

Chapter 3 WEIGHT AND BALANCE

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Chapter 3A WEIGHT AND C.G. DATA

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General

A1. This chapter contains the information necessary to enable the aircraft weight and centre of gravity (C.G.) position to be calculated for any prescribed loading condition. General information on aircraft weighing procedure and C.G. determination is given in A.P. 4747A. The procedure for weighing this aircraft is contained in Chap. 3B.

GENERAL INFORMATION

C.G. position

A2. The aircraft C.G. position is determined with the aircraft datum horizontal (i.e. in rigging attitude) and with the alighting gear down. The effect of retracting the alighting gear is given in para A11.

A3. All moment arms are measured in inches parallel to the aircraft datum and are positive when they refer to items aft of the C.G. datum and negative when they refer to items forward of this datum.

C.G. datum

A4. The C.G. datum on this aircraft is located in the bomb bay and is marked by a spigot mounted on a stringer attached to the underside of the tank floor 8.0 inches to the port side of the aircraft centre line. The datum spigot is on fuselage station 316, 2.25 inches below the aircraft datum. As the datum spigot is in a somewhat inaccessible position a transfer, indicating its location, is affixed to an adjacent fuel pipe. Standard dimensions between the C.G. datum and the jacking points for use when weighing the aircraft on hydrostatic units are contained in Chap. 3B.

Basic weight

A5. The actual basic weight and moment for individual aircraft will be found in the relevant log documents (Naval Forms A700 and A701). A typical basic weight and moment for the aircraft is 27 130 lb with a moment of 570 110 lb in.

Weight limitations

A6. The weight limitations for this aircraft are as follows:-

Carrier operation

Maximum take-off weight	...	...	...	46 000 lb
Maximum landing weight, normal	...	...	...	35 000 lb
Maximum landing weight, emergency	...	...	...	37 000 lb

Airfield operation

Maximum take-off weight	...	...	...	46 000 lb
Maximum landing weight, normal	...	...	...	36 000 lb
Maximum landing weight, emergency	...	...	...	40 000 lb

C.G. limitations

A7. The permissible limits of the centre of gravity are as follows:-

Forward limit	...	...	...	16.52 inches aft of the C.G. datum (0.26 S.M.C.)
Aft limit	...	...	...	26.60 inches aft of the C.G. datum (0.33 S.M.C.)
Aft limit, catapult launch with wing tanks	...	...	...	22.25 inches aft of the C.G. datum (0.30 S.M.C.)

C.G. on standard mean chord

A8. The length of the standard mean chord (S.M.C.) is 143.64

inches, its leading edge being 20.8 inches forward of the C.G. datum. The aircraft C.G. may be expressed as a decimal of the S.M.C. by evaluating the following formula:-

$$\frac{\bar{x} + 20.8}{143.64}$$

where \bar{x} is the moment arm in inches of the condition under consideration.

Nose ballast

Wing tanks not fitted

A9. Provision is made for the fitment of ballast at fuselage station 42, but it should be noted that when the wing tanks are not fitted, ballast is not necessary to keep the aircraft centre of gravity within the approved C.G. limits. As the ballast utilises the same mounting attachments as the radar set (Chap. 2, this Section) the ballast assembly can only be fitted when the radar set is removed and should only be fitted then if it is desired to maintain the same flying characteristics as would be obtained with the radar set installed.

Wing tanks fitted

A9A. If it is required to catapult launch the aircraft with the wing tanks fitted but without the radar set installed it will be necessary under certain loading configurations to fit the ballast, e.g. catapult launch with empty wing tanks.

A10. The total weight of the ballast assembly available to compensate for the radar set is 220 lb with a moment of -60 155 lb in. (This total is obtained by using the four $\frac{5}{16}$ in. thick plates.) Should it be required to compensate for other nose mounted units, a further 100 lb is available in 25 lb increments (four $\frac{5}{16}$ in. thick plates). A description of the ballast assembly and the method of installing it in the fuselage nose is contained in Sect. 2, Chap. 2.

Alighting gear retraction

A11. When the alighting gear is retracted it causes an aft movement of the C.G. The moment change associated with alighting gear retraction is +15 200 lb in.

Fuel

A12. All fuel weights quoted assume the use of AVCAT fuel at a density of 8.3 lb/gallon. The density of alternative fuels should be taken as follows:-

AVTUR	...	...	...	8.0 lb/gallon
AVTAG	...	...	...	7.7 lb/gallon

Engine C.G. datum

A13. The engine C.G. datum (centre line of front trunnions) is at fuselage station 224.2, i.e., 91.8 inches forward of the aircraft datum point.

Engine/E.C.U. change

A14. The weight and centre of gravity for any engine will be found on Form 701.b which is attached to the engine log card (Form 701.a) for that engine. The engine C.G. quoted on Form 701.b is given relative to the engine C.G. datum which is defined in the previous paragraph. An example showing how to calculate the new aircraft basic weight and moment, when a new or reconditioned engine/E.C.U. differs in weight and/or C.G. position from the existing unit, is given below.

A15. Assume a new E.C.U. — weight 1942 lb; C.G. position 33.9 in. aft of engine C.G. datum — is to be fitted as replacement for an existing E.C.U. — weight 1930 lb; C.G. position 33.8 in. aft of engine C.G. datum. Conversion of the C.G. for the new E.C.U. for aircraft use is effected as follows:-

Engine C.G. datum is 91.8 inches forward of aircraft C.G. datum

E.C.U. C.G. position is 33.9 inches aft of engine C.G. datum.

∴ E.C.U. C.G. = 91.8 - 33.9 = 57.9 inches forward of aircraft C.G. datum

	Weight (lb)	C.G. (in.)	Moment (lb in.)
◀ Typical aircraft basic weight	27 130	21.01	570 110
Subtract Existing E.C.U.	-1 930	-58.0	+111 940
	<u>25 200</u>		<u>682 050</u>
Add New E.C.U.	+1 942	-57.9	-112 442
NEW AIRCRAFT BASIC WEIGHT	<u>27 142</u>	<u>20.99</u>	<u>569 608</u> ▶

LOADING AND C.G. COMPUTER (fig A1)**Description**

A16. The computer consists of a plastic frame in which two sliding panels are mounted. The top panel is transparent and has a weight and C.G. grid engraved on its underside. The horizontal lines represent weight while the intersecting lines within the fan represent the C.G. range. The upper surface of this panel has a matt finish to enable it to be marked with a chinagraph pencil.

A17. Engraved on the bottom panel to the same scale are a series of lines representing the effect on weight and C.G. movement that the indicated items of variable and expendable load have when fitted to the aircraft. The upper panel moves in an up and down direction, and the lower panel in a sideways direction.

Instructions for use

A18. The procedure necessary to operate the computer is as follows:-

- (1) Check on the current basic weight and corresponding C.G. position, the latter being obtained by dividing the basic moment by the basic weight. These figures are shown in Form A.700, Part 1, for the aircraft concerned.
- (2) Mark the basic weight and C.G. position, determined in operation (1), on the transparent weight/C.G. grid with a chinagraph pencil.
- (3) Move the grid until the mark made in operation (2) lines up with the lower end of the load line on the bottom panel representing the item of load to be added.
- (4) With the computer scales in this position, reproduce on the grid the load line shown on the bottom panel.

Note...

The only exception to this occurs when adding fuel, when a straight line may be drawn between zero fuel and the quantity of fuel it is desired to add.

- (5) Repeat this process by placing the top point of the previously traced load line over the bottom point of the next load line until a continuous series of lines are traced on the transparent grid representing all the items of load required for that particular flight.

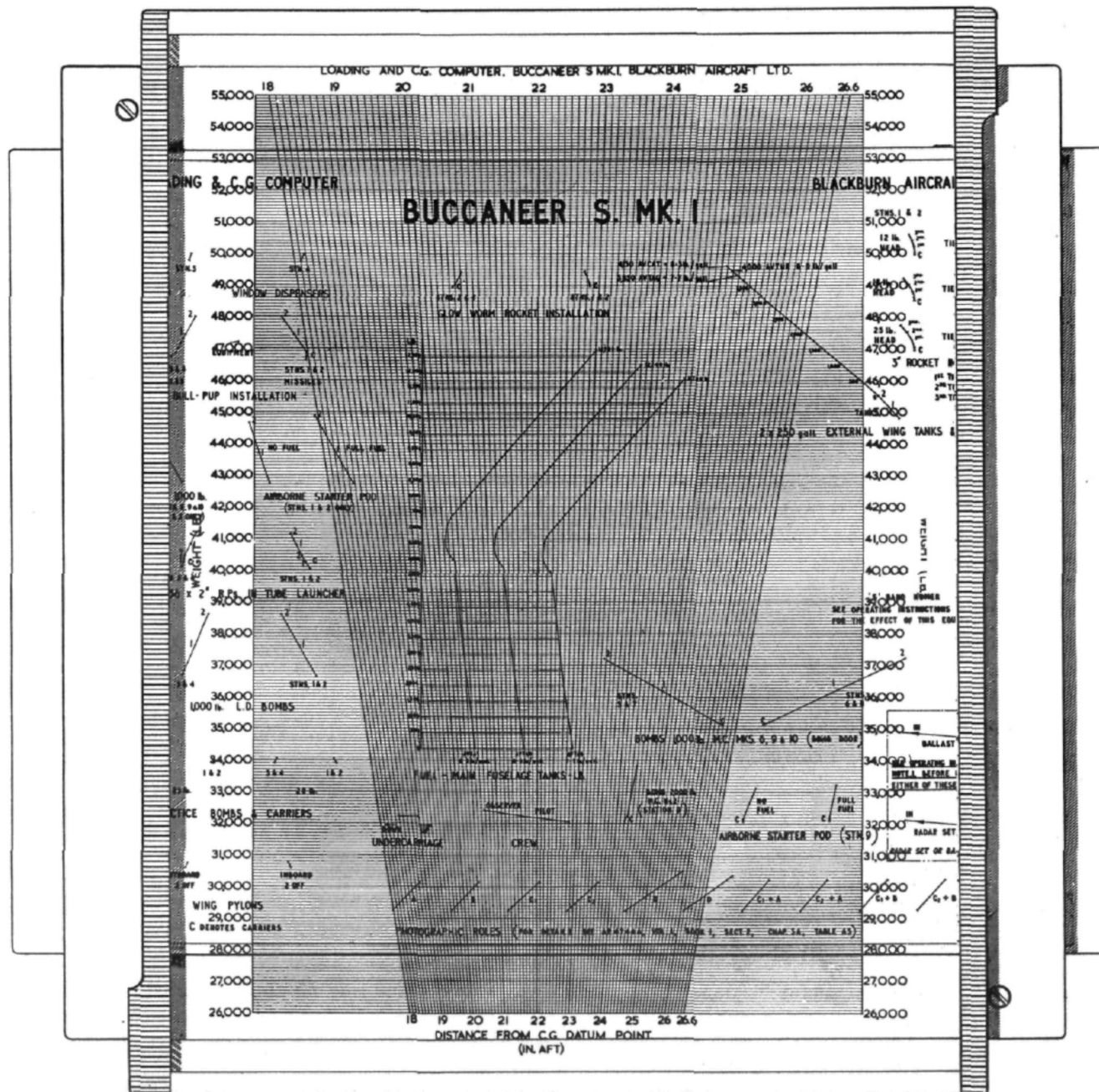


Fig. A1. Loading and C.G. computer

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- (6) The top point of the last line traced will indicate the weight and C.G. position of the aircraft when fitted with these items of variable and expendable load.
- (7) Ensure that the C.G. remains within the limits as fuel is used and stores expended, by reversing the procedure described in the preceding operations for all expendable loads.

Notes...**(1) Radar set and ballast**

The radar set is a basic weight item and is therefore included in the basic weight and moment entered in the Form A.700. It has been shown on the computer for the following reasons:-

- (a) It is an item of equipment which may frequently be removed from the aircraft.
- (b) There may be a requirement to maintain the same flying characteristics when the radar set is removed (para A9).

(2) 'S' band homer

The effect of this is not large enough to be included on the computer but should the equipment be required on the aircraft, the weight and moment should be added to the basic weight and moment before commencing operations with the computer. The total weight per aircraft is 37.2 lb and the associated moment is -33 lb in.

◀ **TABLE A1** Removable equipment checking list

Section	ARI No.	System	Total weight (lb)	Total moment (lb in.)
1	ARI 5930	Search and fire control radar	272.9	-69 871
2	-	Strike sight, Mk. 2	121.4	-27 360
3	ARI 5880	Doppler navigation system	147.0	+22 904
4	ARI 5848-F-3-Q-9	IFF and SIF	46.7	+9 052
5	ARI 18107	TACAN	58.8	+10 970
6	ARI 18120	UHF homer	19.0	+3 107
7	ARI 18124	UHF radio	50.3	+7 329
8	ARI 23057	UHF standby, Type M4 or	10.5	+1 748
8	ARI 23057	UHF standby, Type M6	8.8	+1 457
9	ARI 18179	HF radio	123.0	+21 775
10	ARI 23061	Radio altimeter, Mk. 7	20.9	-1 159
	ARI 18165	Wide band homer (special order only - see Table A3)	-	-
11	-	Autopilot and associated equipment	-	-

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TABLE A2 Removable equipment included in basic weight

Item	Ref No.	Description	Weight (lb)	Moment (lb in.)
1. ARI 5930 - SEARCH AND FIRE CONTROL RADAR				
1-1	5841-AP-214711	Radar set	235.0	-63 582
1-2	5841-AP-214708	Indicator, azimuth range	22.0	-3 696
1-3	5841-AP-214968	Visor for azimuth range indicator	1.3	-219
1-4	5841-AP-214710	Control, indicator	10.3	-1 725
1-5	5841-AP-215531	Control, radar set	4.3	-649
TOTAL: ARI 5930			272.9	-69 871
2. STRIKE SIGHT				
2-1	8B/4736 or 8B/5111	Pilot's display unit, Mk. 2 (pre-Mod 814) Pilot's display unit, Mk. 2, Type 2 (post-Mod 814)	28.0 28.0	-6 104 -6 104
2-2	8B/4507	Waveform generator, Mk. 2	21.0	-3 379
2-3	8B/4745 or 8B/5018	Control and release computer, Mk. 2 Control and release computer, Mk. 3	46.5 46.5	-11 360 -11 360
2-4	6G/29	Gyro unit, Mk. 2	11.4	-2 764
2-5	14A/5951	Weapons system recorder, Mk. 1	11.7	-3 028
2-6	14A/5996	Display supply and control unit, Mk. 1	2.8	-725
TOTAL: Strike sight			121.4	-27 360
3. ARI 5880 - DOPPLER NAVIGATION SYSTEM				
3-1	5826-AP-214402	Aerial	22.5	+3 980
3-2	5826-AP-214401	Navigational computer	54.7	+9 890
3-3	5826-AP-214400	Indicator, drift angle/ground speed	8.0	-1 316
3-4	6B/3226	Coupling unit, Type 9263	29.3	+5 757
3-5	6B/3225	Roller map display head, Type 9063	5.0	-811
3-6	5826-AP-214403	Transmitter/receiver unit	27.5	+5 404
TOTAL: Doppler navigation system			147.0	+22 904

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TABLE A2 (continued)

Item	Ref No.	Description	Weight (lb)	Moment (lb in.)
9. ARI 18179 - HF RADIO				
9-1	5985-99-999-8558	Tuner, RF unit, Type 13037	17.5	+3 479
9-2	5915-99-999-8556	Network impedance, Type 13038	3.2	+558
9-3	5985-99-999-8557	Selector unit, Type 13036	11.0	+2 159
9-4	5821-99-913-2246	Power supply unit, Type 13025	18.5	+3 058
9-5	5821-99-913-2232	RF amplifier unit, Mk. 1, Type 13024	14.0	+2 540
9-6	5821-99-913-2249	Transmitter/receiver unit, Type 13023	20.0	+3 305
9-7	5995-99-999-8552	Connector assembly, RF, Type 13414	1.3	+239
9-8	5821-99-913-3108	Control unit, Type 13027	2.5	-363
9-9	5821-99-913-2245	Interconnection box, Type 13026	3.0	+496
9-10	5821-99-913-2244	Converter, frequency electronic, Type 9493	32.0	+6 304
TOTAL: ARI 18179			123.0	+21 775
10. ARI 23061 - RADIO ALTIMETER, MK. 7				
10-1	10D/21794	Transmitter/receiver unit, Type 16098	14.3	-1 782
10-2	10U/17445	Amplifier unit, Type 16089	4.7	+975
10-3	10L/16720	Control unit, Type 16095	1.9	-352
TOTAL: ARI 23061			20.9	-1 159
11. AUTOPILOT AND ASSOCIATED EQUIPMENT				
11-1	6TG/5001 or	Autopilot computer, Model A3 (pre-Mod 445)	58.0	+9 970
11-1A	6TG/5064 or	Autopilot computer, Model A4 (post-Mod 445, pre-Mod 839)	58.0	+9 970
11-1B	- or	Autopilot computer, Model A5 (post-Mod 839, pre-Mod 1019)	58.0	+9 970
11-1C	-	Autopilot computer, Model B5 (post-Mod 1019)	58.0	+9 970
11-2	6A/5404 or	Air data computer, Type B	27.7	+4 629
11-2A	6A/8743	Air data computer, Type C	23.3	+3 883
11-3	6A/6822 or	ADC power supply unit, Type B	8.9	+1 491
11-3A	6A/8548	ADC power supply unit, Type C	9.8	+1 633
11-4	6TG/5008	Rate gyros (3 off), Type 3C/1485	5.4	+258
11-5	6A/6435	Pitot-static transducer	5.5	+228
11-6	6A/6434	Static transducer	5.5	+275
11-7	6A/5935 or	Height lock transducer	5.0	+294

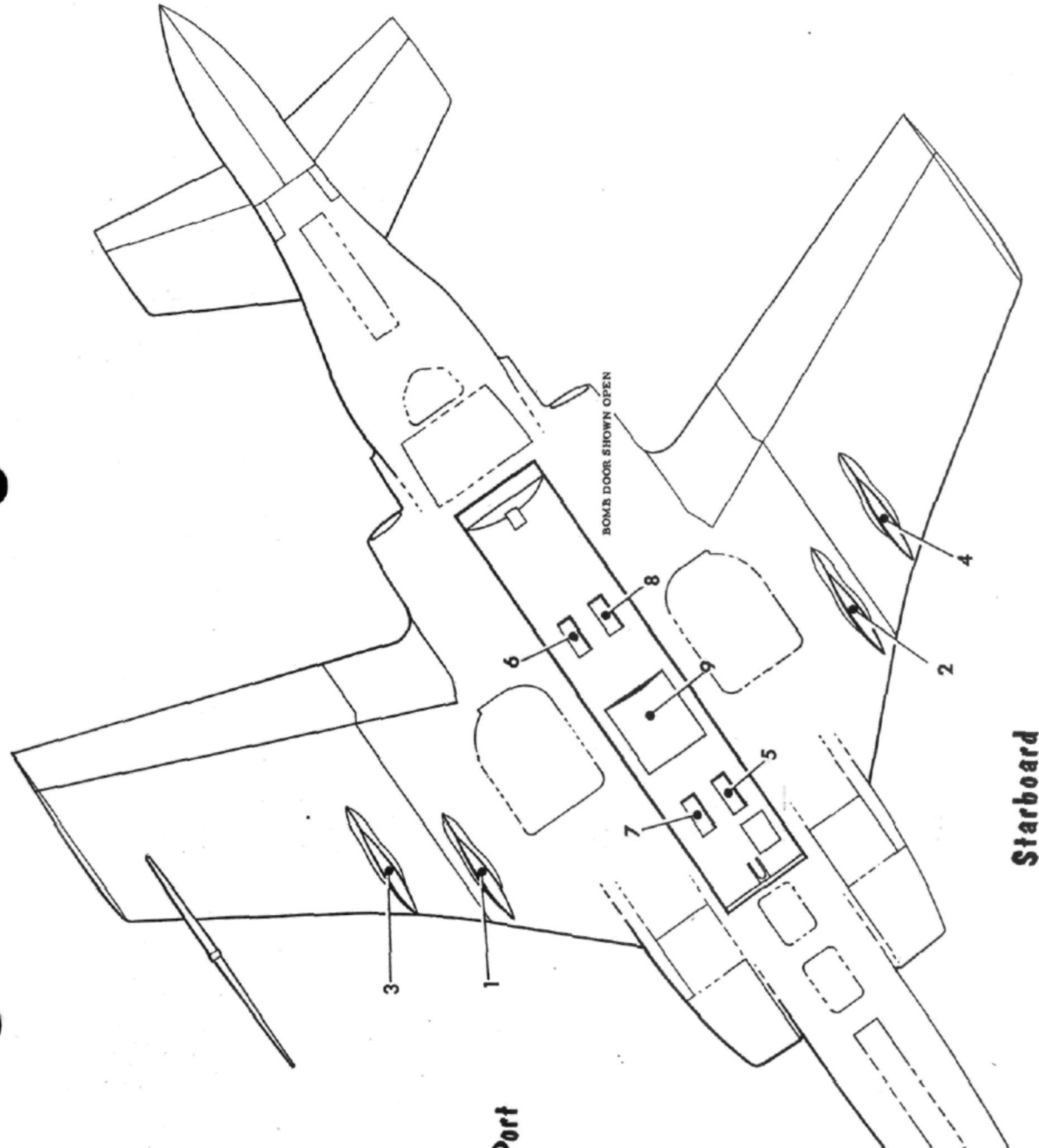


Fig. A3. Armament stations

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TABLE A5 Photographic roles

	A		B		C ₁		C ₂		D		C ₁ + A		C ₂ + A		C ₁ + B		C ₂ + B	
Description	Weight (lb)	Moment (lb in.)	Weight (lb)	Moment (lb in.)	Weight (lb)	Moment (lb in.)	Weight (lb)	Moment (lb in.)	Weight (lb)	Moment (lb in.)	Weight (lb)	Moment (lb in.)	Weight (lb)	Moment (lb in.)	Weight (lb)	Moment (lb in.)	Weight (lb)	Moment (lb in.)
Control panel - Observer's port console	10.7	-1533	10.7	-1533	10.7	-1533	10.7	-1533	10.7	-1533	10.7	-1533	10.7	-1533	10.7	-1533	10.7	-1533
Camera crate (less cameras)	290.0	-5307	290.0	-5307	290.0	-5307	290.0	-5307	290.0	-5307	290.0	-5307	290.0	-5307	290.0	-5307	290.0	-5307
Photoflash crate (incl 33 dischargers)	613.9	52488	613.9	52488	613.9	52488	613.9	52488	613.9	52488	613.9	52488	613.9	52488	613.9	52488	613.9	52488
Cartridges (198 off) 40 mm dia (incl adapters)									256.8	21905								
F97 Camera									29.5	-363								
F95 Camera (2) 12 in. lens - fwd vertical	35.6	-1595									35.6	-1595	35.6	-1595				
F95 Camera 12 in. lens - vertical	17.8	-548									17.8	-548	17.8	-548				
F95 Camera 12 in. lens - fwd facing					17.8	208					17.8	208			17.8	208		
F95 Camera 12 in. lens - port oblique					17.8	465					17.8	465			17.8	465		
F95 Camera 12 in. lens - starboard oblique					17.8	459					17.8	459			17.8	459		
F95 Camera 4 in. lens - fwd vertical			15.3	-676											15.3	-676	15.3	-676
F95 Camera (2) 4 in. lens - vertical			30.6	-924											30.6	-924	30.6	-924
F95 Camera 4 in. lens - fwd facing							15.3	113					15.3	113			15.3	113
F95 Camera 4 in. lens - port oblique							15.3	390					15.3	390			15.3	390
F95 Camera 4 in. lens - starboard oblique							15.3	404					15.3	404			15.3	404
TOTALS	968.0	43505	960.5	44048	968.0	46780	960.5	46555	1200.9	67190	1021.4	44637	1013.9	44412	1013.9	45180	1006.4	44955

Notes...

(1) The cast base fitted at each F.95 camera position is included in the weight of the camera crate.

(2) The weight of the cameras shown includes film as follows:-

F.95 Camera (70 m/m film) 100 ft ... 1 lb
F.97 Camera (9½ in. film) 100 ft ... 3.75 lb

(3) The photoflash crate includes the weight of 33 dischargers at 10.84 lb each. The total weight of the crate is made up as follows: Crate (bare) 256.2 lb + Dischargers (33) 357.7 lb = 613.9 lb.

(4) An adapter is required with the 40 mm dia photoflash cartridges. The weight of the adapters is included in the weight of cartridges shown of 256.8 lb i.e., Cartridges 40 mm dia (198 × 1.125 lb) + Adapters (198 × 0.172 lb) = 256.8.

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TABLE A6 (continued)

Item	Description	TYPE OF STORE CARRIED							
		96 x 2 in. rockets (wing pylons)		4 Bullpup missiles (wing pylons)		Photographic pack (day) (bomb bay)		Photographic pack (night) (bomb bay)	
		Weight (lb)	Moment (lb in.)	Weight (lb)	Moment (lb in.)	Weight (lb)	Moment (lb in.)	Weight (lb)	Moment (lb in.)
34B	Wing pylon, inner, c/w ejector unit and sole plate (store station 1 and 2) - 2 off	188-6	+1832						
35B	Wing pylon, outer, c/w ejector unit and sole plate (store station 3 and 4) - 2 off	162-0	+5392						
36	Launcher for 24 x 2 in. rocket projectiles (store station 1 and 2) - 2 off	212-0	+1900						
37	Launcher for 24 x 2 in. rocket projectiles (store station 3 and 4) - 2 off	212-0	+7236						
43	Pilot	180-0	-34704	180-0	-34704	180-0	-34704	180-0	-34704
44	Observer	180-0	-26064	180-0	-26064	180-0	-26064	180-0	-26064
53	Rocket control panel, observer's port console	2-0	-287						
100	Fuel in fuselage tanks (1530 gallons AVCAT)	12700-0	+376809	12700-0	+376809	12700-0	+376809	12700-0	+376809
103	Rocket projectiles 2 in. (24 off at each store station 1 and 2)	484-0	+2804						
104	Rocket projectiles 2 in. (24 off at each store station 3 and 4)	484-0	+14988						
49	Bullpup pylon, c/w launcher (store station 1 and 2) - 2 off			243-6	+6164				
50	Bullpup pylon, c/w launcher (store station 3 and 4) - 2 off			241-6	+13964				
51B	Fuze charging unit, Type EL/EA, Mk. 1 (5D/2247)			21-0	+4093				
52B	Fuze control unit, Type EL/EA, Mk. 1 (5D/2266)			2-5	-364				
57	Bullpup role equipment, proportional control handle			0-9	-175				
58	Bullpup role equipment, transmitter and mounting tray			23-8	+5836				
59	Bullpup role equipment, RF amplifier			6-5	+1554				
60	Bullpup role equipment, signal data converter			3-7	+864				
116	Bullpup missile (store station 1 and 2) - 2 off			1144-0	+4461				
117	Bullpup missile (store station 3 and 4) - 2 off			1144-0	+41298				
	Photographic equipment - see Table A5, Role C1 + A					1021-4	+44637		
	Photographic equipment - see Table A5, Role D							1200-9	+67190
	Typical basic weight - (para A5)	27130-0	+570110	27130-0	+570110	27130-0	+570110	27130-0	+570110
12-2	Less: bomb distributor - (Sect. 2, Chap. 5B)					-11-5	-(-1668)	-11-5	-(-1668)
	ALL-UP WEIGHT excluding external wing tanks	41934-6	+920016	43021-6	+963846	41200-0	+932456	41379-4	+955009
102	External wing tanks, jettisonable type (store station 1 and 2) - 2 off					750-0	-376	750-0	-376
101	Fuel in external wing tanks (250 gallons/tank AVCAT)					4150-0	-31126	4150-0	-31126
	ALL-UP WEIGHT including external wing tanks					46100-0	+900954	46279-4	+923507

◀ TYPICAL SPECIFICATION ROLES

It is emphasised that the roles listed overleaf are typical only and may be varied to suit operational requirements.

The item numbers quoted in the left hand column refer to the relevant items in Tables A2, A3 and A4. ▶

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TABLE A7 (continued)

Item	Description	TYPE OF STORE CARRIED							
		96 x 2 in. rockets (wing pylons)		4 Bullpup missiles (wing pylons)		Photographic pack (day) (bomb bay)		Photographic pack (night) (bomb bay)	
		Weight (lb)	Moment (lb in.)	Weight (lb)	Moment (lb in.)	Weight (lb)	Moment (lb in.)	Weight (lb)	Moment (lb in.)
34B	Wing pylon, inner, c/w ejector unit and sole plate (store station 1 and 2) - 2 off	188.6	+1832						
35B	Wing pylon, outer, c/w ejector unit and sole plate (store station 3 and 4) - 2 off	162.0	+5392						
36	Launcher for 24 x 2 in. rocket projectiles (store station 1 and 2) - 2 off	212.0	+1900						
37	Launcher for 24 x 2 in. rocket projectiles (store station 3 and 4) - 2 off	212.0	+7236						
43	Pilot	180.0	-34704	180.0	-34704	180.0	-34704	180.0	-34704
44	Observer	180.0	-26064	180.0	-26064	180.0	-26064	180.0	-26064
53	Rocket control panel, observer's port console	2.0	-287						
100	Fuel in fuselage tanks (1530 gallons AVCAT)	12700.0	+376809	12700.0	+376809	12700.0	+376809	12700.0	+376809
103	Rocket projectiles 2 in. (24 off at each store station 1 and 2)	484.0	+2804						
104	Rocket projectiles 2 in. (24 off at each store station 3 and 4)	484.0	+14988						
49	Bullpup pylon, c/w launcher (store station 1 and 2) - 2 off			243.6	+6164				
50	Bullpup pylon, c/w launcher (store station 3 and 4) - 2 off			241.6	+13964				
51B	Fuze charging unit, Type EL/EA, Mk. 1 (5D/2247)			21.0	+4093				
52B	Fuze control unit, Type EL/EA, Mk. 1 (5D/2266)			2.5	-364				
57	Bullpup role equipment, proportional control handle			0.9	-175				
58	Bullpup role equipment, transmitter and mounting tray			23.8	+5836				
59	Bullpup role equipment, RF amplifier			6.5	+1554				
60	Bullpup role equipment, signal data converter			3.7	+864				
116	Bullpup missile (store station 1 and 2) - 2 off			1144.0	+4461				
117	Bullpup missile (store station 3 and 4) - 2 off			1144.0	+41298				
	Photographic equipment - see Table A6, Role C1 + A					1021.4	+44637		
	Photographic equipment - see Table A6, Role D							1303.0	+75899
	Typical basic weight - (para A5)	27130.0	+570110	27130.0	+570110	27130.0	+570110	27130.0	+570110
12-2	Less: bomb distributor - (Sect. 2, Chap. 5B)					-11.5	-(-1668)	-11.5	-(-1668)
	ALL-UP WEIGHT excluding external wing tanks	41934.6	+920016	43021.6	+963846	41200.0	+932456	41481.5	+963718
102	External wing tanks, jettisonable type (store station 1 and 2) - 2 off					750.0	-376	750.0	-376
101	Fuel in external wing tanks (250 gallons/tank AVCAT)					4150.0	-31126	4150.0	-31126
	ALL-UP WEIGHT including external wing tanks					46100.0	+900954	46381.5	+932216

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◀ TABLE A7 Typical specification roles

Item No.	Description of item	TYPE OF STORE CARRIED					
		2,000 lb store (bomb bay)		4 x 1,000 lb bombs (bomb bay)		4 x 1,000 lb bombs (wing pylons)	
		Weight (lb)	Moment (lb in.)	Weight (lb)	Moment (lb in.)	Weight (lb)	Moment (lb in.)
30A	Carrier for bomb, A/C 2,000 lb MC No. 2 – post-Mod 5037	55.5	+1756				
31	Bomb door fairing	87.4	+3819				
43	Pilot	180.0	-34704	180.0	-34704	180.0	-34704
44	Observer	180.0	-26064	180.0	-26064	180.0	-26064
51	Fuze charging unit, Type EP, Mk. 1 (5D/1963)	23.5	+4578				
52	Fuze control unit, Type EP, No. 2, Mk. 1 (5D/1979)	2.3	-335				
100	Fuel in fuselage tanks (1530 gallons AVCAT)	12700.0	+376809	12700.0	+376809	12700.0	+376809
105	2,000 lb bomb, A/C, HE, MC, No. 2 (store station 9)	1630.0	+44092				
32	Carrier for bomb, 1,000 lb, Mk. 10 (store station 5 and 7) – 2 off			98.0	-2148		
33	Carrier for bomb, 1,000 lb, Mk. 10 (store station 6 and 8) – 2 off			98.0	+7564		
51B	Fuze charging unit, Type EL/EA, Mk. 1 (5D/2247) – post-Mod 502			21.0	+4093	21.0	+4093
52B	Fuze control unit, Type EL/EA, Mk. 1 (5D/2266) – post-Mod 502			2.5	-364	2.5	-364
106	1,000 lb bomb, A/C, HE, MC, Mk. 10 (store station 5 and 7) – 2 off			2020.0	-46562		
107	1,000 lb bomb, A/C, HE, MC, Mk. 10 (store station 6 and 8) – 2 off			2020.0	+154186		
34B	Wing pylon, inner, c/w ejector unit and sole plate (store station 1 and 2) – 2 off					188.6	+1832
35B	Wing pylon, outer, c/w ejector unit and sole plate (store station 3 and 4) – 2 off					162.0	+5392
110	1,000 lb bomb, low drag, Mk. N1 (store station 1 and 2) – 2 off					1970.0	+15110
111	1,000 lb bomb, low drag, Mk. N1 (store station 3 and 4) – 2 off					1970.0	+64616
	Typical basic weight – (para A5)	27130.0	+570110	27130.0	+570110	27130.0	+570110
	ALL-UP WEIGHT excluding external wing tanks	41988.7	+940061	44449.5	+1002920	44504.1	+976830
102	External wing tanks, jettisonable type (store station 1 and 2) – 2 off	750.0	-376	750.0	-376		
101	Fuel in external wing tanks (250 gallons/tank AVCAT)	4150.0	-31126	4150.0	-31126		
	ALL-UP WEIGHT including external wing tanks	46888.7	+908559	49349.5	+971418		

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Chapter 3B PROCEDURE FOR WEIGHING

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Introduction

B1. This chapter describes the method of weighing the aircraft using hydrostatic weighing units (HWU). A double system of jacking is adopted, using both the main and alternative jacking points with an additional point created by fitting a weighing adapter to the nose wheel leg. General information on the use of hydrostatic weighing units is contained in A.P. 4747A. Reference should also be made to Sect. 2, Chap. 4 for information on jacking the aircraft.

Preparation of aircraft

B2. The aircraft should be weighed after the engines have been run, thereby ensuring that the fuel supply lines to the engines, including the recuperators, are fully primed. After running the engines, the following procedure should be effected before weighing the aircraft:-

- (1) Replenish the hydraulic systems (general services and flying controls), engine oil and windscreen washing reservoir (Chap. 2), ensuring that the correct levels are maintained.
- (2) Thoroughly clean the aircraft, both inside and outside, ensuring that no tools, etc, remain in the aircraft.
- (3) Operate the bomb door to the half-open position (Chap. 1) to facilitate access to the aircraft levelling points and, if required, the CG datum spigot.

- (4) Completely drain the fuel system, with the aircraft in rigging position, as described in Cover 3, Sect. 4, Chap. 2.

Note...

After draining the system, the fuel recuperators in No. 1 tank will remain full. The weight of this fuel is included in the basic weight.

- (5) Ensure that the wheel brakes are released, air brakes closed and that all flying control surfaces are in the neutral position.
- (6) Close the canopy and ensure that all access panels and doors are fitted and/or closed.
- (7) Remove any ground equipment that may be fitted to the aircraft, such as engine intake covers, crew access ladders, etc.

B3. For routine weighings, the equipment should be checked to Table A1 — Removable equipment checking list (which is detailed in Table A2) and any deviations noted (including liquid oxygen contents). After modernisation a more comprehensive check to Vol. 3, Part 2 — Appendix A may be necessary. Should any items of variable or expendable load be fitted to the aircraft at the time of weighing, they should be taken into account when computing the basic weight and moment.

Fuel included in basic weight

B4. The total quantity of fuel included in the basic weight is approximately 17.5 gallons. Assuming that the fuel is AVCAT, this weighs 145 lb and is made up of 40 lb in each of the two recuperators and 65 lb in the fuel tanks and system. As the recuperators fuel is not normally drained before the aircraft is weighed, only the fuel in the tanks and system (65 lb with a moment of -1983 lb in.) need be added to obtain the basic weight. If an aircraft is weighed with the recuperators empty, i.e., immediately after overhaul, then the recuperators fuel (80 lb with an associated moment of -8160 lb in.) must also be added.

Weighing procedure

B5. The procedure for weighing the aircraft is as follows:-

- ◀ (1) Fit the weighing adapter, Ref No. 26NA/95377, to the forward face of the nose wheel unit pivot bracket.
- (2) Remove or open, as applicable, the panels and doors giving access to the main and alternative jacking points.
- (3) Position jacks at the alternative jacking points on the rear spar (station 31.1 port and starboard) and the forward main jacking point (fuselage station 166.25). The following equipment should be used:-

At each alternative jacking point

Jack, 10-ton, hydraulic, Type B	Ref No. 4Q/2625	1 off
Trestle, Mk. 1	Ref No. 4Q/2652	1 off
Adapter head, Mk. 105	Ref No. 4Q/2661	1 off
Pad, jacking	Ref No. 4Q/3053	1 off

At the forward main jacking point

Jack, 5-ton, hydraulic, Type C	Ref No. 4Q/2617	1 off
Trestle, Mk. 3	Ref No. 4Q/2620	1 off
Adapter head, Mk. 110	Ref No. 4Q/2665	1 off
Pad, jacking	Ref No. 4Q/3052	1 off

- (4) With the jacking pads and adapter heads in position, raise the aircraft into the rigging position by the simultaneous operation of all three jacks (*Sect. 2, Chap. 4*).
- (5) After checking that the aircraft is approximately level laterally, check the fore-and-aft level with a straightedge and clinometer. The straightedge should be placed across the two levelling points situated on the port side of the bomb bay at stations 263.3 and 304.8. Adjust the height of the jacks, if necessary, to give a zero reading on the clinometer.

- (6) Locate the appropriate jacks under the main plane at the main jacking points and the auxiliary jacking point on the nose wheel leg. Special jacking pads should be inserted at the main jacking points. The following equipment is required:-

At each main jacking point

Jack, 10-ton, hydraulic, Type A	Ref No. 4Q/2293	1 off
Trestle, Mk. 1	Ref No. 4Q/2294	1 off
Pad, aircraft weighing, 10 ton (to be developed)		1 off
Adapter, universal resilient (to be developed)		1 off
Weighing unit, 10-ton, hydrostatic, Mk. 8	Ref No. 4GB/4894	1 off

At the nose wheel jacking point

Jack, pillar, 8-ton, hydraulic	Ref No. 4Q/1309	1 off
Levelling stand 10.20Y.3143A	Ref No. 26FY/NIV	1 off
Adapter, universal resilient (to be developed)		1 off
Weighing unit, 6¼-ton, hydrostatic, Mk. 8	Ref No. 4GB/NIV	1 off
◀ Weighing adapter, forward	Ref No. 26NA/95377	1 off ▶

- (7) Hold in position the HWU and adapters while the jacks are elevated to a point where the weighing pads fit snugly into the HWU but with little or no load recorded on the weighing unit dials.
- (8) Simultaneously elevate the three jacks supporting the HWU approximately ¼ in., thereby transferring the weight of the aircraft to the weighing units from the other three jacks. When the transference of load is complete, any final adjustments to the fore-and-aft or lateral level should be made, at the same time ensuring that the jacks at the alternative points on the rear spar and the forward main jacking point are free of all load.
- (9) The readings of the HWU may now be taken and the weight of the aircraft ascertained as described in A.P. 4747A.
- (10) Lower the jacks slowly until the aircraft weight is again taken by the other set of jacks. Ensure that the HWU return to their original zero setting. Repeat operations (8) and (9); the instrument readings recorded on the second lift should not differ from the first by more than the following amounts:-

Sum of readings at main jacks	± 3 units
Reading at nose jack	± 2 units

- (11) If the readings differ by more than these amounts, operations (8), (9) and (10) should be repeated until two sets of readings that are within the limits are obtained.
- (12) The horizontal distances from the datum point (station 316) to the forward and rear jacking points are as follows:-
- | | |
|------------------------------------|----------------|
| C G datum to forward jacking point | -222.85 inches |
| C G datum to rear jacking point | +68.70 inches |
- (13) On completion, simultaneously lower the three jacks supporting the HWU until the weight of the aircraft is supported on the jacks at the alternative jacking points on the rear spar and the

forward main jacking point. This operation should be effected slowly to avoid any damage which could be caused due to a sudden change in load on the HWU.

- (14) Remove the jacks from beneath the main jacking points under the main plane and the auxiliary jacking point on the nose wheel leg.
- (15) Lower the remaining jacks and remove them from beneath the aircraft.
- (16) Remove the weighing adapter and refit or close all access panels and doors.

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