

GFA FORM W1 REV 2.1 (10 JUNE 2023) GUIDELINES

WEIGHING OF SAILPLANES AND POWERED SAILPLANES.

These forms and procedures are based on and consistent with GFA Weight and Balance of Sailplanes AIRW-D011 Ver 1.1 issued May 2023. Form W1 has been substantially revised. Please discard all superseded Form W1's that you may have and adopt these improved forms and procedures. The process form on page 2 is for recording of data as the sailplane is weighed. The results are transferred to page 3.

EQUIPMENT LIST AND CONFIGURATION

The equipment list has been further expanded to record more effectively the configuration of the sailplane when it is weighed. It is now on separate pages after the weighing form. This configuration record must be kept with the associated weighing form in the sailplane records.

Be careful when weighing any sailplane to make sure you record the equipment status at the time of weighing. Items such as oxygen bottles, water bags and tail parachutes are often left out, either in error or deliberately, to get a lower empty weight. If the Registered Operator wants these items left out, make sure the placards in the glider clearly state that the relevant items are not included in the weight and balance placards. In extreme cases you may have to provide two sets of weight and balance placards, one with the items installed and one with them removed.

WEIGHING MODELS AND DIMENSION 'a'

A significant change from the previous version of the form is how dimension 'a' is used. In the previous Form W1 the equations were modified so that 'a' was always positive. In this revision the one equation is used and care must be taken to ensure whether 'a' is positive or negative.

If G_1 is ahead of the datum 'a' is a negative number. There is a reminder in each of the weigh model diagrams. Dimension b is **always** the distance between G_1 and G_2 in all models and is always positive.

If using the table method to add weights and moments, the arm of $G_2 = a + b$.

Where a sailplane has its main wheel position at, or very close to, the empty C of G position it is strongly recommended to use **Model 3**.

TRICYCLE UNDERCARRIAGE

For tricycle undercarriage motor gliders (Grob, Dimona etc.), provision has been made for the use of three pad weighing equipment. G_1 left and right boxes have been provided for tail draggers (models 1 & 1a) and G_2 left and right boxes for nose wheel sailplanes (model 2).

For conventional single main wheel sailplanes, the "left" and "right" boxes are just ignored.

MAIN PINS

The main pin/s may be included in the wing structure weight unless otherwise stated in the manufacturer's maintenance manual. A box is provided for entry of this item unless the manual indicates they are part of the non-lifting parts total for the fuselage and tailplane.

PILOT 1 CALCULATIONS

An additional page has been added to the weight and balance sheet to enable the minimum and maximum pilot weight s to be calculated. The equations shown are for conventional sailplanes with the pilot(s) ahead of the CG limits. Consult AIRW-D011 Weight and Balance of Sailplanes for sailplanes with the pilot(s) behind the CG limits or for unconventional layouts.

Forward the completed pages 3 and 4 of Form W1 to: returns@glidingaustralia.org.

WEIGHT AND BALANCE PROCESS FORM

SCALES

	Make / Model	Owner	Max load	Resolution	Calibration Date
Main(s)					
Tail					

What steps were taken to check and ensure scale performance on the day?

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RAW DATA – Component Weights: Weigh each wing OR Fuselage and Tailplane for G_{WNLP}

	Wing - Port		Wing - Starboard		Main Spar Pin(s)	Fuselage	Tailplane
	Inner	Outer	Inner	Outer			
Weigh 1							
Weigh 2							
Average							

RAW DATA – Rigged Sailplane: Averages go to Form W1 and check sum. Check on meeting consecutive weighing accuracy requirement.

	G ₁		G ₂	Total
Weigh 1				
Weigh 2				
Average				
Check Weigh 1 and Weigh 2 within tolerances	1.002 x G ₁ Avg		G ₂ Avg + 0.1	
	0.998 x G ₁ Avg		G ₂ Avg - 0.1	

The consecutive Weigh 1 and Weigh 2 readings must be within the tolerances detailed in MOSP 3 Section 20 May 2023 (or later).

RESULTS:

	Weight empty	CofG	a	b
Previous Weigh Date:	kg	mm	mm	mm
Current Weight	kg	mm	mm	mm

Compare the measured a and b with the previous measured values to validate the a and b used. Discrepancies may require remeasuring to determine the issue(s) or consulting earlier weighs (if available).


Do the changes between the new weigh and the previous weigh have reasonable explanation?.....

Present and record the placards which flow from this weighing:

Independent checking of results and placards carried out?

W&B Authority signature _____ Member No. _____ Date _____

Circle authority level >> Basic Advanced

	FORM W1 SAILPLANE / POWERED SAILPLANE WEIGHING RECORD			GFA Form W1 Rev.2 01.06.2023
	Scales used:	Place:	Date:/...../.....	
Calibration date:	Level Ref:	Datum:		

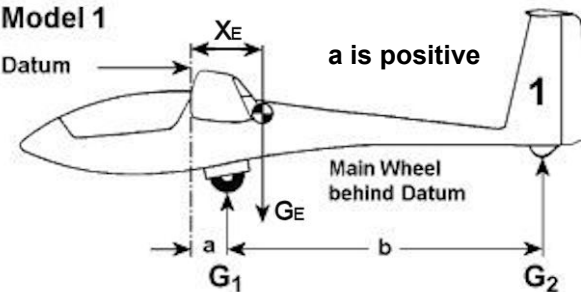
SAILPLANE / POWERED SAILPLANE DETAILS

Type	Serial number	C of R. No. G	Reg. VH -		Other Marks
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WEIGHING MODELS

MEASUREMENTS AND CALCULATIONS

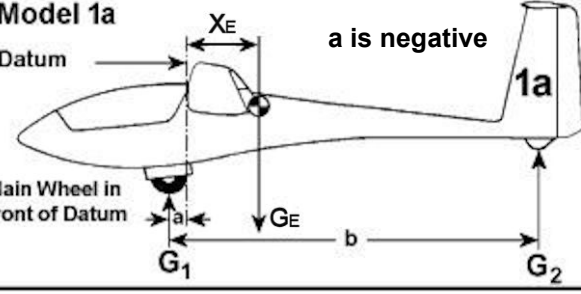
Model 1



a is positive

Main Wheel behind Datum

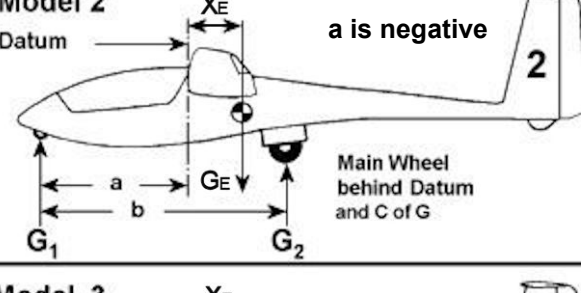
Model 1a



a is negative

Main Wheel in front of Datum

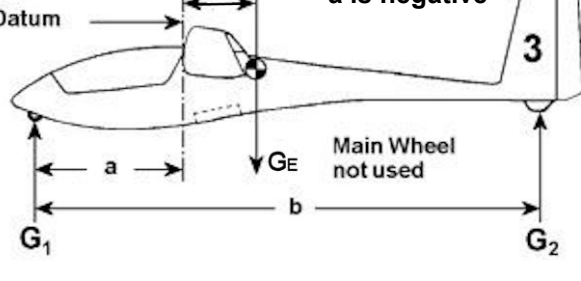
Model 2



a is negative

Main Wheel behind Datum and C of G

Model 3



a is negative

Main Wheel not used

Left Wing			Right Wing		
Winglet		kg	Winglet		kg
Outer Panel		kg	Outer Panel		kg
Inner Panel		kg	Inner Panel		kg
Total Left Wing		kg	Total Right Wing		kg
Note: Some sailplanes require main pin(s) weight to be in non lifting parts			Add Left Wing		kg
			Add main pin/s * (See manual)		kg
			Total Wings G_{WINGS}		kg
Fwd wheel / Tricycle landing gear			Aft wheel / Tricycle landing gear		
G ₁ Left	G ₁ Right	kg	G ₂ Left	G ₂ Right	kg
Total Empty Weight = G₁ + G₂ = G_E			kg		
Weight of Non-Lifting Parts = G_E - G_{WINGS} = G_{WF+T}			kg		
Dimension a (Datum to G ₁) <i>a is negative if fwd of datum</i>			mm		
Dimension b (G ₁ to G ₂)			mm		
Datum to G ₂ = a + b <i>a is negative if fwd of datum</i>			mm		
Empty CG $X_E = \frac{G_2 \times b}{G_E} + a =$			mm		
Check Sum – These two moments must agree!					
Moment Empty = G₁ x a + G₂ x (a+b) =			kg.mm		
Moment Empty = G_E x X_E =			kg.mm		

LOGBOOK ENTRY

Empty Weight	kg	CG Arm	mm
Moment Empty	kg.mm	Weight of Non-Lifting Parts	kg
Weighed by Name, Member No:		Date	
Calculation checked by Name, Member No:		Date	

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DATA FROM TYPE CERTIFICATE DATA SHEET OR FLIGHT MANUAL			
Max Weight	G_{MAUW}		kg
Max Weight without Water Ballast	G_{MWDRY}		kg
Max Weight of Non Lifting Parts	G_{MWNLP}		kg
Fwd CG Limit	X_{FWD}		mm
Aft CG Limit	X_{AFT}		mm
Safe Aft Limit (if applicable)	$X_{SAFEAFT} = X_{AFT} - 0.05 (X_{AFT} - X_{FWD}) =$		mm
P1 Arm	X_{P1}		mm
MINIMUM PILOT 1 WEIGHT (For Conventional Single Seat and Tandem Two Seat Sailplanes)			
$P_{1MIN} = \frac{G_E \times (X_E - X_{AFT})}{(X_{AFT} - X_{P1})}$	$\frac{\times (\quad - \quad)}{(\quad - \quad)} =$		kg
MAXIMUM PILOT 1 WEIGHT (For Conventional Single Seat and Tandem Two Seat Sailplanes)			
Maximum all up weight $P_{1MAX} = G_{MAUW} - G_E$	$-$	$=$	kg
Maximum dry weight $P_{1MAX} = G_{MWDRY} - G_E$	$-$	$=$	kg
Maximum of Non Lifting Parts $P_{1MAX} = G_{MWNLP} - G_{WF+T}$	$-$	$=$	kg
Forward Centre of Gravity $P_{1MAX} = \frac{G_E \times (X_E - X_{FWD})}{(X_{FWD} - X_{P1})}$	$\frac{\times (\quad - \quad)}{(\quad - \quad)} =$		kg
Seat Limit			kg
Select the smallest value of P_{1MAX} from above	$P_{1MAX} =$		kg
CHECK SUM			
Empty Aircraft (from page 2 results)	Weight G_E		Empty Moment
Min Pilot Weight	P_{1MIN}	Pilot Arm X_{P1}	Pilot Moment = $P_{1MIN} \times X_{P1}$
Calculated Arm must be equal or less than X_{AFT} (or $X_{SAFEAFT}$ if used)!	Total Weight	Arm = Total Moment / Total Weight	Total Moment

A similar check can be done using the P_{1MAX} and the calculated arm must be equal or greater X_{FWD} .

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RECORD OF SAILPLANE CONFIGURATION			
VH-	Date:	Name:	
Front / Left Cockpit		Rear / Right Cockpit	
Item	Model	Item	Model
Airspeed Indicator		Airspeed Indicator	
Altimeter		Altimeter	
Pneumatic Vario		Pneumatic Vario	
Elec vario - meter (1)		Elec vario - meter (1)	
Elec vario - meter (2)		Elec vario - meter (2)	
Flight computer display		Flight computer display	
Engine control unit		Engine control unit	
Radio		Radio (Repeater)	
Transponder		Transponder	
Flarm display		Flarm display	
Compass		Compass	
OAT gauge		OAT gauge	
Flap position indicator		Flap position indicator	
Pneumatic vario flask		Pneumatic vario flask	
Emergency Locator ELT		Emergency Locator ELT	
Directional gyro / turn & slip		Directional gyro / turn & slip	
ADS-B unit (Rx or Rx & Tx)		ADS-B unit (Rx or Rx & Tx)	
G Meter		G Meter(s)	
Flarm module		Flarm module	
Microphone(s)		Microphone(s)	
Loudspeaker(s)		Loudspeaker(s)	
Headset(s)		Headset(s)	
Oxygen regulator		Oxygen regulator	
Seat harness		Seat harness	
Seat back		Seat back	
Head rest		Head rest	
Cushions		Cushions	

Keep this page with weigh results in sailplane records

Fuselage, Tail and Wings			
VH-	Date:	Name:	
Item	Model / Location	Weight (if req'd)	Arm (if req'd)
Tie down kit			
Oxygen bottle			
Release – nose / aerotow			
Release – belly / winch			
Tail Parachute			
Battery – main 1			
Battery – main 2			
Battery – main 3			
Battery – tail 1			
Battery – tail 2			
Solar module(s)			
Solar regulator			
Fuel – fuselage tank	Undrainable fuel		
Fuel – wing tanks(s)	Undrainable fuel		
Oil level			
Coolant level			
Water ballast – tail			
Water ballast - wings			
Fixed ballast weights			
Notes: 			

BATTERIES: Record those batteries which are mandatory fitment as part of the empty weight determination. Consider if battery fitment needs detailed placards. Example: If minimum pilot weight was first determined with heavy forward battery(s), a minimum weight pilot flying with light LiFePO4 forward battery(s) (or battery in alternate location) may exceed aft limit.

CONFIGURATION RECORDING IS IMPORTANT. Weighing an aircraft and finding a weight and / or CG change without being able to identify the cause is a serious concern. Tracking the equipment fitted at the time of weighing is an important tool in investigating weight and balance changes.

Keep this page with weigh results in sailplane records