Chapter 3 LOADING AND C.G. DATA

(*Completely revised*)

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

Introduction

1. These loading and C.G. data are issued to enable the aircraft weight and centre of gravity (C.G.) position to be determined for all loading conditions. General information on the determination of aircraft weight and C.G. position are contained in A.P.1464D, Vol. 1, Part 2, Sect. 1, Chap. 3.

C.G. position

2. The C.G. position is determined with the aircraft in the rigging position (i,e. with the fuselage datum line horizontal) and the under-carriage *down* and is defined by its distance, measured parallel to the fuselage datum, from the C.G. datum point. This distance is known as the "moment arm" of the C.G. and is given by the following expression:—

$$\frac{\text{(Tare weight} \times \text{tare moment arm)} + \text{(weights of loads} \times \text{respective moment arms)}}{\text{Total weight}}$$

$$= \frac{\text{Tare weight} + \text{total weight of loads}}{\text{Tare moment} + \text{load moments}}$$

All moments arms are measured in feet 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.

Datum point

3. The position of the datum point is indicated by a peg on the port side of the fuselage. This peg is located at the intersection of a line, normal to the fuselage datum, through the lower wing/fuselage attachment fitting (transverse datum) with a line parallel to and 15 inches below the fuselage datum line.

Permissible limits of C.G. travel

4. The approved limits of C.G. travel with undercarriage *down* are as follows:—

Forward limit +0·735 ft. (0·233 S.M.C.)
Aft limit (auxiliary tanks not fitted)
+1·154 ft. (0·291 S.M.C.)
Aft limit (auxiliary tanks empty)
+1·183 ft. (0·295 S.M.C.)
Aft limit (auxiliary tanks full)
+1·349 ft. (0·318 S.M.C.)

The figures in brackets are the C.G. position expressed as a decimal of the Standard Mean Chord (*para* .20) and are for reference only. The aircraft C.G. must be kept within the above limits, even when load and/or fuel are wholly or partially expended.

5. For ferrying only, the aft C.G. limit (undercarriage *down*), with auxiliary tanks full, is extended to +1·385 ft. (0·323 S.M.C.) and with auxiliary tanks empty to +1·219 ft. (0·300 S.M.C.). The above extension covers

the non-fitment of the "Service Fit" items marked with asterisks in Table No. 1 Aircraft operating to these ferrying C.G. positions are restricted to altitudes below 45000 ft.

6. Reference must be made to Pilot's Notes for the operation of the aircraft at aft C.G. positions, which occur with full auxiliary tanks and without ammunition.

Maximum permissible all-up weight

7. The weight limitations applicable to aircraft covered by these loading data are:—

Maximum take-off weight, without auxiliary tanks ...	=14200 lb.
Maximum take-off weight, with auxiliary tanks... ...	=15610 lb.
Maximum take-off weight, overload	=15690 lb.
Maximum landing weight, normal	=12240 lb.
Maximum landing weight, overload	=13170 lb.

Basic weight

8. Items of non-expendable removable equipment common to all roles are listed in Table 1; these are shown added to the Tare Weight to give the aircraft Basic Weight. The numbers in the column headed "Item No." are the key to the numbered spots in fig. 1.

Typical service loads

9. The weight, arm and moment of all items of operating role equipment, expendable load, crew and fuel for the typical Service loadings listed in the aircraft Appendix A, Serial No. 2108 are given in Tables 2 and 3.

Modification standard

10. The basic modification standard associated with the Basic Weight quoted is given below. For the weight and moment effect of significant modifications included in or additional to the basic standard, refer to para. 11 and 12.

2, 4, 6, 7, 10, 13 to 21, 25 to 27, 32 to 35, 37, 38, 40 to 42, 44 to 46, 51 to 55, 57 to 59, 61, 67, 68, 72 to 75, 77 to 80, 84, 86, 90 to 92, 95, 96, 98 to 102, 107, 109 110, 113, 117, 120, 122, 126, 132, 133, 135, 136, 141, 144, 147, 148, 150 to 152, 158, 162, 164, 165, 167 to 169, 172, 179, 180, 183 to 187, 189, 192, 200, 203, 205 to 207, 216, 217, 220, 222, 224, 226, 229 to 231, 236, 238, 240 to 242, 248, 252, 253, 257 to 263, 268, 270, 272 to 277, 280 to 282, 285, 290, 293, 295, 300, 302, 309, 311, 314 to 316, 321, 323, 324 328, 332, 338, to 342, 344, 348, 349*, 350, 353, 358, 362, 363, 368 to 371, 373, 379 to 381, 386, 388, 395*, 396 to 398, 405, 407, 412 to 414, 416, 418, 419*, 412, 422, 425, 426, 432, 435, 437, 442, 445 to 447, 450, 451, 453, 454, 459, 460, 462, 473, 482, 484, 486 to 488, 493, 500 to 504, 506, 510, 513 to 515, 518, 520 to 522, 524, 525, 532, 537 to 541, 544, 550, 555 to 558, 560, 561, 563 to 565, 571, 574, 576, 579, 585, 586, 596, 607, 610, 615, 617, 620 to 624, 630, 631, 633, 634, 636 to 639, 641 655, 659, 661, 669, 671, 673, 677, 682, 684, 686, 689, 694, 697 to 699, 703, 704, 712, 714, 715, 719, 720, 727, 733, 734, 737, 738, 751 to 753, 757, 759, 761, 765, 779, 780, 786, 790, 792, 793, 795, 796, 803, 805, 806, 810, 811, 816, 820, 822, 841, 844, 846, 847, 856, 860, 870, 875, 876, 886, 888 to 890, 898, 902, 913, 916, 917, 921, 929, 933, 938, 941, 953, 954, 963 to 965, 968, 978, 990, 994, 1011, 1013, 1016, 1019.

Note . . .

*Modifications marked * affect items of removable military load only.*

Effect of modifications

11. The following modifications having a significant effect on weight and/or C.G. position are allowed for in the Basic Weight given in Table 1. When any of these modifications are not incorporated, their effect must be calculated, and, if necessary, the load adjusted to counteract the effect of their omission on aircraft C.G. position. The omission of modifications other than those listed below may be ignored. Weights and moments refer to Basic Weight changes unless otherwise indicated.

Mod. No.	Description	Fixed Weight (lb.)	Fixed Moment (lb. ft.)
37	Introduction of 2nd generator, Type HX2	+53·0	— 7
86	Introduction of armour on gun doors	+27·7	— 53
100	Introduction of servicing cocks in wing tank fuel feed	+ 4·8	+ 26
120	Deletion of oil pressure gauge	— 2·0	— 5
162	Introducing provision for telescramble	+19·0	+ 22
183	Extending front jet pipe drain	+ 2·6	+ 14
186	Blanking off holes in rib No. 1	+ 2·0	+ 2
273	Introduction of anti "G" equipment	+ 4·5	— 26
282	Introduction of link chute extensions	+ 3·2	— 10
285	Introduction of re-setting type fire detectors	+ 1·9	+ 3
302	Re-routing fire warning cables at rib No. 1	+ 2·0	+ 4
321 & 262	Introduction of strengthened elevator and re-designed balance weights	+43·0	+ 84
328	Introduction of Rebecca, Mk. 7:—		
	Part A—Fixed fittings:—		
	Changes to fixed (Tare Weight) items	+10·8	— 40
	Changes to removable load items:—		
	(a) Remove receiver, R.3121 and control unit ...	—36·5	+324
	(b) Reposition G.45 camera from nose to wing pylon	—	+ 48
	TOTAL—Part A	—25·7	+332

Continued—

Mod. No.	Description	Fixed Weight (lb.)	Fixed Moment (lb. ft.)
	Part B—Items to complete installation:—		
	Changes to fixed (Tare Weight) items	+ 5·1	— 36
	Changes to removable load items:—		
	(a) Add receiver, TR.3708	+30·8	—273
	(b) Add control unit, Type 909	+ 2·6	— 11
	(c) Add junction box, Type 397	+ 3·0	— 28
	(d) Add meter, range and heading	+ 1·3	— 9
	TOTAL—Part B	+42·8	—357
369	Deletion of lead from elevator connecting-rods ...	— 3·3	— 61
412	Introduction of re-designed tail plane with 18 S.W.G. skin and divided structure	+15·3	+286
414	Deletion of rear bearing temperature indicator ...	— 2·2	+ 5
532	Stiffening top surface of air intakes	+ 1·1	— 3
538	Reinforcing skin at main undercarriage wheel well wall	+ 3·3	+ 5

12. The following modifications are *not* allowed for in the Basic Weight given in Table 1. When any of these modifications are incorporated, their effect must be calculated and, if necessary, the load adjusted to counteract their effect on the aircraft C.G. position. Weights and moments refer to Basic Weight changes unless otherwise indicated.

Mod. No.	Description	Weight (lb.)	Moment (lb. ft.)
235	Introduction of switch overrun control in camera gun circuit	+ 2·5	+ 1
391	Redesigned fire extinguisher system with bottles Ref. No. 20A/266 in lieu of Ref. No. 27N/67 or 27N/105 ...	+13·7	+ 78
409	Introduction of stand-by V.H.F. and independent power supply:—		
	Fixed (Tare Weight) items including battery	+16·3	— 60
	Removable load (Basic Weight) items:—		
	Transmitter-receiver, T.R.2002	+ 8·2	— 24
467	Introduction of C.A.U. Acre 9 in lieu of Acre 8, Mk. 1A	+ 1·5	— 1
478	Introduction of power failure warning light	+ 2·8	— 20
530	Increasing gauge of acorn fairings	+ 2·6	+ 50

Continued—

Mod. No.	Description	Weight (lb.)	Moment (lb. ft.)
536	Introduction of fusing unit No. 3, Mk. 1 in lieu of 50/1476	+ 0·6	+ 1
545	Repositioning voltage regulator and suppressor in flap shroud	+ 0·8	+ 5
551	Extending fuselage tank vent	+ 0·9	— 1
553	Introduction of relief valve in hand pump line	+ 0·5	— 2
575	Provision for V.T. fuse in bomb pylon	+ 2·9	+ 3
608	Deleting servicing cocks from No. 1 tanks	— 2·0	— 6
613	Making provision for V.G. recorder:—		
	Fixed installation	+ 1·1	— 4
	V.G. recorder	+ 1·6	— 5
616	Improved main undercarriage door lock and mechanism	+ 2·7	+ 7
649	Modifying flight instrument inverter circuit	+ 1·2	— 5
666	Repositioning mic-tel. relays	+ 1·4	— 4
707	Introduction of plastic pylon tanks as alternative to metal	See note 3 in Tables 2 and 3	
713	Introduction of hydraulic pump failure warning ...	+ 2·4	— 14
735	Introduction of 3 in. dia. pulleys for flying control cables	+ 0·9	+ 1
739	Deleting flap interconnecting plate and increasing mast flap angle from 60 deg. to 70 deg.	— 9·0	— 51
775	Introduction of artificial horizon Ref. No. 6A/3063 in lieu of Ref. No. 6A/2717	+ 1·8	— 14
801	Introduction of relays Ref. No. 10F/Z.530453 in lieu of Ref. No. 5CW/3945	— 0·8	+ 3
821	Introduction of improved flap torque tube mechanism	+ 1·2	+ 7
866	Introduction of earth plates for Type 91 aerials (Rebecca)	+ 1·2	— 5
872	Introduction of T.R.1998 and additional aerial in starboard boom	+ 5·3	+ 19
901	Introduction of steel cannon mounting slides in lieu of dural	+ 0·9	— 2
935	Introduction of locating spigots at fuselage tank filler neck	+ 1·1	— 1
943	Improved locking of wing/fuselage attachment bolts ...	+ 1·3	Nil
947	Improved fuselage tank vent pipe	+ 0·7	— 1
956	Introduction of Lucas/Ultra top speed engine control:—		
	Airframe parts	+12·0	— 54
	E.C.U. parts	+11·3	+ 19
	TOTAL	+21·3	— 35
960	Introduction of cabin pressure control valve Ref. No. 27KD/597 in lieu of Ref. No. 27KD/19	+ 1·6	— 13

Continued—

Mod. No.	Description	Weight (lb.)	Moment (lb. ft.)
983	Introducing wing tank in 0·03 in. material in lieu of 0·02 in. (Marston Mod. T.108 or Fireproof tanks Mod. M.131)		
	Tank No. 1 Port	+ 3·0	+ 6
	Tank No. 1 Starboard	+ 3·0	+ 6
	Tank No. 2 Port	+ 1·6	— 1
	Tank No. 2 Starboard	+ 1·6	— 1
	Tank No. 3 Port	+ 2·5	+ 7
	Tank No. 3 Starboard	+ 2·5	+ 7
	Tank No. 4 Port	+ 2·3	+ 3
	Tank No. 4 Starboard	+ 2·3	+ 3
	TOTAL	+18·8	+ 30
1003	Introduction of plastic tip tanks as alternative to metal	See Note 3 in Tables 2 and 3	

Note . . .
The effect on fuel capacity, weight and moment by the embodiment of Mod. 983 *is given in Table* 3 *and fig.* 3.

Removal or non-fitment of equipment

13. If, for any reason, items of non-expendable removable load specified in Table 1 or items of fixed equipment (included in the Tare Weight) are omitted, their effect must be calculated and, if necessary, equivalent ballast (*para.* 14) substituted to counteract the effect of their omission on the aircraft C.G. position. Details of the weight and moment of certain major items of fixed equipment are listed below; this list will be amplified by amendment action upon receipt of requests from Service Units through the appropriate channels.

Item	No. off	Weight (lb.)	Moment (lb. ft.)
Godfrey C.A.U. (A.C.R.E. 8, Mk. 1A)	1	9·5	— 2
Ammunition chutes	4 sets	18·8	—56
Bomb pylon	2	42·0	+38
G.G.S. control unit	3	4·0	—24
Starter cartridge in flap shroud	4	16·5	+94

Ballast

14. When ballast is required due to the removal or non-fitment of equipment, etc. (*para.* 13), this may be installed as follows:—

(a) Ballast of the same weight may be secured in the same manner and on the same mounting as the item it replaces.

(b) Ballast having equivalent effect on the C.G. may be installed in the ammunition boxes. The weight of such ballast may be determined by calculation using weights and moments or by using the following formula:—

$$B_A = \frac{M + 1{\cdot}2W_E}{4{\cdot}2}$$

where:—

B_A = Weight of ballast in ammunition boxes.

M = Total moment change due to item. removed

W_E = Total weight of items removed.

Example:—

To find the ballast required in the ammunition boxes to counteract the removal of 250 lb. of equipment having a total moment change of + 1000 lb. ft.

i.e., $M = 1000$

$W_E = 250$

Ballast required.

$$= \frac{1000 + 1{\cdot}2 \times 250}{4{\cdot}2}$$

$$= \frac{1000 + 300}{4{\cdot}2}$$

$$= \frac{1300}{4{\cdot}2} = 310 \text{ lb.}$$

Note . . .
Dummy ammunition may be used for this purpose:—

Ref. No. 12C/881 Cartridges, S.A. 20 mm. Hispano, ballast, Grade 3 Mk. 1, L.H. Feed, belted in Hispano links, Mk. 1.

Ref. No. 12C/882 Cartridges, S.A. 20 mm. Hispano, ballast, Grade 3, Mk. 1, R.H. feed, belted in Hispano links, Mk. 1.

Weight = 62·5 lb. per 100 rounds.

Max. capacity of ammunition boxes = 150 rounds each=600 rounds per aircraft.

Disposable load

15. The normal consumption of fuel or expendable stores from the loading given in Tables, 2 or 3, will not cause the aircraft C.G. position to move beyond the limits quoted in para. 4. The data contained in the

following paragraphs will, however, enable the aircraft C.G. position to be determined for any load condition.

Internal fuel

16. The weight and corresponding moment for full internal fuel are given in Tables 2 and 3. However, when partial fuel loads are carried, the distribution between the various internal tanks is not proportional to their capacities. The curve of fuel weight plotted against moment as given in fig. 2 and 3 is included in these data to ensure that the correct fuel moment is used for any given fuel weight. Point "A" in fig. 2 and 3 defines the fuel loading which gives the most forward aircraft C.G. position and point "B" defines the most aft internal fuel loading.

Auxiliary fuel

17. When full wing-tip tank fuel is carried in addition to internal fuel, an aircraft C.G. position aft of that given by point "B" in fig. 2 and 3 is obtained. The order of fuel consumption (via the transfer system) is:—tip tank rear compartments, tip tank forward compartments and, lastly, internal fuel. When full wing-tip tank and pylon tank fuel is carried in addition to internal fuel, an aircraft C.G. position slightly forward of that given with full wing-tip tanks only is obtained. The order of fuel consumption with pylon tanks fitted is :—tip tanks rear compartments, pylon tanks, tip tanks forward compartments and, lastly, internal fuel.

Expendable stores

18. The aircraft C.G. position moves *aft* when ammunition, bombs or R.Ps. are expended, and *forward* when tip tanks or pylon tanks are jettisoned.

Loading restrictions

19. The carriage of R.Ps. and 2×1000 lb. bombs together is prohibited.

Miscellaneous data

20. Length of Standard Mean Chord (S.M.C.)=7·23 feet.

The equation to express the C.G. position as a decimal of the Standard Mean Chord from its leading edge (C.G. to S.M.C.) is:—

$\frac{\bar{x}+0\cdot95}{7\cdot23}$ where $\bar{x}$ is the moment arm (ft) of the condition under consideration.

Fuel weight

21. The following fuels are cleared for use in the aircraft:—

Fuel	*Density (lb./gall.)*
AVTAG	7·7
AVTUR	8·0

The fuel weights given in para. 22, Table 2 and 3, and fig. 2 and 3, refer to AVTUR, and must be adjusted when the other fuel is used.

Loading examples

Note . . .
The following examples are for aircraft to pre-Mod. 983 standard.

22. (1) Forward C.G. check

	Weight (lb.)	*Moment (lb. ft.)*
A.U.W., role C (Table 2)	14130	+ 15590
Deduct auxiliary fuel (item 36 and 37) ...	— 1248	— 4111
Deduct wing-tip tanks (item 28)	— 169	— 517
Deduct internal fuel (items 31 to 35) ...	— 2664	— 2591
Add internal fuel to Point A in fig. 2 ...	+ 552	— 34
	10601	+ 8337

C.G. position $= \frac{8337}{10601} = +0\cdot786$ ft., i.e., within limit of para. 4.

(2) Aft C.G. check, auxiliary tanks full

A.U.W., role C (Table 2)	— 14130	+ 15590
Deduct ammunition (item 21)	— 375	+ 1125
Deduct R.Ps. (item 23)	— 784	+ 157
	12971	+ 16872

C.G. position $= \frac{16872}{12971} = +1\cdot301$ ft., i.e., within limit of para. 4.

(3) Aft C.G. check, auxiliary tanks empty

A.U.W., role D (Table 2)	15554	+ 16422
Deduct ammunition (item 21)	— 375	+ 1125
Deduct R.Ps. (item 23)	— 784	+ 157
Deduct auxiliary fuel (items 36 to 38) ...	— 2528	— 4777
Deduct internal fuel (items 31 to 35) ...	— 2664	— 2591
Add internal fuel to Point B in fig. 2 ...	+ 2336	+ 2672
	11539	+ 13008

C.G. position $= \frac{13008}{11539} = +1\cdot127$ ft., i.e., within limit of para. 4.

(4) Aft C.G. check, auxiliary tanks not fitted

Totals from example (3) above	11539	+ 13008
Deduct wing tip-tanks (item 28)	— 169	— 517
Deduct pylon tanks (item 29)	— 148	— 170
	11222	+ 12321

C.G. position $= \frac{12321}{11222} = +1\cdot098$ ft., i.e. within limit of para. 4.

23. The above examples show the most forward and most aft C.G. positions obtainable with any permissible combination of fuel, ammunition and external stores on aircraft operating with full service equipment defined in Tables 1 and 2 and in the modification condition given in para. 10. Further corrections must be made for aircraft operating in non-standard conditions (*para.* 13), and for differences in modification condition from the basic modification standard (*para.* 11 *and* 12), to obtain the extreme C.G. positions attainable in Service for the particular aircraft under consideration.

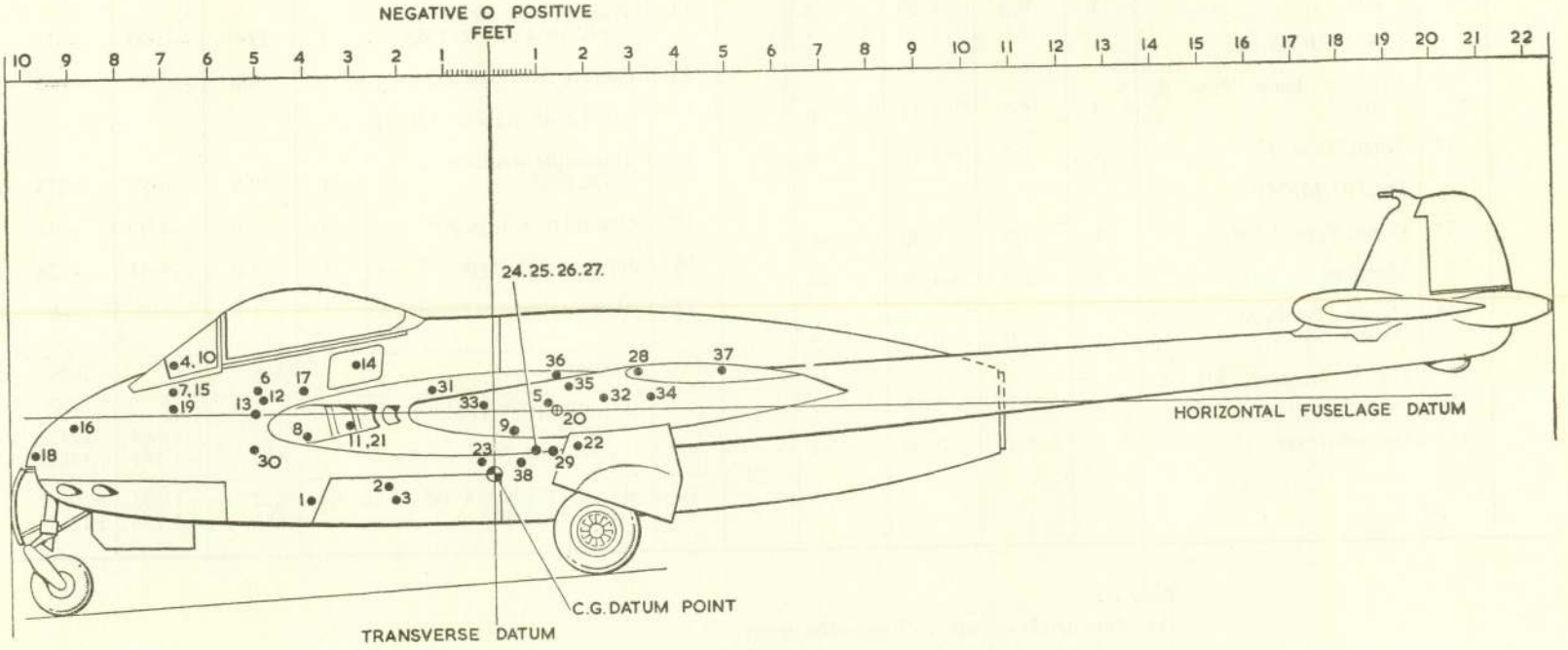

Fig. 1. Loading and C.G. diagram

TABLE 1

Basic Weight

Note Ref.	Item No.	Items of removable Military load common to all roles	No. Off	Weight (lb.)	Arm (ft.)	Moment (lb. ft.)
		ARMAMENT				
1	1	Guns, Hispano, 20 mm., Mk. 5, No. 2	4	346·0	—3·89	—1346
	2	Belt feed mechanism, Mk. 5	4	54·0	—2·20	—119
	3	Firing unit, Maxiflux, Mk. 2	4	16·5	—2·10	—35
	4	Gunsight, G.G.S. Mk. 4E, L.G.	1	9·3	—6·80	—63
		ELECTRICAL				
	5*	Landing, lamp Type J, Mk. 2	1	5·0	+1·17	+6
	6*	Torch, Type O	1	0·7	—5·10	—4
		INSTRUMENT				
	7*	Clock, Type V 308	1	0·9	—6·80	—6
	8	Map case	1	1·0	—4·00	—4
	9*	Camera, G45B, Mk. 3, complete	1	5·0	+0·31	+2
2	10*	G.G.S. recorder, Mk. 3, complete	1	3·1	—6·80	—21
	11	Oxygen charge		4·7	—3·00	—14

Note Ref.	Item No.	Items of removable Military load common to all roles	No. Off	Weight (lb.)	Arm (ft.)	Moment (lb. ft.)
		MISCELLANEOUS				
	12	Crowbar	1	1·0	—5·00	—5
	13*	First aid kit	1	3·0	—5·20	—16
		RADIO				
3		A.R.I.5488 (V.H.F.) ...				
	14	Transmitter-receiver TR. 1934 or TR. 1985 ...	1	27·0	—2·90	—78
	15	Control unit Type 382 ...	1	0·8	—6·80	—5
		A.R.I.5849 (Rebecca Mk. 7)				
	16*	Transmitter-receiver TR. 3708	1	30·8	—8·85	—273
	17*	Control unit, Type 909 ...	1	2·6	—4·13	—11
	18*	Junction box, Type 397 ...	1	3·0	—9·43	—28
	19*	Meter, range and heading ...	1	1·3	—6·70	—9
		TOTAL		516		—2029
		AIRCRAFT TARE WEIGHT ...				
		pre-Mod. 983		8106	+1·584	+12836
		post-Mod. 983		8125	+1·584	+12866
	20	BASIC WEIGHT pre-Mod. 983		8622	+1·253	+10807
		post-Mod. 983		8641	+1·254	+10837

Note . . .

(1) *Gun weight includes rack operating lever.*

(2) *G.G.S. Recorder includes magazines and base plate.*

(3) *Refer to Mod.* 872 *(para.* 12*) for the weight and moment change when TR.*1998 *and additional aerial are fitted, and to Mod.* 409 *for the effect of introduction of Stand-by V.H.F., TR.*2002.

(4) *Items marked * are "Service Fit" and are not available for fitment to aircraft before delivery.*

TABLE 2

Typical service loads—pre-Mod. 983

Note Ref.	Item No.	ITEMS OF REMOVABLE MILITARY LOAD	No. Off	ROLE A, FIGHTER			ROLE B.1, FIGHTER/BOMBER 2×1000 lb. BOMBS			ROLE B.2, FIGHTER/BOMBER 4×25 lb. PRACTICE BOMBS			ROLE C, FIGHTER+R.Ps.			ROLE D, OVERLOAD		
				Weight (lb.)	Arm (ft.)	Moment (lb. ft.)	Weight (lb.)	Arm (ft.)	Moment (lb. ft.)	Weight (lb.)	Arm (ft.)	Moment (lb. ft.)	Weight (lb.)	Arm (ft.)	Moment (lb. ft.)	Weight (lb.)	Arm (ft.)	Moment (lb. ft.)
		ARMAMENT																
	21	Ammunition, 20 mm. Hispano	600	375	—3·00	—1125	375	—3·00	—1125	375	—3·00	—1125	375	—3·00	—1125	375	—3·00	—1125
	22	Projectors, rocket, Mk. 8, Type 17 ...	4	—	—	—	—	—	—	—	—	—	28	+1·80	+50	28	+1·80	+50
1	23	Projectile, rocket, 60 lb. head	8	—	—	—	—	—	—	—	—	—	784	—0·20	—157	784	—0·20	—157
	24	Bombs HE/MC, 1000 lb. short tail ...	2	—	—	—	2160	+0·90	+1944	—	—	—	—	—	—	—	—	—
	25	Carriers, practice bomb	2	—	—	—	—	—	—	46	+0·90	+41	—	—	—	—	—	—
	26	Bombs, practice, 25 lb.	4	—	—	—	—	—	—	100	+0·90	+90	—	—	—	—	—	—
	27	Cover plates, bomb pylon	2	4	+0·90	+4	—	—	—	—	—	—	4	+0·90	+4	—	—	—
		AUXILIARY FUEL TANKS																
2	28	Wing-tip tanks	2	169	+3·06	+517	169	+3·06	+517	169	+3·06	+517	169	+3·06	+517	169	+3·06	+517
3	29	Under-wing pylon tanks	2	—	—	—	—	—	—	—	—	—	—	—	—	148	+1·15	+170
		CREW ...																
4	30	Pilot	1	236	+5·12	—1208	236	—5·12	—1208	236	—5·12	—1208	236	—5·12	—1208	236	—5·12	—1208
		TOTAL ROLE EQUIPMENT PLUS PILOT		784	—	—1812	2940	—	+128	926	—	—1685	1596	—	—1919	1740	—	—1753
		FUEL at 8·0 lb./gall.																
	31	Fuselage tank ... ... 92 gall.		736	—1·30	—957												
	32	Wing tanks No. 1 ... ... 110 gall.		880	+2·30	+2024												
	33	Wing tanks No. 2 ... ... 55 gall.		440	—0·20	—88	(As role A)			(As role A)			(As role A)			(As role A)		
	34	Wing tanks No. 3 ... ... 47 gall.		376	+3·30	+1241												
	35	Wing tanks No. 4 ... ... 29 gall.		232	+1·60	+371												
		TOTAL INTERNAL FUEL 333 gall.		2664	—	+2591	2664	—	+2591	2664	—	+2591	2664	—	+2591	2664	—	+2591
	36	Wing-tip tank, forward compartment 68 gall		544	+1·32	+718	544	+1·32	+718	544	+1·32	+718	544	+1·32	+718	544	+1·32	+718
	37	Wing-tip tank, aft compartment 88 gall.		704	+4·82	+3393	704	+4·82	+3393	704	+4·82	+3393	704	+4·82	+3393	704	+4·82	+3393
3	38	Under-wing pylon tanks ... 160 gall.		—	—	—	—	—	—	—	—	—	—	—	—	1280	+0·52	+666
		TOTAL AUXILIARY FUEL		1248	—	+4111	1248	—	+4111	1248	—	+4111	1248	—	+4111	2528	—	+4777
		TOTAL ROLE EQUIPMENT PLUS CREW AND FUEL		4696	—	+4890	6852	—	+6830	4838	—	+5017	5508	—	+4783	6932	—	+5615
		BASIC WEIGHT (From Table 1)		8622	+1·253	+10807	8622	+1·253	+10807	8622	+1·253	+10807	8632	+1·253	+10807	8622	+1·253	+10807
		A.U.W.		13318	+1·179	+15697	15474	+1·140	+17637	13460	+1·176	+15824	14130	+1·103	+15590	1554	+1·056	+16422

Note . . .

(1) *Alternative R.P. loads on Mk. 8 projectors are as follows:—*

Item	*No. Off*	*Weight (lb.)*	*Arm (ft.)*	*Moment (lb. ft.)*
Projectile, rocket, 60 lb. hd. ...	4	392	+0·18	+ 71
Projectile, rocket, 25 lb. hd.	8	504	+0·72	+363
Projectile, rocket, 25 lb .hd. ...	4	252	+1·10	+277

(2) *The data given in the table refers to metal wing-tip tanks; Mod. 1003 introduces plastic wing-tip tanks as alternative to metal, and data for these plastic tanks is as follows:—*

Item	*No. Off*	*Weight (lb.)*	*Arm (ft.)*	*Moment (lb. ft.)*
Plastic wing-tip tank (Mod. 1003) ...	2	250	+3·06	+765

Fuel capacity of plastic wing-tip tanks is the same as that of metal tanks (item 36 and 37)

(3) *The data given in the table refers to metal pylon tanks; Mod. 707 introduces plastic pylon tanks as alternative to metal, and data for these plastic tanks is as follows:—*

Item	*No. Off*	*Weight (lb.)*	*Arm (ft.)*	*Moment (lb. ft.)*
Plastic pylon tank (Mod. 707) ...	2	193	+1·15	+222
Fuel in plastic pylon tanks (2 × 77 gall. = 154 gall.) ...		1232	+0·52	+641

(4) *Pilot weight includes:—*

	Weight (lb.)
Pilot and parachute	200
Dinghy	29
Emergency oxygen	4
Anti-g suit	3
TOTAL	236

TABLE 3

Typical service loads—post-Mod. 983

Note Ref.	Item No.	ITEMS OF REMOVABLE MILITARY LOAD	No. Off	ROLE A, FIGHTER			ROLE B.1, FIGHTER/BOMBER 2×1000 lb. BOMBS			ROLE B.2, FIGHTER/BOMBER 4×25 lb. PRACTICE BOMBS			ROLE C, FIGHTER+R.Ps.			ROLE D, OVERLOAD		
				Weight (lb.)	Arm (ft.)	Moment (lb. ft.)	Weight (lb.)	Arm (ft.)	Moment (lb. ft.)	Weight (lb.)	Arm (ft.)	Moment (lb. ft.)	Weight (lb.)	Arm (ft.)	Moment (lb. ft.)	Weight (lb.)	Arm (ft.)	Moment (lb. ft.)
		ARMAMENT																
	21	Ammunition, 20 mm. Hispano	600	375	—3·00	—1125	375	—3·00	—1125	375	—3·00	—1125	375	—3·00	—1125	375	—3·00	—1125
	22	Projectors, rocket, Mk. 8, Type 17 ...	4	—	—	—	—	—	—	—	—	—	28	+1·80	+50	28	+1·80	+50
1	23	Projectile, rocket, 60 lb. head ...	8	—	—	—	—	—	—	—	—	—	784	—0·20	—157	784	—0·20	—157
	24	Bombs HE/MC, 1000 lb. short tail ...	2	—	—	—	2160	+0·90	+1944	—	—	—	—	—	—	—	—	—
	25	Carriers, practice bomb	2	—	—	—	—	—	—	46	+0·90	+41	—	—	—	—	—	—
	26	Bombs, practice, 25 lb.	4	—	—	—	—	—	—	100	+0·90	+90	—	—	—	—	—	—
	27	Cover plates, bomb pylon	2	4	+0·90	+4	—	—	—	—	—	—	4	+0·90	+4	—	—	—
		AUXILIARY FUEL TANKS																
2	28	Wing-tip tanks	2	169	+3·06	+517	169	+3·06	+517	169	+3·06	+517	169	+3·06	+517	169	+3·06	+517
3	29	Under-wing pylon tanks	2	—	—	—	—	—	—	—	—	—	—	—	—	148	+1·15	+170
		CREW ...																
4	30	Pilot	1	236	—5·12	—1208	236	—5·12	—1208	236	—5·12	—1208	236	—5·12	—1208	236	—5·12	—1208
		TOTAL ROLE EQUIPMENT PLUS PILOT		784	—	—1812	2940	—	+128	926	—	—1685	1596	—	—1919	1740	—	—1753
		FUEL at 8·0 lb./gall.																
	31	Fuselage tank ... ... 92 gall.		736	—1·30	—957												
	32	Wing tanks No. 1 ... ... 108 gall.		864	+2·30	+1987												
	33	Wing tanks No. 2 ... ... 54 gall.		432	—0·20	—86	(Details as role A)			(Details as role A)			(Details as role A)			(Details as role A)		
	34	Wing tanks No. 3 ... ... 46 gall.		368	+3·30	+1214												
	35	Wing tanks No. 4 ... ... 28 gall.		224	+1·60	+358												
		TOTAL INTERNAL FUEL 328 gall.		2624	—	+2516	2624	—	+2516	2624	—	+2516	2624	—	+2615	2624	—	+2516
	36	Wing-tip tank, forward compartment 68 gall		544	+1·32	+718	544	+1·32	+718	544	+1·32	+718	544	+1·32	+178	544	+1·32	+718
	37	Wing-tip tank, aft compartment 88 gall.		704	+4·82	+3393	704	+4·82	+3393	704	+4·82	+3393	704	+4·82	+3393	704	+4·82	+3393
3	38	Under-wing pylon tanks ... 160 gall.		—	—	—	—	—	—	—	—	—	—	—	—	1280	+0·52	+666
		TOTAL AUXILIARY FUEL		1248	—	+4111	1248	—	+4111	1248	—	+4111	1248	—	+4111	2528	—	+4777
		TOTAL ROLE EQUIPMENT PLUS CREW AND FUEL		4656	—	+4815	6812	—	+6755	4798	—	+4942	5468	—	+4708	6892	—	+5540
		BASIC WEIGHT(From Table 1)		8641	+1·254	+10837	8641	+1·254	+10837	8641	+1·254	+10837	8641	+1·254	+10837	8641	+1·254	+10837
		A.U.W.		13297	+1·177	+15652	15453	+1·138	+17592	13439	+1·174	+15779	14109	+1·102	+15545	15533	+1·054	+16377

Note . . .

(1) *Alternative R.P. loads on Mk. 8 projectors are as follows:—*

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Projectile, rocket, 25 lb. hd. ...	4	252	+1·10	+277

(2) *The data given in the table refers to metal wing-tip tanks; Mod.* 1003 *introduces plastic wing-tip tanks as alternative to metal, and data for these plastic tanks is as follows:—*

Item	*No. Off*	*Weight (lb.)*	*Arm (ft.)*	*Moment (lb. ft.)*
Plastic wing-tip tank (Mod. 1003) ...	2	250	+3·06	+765

Fuel capacity of plastic wing-tip tanks is the same as that of metal tanks (item 36 *and* 37)

(3) *The data given in the table refers to metal pylon tanks; Mod.* 707 *introduces plastic pylon tanks as alternative to metal, and data for these plastic tanks is as follows:—*

Item	*No. Off*	*Weight (lb.)*	*Arm (ft.)*	*Moment (lb. ft.)*
Plastic pylon tank (Mod. 707) ...	2	193	+1·15	+222
Fuel in plastic pylon tanks (2 × 77 gall. = 154 gall.) ...		1232	+0·52	+641

(4) *Pilot weight includes:—*

	Weight (lb.)
Pilot and parachute	200
Dinghy	29
Emergency oxygen	4
Anti-g suit	3
TOTAL	236

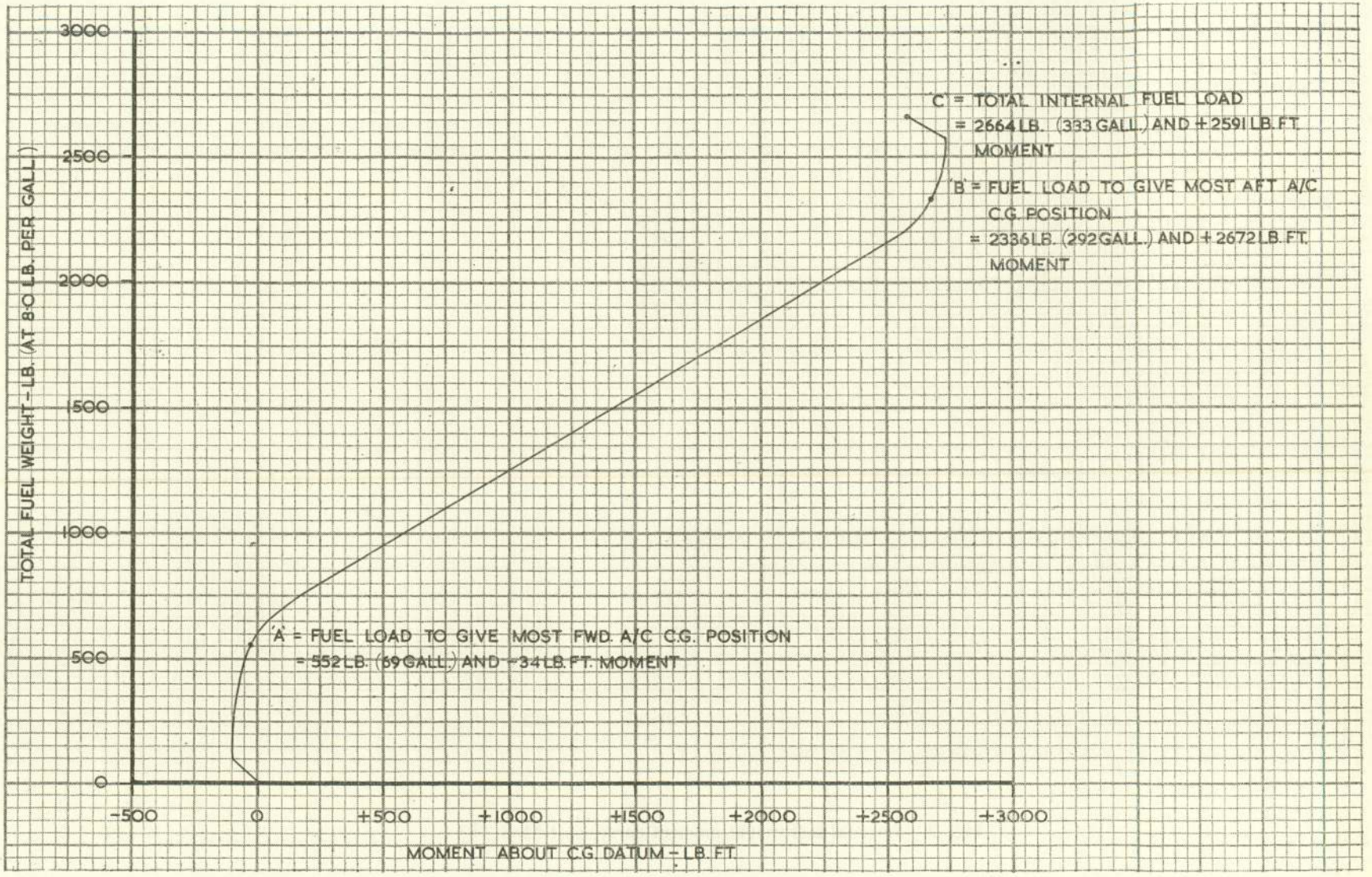

Fig. 2. Internal fuel/weight moment curve, pre-Mod. 983

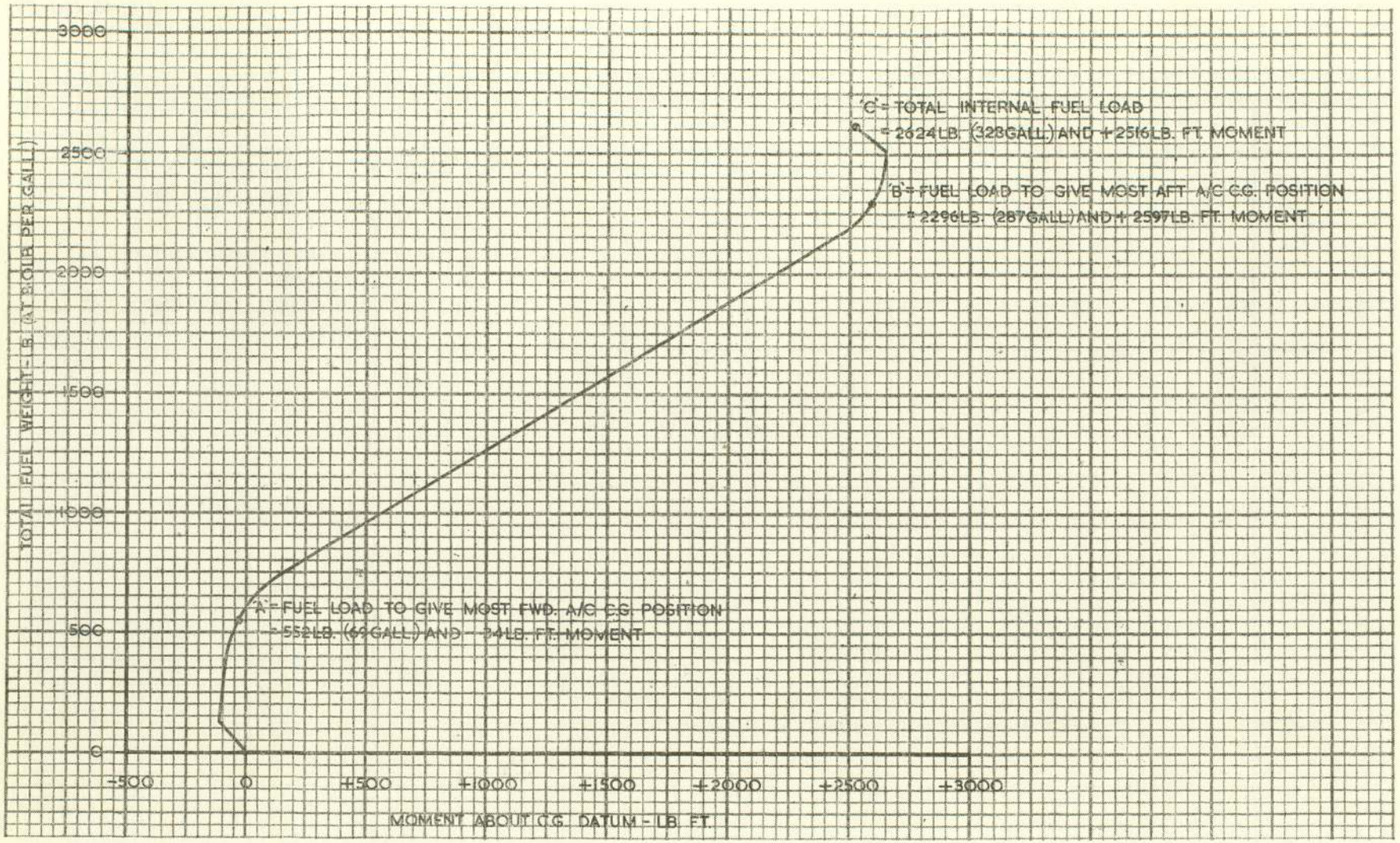

Fig. 3. Internal fuel weight/moment curve, post-Mod. 983