.3	175	181	152	157	5.32	5:19	809.1	836.8
2600	23.0	158.0	79.0	11.4	185	191	161	166	4.81	4:48	772.8	797.9
	22.0	149.0	75.0	10.8	181	187	157	163	5.07	5:04	798.1	824.6
	21.0	140.0	70.0	10.3	177	183	154	159	5.32	5:19	818.3	846.1
	20.0	131.0	66.0	9.8	171	177	149	154	5.59	5:35	830.9	960.1
2500	23.0	151.0	76.0	10.8	181	187	157	163	5.07	5:04	798.1	824.6
	22.0	143.0	72.0	10.4	178	184	155	160	5.27	5:16	815.1	842.5
	21.0	135.0	68.0	9.9	174	180	151	156	5.54	5:32	837.0	865.8
	20.0	126.0	63.0	9.4	167	173	145	150	5.83	5:49	846.0	876.4
2400	23.0	144.0	72.0	10.3	178	184	155	160	5.32	5:19	823.0	850.7
	22.0	136.0	68.0	9.8	175	181	152	157	5.59	5:35	850.4	879.5
	21.0	128.0	64.0	9.4	172	178	149	155	5.83	5:49	871.4	901.8
	20.0	119.0	60.0	8.9	168	174	146	151	6.16	6:09	898.9	931.0
2350	23.0	136.0	68.0	9.7	175	181	152	157	5.65	5:38	859.1	888.6
	22.0	128.0	64.0	9.3	172	178	149	155	5.89	5:53	880.7	911.5
	21.0	121.0	61.0	8.9	167	173	145	150	6.16	6:09	893.6	925.7
	20.0	113.0	57.0	8.4	162	168	141	146	6.52	6:31	918.4	952.4
1950	16.9	72.0	36.0	5.8	121	127	105	110	9.45	9:26	993.5	1042.7

=optimum engine setting

ACCURACY OF DATA IS ± 3%
EACH 100 LBS. CHANGE IN AIRPLANE WEIGHT WILL AFFECT T.A.S. BY 1.1 MPH

FIGURE 3C

CRUISE & RANGE DATA

54.8 Gallons with bladders

2740 LBS. & 2300 LBS.; BEST POWER MIXTURE
~~64 GAL.~~ USABLE FUEL; NO RESERVE FOR RANGE CALCULATIONS
STANDARD ATMOSPHERE

ALTITUDE 10,000 FT. MSL

Altitude 10,000ft M.S.L - Revised for fuel bladders

RPM	M.P. IN.	B.H.P	% B.H.P.	Gal. Hour	TAS (MPH) 2740lb	TAS (MPH) 2300lb	TAS (KTS) 2740lb	TAS (KTS) 2300lb	*Endurance Hrs.	*Endurance HR:MIN	*Range NM 2740lb	*Range NM 2300lb
2700	21.0	150.0	75.0	11.1	185	191	161	166	4.94	4:56	793.7	819.4
	20.0	141.0	71.0	10.5	182	188	158	163	5.22	5:13	825.4	852.6
	19.0	133.0	67.0	10.1	177	183	154	159	5.43	5:25	834.5	862.8
	18.0	123.0	62.0	9.7	171	177	149	154	5.65	5:38	839.5	869.0
2600	21.0	144.0	72.0	10.5	182	188	158	163	5.22	5:13	825.4	852.6
	20.0	126.0	68.0	10.1	179	185	156	161	5.43	5:25	844.0	872.3
	19.0	127.0	64.0	9.7	174	180	151	156	5.65	5:38	854.2	883.7
	18.0	118.0	59.0	9.2	166	172	144	149	5.96	5:57	859.3	890.3
2500	21.0	138.0	69.0	10.1	179	185	156	161	5.43	5:25	844.0	872.3
	20.0	130.0	65.0	9.7	175	181	152	157	5.65	5:38	859.1	888.6
	19.0	122.0	61.0	9.3	171	177	149	154	5.89	5:53	875.6	906.3
	18.0	113.0	57.0	8.8	164	170	143	148	6.23	6:13	887.5	920.0
2400	21.0	132.0	66.0	9.7	176	182	153	158	5.65	5:38	864.1	893.5
	20.0	123.0	62.0	9.2	172	178	149	155	5.96	5:57	890.3	921.4
	19.0	116.0	58.0	8.7	167	173	145	150	6.30	6:17	914.1	947.0
	18.0	108.0	54.0	8.3	160	166	139	144	6.60	6:36	918.0	952.4
2350	21.0	125.0	63.0	9.1	173	179	150	156	6.02	6:01	905.3	936.7
	20.0	116.0	58.0	8.6	167	173	145	150	6.37	6:22	924.7	958.0
	19.0	109.0	55.0	8.3	162	168	141	146	6.60	6:36	929.5	963.9
	18.0	101.0	51.0	7.8	155	161	135	140	7.03	7:01	946.3	983.0
1950	16.9	75.0	38.0	5.9	126	132	109	115	9.29	9:17	1017.0	1065.4

=optimum engine setting

ACCURACY OF DATA IS ± 3%
EACH 100 LBS. CHANGE IN AIRPLANE WEIGHT WILL AFFECT T.A.S. 1.1 MPH

FIGURE 3D

CRUISE & RANGE DATA

54.8 Gallons with bladders

2740 LBS. & 2300 LBS.; BEST POWER MIXTURE
~~64 GAL.~~ USABLE FUEL; NO RESERVE FOR RANGE CALCULATIONS
STANDARD ATMOSPHERE

ALTITUDE 15,000 FT. MSL

Altitude 15,000ft M.S.L - Revised for fuel bladders

			%	Gal.	TAS (MPH)		TAS (KTS)		*Endurance		*Range NM	
RPM	M.P.	B.H.P	B.H.P.	Hour	2740lb	2300lb	2740lb	2300lb	Hrs.	HR:MIN	2740lb	2300lb
2700	17.5	125.0	63.0	9.8	179	185	156	161	5.59	5:35	869.8	899.0
2600	17.5	120.0	60.0	9.3	175	181	152	157	5.89	5:53	896.1	926.8
2500	17.5	116.0	58.0	8.9	172	178	149	155	6.16	6:09	920.3	952.4
2400	17.5	110.0	55.0	8.4	166	172	144	149	6.52	6:31	941.1	975.1
2350	17.5	103.0	52.0	7.9	161	167	140	145	6.94	6:56	970.5	1006.7
1950	16.8	81.0	41.0	6.3	137	143	119	124	8.70	8:41	1035.6	1080.9

ACCURACY OF DATA IS ± 3%
EACH 100 LBS. CHANGE IN AIRPLANE WEIGHT WILL AFFECT T.A.S. BY 1.1 MPH

FIGURE 4

STALL SPEED Vs. BANK ANGLE

GROSS WEIGHT 2740 LBS.; I.A.S. MPH; POWER OFF

FLAP SETTING	0° BANK	20° BANK	40° BANK	60° BANK
0° (Flaps Up)	68	71	80	98
15° (Take Off)	64	67	76	93
33° (Landing)	62	65	74	90

FIGURE 5

MAXIMUM RANGE

The speed at which the M20F is most efficient (i.e. the Ratio of Lift to Drag is at a Maximum) is 104 MPH INDICATED AIRSPEED, Gear & Flaps Up. Flying at this airspeed will give maximum range under zero wind conditions.

GLIDE RANGE

Landing gear and flaps up, no wind, 2740 lbs. gross weight.

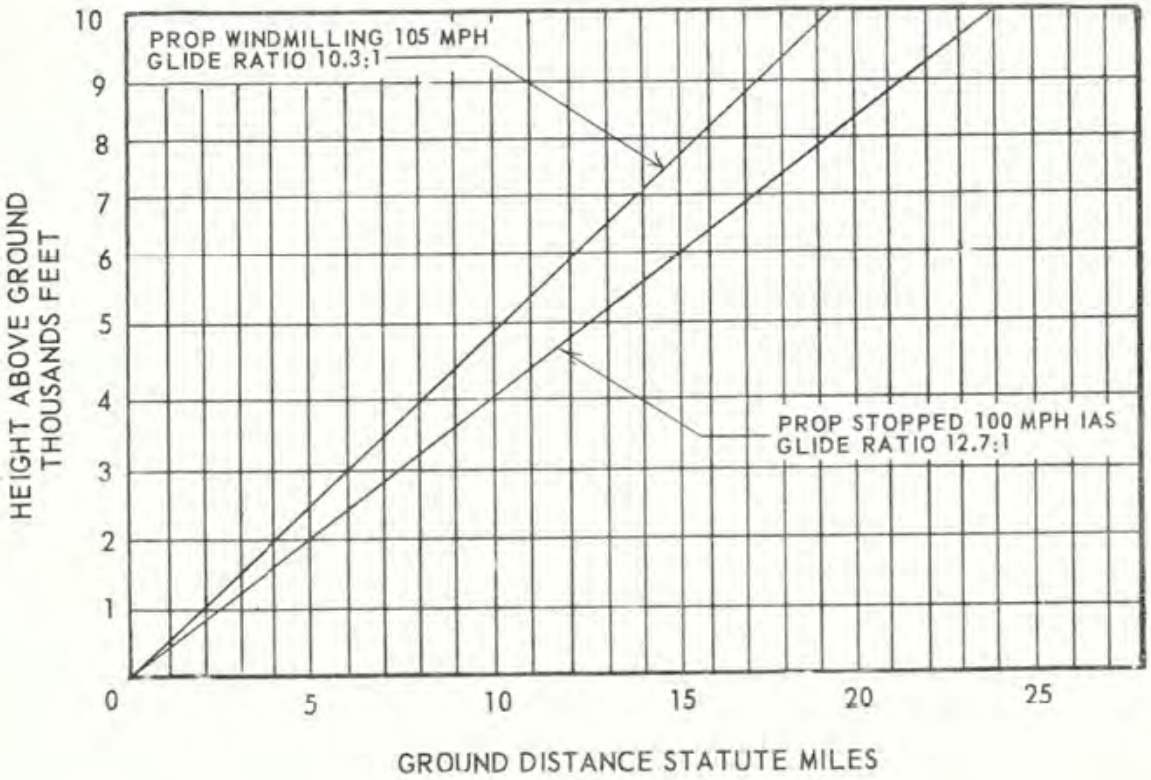
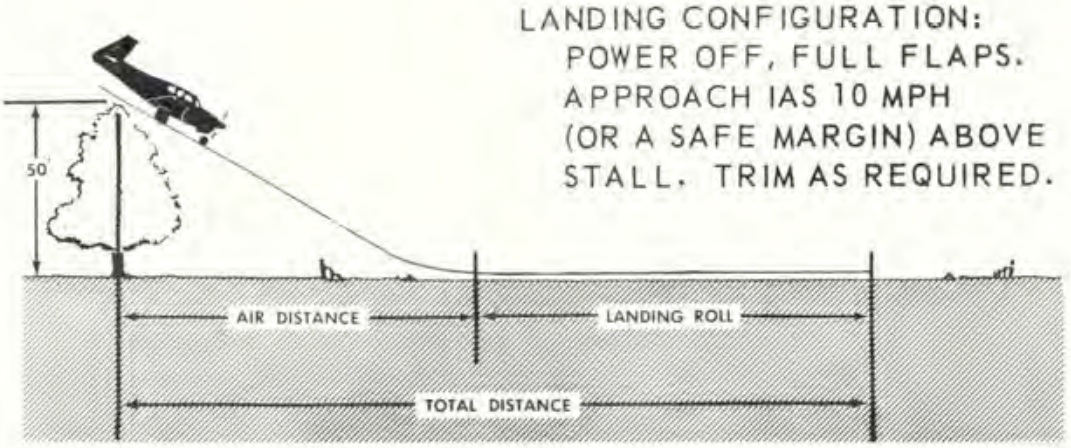


FIGURE 6
LANDING DATA



LANDING DISTANCES

STANDARD ATMOSPHERE. HARD SURFACE RUNWAY.
WIND CALM. BRAKES APPLIED DURING ROLL OUT.

		LANDING WEIGHT = 2300 POUNDS			LANDING WEIGHT = 2740 POUNDS		
ALTITUDE FEET MSL	TEMP. (STD.) °F	AIR DISTANCE (FEET)	GROUND ROLL (FEET)	TOTAL DISTANCE (FEET)	AIR DISTANCE	GROUND ROLL	TOTAL DISTANCE
SEA LEVEL	59°	775	640	1415	1000	785	1785
2500	50°	820	685	1505	1055	845	1900
5000	41°	865	740	1605	1115	910	2025
7500	32°	915	800	1715	1185	990	2175

PART V

OPERATING LIMITATIONS

FAA/DOA APPROVED MOONEY M20F

Operating limitations given in this section of the Executive 21 Owners Manual are Federal Aviation Agency – Delegation Option Authority approved and mandatory. This document, or a copy thereof, must be carried in the airplane at all times.

Operating limitations also include all information in the form of placards and markings in the aircraft.

Operating limitations also include data in the aircraft Weight & Balance Record.

The following limitations must be observed in the operation of this airplane.

Engine	Lycoming Model IO-360-A1A
Engine Limits	Limits for all operations – 2700 RPM, 200 HP
Fuel	100/130 Octane Aviation Gasoline, 64 Gal.
Propeller	Hartzell Constant Speed Hub HC-C2YK-1 Blade 7666-2 Pitch Setting at 30-inch station: High 29° ± 2°, Low 14° ± 0°
Cowl Flaps	Open for Take-off and Landing (Do Not Open Above 150 MPH)

Replaced, see supplement

Power Plant Instruments

Tachometer	
Radial Red Line (Rated)	2700 RPM
Green Arc-Narrow (Rated Operating range)	2500-2700 RPM
Green Arc-Wide (Recommended Operating Range)	2350-2500 RPM
Red Arc-Wide (No Continuous Operation in this Range)	2100-2350 RPM
Cylinder Head Temperature	
Radial Red Line (Maximum)	475° F
Green Arc (Operating Range)	300° to 450° F
Oil Pressure	
Radial Red Line (Minimum Idling)	25 PSI
Radial Red Line (Maximum)	100 PSI
Green Arc (Operating Range)	60 to 90 PSI
Yellow Arc (Idling Range)	25 to 60 PSI
Yellow Arc (Starting & Warm-up Range)	90 to 100 PSI

Fuel Pressure	
Radial Red Line (Minimum)	14 PSI
Radial Red Line (Maximum)	30 PSI
Green Arc (Operating Range)	14 to 30 PSI
Oil Temperature	
Radial Red Line (Maximum)	245° F
Green Arc (Operating Range)	100° to 225° F

Airspeed Limitations

Never-Exceed Speed	200 MPH CAS
Maximum Structural Cruising Speed	175 MPH CAS
Maximum maneuvering Speed	135 MPH CAS
Maximum Gear Operating Speed	120 MPH CAS
Maximum Gear Extended Speed	120 MPH CAS
Maximum Flap Operating Speed	105 MPH CAS

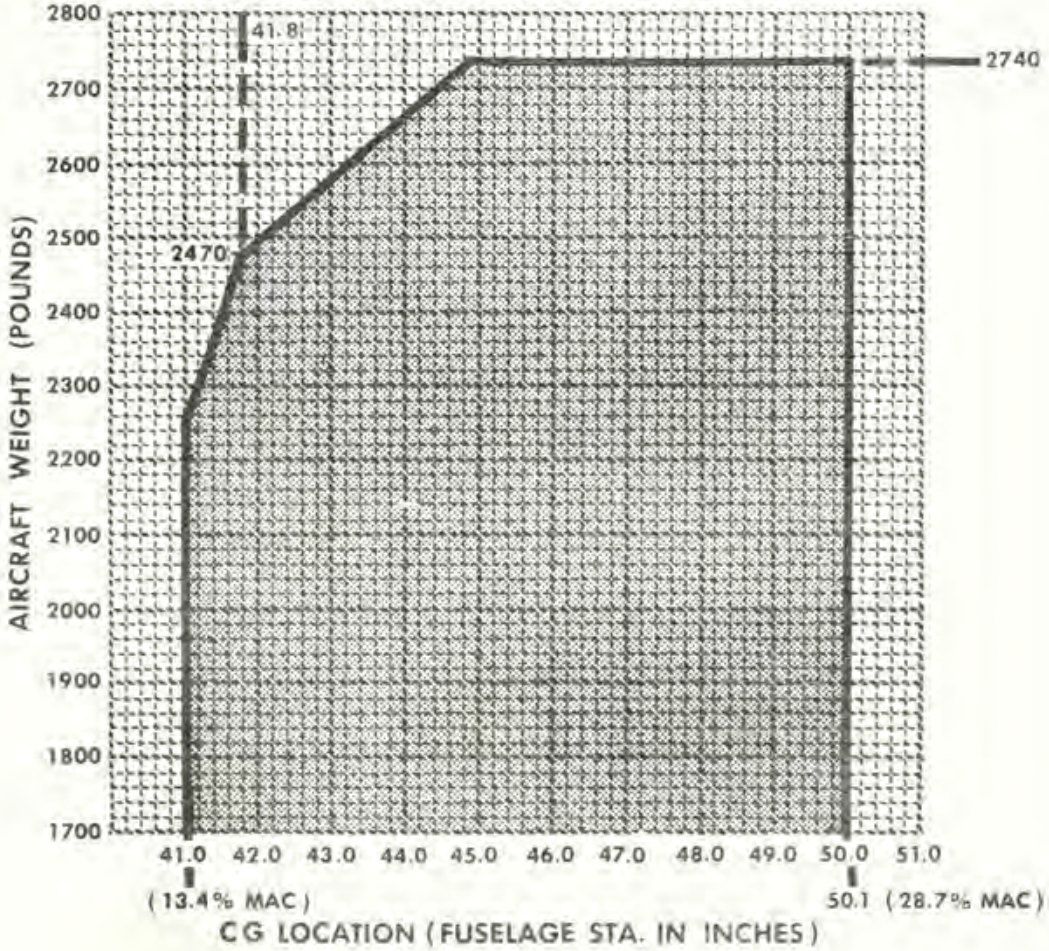
Flight Load Factors

Maximum Positive Load Factor = 3.8
Maximum Negative Load Factor = -1.5
Maximum Positive Load Factor, Flaps Down (33°) = 2.0

Maximum Weight & CG Range

Maximum Weight - 2740 Pounds

LOADING ENVELOPE (GEAR EXTENDED)



Datum (fuselage station 0.0) is five inches aft of the center line of the nose gear attaching bolts, and 33 inches forward of the wing leading edge at wing station 59.25.

Consult the Weight & Balance Record for loading schedule information.

NOTE: a. The front seat positions can adversely affect CG limitations at the most rearward loading. Allowable baggage weight is dictated by seat positions.
b. It is the responsibility of the airplane owner and the pilot to insure that the airplane is properly loaded.

Aircraft Instrumentation Markings and their Significance

(a) Radial Red Line - 200 MPH CAS
(Never-Exceed Speed which is the Maximum Safe Airspeed)
(b) Yellow Arc - 175 to 200 MPH
(Denotes Range of Speeds in which Operations should be Conducted with Caution and Only in Smooth Air)
(c) Green Arc - 69 to 175 MPH CAS
(Denotes Normal Operating Speed Range)
(d) White Arc - 64 to 105 MPH CAS
(Denotes Speed Range in which Flaps may be Safely Lowered)

Maneuvers involving approach to stalling angle or full application of elevator, rudder, or aileron should be confined to speeds below maneuvering speed. No snap maneuvers or whip stalls are approved at any speed. No inverted or acrobatic maneuvers, including spins, are approved.

Types of Operation

VFR, IFR, Day and Night Operations are Approved. Do Not Fly in Icing Conditions.

Power Boost

Turn Power Boost off when operating in icing conditions. Icing conditions prevail any time the temperature and moisture conditions combine to produce the possibility of impact ice.

Placards

(1) This airplane must be operated as a normal category airplane in compliance with the operating limitations stated in the form of placards, markings, and manuals. No acrobatic maneuvers, including spins, are approved. Maximum speed landing gear extended, 120 MPH. Maximum speed for operation of gear, 120 MPH. Maximum maneuvering flight load factor: flaps up +3.8, −1.5; flaps down +2.0

(2) (On Storm Window) Do Not Open Above 150 MPH.

(3) Load In Accordance With Loading Schedule
Maximum Baggage Limit – 120 Pounds

(4) In Case of Engine Fire Turn Cabin Heater OFF

(5) Retract Flaps After Landing

(6) WARNING: Do Not Exceed 10 Pounds in This Compartment. See Aircraft Loading Schedule Data for Baggage Compartment Allowable.

Instrument Markings (Except Power Plant)

Vacuum Warning Lights	
"High" light	5.0 inches of Hg.
"Low" light	4.25 inches of Hg.

Maximum Altitude Loss in Stalls at Gross Weight – 220 Ft.

Stall warning is provided by a horn emitting a constant sound of a different pitch than the gear warning horn.

The stall warning horn is inoperative with the master switch off.

Per AD 2004-25-04, alternate method of compliance for flush style fuel caps on O&N fuel bladders installed in this aircraft:

Pilot Operating Procedures–Preflight Fuel System Check

(1) Place a suitable container under the fuel strainer drain outlet prior to operating the strainer drain control for at least 4 seconds. Check strainer to ensure drain is closed.

(2) Inspect the fluid drained from the fuel strainer and each wing tank quick drain for evidence of fuel contamination in the form of water, rust, sludge, ice, or any other substance not compatible with fuel. Also check for proper fuel grade before the first flight of each day and after each refueling. If any contamination is detected, comply with paragraph (f)(4) of this AD.

(3) Repeat steps in paragraph (f)(1) and (f)(2) of this AD on each wing tank quick drain.

(4) If the airplane has been exposed to rain, sleet, or snow, or if the wing fuel tanks or fuel strainer drains produce water or other contamination, you must purge the airplane fuel system to the extent necessary to ensure that there is no water, ice, or other fuel contamination.

CHALLENGER AIR FILTER CLEANING INSTRUCTIONS
Issue Date: March 9, 2004 Revision C Document #4003

INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

Airworthiness limitations section is FAA approved and specifies maintenance required under sections 43.16 and 91.403 of the Federal Aviation Regulations unless alternative program has been approved.

AIRWORTHINESS LIMITATIONS

Servicing: Challenger's cleaning instructions must be followed carefully for maximum air filter life. Air filter must be cleaned every 100 hours or 12 months or sooner if operated in extreme dusty conditions. Air filter assembly must be replaced after 25 cleanings or sooner if any deterioration or damage is found during inspections.

Note: Air Filters exposed to in flight rain encounter must be inspected before next flight. If red oil color is missing, clean and re-oil per these instructions.

1. Remove the air filter assembly from the aircraft air box per the Aircraft Manufacturer's Instructions. **(Do Not Remove Filter Element From It's Frame)**
   Cleaning Hints - Use only Challenger Air Filter Cleaner Kit #CP99-5050.
   NO GASOLINE CLEANING, STEAM CLEANING, CAUSTIC CLEANING SOLUTION, STRONG DETERGENTS, HIGH PRESSURE WASH, OR PARTS CLEANING SOLVENTS! Any of these methods will cause harm to the filter. Plus shrink and harden the rubber end caps!
2. Remove old gasket from filters with mounting frames.
3. Pre-Cleaning - Tap the air filter to dislodge any embedded dirt, then gently brush with a soft bristle brush. Challenger P/N CP2508 or equivalent.
4. Spray-On Cleaner - Spray Challenger Filter Cleaner liberally onto the air filter element and let soak for 10 minutes.
5. Rinse Off - Rinse off the filter with low water pressure. Always flush from the clean side to the dirty side. This removes the dirt and does not drive the dirt into the filter. The filter will turn white in color.
6. Drying Hints - Always dry naturally, no high-pressure air. After rinsing, shake off all excess water and let the air filter dry naturally. High pressure air will damage the filter element.
7. Squeeze Bottle Oiling - After cleaning the air filter, always re-oil before using. Lightly squeeze Challenger Filter Oil into the filter element and along every third pleat. Only one pass per pleat. Let the oil wick into cotton fabric for 20 minutes. Re-oil any white spot still showing.
   Caution: Do not over oil. If oil is dripping from the filter re-clean and start again.
8. Oiling Hints - NEVER use automatic transmission fluid, motor oil, diesel fuel, WD-40, LPS or any other light weight oils. NEVER use the filter without oiling (The filter will not stop the dirt without proper oiling). **USE ONLY FORMULATED CHALLENGER AIR FILTER OIL.**
   Challenger Air Filter oil is a compound of mineral and animal oils blended with special polymers to form a very efficient tack barrier. The red dye is added to show where you have applied the oil, eventually, the red color will fade, but the oil will remain on the filter.
9. Install new mounting gaskets for air filters with mounting frames.
10. Re-install - Re-install your air filter per the Aircraft Maintenance Instructions and Challenger Installation Instruction #0402. Make sure the air filter assembly is properly seated and is mounted to the filter air box. Tighten all nuts, bolts or screws, etc., in accordance with the Aircraft Manufacturer's Specifications.

FOR ANY QUESTIONS, PLEASE CALL
CHALLENGER PRODUCT SUPPORT 937-667-0510 or
EMAIL PREMFILTER@AOL.COM

FAA
APPROVED
MAR 10 2004
CHICAGO AIRCRAFT
CERTIFICATION OFFICE
CENTRAL REGION

Brentwing Engineering, Inc.
P. O. Box 486
Pittsburg, KS 66762

FAA APPROVED
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
FOR

Mooney Aircraft Model M20F
M20F S/N 660002 through 660004, 670001 through 670363, 670365 through 670385, 670387 through 670482, 670484 through 670539, 680001 through 680206, 690003 through 690090, 690092, 700001 through 700004

With Bladder Type Wing Fuel Cells

Registration No. N3275F

Aircraft S/N 670368

This Supplemental Flight Manual must be carried on board the airplane when the airplane is modified by the installation of Bladder Type Fuel Cells in the place of the original Integral Fuel Tanks in accordance with Supplemental Type Certificate No. SA2277CE.

The information contained in this document supplements or supersedes the information contained in the form of Placards, Markings, and the Type Certificate Data Sheet, only in those areas listed herein. For limitations, procedures, and performance not contained in this manual, consult the original Placards, Markings, and Type Certificate Data Sheet.

FAA APPROVED J M Baker

for ROBERT A. GAMBRILL, JR.
Manager, Wichita Aircraft Certification Office
CENTRAL REGION
Wichita, Kansas

FAA APPROVED DATE: 9/11/87

LOG OF REVISIONS

REV.	PAGES	DESCRIPTION	FAA APPROVED BY/FOR *	DATE
(0)	1 - 4	Original	D M Baker	9/11/87

*Manager, Wichita Aircraft Certification Office
Central Region
Wichita, Kansas

I. GENERAL

FUEL

Total Fuel Capacity: 57.3 U.S. Gallons
Usable Fuel Capacity: 54.8 U.S. Gallons
Minimum Fuel Octane Rating and Color

Grade	Color
100	Green
100LL	Blue

II. LIMITATIONS

FUEL LIMITATIONS

2 Standard Tanks: 28.65 U.S. Gallons Each
Total Fuel: 57.3 U.S. Gallons
Usable Fuel: 54.8 U.S. Gallons
Unusable Fuel: 2.5 U.S. Gallons

Fuel Grade (and Color): 100 Minimum Grade Aviation Fuel (Green). 100LL (Low Lead) Aviation Fuel (blue) with a lead content limited to 2 cc per gallon is also approved.

DECALS AND PLACARDS

INTERIOR

On Fuel Selector Valve Below Words "LEFT" & RIGHT":
"27.4 GAL."

EXTERIOR:

On Fuel Tank Caps:
"FUEL-100(GREEN) OR
100LL (BLUE) MIN. OCT.
27.4 U.S. GAL"

III. EMERGENCY PROCEDURES

No Change

IV. NORMAL PROCEDURES

No Change

V. PERFORMANCE

Airplane range must be adjusted for reduced fuel capacity with this installation.

VI. WEIGHT AND BALANCE

PROBLEM FORM	WEIGHT	MOMENT
Current Aircraft Empty Weight		
Oil--8 qt. @ 1.875 lbs./qt. (Sta.-11.5) (Sump assumed full for all flights)		
* Pilot and Copilot Seats (#1 and #2)		
Left and Right Rear Seats (#3 and #4)		
Fuel (Max. Usable 54.8 Gal. 328.8 lbs @ Sta. 48.43)		
Baggage (Max. 120 lbs. @ Sta. 95.5)		
Hat Rack (Max. 10 lbs. @ Sta. 119.0)		

Loaded Aircraft Weight

Total Moment

*Obtain the moment/1000 value for each seat position (FWD, MID, or AFT) from the loading computation in the original flight manual.

Notes: 1. Refer to the original flight manual for basic C.G. moment envelope.

Garmin International, Inc.
1200 E. 151st Street
Olathe, Kansas 66062 U.S.A.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL
for the
Garmin GNS 400W, 420W, 420AW, 430W, or 430AW
GPS/SBAS Navigation System
as installed in

MOONEY M20F
Make and Model Airplane

Registration Number: N3275F Serial Number: 670368

This document serves as an Airplane Flight Manual Supplement or as a Supplemental Airplane Flight Manual when the aircraft is equipped with the Garmin GNS 400W, 420W, 420AW, 430W, or 430AW GPS/SBAS Navigation System. This document must be carried in the airplane at all times when the Garmin GNS unit is installed in accordance with STC SA01933LA-D. This document must be incorporated into the FAA Approved Airplane Flight Manual or provided as an FAA Approved Supplemental Airplane Flight Manual.

The information contained herein supplements the information in the FAA Approved Airplane Flight Manual. For limitations, procedures, loading and performance information not contained in this document, refer to the FAA Approved Airplane Flight Manual, markings, or placards.

FAA Approved By: Michael Warren

Michael Warren
ODA STC Unit Administrator
Garmin International, Inc.
ODA-240087-CE

Date: 28-MAR-2013

LOG OF REVISIONS				
Rev. No.	Page No.	Date	Description	FAA Approved
A Original	All	11-20-07	Complete Supplement	Seyed-Youssef Hashemi Mgr. Flt. Test Br., ANM-160L FAA, Los Angeles ACO Transport Airplane Directorate Date: Nov. 20, 2007
B	All	07/31/09	Added '-D' to STC number, added LP approach type	David G Armstrong ODA STC Unit Administrator ODA-240087-CE Garmin International, Inc.
C	All	03/21/13	Complete Rewrite	See Page 1

Table of Contents

Section 1. GENERAL

1.1 Garmin 4XXW Series GPS/WAAS Nav Com

The Garmin GNS Series GPS/WAAS Navigator is a panel-mounted product that contains a GPS/WAAS receiver for GPS approved primary navigation under TSO-C146a, (plus optional VHF Com and VHF Nav radios) in an integrated unit with a moving map and color display. The 4XXW Series unit features a graphical display which may also be used to depict traffic, weather, or terrain data.

The navigation functions are operated by dedicated keys and graphical menus which are controlled by the buttons and the dual concentric rotary knob along the bottom and right side of the display.

Optional VHF Com and VHF Nav radio functions are controlled via dedicated buttons and knobs on the left side of the display and adjacent to frequencies they are controlling.

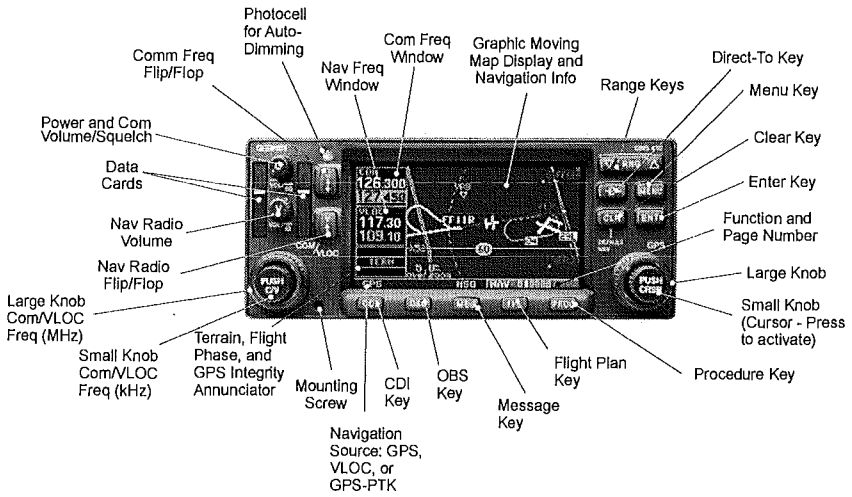


Figure 1 - 430W Series Control and Display Layout

1.2 GPS/SBAS TSO-C146a Class 3 Operation

The GNS complies with AC 20-138A and has airworthiness approval for navigation using GPS and SBAS (within the coverage of a Satellite Based Augmentation System complying with ICAO Annex 10) for IFR en route, terminal area, and non-precision approach operations (including those approaches titled "GPS", "or GPS", and "RNAV (GPS)" approaches). The Garmin GNSS navigation system is composed of the GNS navigator and antenna, and is approved for approach procedures with vertical guidance including "LPV" and "LNAV/VNAV" and without vertical guidance including "LP" and "LNAV," within the U.S. National Airspace System.

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-105 and meets the equipment performance and functional requirements to conduct RNP terminal departure and arrival procedures and RNP approach procedures without RF (radius to fix) legs. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

The Garmin GNSS navigation system complies with the equipment requirements of AC 90-100A for RNAV 2 and RNAV 1 operations. In accordance with AC 90-100A, Part 91 operators (except subpart K) following the aircraft and training guidance in AC 90-100A are authorized to fly RNAV 2 and RNAV 1 procedures. Part 91 subpart K, 121, 125, 129, and 135 operators require operational approval from the FAA.

Applicable to dual installations consisting of two Garmin GNSS units: The Garmin GNSS navigation system has been found to comply with the requirements for GPS Class II oceanic and remote navigation (RNP-10) without time limitations in accordance with AC 20-138A and FAA Order 8400.12A. The Garmin GNSS navigation system can be used without reliance on other long-range navigation systems. This does not constitute an operational approval.

The Garmin GNSS navigation system has been found to comply with the navigation requirements for GPS Class II oceanic and remote navigation (RNP-4) in accordance with AC 20-138A and FAA Order 8400.33. The Garmin GNSS navigation system can be used without reliance on other long-range navigation systems. Additional equipment may be required to obtain operational approval to utilize RNP-4 performance. This does not constitute an operational approval.

The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for P-RNAV operations in accordance with JAA Administrative & Guidance Material Section One: General Part 3: Temporary Guidance Leaflets, Leaflet No 10 (JAA TGL-10 Rev 1). The GNSS navigation system has one or more TSO-C146a Class 3 approved Garmin GNS Navigation Systems. The Garmin GNSS navigation system complies with the accuracy, integrity, and continuity of function, and contains the minimum system functions required for B-RNAV operations in accordance with EASA AMC 20-4. The Garmin GNSS navigation system complies with the equipment requirements for P-RNAV and B-RNAV/RNAV-5 operations in accordance with AC 90-96A CHG 1. This does not constitute an operational approval.

Garmin International holds an FAA Type 2 Letter of Acceptance (LOA) in accordance with AC 20-153 for database integrity, quality, and database management practices for the navigation database. Flight crew and operators can view the LOA status at FlyGarmin.com then select "Type 2 LOA Status."

Navigation information is referenced to the WGS-84 reference system.

Note that for some types of aircraft operation and for operation in non-U.S. airspace, separate operational approval(s) may be required in addition to equipment installation and airworthiness approval.

Section 2. LIMITATIONS

2.1 Pilot's Guide

The Quick Reference Guide, part number and revision listed below (or later applicable revisions), must be immediately available for the flight crew whenever navigation is predicated on the use of the 4XXW Series unit.

- 400W Series Pilot's Guide & Reference P/N 190-00356-00 Rev H

The Pilot's Guide Addendum, part number and revision listed below (or later applicable revision), must be immediately available for the flight crew whenever one or more of the following functions are installed and utilized with the 4XXW Series unit:

GDL 69/69A XM Satellite Data link
GDL 88 ADS-B Transceiver
GTX 330/330D TIS
GTS 8XX Series TAS

- 400W/500W Series Optional Displays P/N 190-00356-30 Rev J

The Pilot's Guide Addendum, part number and revision listed below (or later applicable revision), must be immediately available for the flight crew whenever one or more of the following functions are installed and utilized with the 4XXW Series unit:

Stormscope® Lightning Detection System
Skywatch® Traffic Advisory System
Bendix/King® Traffic Advisory System
Avidyne/Ryan TCAD Traffic System

- 400W/500W Series Display Interfaces P/N 190-00356-31 Rev D

2.2 Kinds of Operation

This AFM supplement does not grant approval for IFR operations to aircraft limited to VFR operations. Additional aircraft systems may be required for IFR operational approval. Systems limited to VFR shall be placarded in close proximity to the 4XXW Series unit: **"GPS LIMITED TO VFR USE ONLY"**.

2.3 System Software

This AFMS/AFM is applicable to the software versions shown in Table 1.

The Main and GPS software versions are displayed on the start-up page immediately after power-on.

Software Item	**Approved Software Version** *(or later FAA approved versions for this STC)*	
	SW version	As displayed on unit
Main SW Version	5.03	5.03
GPS SW Version	5.0	5.0

Table 1 – Required Equipment

2.4 Navigation database

GPS/SBAS based IFR enroute, oceanic, and terminal navigation is prohibited unless the flight crew verifies and uses a valid, compatible, and current navigation database or verifies each waypoint for accuracy by reference to current approved data.

"GPS", "or GPS", and "RNAV (GPS)" instrument approaches using the Garmin navigation system are prohibited unless the flight crew verifies and uses the current navigation database. GPS based instrument approaches must be flown in accordance with an approved instrument approach procedure that is loaded from the navigation database.

Discrepancies that invalidate a procedure should be reported to Garmin International. The affected procedure is prohibited from being flown using data from the navigation database until a new navigation database is installed in the aircraft and verified that the discrepancy has been corrected. Navigation database discrepancies can be reported at FlyGarmin.com by selecting "Aviation Data Error Report." Flight crew and operators can view navigation database alerts at FlyGarmin.com then select "NavData Alerts."

If the navigation database cycle will change during flight, the flight crew must ensure the accuracy of navigation data, including suitability of navigation facilities used to define the routes and procedures for flight. If an amended chart affecting navigation data is published for the procedure, the database must not be used to conduct the procedure.

2.5 Flight Planning

For flight planning purposes, in areas where SBAS coverage is not available, the flight crew must check RAIM availability.

- Within the United States, RAIM availability can be determined using the Garmin WFDE Prediction program, Garmin part number 006-A0154-04 software version 3.00 or later approved version with Garmin approved antennas or the FAA's enroute and terminal RAIM prediction website: www.raimprediction.net, or by contacting a Flight Service Station.
- Within Europe, RAIM availability can be determined using the Garmin WFDE Prediction program or Europe's AUGER GPS RAIM Prediction Tool at http://augur.ecacnav.com/augur/app/home.
- For other areas, use the Garmin WFDE Prediction program.

This RAIM availability requirement is not necessary if SBAS coverage is confirmed to be available along the entire route of flight. The route planning and WFDE prediction program may be downloaded from the Garmin website on the internet. For information on using the WFDE Prediction Program, refer to Garmin WAAS FDE Prediction Program, part number 190-00643-01, 'WFDE Prediction Program Instructions'.

For flight planning purposes, for operations within the U.S. National Airspace System on RNP and RNAV procedures when SBAS signals are not available, the availability of GPS RAIM shall be confirmed for the intended route of flight. In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended route of flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met. The flight may also be re-planned using non-GPS based navigational capabilities.

For flight planning purposes for operations within European B-RNAV/RNAV-5 and P-RNAV airspace, if more than one satellite is scheduled to be out of service, then the availability of GPS RAIM shall be confirmed for the intended flight (route and time). In the event of a predicted continuous loss of RAIM of more than five minutes for any part of the intended flight, the flight shall be delayed, canceled, or rerouted on a track where RAIM requirements can be met.

Applicable to dual installations consisting of two Garmin GNSS units:

For flight planning purposes, for operations where the route requires Class II navigation the aircraft's operator or flight crew must use the Garmin WFDE Prediction program to demonstrate that there are no outages on the specified route that would prevent the Garmin GNSS navigation system to provide GPS Class II navigation in oceanic and remote areas of operation that requires RNP-10 or RNP-4 capability. If the Garmin WFDE Prediction program indicates fault exclusion (FDE) will be unavailable for more than 34 minutes in accordance with FAA Order 8400.12A for RNP-10 requirements, or 25 minutes in accordance

with FAA Order 8400.33 for RNP-4 requirements, then the operation must be rescheduled when FDE is available.

Both Garmin GPS navigation receivers must be operating and providing GPS navigation guidance for operations requiring RNP-4 performance.

North Atlantic (NAT) Minimum Navigational Performance Specifications (MNPS) Airspace operations per AC 91-49 and AC 120-33 require both GPS/SBAS receivers to be operating and receiving usable signals except for routes requiring only one Long Range Navigation sensor. Each display computes an independent navigation solution based on its internal GPS receiver.

Whenever possible, RNP and RNAV routes including Standard Instrument Departures (SIDs), and Standard Terminal Arrival (STAR), routes should be loaded into the flight plan from the database in their entirety, rather than loading route waypoints from the database into the flight plan individually. Selecting and inserting individual named fixes from the database is permitted, provided all fixes along the published route to be flown are inserted. Manual entry of waypoints using latitude/longitude or place/bearing is prohibited.

It is not acceptable to flight plan a required alternate airport based on RNAV(GPS) LP/LPV or LNAV/VNAV approach minimums. The required alternate airport must be flight planned using an LNAV approach minimums or available ground-based approach aid.

Navigation information is referenced to the WGS-84 reference system, and should only be used where the Aeronautical Information Publication (including electronic data and aeronautical charts) conform to WGS-84 or equivalent.

2.6 Approaches

- Instrument approaches using GPS guidance may only be conducted when the GNS is operating in the approach mode. (LNAV, LNAV+V, L/VNAV, LPV, or LP)
- When conducting instrument approaches referenced to true North, the NAV Angle on the AUX-Units/Position page must be set to **True**.
- The navigation equipment required to join and fly an instrument approach procedure is indicated by the title of the procedure and notes on the IAP chart. Navigating the final approach segment (that segment from the final approach fix to the missed approach point) of an ILS, LOC, LOC-BC, LDA, SDF, MLS, VOR, TACAN approach, or any other type of approach not approved for GPS, is not authorized with GPS navigation guidance. GPS guidance can only be used for approach procedures with GPS or RNAV in the procedure title. When using the Garmin VOR/LOC/GS receivers to fly the final approach segment, VOR/LOC/GS navigation data must be selected and presented on the CDI of the pilot flying.

- Advisory vertical guidance deviation is provided when the GNS annunciates LNAV + V. Vertical guidance information displayed on the VDI in this mode is only an aid to help flight crews comply with altitude restrictions. When using advisory vertical guidance, the flight crew must use the primary barometric altimeter to ensure compliance with all altitude restrictions.
- Not all published Instrument Approach Procedures (IAP) are in the navigation database. Flight crews planning to fly an RNAV instrument approach must ensure that the navigation database contains the planned RNAV Instrument Approach Procedure and that approach procedure must be loaded from the navigation database into the GNS system flight plan by its name. Users are prohibited from flying any approach path that contains manually entered waypoints.
- IFR approaches are prohibited whenever any physical or visual obstruction (such as a throw-over yoke) restricts pilot view or access to the GNS and/or the CDI.

2.7 Autopilot Coupling

IFR installations of a Garmin 4XXW Series unit allow the operator to fly all phases of flight based on the navigation information presented to the pilot; however, not all modes may be coupled to the autopilot. All autopilots may be coupled in Oceanic (OCN), Enroute (ENR), and Terminal (TERM) modes; however, the FAA requires that vertical coupling of an autopilot for approaches be demonstrated to meet their intended function and provide safe and proper operation to published minimums. This installation is limited to:

☐ Lateral coupling only for GPS approaches. Coupling to the vertical path for GPS approaches is not authorized.

2.8 Terrain Proximity Function

Terrain and obstacle information appears on the map and terrain display pages as red and yellow tiles or towers, and is depicted for advisory use only. Aircraft maneuvers and navigation must not be predicated upon the use of the terrain display. Terrain and obstacle information is advisory only and is not equivalent to warnings provided by TAWS.

The terrain display is intended to serve as a situational awareness tool only. By itself, it may not provide either the accuracy or the fidelity on which to base decisions and plan maneuvers to avoid terrain or obstacles.

2.9 VNAV – Vertical Navigation Calculation Page

VNAV information accessible by pressing the "VNAV" button may be utilized for advisory information only. Use of VNAV information for Instrument Approach Procedures does not guarantee Step-Down Fix altitude protection, or arrival at approach minimums in a normal position to land.

2.10 Weather Display (Optional)

This limitation applies to data linked weather products from SiriusXM via a GDL 69/69A or FIS-B via a GDL 88.

Do not use data link weather information for maneuvering in, near, or around areas of hazardous weather. Information provided by data link weather products may not accurately depict current weather conditions.

Do not use the indicated data link weather product age to determine the age of the weather information shown by the data link weather product. Due to time delays inherent in gathering and processing weather data for data link transmission, the weather information shown by the data link weather product may be significantly older than the indicated weather product age.

Do not rely solely upon data link services to provide Temporary Flight Restriction (TFR) or Notice to Airmen (NOTAM) information. Not all TFRs and NOTAMS can be depicted on the GNS.

2.11 Traffic Display (Optional)

Traffic may be displayed on the GNS when connected to an approved optional TCAS I, TAS, TIS, or ADS-B traffic device. These systems are capable of providing traffic monitoring and alerting to the flight crew. Traffic shown on the display may or may not have traffic alerting available. The display of traffic is an aid to visual acquisition and may not be utilized for aircraft maneuvering.

2.12 Manual GTN Crossfill

When Manual GTN Crossfill is in use, the crew must verify each flight plan leg prior to using the GNS to navigate. See section 7.2 for additional information.

Section 3. EMERGENCY PROCEDURES

3.1 Emergency Procedures

No change.

3.2 Abnormal Procedures

3.2.1 LOSS OF GPS/SBAS NAVIGATION DATA

When the GPS/SBAS receiver is inoperative or GPS navigation information is not available or invalid, the GNS will enter one of two modes: Dead Reckoning mode (DR) or Loss Of Integrity mode (LOI). The mode is indicated on the GNS by an amber "DR" or "INTEG".

If the Loss Of Integrity annunciation is displayed, revert to an alternate means of navigation appropriate to the route and phase of flight.

If the Dead Reckoning annunciation is displayed, the map will continue to be displayed with an amber ownship icon. Course guidance will be removed on the CDI. Aircraft position will be based upon the last valid GPS position, then estimated by Dead Reckoning methods. Changes in true airspeed, altitude, heading, or winds aloft can affect the estimated position substantially. Dead Reckoning is only available in Enroute and Oceanic modes. Terminal and Approach modes do not support Dead Reckoning.

If Alternate Navigation Sources (ILS, LOC, VOR, DME, ADF) Are Available:

Navigation.....**USE ALTERNATE SOURCES**

If No Alternate Navigation Sources Are Available:

DEAD RECKONING (DR) MODE:

Navigation.....**USE GNS**

NOTE

All information normally derived from GPS will become less accurate over time.

LOSS OF INTEGRITY (LOI) MODE:

Navigation.....**FLY TOWARDS KNOWN VISUAL CONDITIONS**

NOTE

All information derived from GPS will be removed.

NOTE

The airplane symbol is removed from all maps. The map will remain centered at the last known position. "No GPS Position" will be annunciated in the center of the map.

3.2.2 GPS APPROACH DOWNGRADE

During a GPS LPV, LNAV/VNAV, or LNAV+V approach, if GPS accuracy requirements cannot be met by the GPS receiver, the GNS will downgrade the approach. The downgrade will remove vertical deviation indication from the VDI and change the approach annunciation accordingly from LPV, L/VNAV, or LNAV+V to LNAV. The approach may be continued using the LNAV only minimums.

During a GPS approach in which GPS accuracy requirements cannot be met by the GPS receiver for any GPS approach type, the GNS will flag all CDI guidance and display a system message "ABORT APPROACH - Loss of Navigation". Immediately upon viewing the message, the unit will revert to Terminal navigation mode alarm limits. If the position integrity is within these limits lateral guidance will be restored and the GPS may be used to execute the missed approach, otherwise alternate means of navigation must be utilized.

3.2.3 LOSS OF COM RADIO TUNING FUNCTIONS

If alternate COM is available:

Communications..... **USE ALTERNATE COM**

If no alternate COM is available:

COM RMT XFR key (if installed).....**PRESS AND HOLD FOR 2 SECONDS**

NOTE

This procedure will tune the active COM radio the emergency frequency 121.5, regardless of what frequency is displayed on the GNS. Certain failures of the tuning system will automatically tune 121.5 without flight crew action.

Section 4. NORMAL PROCEDURES

Refer to the 4XXW Series unit Quick Reference Guide defined in paragraph 2.1 on page 7 of this document for normal operating procedures. This includes all GPS operations, VHF COM and NAV, and Multi-Function Display information. For information on TIS traffic or data linked weather, see the Pilot's Guide addendum for optional displays. For information on active traffic device or Stormscope operation and displays see the Pilot's Guide addendum for display interfaces.

The 4XXW Series unit requires a reasonable degree of familiarity to prevent operations without becoming too engrossed at the expense of basic instrument flying in IMC and basic see-and-avoid in VMC. Pilot workload will be higher for pilots with limited familiarity in using the unit in an IFR environment, particularly without the autopilot engaged. Garmin provides training tools with the Pilot's Guide and PC based simulator. Pilots should take full advantage of these training tools to enhance system familiarization.

4.1 Unit Power On

Database ..... **REVIEW EFFECTIVE DATES**
Self Test ..... **VERIFY OUTPUTS TO NAV INDICATORS**
Self Test - GPS Remote Annunciator (If Installed):
- VLOC ..... **ILLUMINATED**
- GPS ..... **ILLUMINATED**
- INTG ..... **ILLUMINATED**
- TERM ..... **ILLUMINATED**
- WPT ..... **ILLUMINATED**
- APR ..... **ILLUMINATED**
- MSG ..... **ILLUMINATED**
- SUSP ..... **ILLUMINATED**

4.2 Before Takeoff

System Messages and Annunciators ..... **CONSIDERED**

4.3 HSI and EHSI Operation

If an HSI is used to display navigation data from the GNS the pilot should rotate the course pointer as prompted on the GNS.

If an EHSI is used to display navigation data from the GNS the course pointer may autoslew to the correct course when using GPS navigation. When using VLOC navigation the course pointer will not autoslew and must be rotated to the correct course by the pilot. For detailed information about the functionality of the EHSI system, refer to the FAA approved Flight Manual or Flight Manual Supplement for that system.

CAUTION

The pilot must verify the active course and waypoint for each flight plan leg. The pilot must verify proper course selection each time the CDI source is changed from GPS to VLOC.

4.4 Autopilot Operation

The GNS may be coupled to an optional autopilot, if installed in the aircraft, when operating as prescribed in the LIMITATIONS section of this manual.

Autopilots coupled to the GNS system in an analog (NAV) mode will follow GPS or VHF navigation guidance as they would with existing VOR receivers.

Autopilots that support GPSS or GPS Roll Steering in addition to the analog course guidance will lead course changes, fly arcing procedures, procedure turns, and holding patterns if coupled in GPSS mode.

For autopilot operating instructions, refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

4.5 Coupling the Autopilot during approaches

CAUTION

When the CDI source is changed on the GNS, autopilot mode may change. Confirm autopilot mode selection after CDI source change on the GNS. Refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

☐ This installation prompts the flight crew and requires the pilot to enable the approach outputs just prior to engaging the autopilot in APR mode.

To couple an approach:
Once established on the final approach course with the final approach fix as the active waypoint, the GNS will issue a flashing message indication with the following message "APR Guidance Available, Use PROC before A/P APR".

PROC Button..... **PRESS**
"Enable A/P APR Outputs?" ..... **SELECT**
ENT Button ..... **PRESS**

If coupled, Autopilot will revert to ROL mode at this time.

Autopilot.....**ENGAGE APPROACH MODE**

☐ This installation supports coupling to the autopilot in approach mode once vertical guidance is available.

To couple an approach:
Once established on the final approach course with the final approach fix as the active waypoint, the GNS will enable vertical guidance.

Vertical Guidance.....**CONFIRM AVAILABLE**
Autopilot.....**ENGAGE APPROACH MODE**

☑ The autopilot does not support any vertical capture or tracking in this installation.

Analog only autopilots should use APR mode for coupling to LNAV approaches. Autopilots which support digital roll steering commands (GPSS) may utilize NAV mode and take advantage of the digital tracking during LNAV only approaches.

4.6 Traffic Mode Selection (Optional)

If the GNS is interfaced to a traffic device, the GNS can be used to control the mode of the traffic system. This is accomplished by pressing the cursor knob while on the dedicated traffic page to enter/exit the traffic device menu. It is important to note that while the traffic device menu is active, the current state of the traffic system is *not* displayed. The state of the traffic device is only displayed once the traffic device menu is exited.

Section 5. PERFORMANCE

No change.

Section 6. WEIGHT AND BALANCE

See current weight and balance data.

Section 7. SYSTEM DESCRIPTIONS

7.1 Pilot's Guide

See Garmin 4XXW Series unit Pilot's Guide for a complete description of the 4XXW Series unit.

7.2 Manual GTN Crossfill

Manual GTN Crossfill is a feature that will keep the GNS system in sync with a flight plan that is being used on the GTN system. The GTN *will not* automatically keep its flight plan in sync with changes made on the GNS system. Manual crossfill feature is "one way" – from the GTN to the GNS.

The GTN systems support a variety of procedure leg types that the GNS systems do not support. As such, it is normal and expected that the flight plan leg that is displayed on the GNS system will not always match the flight plan leg on the GTN system. Departure, arrival and approach procedures contain leg types that the GNS does not support. The GNS typically "skips" over these leg types and provides no guidance. Guidance may be available on the GTN but not on the GNS in these cases. The GNS will sequence the procedure as it normally would if Crossfill were not active. Once a leg type is reached that is supported on both the GTN and GNS systems, the systems will automatically sync to the same leg.

If a GNS is interfaced with a GTN then autoswitching from GPS to VLOC guidance on the CDI for ILS/LOC approaches will be disabled on the GNS.

If the flight plan on an interfaced GTN is altered while in a hold, the GNS will reinitiate guidance to the holding waypoint and sequence into the hold upon crossing the waypoint.

If the Missed Approach is activated on the GTN prior to reaching the Missed Approach Point, the GTN will automatically resume leg sequencing upon reaching the Missed Approach Point. The GNS will remain suspended upon reaching the Missed Approach Point and leg sequencing must be manually resumed.

Hartzell Propeller Inc
One Propeller Place
Piqua, Ohio 45356

AFMS_011007_2

FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR STC SA02414CH-D

HARTZELL TWO-BLADE PROPELLER ON MOONEY M20E AND M20F AIRCRAFT

Aircraft Serial Number: B670368

Registration Number: N3275F

GENERAL

This supplement must be attached to the aircraft's FAA Approved Airplane Flight Manual, Owner's Manual and/or Operating Handbook when the airplane is modified by the installation of a Hartzell HC-C2YR-1BFP/F7497 propeller and 835-54(P) spinner in accordance with STC SA02414CH-D.
The information contained herein supplements or supersedes the basic manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this supplement, consult the FAA Approved Airplane Flight Manual, Owner's Manual and/or Operating Handbook.

FAA Approved B-Eng
Brian E. Meyer
DAS Administrator
Hartzell DAS-100082-CE

Date JULY 12, 2007

AFMS_011007_2

AIRPLANE FLIGHT MANUAL SUPPLEMENT

HARTZELL TWO-BLADE PROPELLER ON MOONEY M20E AND M20F AIRCRAFT

LOG OF REVISIONS

Revision Number	Revised Pages	Description of Revision	Approved	Date

NOTE: All changes are indicated by a black vertical line along the left margin.

AFMS_011007_2

AIRPLANE FLIGHT MANUAL SUPPLEMENT

HARTZELL TWO-BLADE PROPELLER ON MOONEY M20E AND M20F AIRCRAFT

SECTION I – GENERAL DESCRIPTION

PROPELLER

The propeller is a two-blade 74-inch diameter constant-speed unit that features aluminum blades in an aluminum "compact" hub. The spinner is fabricated from aluminum alloy. Additional details can be found in Hartzell Propeller Owner's Manual 115N (Propeller Owners Manual).

Manufacturer	Hartzell
Model Number	HC-C2YR-1BFP/F7497
Number of Blades	2
Diameter (MAX)	74 in.
(MIN)	72.5 in.
Type	Single-Acting, Constant Speed, Pressure-to-Increase Pitch
Governor Model	See TCDS 2A3
Blade Angles @ 30.0 inch radius	
Low	15.7 ± 0.2 degrees
High	29.0 ± 1.0 degrees

SECTION II – SYSTEMS OPERATIONS

No Change.

SECTION III – NORMAL PROCEDURES

CRUISE

The HC-C2YR-1BFP/F7497 STC propeller does have an operating limitation on un-damped, 200 Hp IO-360-( )1( ) engines (M20E and F) only. Therefore, the CAUTION statement in this section must be modified to state; "the engine must not be continuously operated above 24" manifold pressure within the range of 2350 to 2550 RPM."

AFMS_011007_2

AIRPLANE FLIGHT MANUAL SUPPLEMENT

HARTZELL TWO-BLADE PROPELLER ON MOONEY M20E AND M20F AIRCRAFT

Examples:

1. With manifold pressure at or below 24", continuous operation is permitted from 2100-2700 RPM.

   Permitted – 2500 RPM, MAN PRESS 24.0"

2. Manifold pressure above 24", continuous operation is prohibited between 2350-2550 RPM.

   Not Permitted - 2500 RPM, MAN PRESS 25.0"

SECTION IV –LIMITATIONS

POWER PLANT

Propeller..... Hartzell Constant Speed
Hub HC-C2YR-1BFP
Blade F7497
Pitch Setting at 30" Radius
Low 15.7 ± 0.2°
High 29.0 ± 1.0°

POWER PLANT INSTRUMENTS

For M20E, F

Tachometer

Radial Red Line (Rated)	2700 RPM
Green Arc –	2100-2350 RPM & 2550-2700 RPM
Yellow Arc – No continuous ops >24" MP	2350-2550 RPM

AFMS_011007_2

AIRPLANE FLIGHT MANUAL SUPPLEMENT

HARTZELL TWO-BLADE PROPELLER ON MOONEY M20E AND M20F AIRCRAFT

WEIGHT AND CENTER-OF-GRAVITY LIMITS

The Hartzell STC propeller and spinner combination is approximately three pounds heavier than most of the Type Certified two-blade propeller/spinner combinations. The STC Installation Instructions contain information for revising the aircraft weight and balance data.

SECTION V – EMERGENCY PROCEDURES

Set the propeller control to LOW RPM in the event of an engine-out glide with a windmilling propeller.

SECTION VI – PERFORMANCE

TAKEOFF

Performance of the HC-C2YR-1BFP/F7497 propeller increases takeoff distance. Add 3% to the takeoff distance (ground roll and distance to 50') determined for your specific aircraft and ambient conditions.

CLIMB

Performance of the HC-C2YR-1BFP/F7497 propeller decreases maximum angle (V_x) of climb rate. Reduce the maximum angle of climb rate for your specific aircraft and conditions by 20 fpm.

Best rate of climb (at V_y) is unchanged.

CRUISE

On models with un-damped 200 Hp IO-360-( )1( ) engines (M20E & F) where the RPM operating limitation applies, on the cruise performance tables mark-out

or note the recommended power settings above 24" MAN PRESS in the 2350-2550 RPM range are prohibited.

SECTION VII – SERVICING

MAINTENANCE

Propeller Care

Routine propeller inspections and servicing is described in the latest revision of Hartzell Propeller Owner's Manual 115N. Also reference this STC's Instructions for Continued Airworthiness (ICA_011007) for more information about maintenance, troubleshooting, and inspection procedures.

FAA APPROVED AIRPLANE FLIGHT MANUAL SUPPLEMENT OR SUPPLEMENTAL FLIGHT MANUAL FOR

AIRCRAFT MODEL: Mooney M20-F

SERIAL NUMBER: 67-0368

REGISTRATION NUMBER: N3275F

This supplement must be attached to the FAA approved Airplane Flight Manual, when the Precise Flight Standby Vacuum has been installed in accordance with STC(s).
SA2160NM, SA2161NM, SA2162NM, SA2164NM, SA2167NM, SA2168NM, SA2683NM - Aircraft
&
SE1779NM - Lycoming Engine
or
SE1780NM - Continental Engine

The information contained in this document supplements or supersedes the basic manual only in those areas listed. For Limitations, Procedures, and Performance information not contained in this supplement, consult the basic Airplane Flight Manual.

FAA APPROVED: _____
Manager,
Special Certification Branch
Seattle Aircraft Certification Office

DATE OF APPROVAL: Feb. 4, 2000

ISSUED: February 4, 2000

SYSTEM DESCRIPTION

A Precise Flight Standby Vacuum System may be installed to provide a temporary vacuum system in the event of a primary vacuum failure. The Standby Vacuum System operates on the differential between the intake manifold and ambient air pressure and is directed through a shuttle valve system to drive your flight instruments.

CAUTION: The use of the Standby Vacuum System requires a degree of Pilot skill and proficiency that is best maintained through practice. It is recommended, upon recurrent IFR training, in VFR conditions, in the presence of a CFI, that the aircraft be flown at the RPM and or Manifold Pressure settings found on the required placard and entered in this AFMS. This procedure will familiarize the pilot with limitations of using engine manifold vacuum for instrument power and maintaining level flight.

I. OPERATING LIMITATIONS

A. INSTRUCTIONS

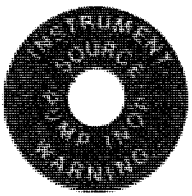
1. The Standby Vacuum System is for emergency or standby use only and not for dispatch purposes.
2. Vacuum powered and/or Vacuum gyro directed autopilot operation may be unreliable when the Standby Vacuum System is the sole source of vacuum. Vacuum powered or vacuum gyro directed autopilot should be OFF when operating with a failed primary vacuum system.
3. The Supplemental Vacuum System is not designed to operate pneumatic de-ice systems. DO NOT operate a pneumatic de-ice system when operating with a failed primary vacuum system.
4. Above 10,000 ft. pressure altitude, engine power settings may have to be significantly reduced to provide adequate vacuum power for proper gyro instrument operation.
5. The following placards are required to be in full view of pilot:

I. OPERATING LIMITATIONS (CONT.)

B. PLACARDS

Placard to be located on the push/pull control cable

Placard to be located around the LED for the pump inop warning light.



Placard to be placed in front and in full view of the pilot.

STANDBY VACUUM SYSTEM EQUIPPED: FOR OPERATING INSTRUCTIONS AND LIMITATIONS SEE SUPPLEMENT IN OWNERS MANUAL OR PILOTS OPERATING HANDBOOK

I. OPERATING LIMITATIONS (CONT.)

B. PLACARDS

One of the following placards must be placed in full view of the pilot near the instrument vacuum indicator after appropriate entries have been made.

Approximate Standby Vacuum Available - Altitude - Power Chart for aircraft with Constant Speed Propeller - Maximum Continuous RPM.

PRESS ALT. (FT.)	RPM	MAN. PRESSURE	SVS VACUUM IN. HG MIN.
2000	Max. Cont.	23.5	3.5
4000	Max. Cont.	22,	3.5
6000	Max. Cont.	20	3.5
8000	Max. Cont.	18	3.5
10,000	Max. Cont.	16	3.5

Approximate Standby Vacuum Available - Altitude - Power Chart for aircraft with a Fixed Pitch Propeller

PRESS ALT. (FT.)	RPM	SVS VACUUM IN. HG MIN.
2000		
4000		
6000		
8000		
10,000		

II. OPERATING PROCEDURES

A. NORMAL PROCEDURES

1. GROUND CHECK

a. Cycle the Standby Vacuum Control Knob **OUT - ON -** , and return Control Knob **IN - OFF** - position.

2. BEFORE TAKEOFF

a. Idle Engine at low speed, momentarily pull the standby vacuum knob **OUT - ON** - and check vacuum gauge. Normally, the vacuum reading will be slightly higher. After checking system push Standby Vacuum System knob **IN - OFF -**. Check that vacuum gauge has returned to the previous reading.

3. ENROUTE

a. Regularly check vacuum gauge and monitor warning light for proper vacuum system operation.

B. EMERGENCY PROCEDURES

1. PRIMARY VACUUM FAILURE WARNING LIGHT ILLUMINATES

a. Pull the Standby Vacuum System knob OUT -ON- and adjust throttle setting as required to maintain adequate vacuum for the primary instruments - Suction Gauge Reading in the Green Arc - If necessary descend to a lower altitude to obtain a larger differential between manifold and ambient pressure. Vacuum power must be closely monitored by checking the vacuum gauge frequently.

b. The SVS is not designed for continued IFR flight. Immediate steps should be taken to return to VFR conditions or to land. If this is not possible, IFR flight should be continued only as long as necessary to return to VFR conditions or land the airplane.

WARNING: FAILURE OF THE VACUUM SYSTEM STILL CONSTITUTES AN EMERGENCY SITUATION REGARDLESS OF THE INSTALLATION OF THE SVS. IT MAY NOT BE POSSIBLE TO MAINTAIN A SAFE ALTITUDE AND MAKE USE OF THE SVS. IN SUCH A SITUATION THE AIRPLANE MUST BE FLOWN USING NON-VACUUM POWERED INSTRUMENTS.

B. EMERGENCY PROCEDURES (CONT.)

c. If descent is impractical:

- Periodically and temporarily reduce power as required to provide adequate vacuum to the aircraft primary instruments.

- Reapply power as required, while comparing vacuum driven gyros against the Turn and Bank Indicator, Turn Coordinator, VSI and/or other flight instruments.

- When an obvious discrepancy is noted between the vacuum driven instruments and other flight instrumentation. Periodically and temporarily reduce power as required to provide adequate vacuum to the aircraft primary instruments.

III. PERFORMANCE

NO CHANGE

- - END - -

S-TEC CORPORATION
MINERAL WELLS, TEXAS 76067

FAA/DAS APPROVED SUPPLEMENTAL FLIGHT MANUAL FOR MOONEY MODELS M20F AND M20G

S-TEC SYSTEM 30 TWO AXIS AUTOMATIC FLIGHT GUIDANCE SYSTEM (14 VOLT SYSTEM)

REG. NO. 3275F

SER. NO. 670368

The information in this manual is FAA Approved material which along with other approved documents is applicable to the operation of the airplane when modified by the installation of the S-TEC System 30 Autopilot Model ST-676-30 installed in accordance with STC SA09212AC-D.

SECTION I

GENERAL

This manual is to acquaint the pilot with the features and functions of the System 30 Two Axis Autopilot and to provide operating instructions for the system when installed in the listed aircraft model(s). The aircraft must be operated within the limitations herein provided when the autopilot is in use.

FAA/DAS APPROVED _____
Walter F. Davis

S-TEC CORPORATION
MINERAL WELLS, TEXAS 76067

FAA/DAS APPROVED
SUPPLEMENTAL FLIGHT MANUAL
FOR
MOONEY MODELS M20F AND M20G

LOG OF REVISIONS

REV. NO.	PAGES AFFECTED	DESCRIPTION	APPROVED	DATE

S-TEC CORPORATION
MINERAL WELLS, TEXAS 76067

FAA/DAS APPROVED
SUPPLEMENTAL FLIGHT MANUAL
FOR
MOONEY MODELS M20F AND M20G

SECTION II

OPERATING LIMITATIONS

1. Autopilot operation prohibited above 185 MPH CAS.
2. Flap extension limited to TAKE OFF position when operating in altitude hold mode.
3. Autopilot must be OFF during take off and landing.

SECTION III

EMERGENCY OPERATING PROCEDURES

In the event of an autopilot malfunction, or any time the autopilot is not performing as expected or commanded, do not attempt to identify the system problem. Immediately regain control of the aircraft by overpowering the autopilot as necessary and then disconnect the autopilot. Do not reengage the autopilot until the problem has been identified and corrected.

1. Autopilot may be disconnected by:

   a. Depressing the "AP Disconnect" Switch on the left horn of the pilot's control wheel (if installed).
   b. Press and hold the mode selector knob for approximately 2 seconds.
   c. Moving the autopilot master switch to "OFF" position.
   d. Pulling the autopilot circuit breaker.

2. Altitude loss during a malfunction and recovery.

   a. The following altitude losses and bank angles were recorded after a malfunction with a 3 second recovery delay:

Configuration	Bank Angle/Altitude Loss
Climb	50°/NONE
Cruise	47°/-160′
Descent	45°/-320′

   b. The following altitude losses and bank angles were recorded after a malfunction with a 1 second recovery delay:

Configuration	Bank Angle/Altitude Loss
Maneuvering	15°/ -20′
Approach (coupled or uncoupled)	20°/ -20′

The above values are the worst case for all the models covered by this document.

SECTION IV

NORMAL OPERATING PROCEDURES

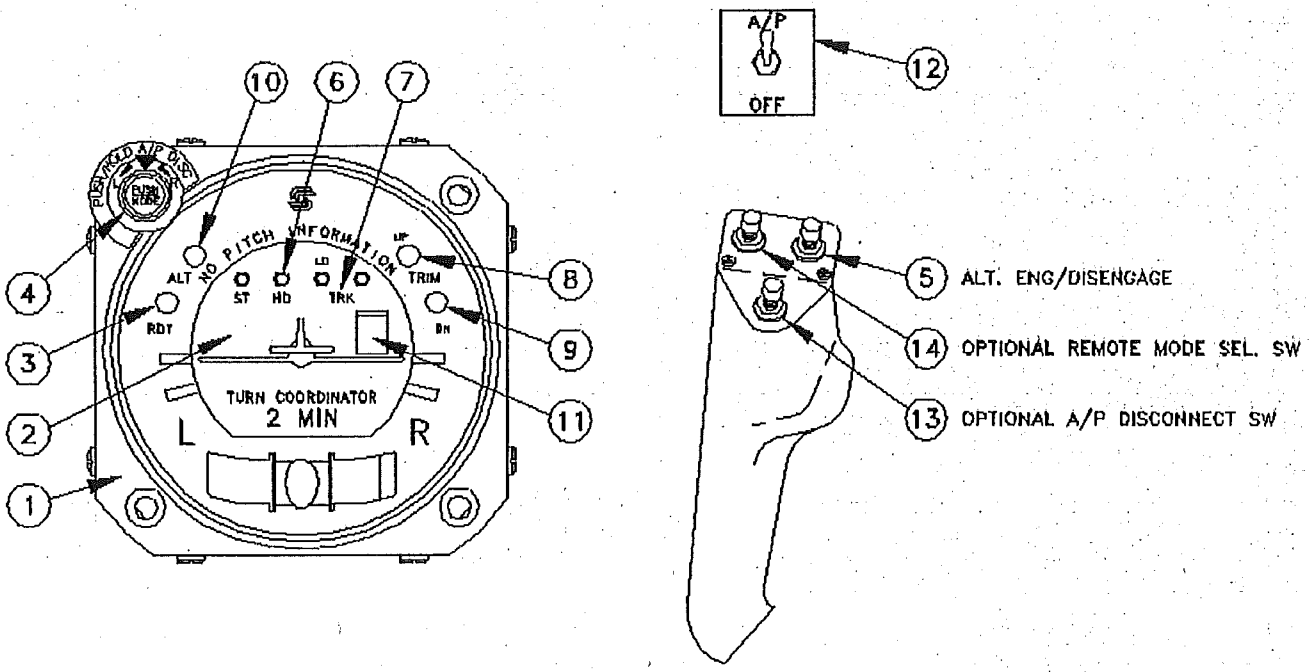
4-1 SYSTEM DESCRIPTION

The System 30 is a pure rate autopilot which uses an inclined rate gyro in the Turn Coordinator instrument as the primary roll and turn rate sensor and an accelerometer and an absolute pressure transducer as pitch rate sensors. The turn coordinator includes an autopilot pick-off, a gyro RPM detector and an instrument power monitor. Low electrical power will cause the instrument "flag" to appear while low RPM will cause the autopilot to disconnect. The autopilot includes an automatic pre-flight test feature that allows a visual check of all the annunciator lamps and checks critical elements of the accelerometer system. The test feature will not enable autopilot function unless the automatic test sequence is satisfactorily completed.

When the pre-flight test is satisfactorily completed and when the rate gyro RPM is correct, the green "RDY" light will illuminate indicating the autopilot is ready for the functional check and operation. The autopilot cannot be engaged unless the "RDY" light is illuminated. When the system is equipped with the optional 3" Air Driven Directional Gyro (D.G.) or a compass system, directional information is provided to the autopilot by a heading bug in the instrument.

Pitch axis control is provided for the altitude hold function by use of the accelerometer and the pressure transducer. When the altitude hold mode is engaged an elevator trim sensor in the pitch servo will detect the elevator trim condition. When elevator trim is necessary to re-establish a trimmed condition, trim indicator lights on the programmer unit will illuminate to indicate the direction to trim to restore a trimmed condition. If the pilot ignores a trim light for more than five seconds the light will begin to flash to get the pilot's attention.

The indicator and annunciator lamp brilliance is controlled through the aircraft instrument light rheostat, except for the "trim" indicators which always illuminate at full intensity.



1. Turn Coordinator, Mode Programmer and Annunciator Unit - Provides basic flight information, autopilot mode switching and annunciation.

2. Mode Annunciation Window - Displays mode in use.

3. Green Ready (RDY) Light - Illuminates when autopilot is ready for engagement. When autopilot is disconnected "RDY" will flash for five seconds accompanied by beeping audio tone.

4. Mode Select/Disconnect Switch - Each momentary push of this knob will select an autopilot mode, left to right, beginning with ST (Stabilizer) mode and ending with (Hi) TRK mode. Holding the knob in for more than 2 seconds will disconnect the autopilot. Turning the knob left or right in the stabilizer mode will provide left/right commands to the autopilot proportional to knob displacement up to a standard rate turn.

5. Altitude Hold Engage/Disengage Switch - This control wheel mounted switch will engage or disengage the Altitude Hold Mode as desired. The blue (ALT) light on the annunciator panel will illuminate when ALT. mode is engaged.

6. Heading Mode - If the system is equipped with a D.G. this mode will permit preselected left/right turns using the D.G. heading bug.

7. TRK (Track) - using the (Lo) mode of the tracking feature will provide low system gain for comfortable cross country tracking of VOR or GPS signals. Using the (Hi) mode of the tracking feature will provide a higher level of system gain for more active tracking of VOR, GPS or Localizer front course signals.

8. Trim UP Light - Illuminates to indicate the need for nose UP trim.

9. Trim DOWN Light - Illuminates to indicate the need for nose DOWN trim. When both lights are out, the aircraft is in trim longitudinally.

10. Blue (ALT) light illuminates when altitude mode is engaged.

11. Flag Window - Red flag visible indicates lack of power (12/24 Volt) to primary turn coordinator unit.

12. Autopilot Master ON-OFF Switch - Refer to pre-flight procedures for operating details.

13. Optional remote AP disconnect switch.

14. Optional Remote Mode Selector Switch - Allows mode selection from the control wheel. Also disconnects autopilot when depressed for approximately two seconds.

4-2 PRE-FLIGHT PROCEDURES

NOTE: During system functional checks the system must be provided adequate DC voltage (12 or 24 VDC minimum as appropriate).

MANDATORY PRE-FLIGHT TEST

1. AP Master Switch - Move to A/P (on) position.
   A. Observe all lights and annunciators illuminate.
   B. Observe the following light sequence of the trim indicators: (Sequence requires 9 seconds.)
      1. Initially both trim UP & DN lights are illuminated.
      2. UP light extinguishes and remains off.
      3. DN light then extinguishes and remains off.
      4. All lights extinguish except for "RDY" light.

2. The autopilot can be engaged and disengaged repeatedly using the remote A/P disconnect switch or the mode selector knob but once the A/P master is switched off the test must be reconducted to get a ready indication. If the ready light does not illuminate after the test a failure to pass the test is indicated and the system will require service. NOTE: ALTITUDE MODE CANNOT BE ENGAGED UNLESS POWER IS ON FOR MORE THAN 15 SECONDS.

SYSTEM FUNCTIONAL TEST

3. Push Mode Switch - STB Annunciator illuminates. Rotate turn knob left and right, observe control wheel moves in corresponding direction. Center turn knob.

4. Set D.G. and place bug under lubber line (if installed) push turn knob to engage HDG mode. Observe HDG annunciator. Move HDG bug left and right observe proper control wheel motion.

5. Overpower Test - Grasp control wheel and overpower roll servo left and right, overpower action should be smooth with no noise or jerky feel. If unusual sounds or excessive play is detected, have the servo installation inspected prior to flight.

6. Radio Check - A. Turn on NAV Radio, with valid NAV signal, engage Lo TRK Mode and move VOR OBS so that VOR needle moves left and right - control wheel should follow the direction of needle movement.

   B. Select Hi TRK Mode - the control wheel should again follow radio needle movement and with more authority than produced by Lo TRK Mode.

7. Move control wheel to level flight position - Engage ALT Mode. Move control wheel fore and aft to overpower pitch servo clutch. Overpower action should be smooth with no noise or jerky feel. If unusual sounds or excessive play is detected, have the servo installation inspected prior to flight.

8. Trim Check - Manually apply back pressure to control wheel for 2-3 seconds - observe the DN trim light illuminates. Apply forward pressure to the control wheel for 2-3 seconds, observe the UP trim light illuminates. Move the control wheel to center - observe both UP/DN lights extinguish.

9. Hold control wheel and push mode knob for 2 seconds - note that roll and pitch servos release. Move control wheel to confirm roll and pitch motions are free, with no control restriction or binding. If the optional disconnect switch is installed it may be used to effect the disconnect for this check.

4-3 IN-FLIGHT PROCEDURES

NOTE: The required pre-flight test can be conducted in flight if necessary. It should be noted, however, that when the UP/DN lights are flashing the pitch servo will momentarily engage and disengage. This alternate engage-disengage sequence is part of the test function. Because of the engage-disengage sequence the test should not be conducted while maneuvering.

1. Check - RDY light on.

2. Trim aircraft for existing flight condition. Maintain Yaw Trim during all Autopilot operations.

3. Center turn-knob - Press turn knob to select stabilizer mode.

4. Set turn knob to level or turning flight, as desired.

5. Set HDG bug to desired heading (if installed) and press knob to engage heading mode, select headings as desired.

6. At desired altitude, press ALT Mode Switch on control wheel. Trim aircraft as necessary to establish cruise condition - disengage ALT Mode to climb or descend.

VOR TRACKING AND VOR-LOC APPROACH

1. Tune NAV receiver and select radial.

2. Maneuver aircraft to selected radial (or localizer) within +/- 1 needle width and within 10 degrees of the course heading.

3. Engage Lo TRK Mode for VOR tracking.

4. Engage Hi TRK Mode for VOR or LOC approach.

Hi TRK Mode may be used to track VOR radials cross country if desired. Use of Hi TRK Mode for cross country tracking may result in some course scalloping if the VOR signal is weak or otherwise "noisy". In areas of poor signal quality Lo TRK Mode may provide more accurate tracking even with reduced gain.

GPS TRACKING AND GPS APPROACH

1. Begin track with a reliable GPS signal and CDI needle centered, with aircraft on the suggested heading to the waypoint.

2. Select the Hi track mode for GPS tracking or GPS approach.

SECTION V

OPERATIONAL DATA

Text of this Section not affected by installation of this equipment.

SECTION VI

REQUIRED OPERATING EQUIPMENT

Text of this Section not affected by installation of this equipment.

SECTION VII

WEIGHT AND BALANCE

Text of this Section not affected by installation of this equipment.

INTRODUCTION

The FAA charges you, the aircraft owner or pilot, with the responsibility of properly loading your aircraft for safe flight. Data presented in this document will enable you to carry out this responsibility and insure that your airplane is loaded to operate within the prescribed weight and center-of-gravity limitations.

FAA regulations also require that any change in the original equipment affecting the empty weight center of gravity be recorded in the Aircraft Log Book. A form for maintaining a permanent record of all such changes is provided on page 3–1. This form, if properly maintained, will enable you to determine the current weight-and-balance status of the airplane for load scheduling. The weight-and-balance data entered as your aircraft left the factory, plus the record you maintain on page 3–1, is all of the data needed to compute loading schedules.

The maximum certificated gross weight for the Mooney Executive 21 under all operating conditions is 2740 pounds. Maximum useful load is determined by subtracting the corrected aircraft empty weight from its maximum gross weight. The Executive 21 must be operated strictly within the limits of the Center-of-Gravity Moment Envelope shown on page 2–3.

WEIGHT & BALANCE RECORD
MOONEY EXECUTIVE 21

M20F 3275F

S/N 670368

TABLE OF CONTENTS

MOONEY AIRCRAFT, INC.
BOX 72
KERRVILLE, TEXAS
78028

SECTION I. EQUIPMENT LIST AND CORRECTED EMPTY WEIGHT DATA

EQUIPMENT CHECKLIST

The equipment checked below was factory installed and is included in the original or basic empty weight of the aircraft.

FAA Registration No. N3275F

1967 M20F Serial No. 670368

DATE INSPECTED

MO	05			
DAY	26			
YR.	67			

FED. A/C SPEC. 2A3 ITEM NO.	ITEM DESCRIPTION	WEIGHT	ARM	MARK ITEMS INSTALLED			
04	Constant-Speed Propeller, Hartzell						
	Hub (HC-C2YK-1) with (7666-2) Blades	53.75	-35.16	x			
	Mooney Spinner	3.60	-34.18	x			
	Hartzell Governor (H-1)	4.50	- 1.40	x			
101	Fuel Pumps:						
	Engine driven (AC)	1.60	- 3.80	x			
	Electric, Dukes	1.91	- 6.50	x			
102	Oil Radiator, Stewart War.	2.40	-23.00	x			
103	Induction Air Filter	1.20	-24.50	x			
104	Starter, Prestolite	17.80	-23.00	x			
201	Main Wheel Brake Assys.	15.40	+ 66.8	x			
202	Main Wheel Tires (6.00-6)	17.00	+ 66.8	x			
205	Nose Wheel (5.00-5)	2.60	- 5.3	x			
206	Nose Wheel Tire & Tube	7.00	- 5.3	x			
301	Generator, 50 AMP	16.60	-24.50	x			
302	Battery, 35 AMP HR	28.10	+110.80	x			
303	Voltage Regulator, 50 AMP	2.00	+ 2.00	x			
601	Dual Warning Indicator (Model 1283)	1.10	+ 4.00	x			

EQUIPMENT INSTALLED OR REMOVED AFTER BASIC WEIGHT & BALANCE

The equipment listed below was factory installed or removed after basic weight and balance of the aircraft.

FAA Registration No. N3275F

1967 M20F Serial No. 670368

ITEM NO.	ITEM DESCRIPTION	WEIGHT	ARM	MOMENT
1	Oil (2 GAL)	-15.00	-11.50	+ 173.00
2	Fuel (Full)	370	48.40	17908
	Weight and Moment Added or Subtracted	- 385		17735 - 17735

CORRECTED EMPTY WEIGHT AS DELIVERED

	WEIGHT	ARM	MOMENT	USEFUL LOAD
Aircraft Empty Weight as Weighed	2077	45.1	93673	
Weight Added or Subtracted	- 385		- 17735	
Corrected Empty Weight and CG (Gear Extended) as Delivered From Factory	1692	44.9	75938	1048

SECTION II. PILOTS LOADING GUIDE

LOADING CALCULATION PROCEDURE

Proper loading of the aircraft is essential for maximum flight performance and safety. This section will assist you in determining whether the aircraft loading schedule is within the approved weight and center-of-gravity limits.

To figure an actual loading problem for your Executive 21, proceed as follows:

Step 1. Refer to the latest entry on page 3–1 for the current empty weight and moment.
NOTE: Since the engine oil is normally kept at the full level, use the oil weight and moment figures shown in the sample problems as constants in calculating all loading problems.

Step 2. Note the pilot's weight and the position his seat will occupy in flight. Find this weight on the left scale of the Loading Computation Graph (page 2–3) and cross the graph horizontally to the point representing the pilot's seat position between the FWD and AFT position lines on the graph for #1 and #2 seats. When this point is located, drop down to the bottom scale to find the value of the moment/1000 due to the pilot's weight and seat position.

Repeat the procedure for the copilot and enter these weights and moment/1000 values in the proper subcolumns in the Problem Form on page 2–2.

Step 3. Proceed as in Step 2 to account for the passengers in seats 3 and 4. Enter the weight and value of moment/1000 in the proper columns.

Step 4. Again proceed as in Step 2 to account for the amount of fuel carried, and enter the weight and moment/1000 values in the proper columns.

Step 5. Once more proceed as in Step 2 to account for the baggage to be carried and enter the figures in the proper columns.

Step 6. Total the weight columns. This total must be 2740 pounds or less. Total the Moment/1000 column.. Do not forget to subtract negative numbers.

Step 7. Refer to the Center-of-Gravity Moment Envelope (page 2–3). Locate the loaded weight of your airplane on the left scale of the graph and trace a line horizontally to the right. Locate the total moment/1000 value for your airplane on the bottom scale of the graph and trace a line vertically above this point until the horizontal line for weight is intersected. If the point of intersection is within the shaded area, your aircraft loading is acceptable. If the point of intersection falls outside the shaded area, you must rearrange the load before takeoff.

EQUIPMENT CHECKLIST (Continued)

FAA Registration No. _____

M20F Serial No. _____

DATE INSPECTED

MO | | | | |

DAY | | | | |

YR. | | | | |

EQUIP. ITEM NO.	ITEM DESCRIPTION	WEIGHT	ARM	MARK ITEMS INSTALLED			
1E	Heated Pitot Installation	.70	+ 38.00				
2E	Rotating Beacon Installation	1.70	+168.00				
3E	Exhaust Gas Temp. Ind.	1.10	+ 12.71				
4E	PC System, Brittain	7.10	+ 46.60				

PROBLEM FORM FAA Registration No. N3275F M20F Serial No. 670368

STEP	ITEM	SAMPLE PROBLEM #1 PILOT & THREE PASS.		SAMPLE PROBLEM #2 PILOT & ONE PASS.		YOUR PROBLEM	
		WEIGHT (POUNDS)	MOMENT 1000	WEIGHT (POUNDS)	MOMENT 1000	WEIGHT (POUNDS)	MOMENT 1000
1	Current Aircraft Empty Weight (From Page 3-1)	1645.0	72.48	1645.0	72.48	1740.95	80.38
	Oil--8 QT @ 1.875 LBS/QT (Sump assumed full for all flights)	15.0	-.17	15.0	-.17		
2	Pilot Seat (#1)*	160.0	6.40	160.0	6.40		
	Co-pilot Seat (#2)*	160.0	6.40	180.0	7.10		
3	Left Rear Seat (#3)*	165.0	12.40	--	--		
	Right Rear Seat (#4)*	145.0	11.00	--	--		
4	Fuel (No. GAL x 6 LBS GAL) (MAX ~~64 GAL 384 LBS~~ 54.8 Gal, 319 Lbs **)	320.0	15.50	360.0	17.43		
5	Baggage (MAX 120 LBS)	120.0	11.40	100.0	9.60		
	Hat Rack (MAX 10 LBS)	10.0	1.19	10.0	1.19		
6	Loaded Aircraft Weight	2740.0		2470.0			
	Total Moment 1000		136.60		114.53		
7	Refer to page 2-3. Center-of-Gravity Envelope, to determine whether your aircraft loading is acceptable. (Hat rack arm Hat rack arm station 119.0, baggage arm station 95.5, fuel arm station 48.43, oil arm station is -11.5***						

*Obtain the moment 1000 value for each seat position (FWD, MID, or AFT.) from page 2-3.

As of 1-4-14

**Revised upon installation of O&N Fuel Bladders, ***Revised by Mooney 4/74

SECTION III. OWNERS WEIGHT & BALANCE RECORD

CORRECTED EMPTY WEIGHT & MOMENT (CG)

Enter below all weight change data from the Aircraft Log Book.

FAA Registration No. N3275F

M20F Serial No. 670368

EMPTY WEIGHT	ARM	MOMENT 1000	USEFUL LOAD	DATE AND SOURCE OF INFORMATION
1692	44.9	75.94	1048	Ref. Page 1-3 of this Report. 5-26-67

MOONEY CORPORATION
Engineering Flight Test

WEIGHT AND BALANCE

MODEL _____ SERIAL NUMBER _____ DATE _____

LOADED AS FOLLOWS

_____

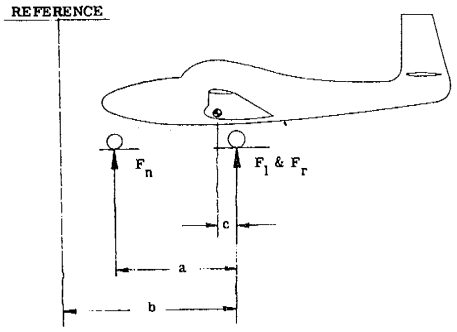
_____

_____

_____

_____

_____



(F_r) Weight - Right Main Wheel = _____ lbs.

(F_l) Weight - Left Main Wheel = _____ lbs.

(F_n) Weight - Nose Wheel = _____ lbs.

(F_t) Total Weight of Aircraft = [_____ LBS]

(a) Distance - Nose Wheel C to Main Wheel C = _____ inches

(b) Distance - Reference to Main Wheel C = _____ inches

(c) C.G. Location $= \frac{(F_n)(a)}{(F_t)} = \frac{(\quad)(\quad)}{(\quad)}$

= _____ inches from main wheels

(d) Fuselage Station of Reference = _____ inches

Fuselage Station of C.G. = (b) - (c) + (d) = _____ inches

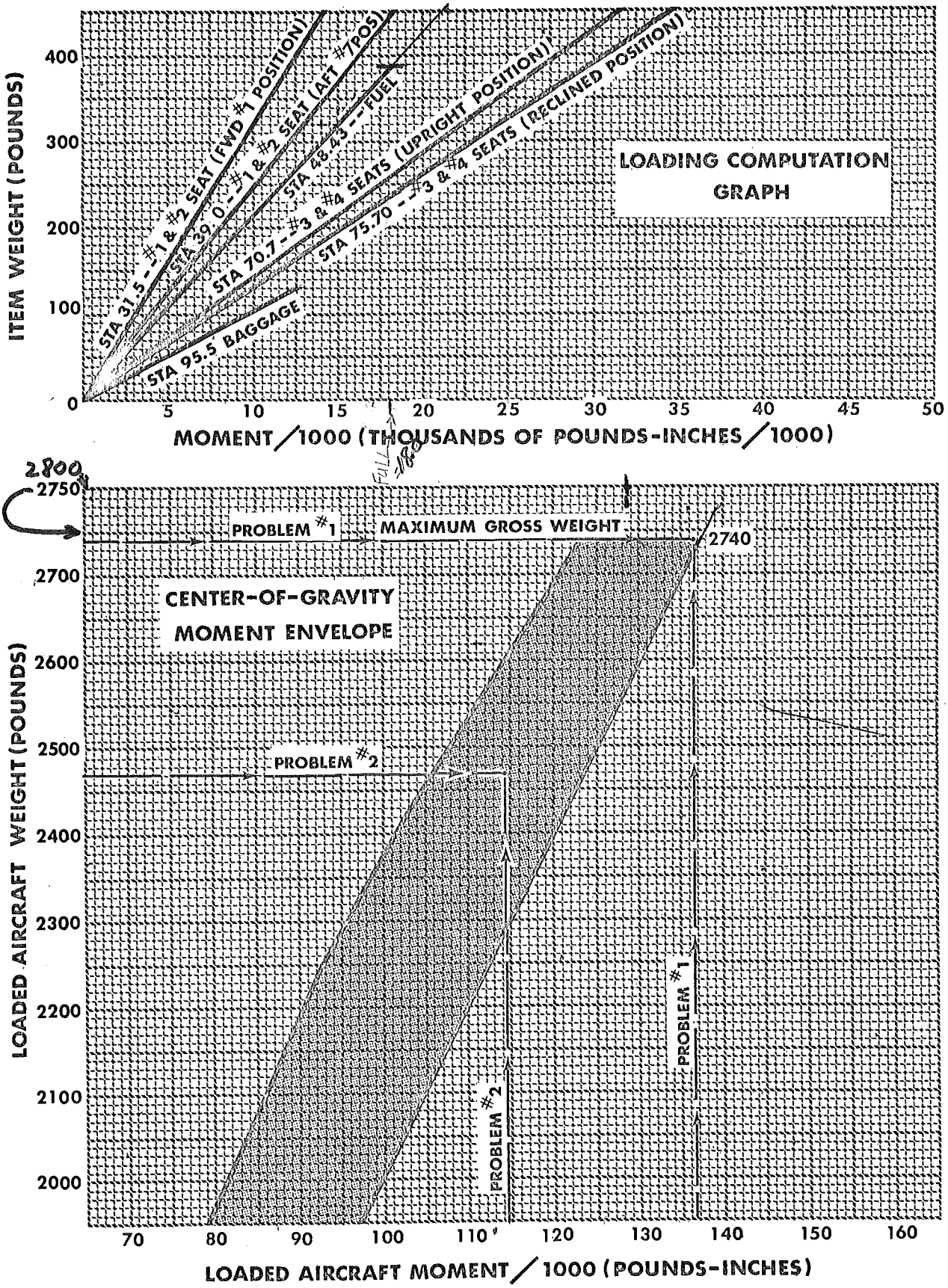
= [_____ % MAC]

EMPTY 1766.3 LBS = 45.8 Arm

Gas 6.0 LBS/gal

WEIGHT & BALANCE RECORD

MOONEY EXECUTIVE 21



WEIGHT AND BALANCE REVISION INFORMATION

Aircraft Registration N3275F
Aircraft Model M20F
Aircraft Serial No. 670368

This supersedes weight and balance dated 07/27/2008

ITEM	WEIGHT	ARM	MOMENT
OLD A/C empty weight	1749.25	46.34	81066.67

Aircraft weight and balance recalculated by weighing aircraft on 8/7/2011 as noted below.

REMOVED			
King ADF KR66	- 3.90	51.00	- 198.90
King KA 42B loop antenna	- 2.40	127.00	- 304.80
Wiring	- 2.00	89.00	- 178.00
New A/C W&B	1740.95		80384.97

80384.97 = 46.17" aft of datum new EWCG
1740.95

New aircraft empty weight is **1740.95** pounds.
The new aircraft empty weight C.G is **46.17** inches aft of datum.
The new useful load is **982.45** pounds at 2740.00 pounds gross weight.

See aircraft flight manual for operating limitations.

Date 01/01/2014 Authorized Signature

Herbert M. Degan, Jr

Certificate N0. 1954363 A&P