



British Microlighting

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WEIGHT & BALANCE SPREADSHEET GUIDENCE

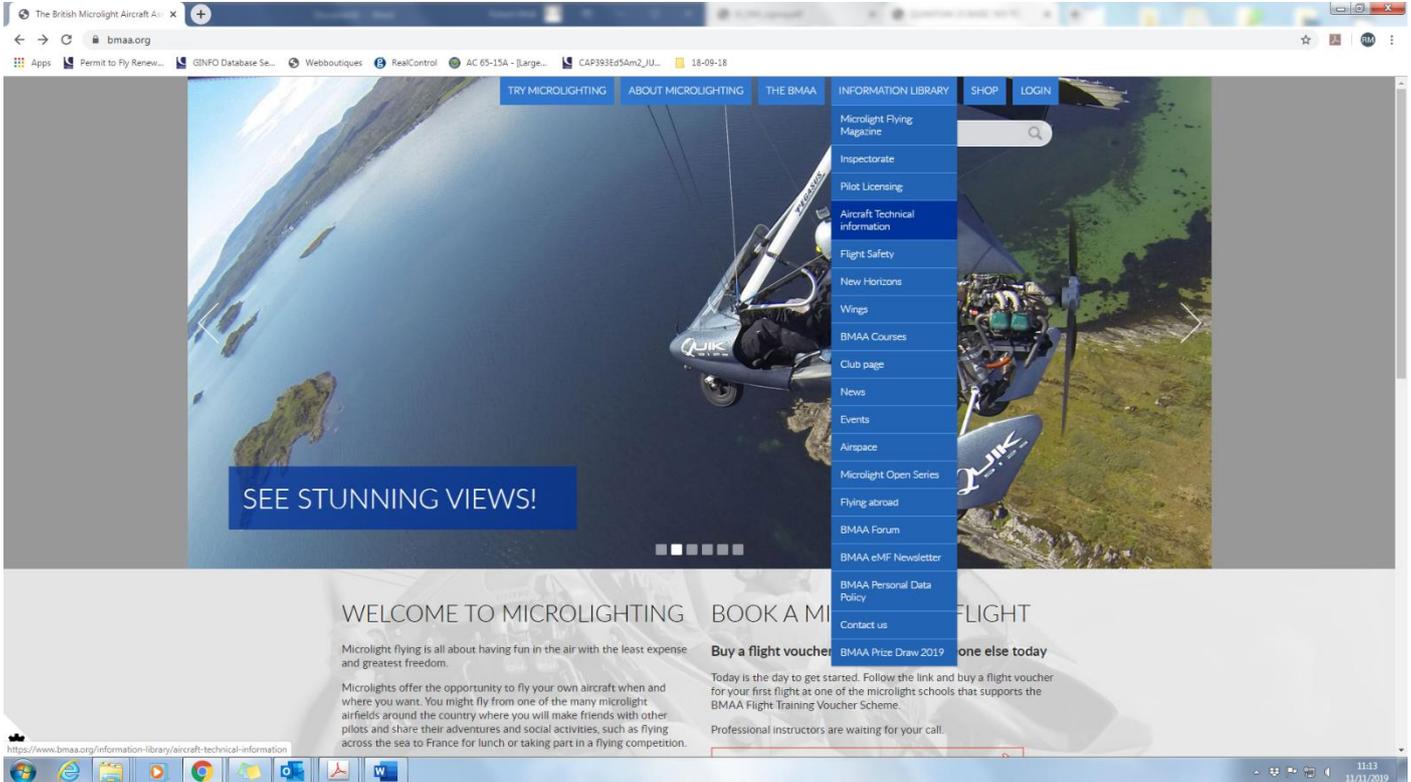
This is a brief step-by-step screen shot guide to using the new BMAA weight and balance spreadsheet (AW/028 Issue 11).

If you have any questions
please contact the BMAA Technical Office
01869 336006

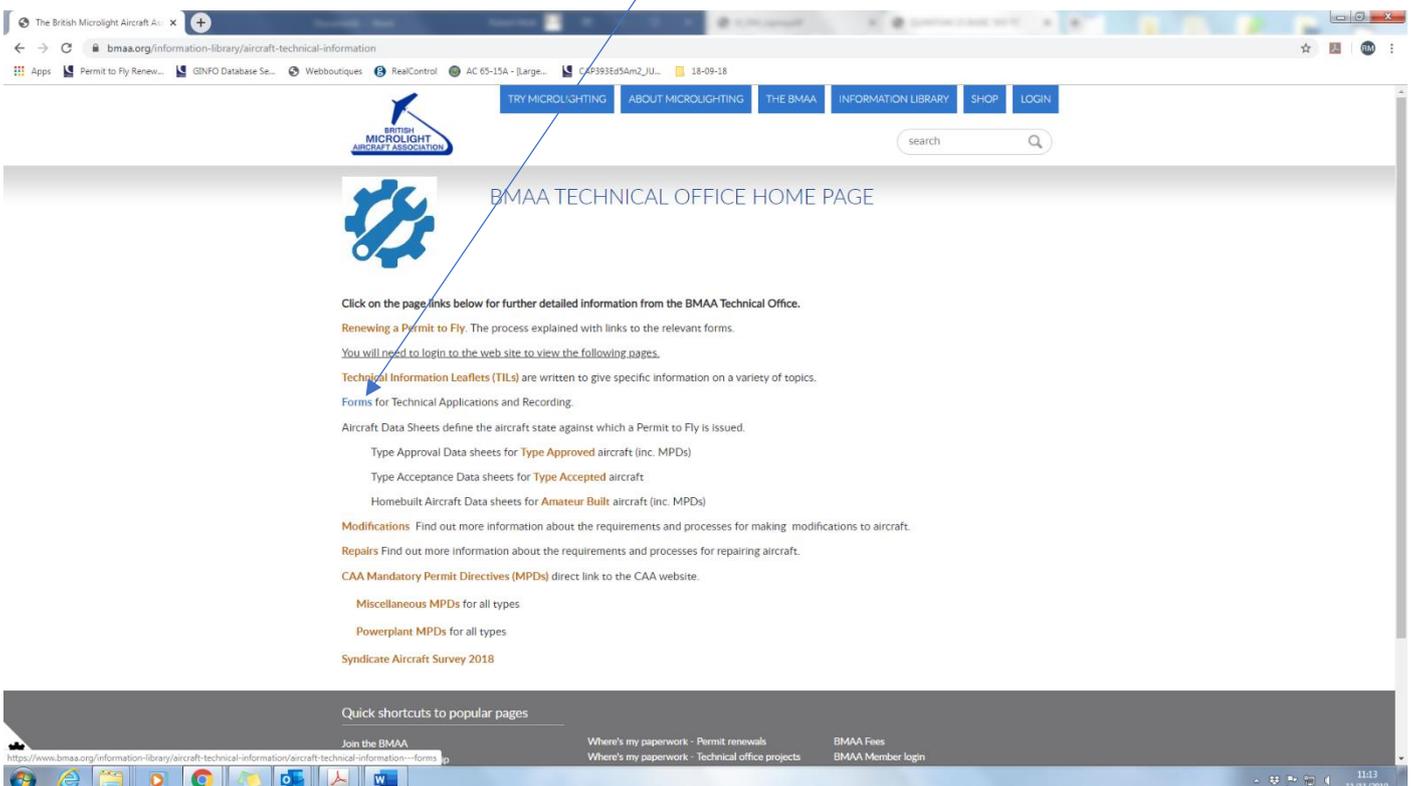
The Spreadsheet can be downloaded from the BMAA website

www.bmaa.org

Click Information Library > Aircraft Technical Information



Click Forms



There are two versions:

.xls works on older versions of MS Excel (2003 and earlier)

.xlsx works on later MS Excel, Apple and Android devices

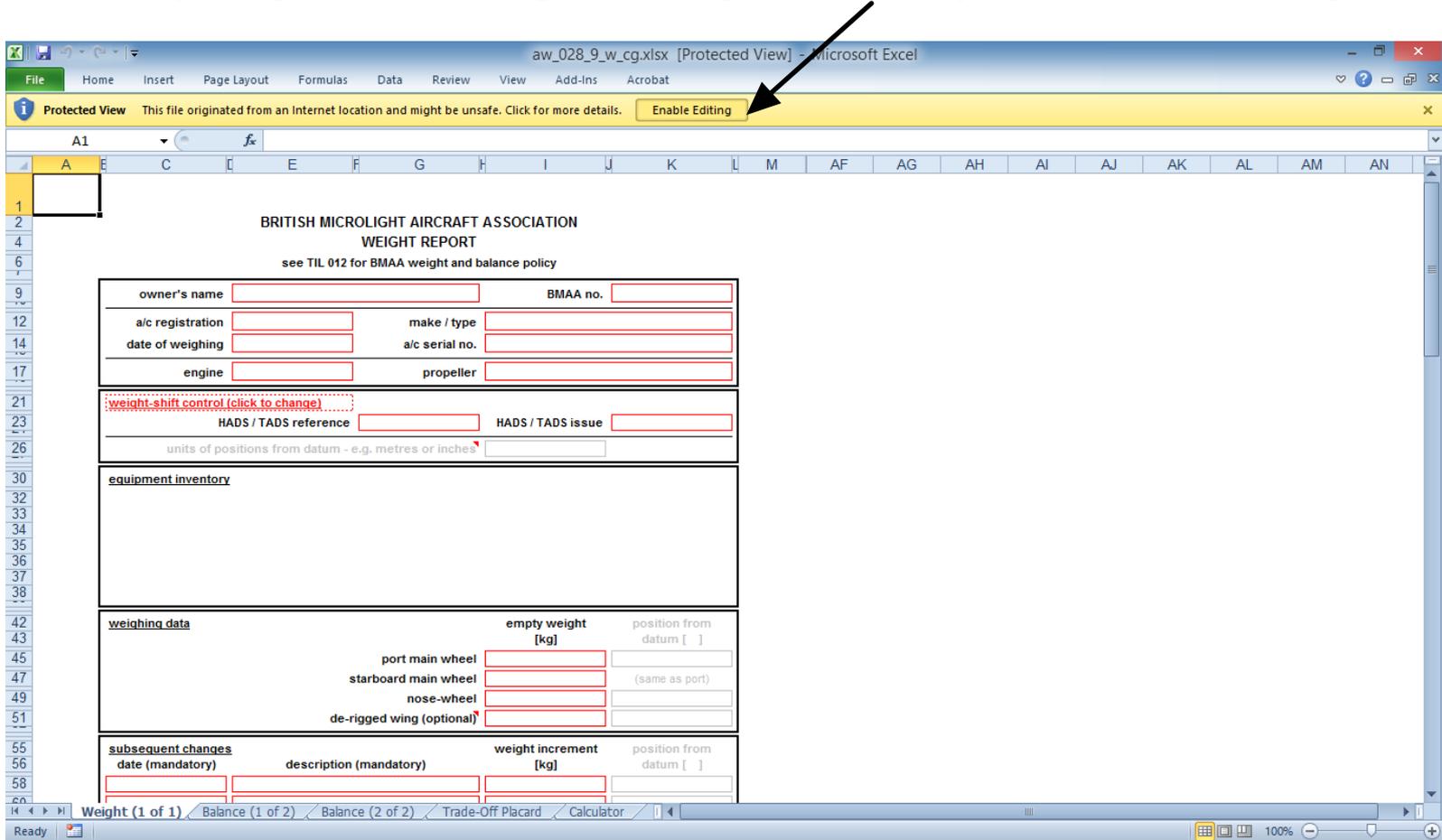
The screenshot shows the BMAA website's 'Forms for Technical Applications and Recording' page. The page lists various forms and their issue numbers. A blue arrow points to the link for 'AW 028 Issue 11 Weight and CG Report Spreadsheet (xlsx for later versions of MS Excel)'. The browser's taskbar at the bottom shows the date as 11/21/2019.

Form ID	Issue	Description
AW 001	Issue 28	Permit Revalidation Application
AW 002a	Issue 10	Modification Application - Word document
AW 002a	Issue 10	Modification Application - PDF
AW 002b	Issue 12	Repair Application - Word document
AW 002b	Issue 12	Repair Application - PDF
AW 002c	Issue 1	Strobe Fitment Application
AW 005	Issue 9	Powered Parachute Inspection Schedule
AW 006	Issue 8	Flexwing Inspection Schedule
AW 007	Issue 8	3-axis & 2-axis Inspection Schedule
AW 008a	Issue 12	BMAA Inspector Initial Application
AW 008b	Issue 12	BMAA Inspector Renewal Application
AW 011a	Issue 7	3-axis Check Flight Schedule for Permit Revalidation
AW 011b	Issue 7	Flexwing Check Flight Schedule for Permit Revalidation
AW 011c	Issue 7	Powered-Parachute Check Flight Schedule for Permit Revalidation
AW 020	Issue 5	Accident Report Form
AW 021	Issue 3	Incident Report Form
AW 022	Issue 7	Homebuilt Aircraft Project Registration
AW 028	Issue 11	Weight and GC Report Spreadsheet (xlsx for later versions of MS Excel)
AW 028	Issue 11	Weight and CG Report Spreadsheet (xls for older versions of MS Excel)
AW 030	Issue 6	Aircraft change of Data Sheet (CDS AW030)
AW 042	Issue 2	Classification of Manufacturer Designed Modification
AW 043	Issue 3	ASI Calibration Help Sheet
AW 046	Issue 1	Details of Removed Aircraft Part
AW 049	Issue 1	Details of Airfield or Airstrip
AW 053	Issue 1	Inspector Authorisation Record
AW 057	Issue 8	Inspector Audit Form
AW 064	Issue 4	Application for Owner Inspection Authorisation
AW 068	Issue 1	Aircraft Worksheet
AW 070	Issue 1	Aircraft Survey Report
AW 071	Issue 3	Aircraft Damage Report
AW 074	Issue 1	Repair Proposal Template - Word document
AW 074	Issue 1	Repair Proposal Template - PDF

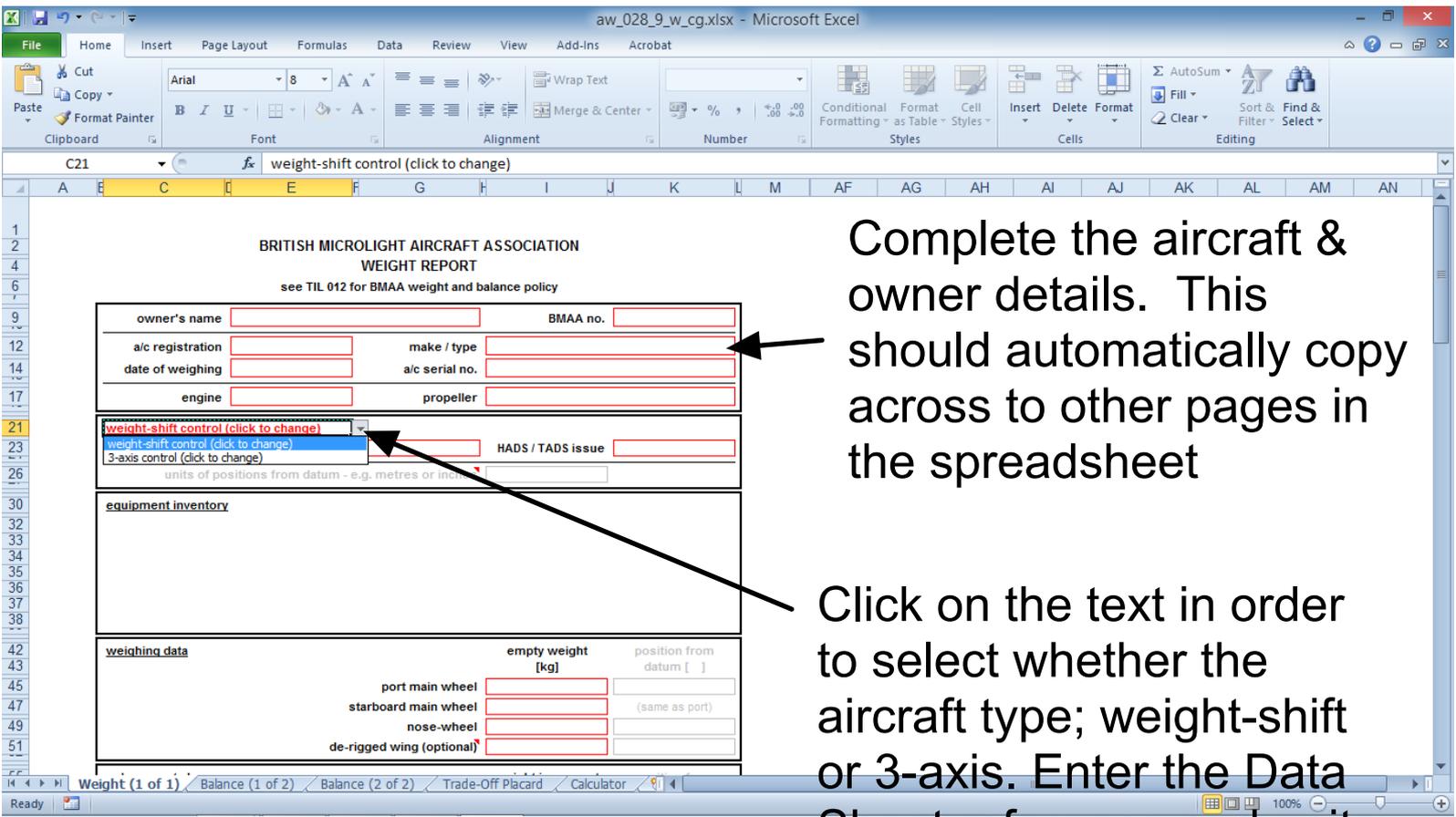
Click or tap on the desired version, then save and open

This screenshot shows the same BMAA website page as above. A blue arrow points to the 'tof_aw_028_w_cg (3).xlsx' file in the Windows taskbar, indicating that the user has successfully downloaded the spreadsheet. The browser's taskbar at the bottom shows the date as 11/21/2019.

If you get a warning message, ensure you enable editing



Part 1: Actual Empty Weight & Inventory



Complete the aircraft & owner details. This should automatically copy across to other pages in the spreadsheet

Click on the text in order to select whether the aircraft type; weight-shift or 3-axis. Enter the Data Sheet reference and units

Inventory, Wheel Weights & Empty CG

aw_028_9_w_cg.xlsx - Microsoft Excel

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C35 Take time to include everything, this will save time and hopefully prevent confusion in the future!!

a/c registration	<input type="text"/>	make / type	<input type="text"/>
date of weighing	<input type="text"/>	a/c serial no.	<input type="text"/>
engine	<input type="text"/>	propeller	<input type="text"/>
3-axis control (click to change)			
HADS / TADS reference	<input type="text"/>	BM##	<input type="text"/>
HADS / TADS issue	<input type="text"/>	1	<input type="text"/>
units of positions from datum - e.g. metres or inches			
<input type="text"/>			
equipment inventory			
Enter all items that are installed at the time of weighing and are additional to the Basic Empty Weight of the aircraft For example - Radio / GPS / Transponder / EFIS / Strobes / Landing Light / Spats / Luggage Hammock / Wingtips / etc, etc			
Take time to include everything, this will save time and hopefully prevent confusion in the future!			
<input type="text"/>			
<input type="text"/>			
weighing data			
		empty weight [kg]	position from datum [mm]
port main wheel	<input type="text"/>	<input type="text"/>	<input type="text"/>
starboard main wheel	<input type="text"/>	<input type="text"/>	(same as port)
nose-wheel or tail-wheel	<input type="text"/>	<input type="text"/>	<input type="text"/>
fixed ballast (optional)	<input type="text"/>	<input type="text"/>	<input type="text"/>
subsequent changes			
date (mandatory)	description (mandatory)	weight increment [kg]	position from datum [mm]
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Weight (1 of 1) Balance (1 of 2) Balance (2 of 2) Trade-Off Placard Calculator

Enter all inventory items in the box provided, these are items that are in addition to the basic airframe. If unsure just add the item to the list. Some examples are shown.

Also enter the wheel weights and datums (if applicable)

Subsequent changes can be accommodated after the wheel weights have been entered, this allows for tracking and updating of the weight report between reweighs.

aw_028_9_w_cg.xlsx - Microsoft Excel

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C82

weighing data			
		empty weight [kg]	position from datum [mm]
port main wheel	<input type="text" value="100"/>	<input type="text" value="-0.04"/>	<input type="text"/>
starboard main wheel	<input type="text" value="100"/>	<input type="text" value="(same as port)"/>	<input type="text"/>
nose-wheel or tail-wheel	<input type="text" value="75"/>	<input type="text" value="1.45"/>	<input type="text"/>
fixed ballast (optional)	<input type="text"/>	<input type="text"/>	<input type="text"/>
subsequent changes			
date (mandatory)	description (mandatory)	weight increment [kg]	position from datum [mm]
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
weight and balance			
		empty weight [kg]	<input type="text" value="275.0"/>
		position from datum [mm]	<input type="text" value="0.386"/>
The data on this form is both a correct and accurate description of the weight and balance of this aircraft at this time An up-to-date occupant/fuel trade-off placard is displayed in the aircraft If applicable, the balance of the aircraft has been checked (using the Balance Check worksheet) and is satisfactory			
signed:	<input type="text"/>	date:	<input type="text"/>
	<input type="text"/>	inspector no.:	<input type="text"/>
BMAA OFFICE USE ONLY			
comments:			
<input type="text"/>			

Weight (1 of 1) Balance (1 of 2) Balance (2 of 2) Trade-Off Placard Calculator

Finally sign and date the form

Part 2: Balance

BRITISH MICROLIGHT AIRCRAFT ASSOCIATION
BALANCE CHECK
see TIL 012 for BMAA weight and balance policy

a/c registration	G-BMAA	make / type	BMAA Microlight
		a/c serial no.	BMAA/HB/###
units of positions from datum - e.g. metres or inches	mm		
HADS / TADS reference	BM##	HADS / TADS issue	1
empty weight			
	empty weight [kg]	275.0	
	position from datum [mm]	0.366	
pilot - fixed position seat			
	minimum load [kg]		maximum load [kg]
fixed position seat			
	position from datum [mm]		
adjustable position seat			
	aft position [mm]		
	forward position [mm]		
weight dependent position			
	light position [mm]		
	intermediate load [kg]		heavy position [mm]
no passenger (click to change)			
	minimum load [kg]		maximum load [kg]
fixed position seat			
	position from datum [mm]		
adjustable position seat			
	aft position [mm]		
	forward position [mm]		
weight dependent position			
	light position [mm]		
	intermediate load [kg]		heavy position [mm]

This section is used to check the balance of an aircraft. It is accessed using the Balance tabs at the foot of the Spreadsheet

Seat types: Fixed, Adjustable & Weight Dependent

BALANCE CHECK
see TIL 012 for BMAA weight and balance policy

a/c registration	G-BMAA	make / type	BMAA Microlight
		a/c serial no.	BMAA/HB/###
units of positions from datum - e.g. metres or inches	mm		
HADS / TADS reference	BM##	HADS / TADS issue	1
empty weight			
	empty weight [kg]	275.0	
	position from datum [mm]	0.366	
pilot - fixed position seat			
	minimum load [kg]		maximum load [kg]
fixed position seat			
	position from datum [mm]		
adjustable position seat			
	aft position [mm]		
	forward position [mm]		
weight dependent position			
	light position [mm]		
	intermediate load [kg]		heavy position [mm]
no passenger (click to change)			
	minimum load [kg]		maximum load [kg]
fixed position seat			
	position from datum [mm]		
adjustable position seat			
	aft position [mm]		
	forward position [mm]		
weight dependent position			
	light position [mm]		
	intermediate load [kg]		heavy position [mm]

You have to physically click (or tap) on the text in order to get the drop down menu to select the seat type for the pilot.

Once selected the Min, Max & Datum fields will become active

Passenger: Repeat the last step in order to activate the passenger cell, again you have the option to choose fixed, adjustable or weight dependent positions.

The screenshot shows a Microsoft Excel spreadsheet with the following structure:

- Row 28:** Pilot - fixed position seat. Includes input fields for minimum load [kg], maximum load [kg], and position from datum [mm].
- Row 30:** Fixed position seat. Includes input field for position from datum [mm].
- Row 33:** Adjustable position seat. Includes input fields for aft position [mm] and forward position [mm].
- Row 36:** Weight dependent position. Includes input fields for light position [mm] and heavy position [mm].
- Row 41:** Intermediate load [kg] and heavy position [mm] input fields.
- Row 43:** Passenger - fixed position seat. Includes input fields for minimum load [kg], maximum load [kg], and position from datum [mm].
- Row 47:** Fixed position seat. Includes input field for position from datum [mm].
- Row 49:** Adjustable position seat. Includes input fields for aft position [mm] and forward position [mm].
- Row 52:** Weight dependent position. Includes input fields for light position [mm] and heavy position [mm].
- Row 55:** Intermediate load [kg] and heavy position [mm] input fields.
- Row 60:** Maximum (combined) occupant load [kg] input field.
- Row 66:** Occupants section. Includes a dropdown menu with options: 'no gross occupant limit (click to change)', 'occupants', 'tank 1', 'no tank 2 (click to change)', and 'no collector tank (click to change)'. It also has input fields for capacity [litres], position from datum [mm], and description (optional).
- Row 70:** Miscellaneous section. Includes input fields for maximum load [kg], position from datum [mm], and description (optional).
- Row 73:** No miscellaneous 1 (click to change) input field.
- Row 75:** No miscellaneous 2 (click to change) input field.

If applicable to the type activate the Maximum Occupant Load cell by clicking on it. Note this is used when the maximum cockpit weight is less than the maximum combined seat & baggage limits. *For example the C42 can have 120kg in either seat, but the overall cockpit limit is only 172kg (not 240kg!). The aircraft data sheet should provide the data.*

If the type is not limited, like the Skyranger, then there is no need to activate this function in the Spreadsheet, you can leave it greyed out.

Fuel:

aw_028_9_w_cg.xlsx - Microsoft Excel

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Clipboard Font Alignment Number Styles Cells Editing

C75 tank 2

fixed position seat	position from datum [mm]		
adjustable position seat	aft position [mm]		
	forward position [mm]		
weight dependent position	light position [mm]		
intermediate load [kg]	heavy position [mm]		
occupants	maximum (combined) occupant load [kg]		
fuel tanks	capacity [litres]	position from datum [mm]	description (optional)
tank 1			
tank 2			
no tank 2 (click to change)			
tank 2			
miscellaneous	maximum load [kg]	position from datum [mm]	description (optional)
no miscellaneous 1 (click to change)			
no miscellaneous 2 (click to change)			
aircraft	MAUW [kg]	aft limit [mm]	forward limit [mm]
no heavyweight cg limit (click to change)		aft limit, heavy [mm]	
intermediate weight [kg]		fwd limit, hvy [mm]	

Input the fuel capacity, additional tanks can be accounted for by clicking and activating the cells - this can be used for slipper and header tanks.

Miscellaneous Items: This is will mainly be used for baggage capacity, again you need to activate the function before being able to use it

aw_028_9_w_cg.xlsx - Microsoft Excel

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Clipboard Font Alignment Number Styles Cells Editing

C84 miscellaneous 1

fixed position seat	position from datum [mm]		
adjustable position seat	aft position [mm]		
	forward position [mm]		
weight dependent position	light position [mm]		
intermediate load [kg]	heavy position [mm]		
occupants	maximum (combined) occupant load [kg]		
fuel tanks	capacity [litres]	position from datum [mm]	description (optional)
tank 1			
tank 2			
no collector tank (click to change)			
miscellaneous	maximum load [kg]	position from datum [mm]	description (optional)
miscellaneous 1			
no miscellaneous 1 (click to change)			
miscellaneous 1			
aircraft	MAUW [kg]	aft limit [mm]	forward limit [mm]
no heavyweight cg limit (click to change)		aft limit, heavy [mm]	
intermediate weight [kg]		fwd limit, hvy [mm]	

Weight & CG limitations:

The screenshot shows an Excel spreadsheet titled 'aw_028_9_w_cg.xlsx'. The active sheet is 'heavyweight cg limit restriction'. The spreadsheet is organized into several sections, each with a dropdown menu and input fields:

- occupants:** A dropdown menu with 'maximum (combined) occupant load [kg]' selected and an input field.
- fuel tanks:** A dropdown menu with 'no collector tank (click to change)' selected. Below it are two rows for 'tank 1' and 'tank 2', each with columns for 'capacity [litres]', 'position from datum [mm]', and 'description (optional)'.
- miscellaneous:** A dropdown menu with 'no miscellaneous 2 (click to change)' selected. Below it are two rows for 'miscellaneous 1' and 'miscellaneous 2', each with columns for 'maximum load [kg]', 'position from datum [mm]', and 'description (optional)'.
- aircraft:** A dropdown menu with 'heavyweight cg limit restriction' selected. Below it are two rows for 'MAUW [kg]', 'aft limit, light [mm]', 'fwd limit, light [mm]', 'aft limit, heavy [mm]', and 'fwd limit, hvy [mm]'.

Arrows from the text 'Enter the Max All Up Weight or MTOW and the corresponding fore and aft CG limits' point to the 'maximum (combined) occupant load [kg]' field and the 'MAUW [kg]' field. Another arrow points to the 'heavyweight cg limit restriction' dropdown menu.

Enter the Max All Up Weight or MTOW and the corresponding fore and aft CG limits

Weight Dependent CG Limitations:

A limited number of types, such as the C42, have variable CG limits depending upon the MAUW/MTOW. The spreadsheet can accommodate such scenarios.

As previous first you need to activate the function by clicking or tapping on the section. Then additional CG limits become available. Enter the values with reference to the aircraft data sheet.

Be sure to match the correct CG limits to the corresponding MAUW limit. For example in the case of the C42:

<u>MAUW</u>	<u>Aft CG Limit</u>	<u>Forward CG Limit</u>
472.5kg	560mm	366mm
≤450kg	560mm	350mm

Finally click on the Balance 2 of 2 tab to see the results

Part 3: Result

The spreadsheet will indicate (Y or N) whether the aircraft remains within limitations in all legal loading condition.

weight and balance

empty weight [kg]
 position from datum []

this aircraft is within the balance requirements of the TADS / HADS **Y**

this aircraft **COMPLIES** with the balance requirements of the TADS / HADS

signed: _____ date: _____ inspector no.: _____

The spreadsheet provides a breakdown of the most forward and most aft loading scenarios.

summary

most aft cg position			most aft cg position (heavy)		
cg position []	0.23		cg position []		
weight [kg]	450.0		weight [kg]		
fraction of cg range [%]	13.32		fraction of cg range [%]		
inside / outside cg range	inside		inside / outside cg range		
cg limit []	0.21		cg limit []		
item	load	position []	item	load	position []
tank 1	60.0 [litre]	-0.29			
Baggage	10.0 [kg]	-0.29			
pilot	120.0 [kg]	0.15			
passenger	1.8 [kg]	0.15			
most forward cg position			most forward cg position (heavy)		
cg position []	0.33		cg position []		
weight [kg]	330.0		weight [kg]		
fraction of cg range [%]	20.00		fraction of cg range [%]		

In this case the result is **inside** by 13.32%

most aft cg position			most aft cg position (heavy)		
cg position []	0.23		cg position []		
weight [kg]	450.0		weight [kg]		
fraction of cg range [%]	40.04		fraction of cg range [%]		
inside / outside cg range	outside		inside / outside cg range		
cg limit []	0.25		cg limit []		
item	load	position []	item	load	position []
tank 1	60.0 [litre]	-0.29			
Baggage	10.0 [kg]	-0.29			
pilot	120.0 [kg]	0.15			
passenger	1.8 [kg]	0.15			
most forward cg position			most forward cg position (heavy)		
cg position []	0.33		cg position []		
weight [kg]	330.0		weight [kg]		
fraction of cg range [%]	60.00		fraction of cg range [%]		
inside / outside cg range	outside		inside / outside cg range		
cg limit []	0.3		cg limit []		
item	load	position []	item	load	position []
pilot	55.0 [kg]	0.15			
passenger	0.0 [kg]	0.15			
tank 1	0.0 [litre]	-0.29			
Baggage	0.0 [kg]	-0.29			

In this case the results are **outside** by some margin.

Naturally this would warrant investigation to determine the cause.

summary

most aft cg position			most aft cg position (heavy)		
cg position []	0.24		cg position []	0.23	
weight [kg]	400.0		weight [kg]	450.0	
fraction of cg range [%]	23.80		fraction of cg range [%]	13.32	
inside / outside cg range	inside		inside / outside cg range	inside	
cg limit []	0.19		cg limit []	0.21	
item	load	position []	item	load	position []
tank 1	60.0 [litre]	-0.29	tank 1	60.0 [litre]	-0.29
Baggage	10.0 [kg]	-0.29	Baggage	10.0 [kg]	-0.29
pilot	71.8 [kg]	0.15	pilot	120.0 [kg]	0.15
passenger	0.0 [kg]	0.15	passenger	1.8 [kg]	0.15
most forward cg position			most forward cg position (heavy)		
cg position []	0.33		cg position []	0.299	
weight [kg]	330.0		weight [kg]	400.0	
fraction of cg range [%]	33.33		fraction of cg range [%]	41.00	
inside / outside cg range	inside		inside / outside cg range	inside	
cg limit []	0.4		cg limit []	0.36	
item	load	position []	item	load	position []
pilot	55.0 [kg]	0.15	pilot	120.0 [kg]	0.15
passenger	0.0 [kg]	0.15	passenger	5.0 [kg]	0.15
tank 1	0.0 [litre]	-0.29	tank 1	0.0 [litre]	-0.29
Baggage	0.0 [kg]	-0.29	Baggage	0.0 [kg]	-0.29

Variable CG Limits:

With variable CG limitations, the spreadsheet will return results for both MAUW figures specified, this case 472.5kg (heavy condition) and 450kg (light condition)

****Don't forget to sign and date the report****

Part 4: Fuel Trade-off Placard

If the aircraft can be loaded over the MAUW, then a Fuel Trade-off Placard must be produced.

The screenshot shows a spreadsheet with a 'FUEL LIMITATIONS PLACARD' for aircraft G-BMAA. The placard includes a table of Cockpit Weight (kg) vs Max Fuel Load (litres) and various weight and fuel capacity parameters. The Cockpit Load Increment is set to 5 kg.

FUEL LIMITATIONS PLACARD	
G-BMAA	
Cockpit Weight (kg)	Max Fuel Load (litres)
170	6
165	13
160	20
155	27
150	34
145	41
140	48
135	55
131 or below	60 (full)

Parameters:

- MTOW [kg]: 450
- Empty Weight [kg]: 275
- Total Fuel Capacity [litres]: 60
- Total Max Occupant Load [kg]: 172
- Max Baggage Load [kg]: 10
- Cockpit Load Increment [kg]: 5
- Max Fuel Load [kg]: 43.2
- Max Cockpit Load [kg]: 182
- Max Fuel + Cockpit Load [kg]: 225.2
- MTOW - Empty Weight [kg]: 175

Type the A/C reg into the top of the table. Then fill out the other red cells with the appropriate figures.

Finally decide on the weight divisions required (resolution) and the table will be produced.

The screenshot shows the same spreadsheet as above, but with the Cockpit Load Increment set to 2 kg. The resulting table has a higher resolution of weight divisions.

FUEL LIMITATIONS PLACARD	
G-BMAA	
Cockpit Weight (kg)	Max Fuel Load (litres)
174	1
172	4
170	7
168	9
166	12
164	15
162	18
160	20
158	23
156	26
154	29
152	31
150	34
148	37
146	40
144	43
142	45
140	48
138	51
136	54
134	56
132	59
131 or below	60 (full)

Parameters:

- MTOW [kg]: 450
- Empty Weight [kg]: 275
- Total Fuel Capacity [litres]: 60
- Total Max Occupant Load [kg]: 172
- Max Baggage Load [kg]: 10
- Cockpit Load Increment [kg]: 2
- Max Fuel Load [kg]: 43.2
- Max Cockpit Load [kg]: 182
- Max Fuel + Cockpit Load [kg]: 225.2
- MTOW - Empty Weight [kg]: 175

Change the size of the table by altering the Cockpit Load Increment number. lower value increases divisions, higher number gives fewer.

Generally 5 works well, for an aircraft with large tanks (like CT range) it would be best to use a figure of 10.

PLACARDING & LOGBOOK:

Do not forget to make a logbook entry with the wheel weights and empty CG location. All placards must be updated. Finally the report (all pages) must be submitted to the BMAA Tech Office for checking and final approval.