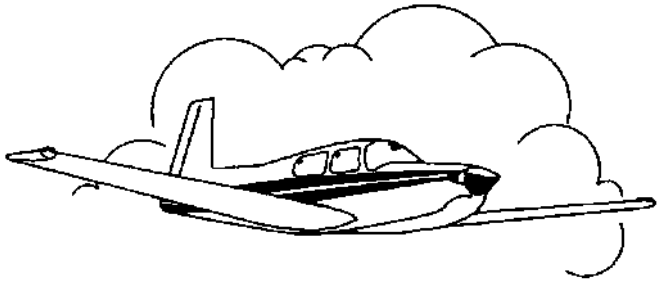
630B User's Guide

Mooney

Flight Calculator



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SERVICE: The calculator's batteries are replaceable by the user without loss of the program provided instructions are followed. Calculators in need of repair (in and out of warranty) should be returned to PROM Software, Inc. Visit us at www.promsoft.com for shipping instructions. Calculators that are out-of-warranty or damaged will be repaired on a time-and-materials basis.

LIMITED WARRANTY: This program uses information provided by the purchaser and/or other sources. Although it is believed to be accurate, PROM Software, Inc. DOES NOT WARRANT THE ACCURACY OF THE INFORMATION, AND ASSUMES NO LIABILITY TO ANY PERSON OR PERSONS IN CONNECTION WITH THE USE OF, OR THE INABILITY TO USE THIS PROGRAM OR CALCULATOR. The calculator will be repaired or replaced, at our option, if defective in manufacture and returned to us within the warranty period. Except for such repair or replacement, the sale, programming, or other handling of the calculator is without warranty or liability

DESCRIPTION

The 630B system performs a number of calculations useful in preflight planning.

The Weight & Balance Program computes gross weight, total moment and CG (center of gravity) for both takeoff and zero fuel. The program stores the entire CG envelope and indicates whether the computed CG's fall within the envelope. The program will indicate if the computed CG's are close to either the forward or aft limit.

The station arms as published in typical flight manuals are stored in the program. The user can change any or all of the arms to suit a particular aircraft. Similarly, the maximum gross weight, empty weight and arm, maximum fuel capacities (in gallons), and default weights can be modified by the user to suit a particular aircraft.

The Density Altitude Program computes the density altitude from the entered indicated altitude, altimeter setting, and outside air temperature.

The True Air Speed Program computes the true airspeed corrected for density altitude.

The Great Circle Distance Program computes the distance and initial magnetic heading between any two points. The points are defined by their latitude and longitude.

The Estimated Time Enroute Program simply calculates the time from the entered distance and airspeed. The answer is expressed in hours and minutes.

The Setup Routine is used to select an aircraft for the weight-&-balance program and to check and/or modify the station arms and default weights.

In response to a prompt, enter a value and push [ENTER]. Incorrect entries may be cleared by pressing the red [C.CE] key unless you have already pushed [ENTER], in which case you should use the [BACKUP] key (see Template Layout below for location). Of course, you can also start over by running the routine again. The Weight-&-Balance Program has a rework key which allows you to start over without erasing the previous entries.

Keyboard TEMPLATE

The eight function keys on the face of the calculator are used to run various programs which are identified by the template to be placed on the calculator. The function keys are identified as follows:

Rework Den Alt Dist Backup

W&B TAS ETE Setup

Weight & Balance - Keys 5 (W&B) and 1 (Rework)

The calculator must be setup by the user for the particular aircraft he or she wishes to use. The message "NEEDS SETUP" will appear if you attempt to run this routine without completing the setup routine.

Use the [W&B] key to start the routine for a new problem. This sets the prompted weights at the default values entered in the setup routine. To rework a loading problem, you can use either the [BACKUP] key to proceed backwards through the computed results and the prompts or the [REWORK] key to start over without clearing any of the weights.

Prompt	**User Response**
	Push key 5 or 1 to start this routine.
Xxxxxx	The aircraft type and serial number that is currently setup will appear for a moment in the display.

Weights below are in pounds, except for fuel, which is in gallons.

PILOT/CO xxx?_	If the default weight (in pounds) shown is correct for the front passengers, push [ENTER]; otherwise enter the desired weight. If the weight is for two persons, it can be entered either as the total weight or as an expression, i.e., 180+190.
REAR PX xxx?_	If the default weight shown is correct for the rear passengers, push [ENTER]; otherwise enter the weight.
BAGGAGE xxx?_	Same as above. This must not exceed 120 pounds.
HATRACK xx?_	Same as above. This must not exceed 10 pounds.
FUEL/G xx?_	If the amount of fuel shown (in gallons) is correct, push [ENTER]; otherwise, enter the correct number of gallons.

The calculator will pause for a moment to make the calculations and then will display the gross weight and the amount by which the computed weight is over or under the maximum gross weight. Push [ENTER] to proceed forward or [BACKUP] to proceed backward in the output list.

If either the Baggage or Hatrack weights exceed the maximum allowed, a message will appear to that effect.

WT: xxxx -xxx	The computed gross weight and amount by which it is less than ("-" sign) or greater than ("+" sign) the maximum gross weight.
CG: xxx.x AA[1]	The computed CG (center of gravity) with the fuel quantities

	entered above. "AA" indicates any of several messages.
ENV: fff.f –aaa.a	The CG Envelope forward (fff.f) and aft (aaa.a) limits for the computed gross weight. "fff.f" and "aaa.a" will appear as 0's if the aircraft is significantly over gross and the "FWD>AFT" message appeared with the computed CG.
LDG FUEL xx?_	Enter the amount of fuel in gallons remaining at the end of the flight. The amount prompted is the takeoff fuel.
LWT: xxxx -xxx	(Appears only if you entered the landing fuel amount.) The computed gross weight of the aircraft with the landing fuel amount and amount by which it is less than ("-" sign) or greater than ("+" sign) the maximum landing weight.
L-CG: xxx.x AA[1]	The calculated CG with the landing fuel amount. "AA" represents any of several messages.
ENL: fff.f -aaa.a	The CG Envelope forward (fff.f) and aft (aaa.a) limits for the computed gross weight with the landing fuel amount. "fff.f" and "aaa.a" will appear as 0's if the aircraft is significantly over gross and the "FWD>AFT" message appeared with the computed CG.
VREF: xx KCAS	The calculated Vref speed is displayed based on the computed landing weight. See Note on Vref Calculations.

Sample output data. These numbers are for illustrative purposes only and are not actual calculations.

M20M 00-0000	Model & serial no
PILOT/CO 360	Front passenger weight
REAR PX 145	Rear passenger weight
BAGGAGE 75	
HATRACK 5	
FUEL/G 96	
WT: 3282 -86	Gross weight (86 lbs under max)
CG: 47.1 OK	CG at gross
ENV: 44.0 -51.0	Envelope limits at gross weight
LDG FUEL 30	Fuel remaining at landing
LWT: 2886 -314	Gross weight at landing
L-CG: 46.9 OK	CG at landing weight
ENL: 42.6 -51.0	Envelope limits at landing weight
VREF: 74 KCAS	Vref at landing weight

Messages that can appear with the computed CG:

OK	CG is within envelope.
^GROSS	The aircraft is over its maximum gross weight.
=FWD^	The CG is either equal to or close to the forward limit. If followed by the "^", the aircraft is over maximum gross weight.
>FWD^	The CG is too far forward. If followed by the "^", the aircraft is over the maximum gross weight.
=AFT^	The CG is either equal to or close to the aft limit. If followed by the "^", the aircraft is over the maximum gross weight.
>AFT^	The CG is too far aft. If followed by the "^", the aircraft is over the maximum gross weight.
FWD>AFT	The forward limit of the envelope is aft of the rear limit (this occurs when the aircraft is significantly over gross weight).

WARNING: These messages are based on the permanently installed CG envelope for the type aircraft selected. The user must check the CG limit calculations at various gross weights to confirm that they are correct for the type aircraft in use.

Computational Notes

The gross weight is computed by adding the empty weight, the weight placed at each of the stations, and the weight the fuel (computed at 6 lbs per gallon).

The total moments are computed in the conventional manner by multiplying the weight at each station by the station arm and summing the results. The CG (center of gravity) is found by dividing the total moment by the gross weight and rounding the result to the nearest 1/10th of an inch.

The CG limits are computed from algorithms permanently loaded into the calculator for the type aircraft selected. These cannot be changed by the user. They have been selected from published information by the aircraft maker (usually the Aircraft Flight Manual). The forward limit is rounded up to the next higher 1/10th of an inch and the aft limit is truncated to the lower 1/10th of an inch.

The fore and aft envelope limits are shown at the calculated gross weight. These should be checked against those in your Pilot Operating Handbook.

The "close" message ("=FWD" or "=AFT") appears if the computed CG is within 10% of either end of the CG range computed for a particular weight. For example, if the forward limit is 46.0 inches, the "=FWD" close message will appear if the computed CG is equal to or less than 46.5 inches. Similarly, if the aft limit is 51.0 inches, the "=AFT" close message is displayed if the computed CG is equal to or greater than 50.5 inches.

Note on Vref Calculations

Vref is calculated as 1.3 times the Vso speed at the calculated landing weight for the particular aircraft. Vref is considered to be the ideal short-final approach speed for a no-wind, standard (i.e., not a short-field) approach. (For short-field approaches, it is common to subtract 5 knots from the Vref speed.) In all cases, consult the Pilot Operating Handbook for specific performance data and recommended airspeeds for your aircraft.

Density Altitude Program - Key 2

This routine computes the density altitude from the entered indicated altitude, altimeter setting, and outside air temperature. The program corrects for pressure altitude readings at other than the standard 29.92 inches.

Prompt	**User Response**
	Push Key 2 to start this routine.
DENSITY ALTITUDE	This will appear in the display for a moment.
IND ALT 0?_	Enter the indicated altitude and push [ENTER]. (This must be 35000 or lower.) Enter the indicated altitude and then the current altimeter setting at the next prompt. The program will correct the indicated altitude to obtain the pressure altitude.
ALTIM 29.92?_	If the altimeter is set at 29.92 inches, push [ENTER]; otherwise, enter the altimeter setting.
OAT/C x.x?_	The standard outside air temperature is shown in degrees Celsius for the pressure altitude. If correct, push [ENTER]; otherwise, enter the outside air temperature.
DEN ALT: xxxxx	The computed density altitude is displayed.

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DENSITY ALTITUDE
IND ALT?    9500
ALTIM?     29.92
OAT/C?     22.00
DEN ALT:   12393
```

Altimeter setting can be entered with or without the decimal point, i.e., 29.92 or 2992.

True Air Speed Program - Key 6

This routine computes the true air speed from the calibrated air speed corrected for density altitude. The density altitude used is the last one computed by the Density Altitude Program above.

Prompt	**User Response**
	Push Key 6 to start this routine.
`TRUE AIR SPEED`	This will appear in the display for a moment.
`KCAS xxx?`	If the calibrated air speed shown is correct, push [ENTER]; otherwise, enter the correct calibrated air speed. (The speed shown is from the last time this routine was used.)
`KTAS: xxx`	The true air speed will appear in the display.

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TRUE AIR SPEED
KCAS?        140
KTAS:        169
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Based on most recent density altitude computed.

Great Circle Distance Program - Key 3

This routine computes the great circle distance (in nautical miles) between two points defined by their latitude and longitude. It also computes the initial magnetic heading. (On short distances, the heading will be valid for the whole leg, however, as distances increase and the magnetic variation changes, the heading will change.)

Prompt	**User Response**
	Push Key 3 to start this routine.
GT CIRCLE DIST	This will appear on the screen for a moment.
LAT#1 0?_	Enter the latitude of the first point. Enter the latitude in the format ddmm.m, e.g., 44 56.3.
LON#1 0?_	Enter the longitude of the first point. Enter the longitude in the format dddmm.m, e.g., 77 23.4.
VAR#1+W 0?_	Enter the magnetic variation of the first point. Enter a westerly variation as a positive number and easterly variation as a negative number.
LAT#2 0?_	Enter the latitude of the second point. This cannot be exactly the same as LAT#1 above.
LON#2 0?_	Enter the longitude of the second point. This cannot be exactly the same as LON#1 above.
DIST/NM: xxxx	The distance in nautical miles is displayed.
INITIAL HDG: xxx	The initial magnetic heading is displayed.

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GT CIRCLE DIST
LAT#1      4428.3     Latitude & longitude of departure
LON#1     07309.2

VAR#1+W         17     Magnetic variation of departure

LAT#2      2958.0     Latitude & longitude of destination
LON#2     09920.0

DIST/NM:      1513     Distance in nautical miles
INITIAL HDG:   261     Initial magnetic heading
-----------------
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Estimated Time Enroute/Fuel Required Program - Key 7

This routine computes the estimated time enroute from the entered distance and ground speed. The result is expressed in hours and minutes. It also computes the required fuel based on the entered fuel consumption rate per hour.

Prompt	**User Response**
	Push Key 7 to start this routine.
`ETE/FUEL REQ`	This will appear in the display for a moment.
`DIST/NM xx?_`	If the distance shown is correct, push [ENTER]; otherwise, enter the correct distance. (The distance shown is the last one computed by the Great Circle Distance program or the last one used in this routine, whichever was later.)
`GS/KNOTS xxx?_`	If the ground speed shown is correct, push [ENTER]; otherwise, enter the correct ground speed. (The speed shown is the last one computed by the True Air Speed Routine or the last one used in this routine, whichever was later.)
`ETE-H:M: hh:mm`	The estimated time enroute in hours and minutes is displayed.
`FUEL/HR xx?_`	Enter the fuel consumption rate in gallons per hour.
`INCL 45-MIN RES`	This message flashes on the screen for a moment to indicate that the fuel required calculations include a 45-minute reserve at the entered fuel flow rate.
`FUEL REQ/G: xxx`	The total fuel required is computed.

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 ETE/FUEL REQ
DIST/NM       745
GS/KNOTS      195
ETE-H:M:     3:49   Estimated flight time
FUEL/HR        16   Fuel burn rate
INCL 45-MIN RES     Estimated fuel required (including
FUEL REQ/G:  73.1   a 45-minute reserve at 16 gallons)
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Battery Replacement & Maintenance

The batteries are of a long-life lithium type that will operate the calculator for about a year, depending upon how much you use it. The calculator is equipped with an "automatic off" feature that turns the calculator off in about 5 minutes if no keys are operated. To turn it back on, press the [CA] key (next to the red [C·CE] key).

To replace the batteries, you should first have replacement batteries at hand. Two lithium-type CR2032 batteries are required.

1) Make sure the calculator is turned off. Place the calculator face down on a table with the contrast adjusting knob in the upper left-hand corner (the writing on the back of the calculator will be right-side up).

2) Remove the Software Cartridge before you replace the batteries.

3) Using a small screwdriver, remove the two screws on the back; while lifting the edge of the calculator's back cover closest to you, slide it up to remove it.

4) Refer to the diagram on the silver-colored battery compartment cover that shows how the batteries are installed. It is essential that the polarity (+ and –) of the batteries be as shown in the diagram. (If there is no diagram, notice carefully how the existing batteries are installed before removing them.) Slide the silver-colored battery compartment cover upward to open the compartment; remove the cover. The batteries are now disconnected; remove and discard them.

5) Install the new batteries, making sure the polarity is correct, and replace the battery compartment cover. (Make sure to replace the battery compartment cover--the batteries are not connected unless the battery compartment cover is in place.) Replace the back of the calculator by first hooking the 3 tabs on the top and then lowering the edge closest to you so you can replace the 2 screws. Install the Software Cartridge.

Initializing the Software Cartridge

If the calculator does not operate after you replace the batteries, you should initialize it with the following steps.

1) With a pencil or straightened paper clip and the calculator ON, push the "ALL RESET" button on the left side of the back of the calculator. You should see 4 stars in the display (2 on the left, 2 on the right).

2) Push [ENTER]. You should now see a single star at the right edge of the display.

3) Turn the calculator off, wait 2 seconds, and then turn it back on. You should see "0." in the display. The calculator is now ready to be configured.

4) Push the [Setup] key.

Adjusting the Display Contrast

The calculator is equipped with a control to adjust the contrast of the LCD (liquid crystal display). As the batteries age, the contrast will need to be adjusted from time to time. Adjust the display contrast with the knob on the right-hand end of the computer (under the On/Off switch). While looking at the display from a position about 70 degrees above the keyboard, first increase the contrast until black squares are clearly visible behind the characters and then decrease the contrast slowly until the squares just disappear. If the display contrast becomes too dim, the batteries should be replaced.

Setup Routine - Key 8

The setup routine is used to select an aircraft for the weight & balance program and to verify the various weights and arms that are required.

A code number is required to access this routine.

Push Key 8 to access the setup routine.

`CODE?_` Enter the appropriate code number from the following table:

360 - Update default payload weights/fuel amount
720 - Clear TAS, Dist, Latitudes & Longitudes

Update Payload Weights Selection - Code 360

The user can install default weights for the pilot, co-pilot, rear passengers, baggage area, and hatrack. If installed, the user will be prompted with these weights and need only push [ENTER] when operating the Weight-&-Balance routine to use the displayed weight.

The calculator must be setup with an aircraft type before this routine can be used.

`UPDATE WEIGHTS` This will appear for a moment to indicate that the program is now requesting entry of the weights.

`PILOT/CO 180?_` If the default weight shown is correct, push [ENTER]; otherwise enter the desired default weight (see below).

`REAR PX 0?_` If the default weight shown is correct, push [ENTER]; otherwise enter the desired default weight.

`BAGGAGE 0?_` If the default weight shown is correct, push [ENTER]; otherwise enter the desired default weight. This must not

exceed 120 pounds.

HATRACK 0?_	If the default weight shown is correct, push [ENTER]; otherwise enter the desired default weight. This must not exceed 10 pounds.
FUEL/G 0?_	If the default number of gallons shown is correct, push [ENTER]; otherwise enter the desired default number of gallons.

WEIGHTS DONE

Clear TAS, Lat/Lon Fixes, Distance, & other values - Code 720

CLEAR	The "remembered" values are cleared to 0. This does not affect the weight & balance routine.

Initialize Calculator and Clear All - Code 180081

If the calculator reports ERROR 3 in XX, it probably needs to be initialized. Perform the following steps to initialize the calculator:

1) Push the [CA] clear key.

2) Push the [SETUP] key (lower, right function key).

3) Enter the appropriate code to initialize the calculator. It is then required that you select an aircraft type for the Weight-&-Balance routine.

Weight-&-Balance Aircraft Selection - Code 360063

WARNING: The calculations of the weight-&-balance routine are determined by the weights and arms entered and/or confirmed in this routine. Incorrect entries in this routine WILL cause incorrect center of gravity computations.

DO NOT use this routine to modify the parameters for weight-&-balance computations unless you are completely familiar with the computations for the type aircraft and you have the Airplane Flight Manual at hand to verify the arms and weights.

SELECT A/C N/Y?_	To select an aircraft (either a new one or to review the parameters of the current one), push the [YES] key.
Mxxx N/Y?_	If you want to use the aircraft type shown, push the [YES] key; otherwise push the [NO] key (or [ENTER]) to proceed to the next type. The calculator will list all the aircraft types – you must push the [YES] key when the type is displayed to select an aircraft type. If an aircraft is selected, the following prompts will appear; otherwise, the program will end.
RESET VALS N/Y?_	(Appears only if the type selected is the same as the type currently in use.) To reset all the weights and arms to the default values provided with the program, push the [YES] key; to simply review the existing values without resetting them, push the [NO] key.
SERIAL # xx-xxxx?_	If the serial number shown is correct, push [ENTER]; otherwise, enter the correct serial number.
MTOW xxxx?_	If the maximum gross weight shown is correct, push [ENTER]; otherwise, enter the correct maximum gross weight.
MLW xxxx?_	If the maximum landing weight shown is correct, push [ENTER]; otherwise, enter the correct maximum landing weight.
EMPTY xxxx?_	If the empty weight shown is correct, push [ENTER]; otherwise, enter the correct empty weight.
VSO/KCAS xx?_	If the landing-configuration stall speed at maximum take-off gross weight (in knots) shown is correct, push +(=); otherwise enter the correct stall speed

VERIFY ARMS	This message will appear for a moment in the display. The values that are shown in the following prompts are the current (or default) arms for the station names shown. The stations shown in these instructions are typical. The stations that actually appear will depend upon the aircraft type selected.
EMPTY xx.x?_	If the empty arm shown is correct, push [ENTER]; otherwise enter the correct empty arm.
PILOT/CO xx.x?_	If the arm shown is correct, push [ENTER]; otherwise enter the correct arm.
REAR PX xx.x?_	If the arm shown is correct, push [ENTER]; otherwise enter the correct arm.
BAGGAGE xx.x?_	If the arm shown is correct, push [ENTER]; otherwise enter the correct arm.
HATRACK xxx?_	If the arm shown is correct, push [ENTER]; otherwise enter the correct arm.
FUEL/G xx.x?_	If the ***arm*** shown is correct for the fuel, push [ENTER]; otherwise enter the correct arm. NOTE this is the fuel ARM, not the number of gallons.
ALL OKAY Y/N?	If all the entries made are correct and as desired, respond by pushing the [YES] key. You MUST answer yes to this question to enable the weight-&-balance program for the aircraft type selected. If you push [NO], the message "INCOMPLETE" will appear and the weight-&-balance program will not operate. In this case, you must start the setup routine again and carry it to completion to enable the weight-&-balance program.
xxxxx READY	The calculator will respond with this display indicating that the weight-&-balance routine is ready for use.

Aircraft Types

M20J

This aircraft type has a gross weight of 2740 pounds. If you have a newer "J" model with the 2900 pound gross weight, change the maximum take-off weight and landing weight to 2900 pounds. Also, verify the VSO entry – this should be at the maximum take-off weight. Note that the maximum take-off and landing weights are the same for this aircraft.

The maximum fuel amount is for standard tanks. If you have installed long-range fuel tanks, you can increase the maximum amount by using the Update Payload Weights Selection routine (Setup code 360). Make sure to use the proper arm for the long-range tank (See Weight-&-Balance Aircraft Selection - Setup code 360063).

M20M

Most M20M's have been modified to have a higher take-off weight of 3368 pounds. If your aircraft has a different maximum take-off weight, enter it when setting up the calculator for your aircraft (See Weight-&-Balance Aircraft Selection – Setup code 360063). If you have installed long-range Monroy fuel tanks, see type M20M-M1 below

M20M-M1

This is the M20M with Monroy long-range fuel tanks installed. An extra station (named "AUX/G") is provided to enter the amount of fuel in the long range tanks. Note that even though the long-range tanks just increase the size of the main tanks, the STC for Monroy tanks treats the extended tanks as another station.

An alternative to this is to calculate a composite arm for the increased tank size and use the M20M aircraft type above with the new arm.[1]

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[1] A typical calculation would be:

89 gals @	6 lbs =	534 lbs @	49.23" =	26,288.82 in/lbs	Main
29 gals @	6 lbs =	174 lbs @	71.00" =	12,354.00 in/lbs	Aux
		708 lbs		38,642.82 in/lbs	Total

The composite arm is 54.58" (38,642.82 / 708). Make sure to use the actual arms and fuel amounts for your aircraft if you do this calculation.