Chapter 3 LOADING AND C.G. DATA

(Completely revised)

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General

1. It is essential that the loading of an aircraft be kept within the limitations of the approval C.G. range and the all-up weight. So far as the C.G. range of this aircraft is concerned only the fore and aft location of the C.G. need be calculated. To determine the C.G. position the aircraft is considered standing with the fuselage datum horizontal and the undercarriage down. Reference should be made to A.P. 1464D, Vol.1, Part 2, Sect.1, Chap.3, for general information on aircraft loading.

Datum point

2. This is the foremost face of a spigot hole situated in the wheel bay on the fuselage skin just forward of the undercarriage door hydraulic jack. This fixed point is located 19 inches aft of the main spar frame and 4 inches below the fuselage datum.

Weight limitations

3. The maximum permissible all up weight for all forms of flying is 18,000 lb. The normal maximum permissible weight for landings is 16,200 lb. Maximum overload for take off and gentle manoeuvres is 22,000 lb.

C.G. range

4. The approved limits of C.G. travel, measured parallel to the fuselage datum are 0 in. to 14.5 in. aft of the C.G. datum point as illustrated on Fig.1.

Operational notes

5. The following notes are inserted to give guidance on particular items of loading peculiar to the type:-

(1) In order to maintain the C.G. position between the given approved limits when the radar head and ranging unit are removed, fit ballast Ref.No. 26FX/100021 (Mod.21)or 26FX/100637 (Mod.637).

(2) When external link collectors (Mod.302) are fitted, the weight of 540 retained links is 67.5 lb. with a load arm of –98.75 inches. (Moment –6,666 lb.in.). In all C.G. calculations which allow for the expenditure of ammunition the effect of these retained links must be taken into consideration.

(3) When drop tanks are carried on the outboard pylons, ammunition or ballast in lieu must also be carried.

(4) When 5 in. H.V.A.R. are carried, only wing stations A, B and D may be used.

Modifications included in given basic weight

6. The typical basic weight and moment given in Table 1 include the following modifications.

Airframe Modifications

Hunter 4/Y/1.

PLUS:-

13, 64, 92, 109, 115, 136, 141, 153, 167, 173, 180, 182, 193, 196, 201, 203, 213, 217, 223, 249, 258, 262, 296, 297, 306, 328, 329, 331, 332, 352, 354, 369, 373.

Changes in weight and moment due to modifications

7. Any modifications that are incorporated on an aircraft but are not included in the given basic weight are additional and must be allowed for when calculating the total weight and C.G. position. The following table gives changes in weight and moment due to such additional modifications:-

Mod. No.	Description	Change of Weight (lb.)	Change of Moment (lb. in.)
9	Inboard pylon, removable parts for aircraft Pre Mod.228 introduced	108.00	1,703
12	Radio, A.R.I.18044 introduced	34.00	–2,620
70	Aerials for Rebecca Mk.7 introduced	9.50	– 214
74	Gun bay connector plug repositioned	0.25	– 27
77	Gun firing panel relay changed	–0.25	20
79	Invertor type 100A in lieu of type 100B	6.25	– 738
85	Aircraft destructor stowage introduced	4.00	– 772
91	Fin and rudder autostabiliser Mk.2 servo unit, type B introduced	9.25	2,331
101	Voltage regulator Type 94 in lieu of Type 57	– 2.00	162
106	Engine starter access door, hinge movement increased	0.25	– 1
118	Steel protection introduced at centre tank and firewall	11.25	428
133	Hydraulic hand pump repositioned	0.25	18
135	Case chute attachments improved	0.25	– 16
138	Fuel system, Rotol flow proportioner Type F.F.P.2 introduced (Superceding Mod.332)	14.25	– 569
143	G.G.S. voltage checking points introduced	0.25	– 31
157	V.G. recorder removable parts introduced	2.50	– 170
158	Fin, plastic portion reinforced	0.25	64
179	Manual control for flood flow introduced	0.50	– 36

Mod. No.	Description	Change of Weight (lb.)	Change of Moment (lb. in.)
183	Flap hinge bolts removal facilitated	0.75	42
185	Access to flap jack anchorage improved	0.75	38
187	U/C. fairing, torque shaft greasing facilitated	0.25	6
188	Aileron controls (post Mod.139). Revised feel unit introduced	1.00	– 188
192	T/P. actuator anchorage bolt access facilitated	0.25	51
194	Rudder bar and control column gaiter improved	0.25	– 45
197	Wings, U/C leg pressure recuperator system introduced	10.00	463
198	Centre fuselage, undercarriage pressure recuperator introduced	0.50	– 1
204	Gun pack feed necks reinforced	0.25	– 22
2	Cabin heating improved	2.50	– 319
210	Cabin conditioning thermostatic control improved	1.00	– 154
216	Guard on frame 56 introduced	0.25	62
227	Attachment for R.P. rails, removable parts introduced	128.50	8,982
228	Wings, R.P. installation and outboard pylon (fixed parts) introduced	78.00	4,941
229	Fuselage, R.P. installation and outboard pylon (fixed parts)	15.75	–1,195
232	Outboard pylon, removable parts introduced	71.00	5,300
233	Wing wiring standardised to Mk.6 aircraft	0.25	6
235	Wheel case breather pipe modified	0.75	55
238	Fuel system, tank gauge terminal boxes improved connections introduced	0.50	– 16
239	Gun bay ventilation pipe attachment improved	0.25	– 28
250	Centre fuselage, generator cooling improved	– 0.25	– 10
252	Centre fuselage, fuel filter de-icing introduced	16.25	2,031
256	1. G.4F compass detector unit repositioned to cater for R.P. 2. Existing equipment moved aft	3.50	626 601
263	External link collector tanks introduced (Pre Mod.302)	15.00	–1,632
264	Fairings for external link collectors introduced	4.00	– 382
265	Main planes, fuel tank gauging introduced	12.25	– 197
266	Fuselage, wing fuel tank gauging introduced	1.00	– 77
268	Accelerometer 6A/3451 in lieu of 6A/3599 (Superseding Mod.92)	– 0.75	124
269	Blast tubes rear location improved	0.50	– 77
272	Rear fuselage skid pad improved	4.00	949
273	Nose wheel door cable duct and lock rods	0.50	– 108
274	De-icing pump type D.1 Mk.2 in lieu of Type D.1 Mk.1	0.50	– 100
275	Tail cone frame 63 changed to stainless steel	1.25	365
276	Radio V.H.F. relay panel revised	– 0.25	20
278	Hood strengthened (Superseding Mod.279)	0.50	– 72
281	Hood jettison - seat ejection systems interconnected	13.00	–1,554
285	Case chute attachments modified	1.25	- 113

Mod. No.	Description	Change of Weight (lb.)	Change of Moment (lb. in.)
287	Front fuselage, additional armour introduced, fixed parts	10.75	–1,765
288	Front fuselage, additional armour introduced, removable	51.75	–9,400
289	Blast tube attachment improved	3.25	– 584
291	Cockpit, revised de-misting installation introduced	4.25	– 619
294	Hydraulics, brake accumulator incorporating filter introduced	1.00	– 185
295	Nosewheel door operating rods strengthened type introduced	0.25	– 52
301	Provision for external link collectors (Superseding Mod.263)	1.25	– 147
302	External link collectors introduced (superseding Mod.264)	19.75	–1,912
303	To make provision for and introduce Avon T.C.U.11501	28.25	1,239
305	Cable protection at base of control column introduced	0.25	– 46
311	Air intake skins reinforced	2.25	– 92
313	Steady for gun pack introduced	0.25	– 27
315	Provision for banner target towing introduced (M.L.Release slip Ref.No.9A/2138)	10.50	771
319	Tailplane, elevator hinge attachment revised	– 0.25	– 66
321	Cabin conditioning additional discharge valve	6.00	– 661
330	Hydraulics, aileron booster accumulator, pressure gauge introduced	0.75	20
332	Fuel system, electrical balancing equipment introduced	10.00	– 953
334	Electrics, ground supply socket, accessibility improved	0.50	– 38
336	Case chute modified	3.50	– 291
344	Hydraulic reservoir, material changed to steel and capacity increased	15.75	835
345	Centre fuselage air intake seal transferred	0.25	8
359	Radar ranging, fuse in A.C. line to type 200 invertor introduced	0.50	– 38
365	Elevator control, full power introduced	3.00	661
366	Hydraulics, self sealing couplings for air brake pipes at rear transport joint introduced	2.00	238
374	Electrics, fuel booster pump warning lights introduced, etc.	2.25	– 78
386	Electrics, Type J batteries Ref.5J/3336 in lieu of type C Ref.6140/101532 introduced	6.75	– 489
390	Flying controls, electrically operated flying tail introduced	3.50	623
391	Increased capacity bleed valve boxes introduced	– 0.50	23
394	Radio, V.H.F. aerial type 229 repositioned and additional type 228 aerial introduced	3.00	219
402	Radio, additional V.H.F. aerial type 228 introduced	4.00	190
406	Flying controls, tailplane actuator, Rotax type A.1606, in lieu of A.1603 or A.1601 introduced	0.75	157
413	Front fuselage, radar ranging head mounting improved	0.50	– 111
414	Electrics, radar ranging additional facilities introduced	1.25	– 221
417	Instruments, autostabiliser Mk.2 introduced	28.50	–2,348
421	Undercarriage wheel door control shaft improved	1.25	43
427	Wings R.P. polythene elect. connect, introduced	0.75	49

Mod. No.	Description	Change of Weight (lb.)	Change of Moment (lb. in.)
428	Hydraulics, emergency control isolated	0.75	– 118
435	Gun pack ventilation improved (post Mod.240)	0.25	– 32
436	R.P. ripple/normal facilities introduced	1.25	– 81
439	Cabin conditioning, electrics amplifier type FLM/A/5 introduced in lieu of FLM/A/1	0.75	– 92
450	Rudder hinge attachment reinforced	0.25	66
451	Front fuselage, nose wheel door lock control rods changed to steel	0.25	– 54
452	Electrics aileron and elevator booster switching revised	13.00	244
455	Front fuselage, footstep reinforced at ladder attachment socket	0.25	– 37
456	Radio V.H.F. sets A.R.I.18064, clearances improved	0.50	– 38
457	Flying controls, aileron gearing reduced for manual operation	13.00	–1,656
462	Front fuselage, additional reinforcing at frame 3, introduced	0.25	– 54
463	Inboard pylon removable parts for aircraft with Mod.228 production version introduced	111.00	1,750
468	Elevator booster 3,500 lb. type introduced	0.50	113
470	E.C.U.11501, compressor seal vent pipe revised	0.50	36
478	Front fuselage, nose wheel door spigot introduced, etc.	0.50	– 99
481	Flap attachment bolts, locking revised	0.50	28
482	Front fuselage, windscreen de-icing system pump mounting strengthened and flexible pipe introduced	0.50	– 100
484	Nose piece, strengthening frame introduced	0.75	– 161
486	Hydraulics, aileron power controls. Micronic filter Pt.No.F.H.S.1211Z introduced	4.00	148
487	Hydraulics, elevator power controls, Micronic filter Pt.No.F.H.S.1211Z introduced	4.75	404
488	Electronics cockpit lighting emergency supply revised and turn and slip emergency control introduced	0.75	– 127
493	Fuel system, pressurising line auxiliary relief valve introduced	3.00	– 24
494	Centre fuselage, fatigue meter introduced	5.00	– 87
498	Windscreen de-icing system non-return valve in delivery pipe	0.25	– 50
501	Main undercarriage to introduce torque link No.'s C.8449.Y. 180(A) & (B) in lieu of C.7950Y. 92(A) & (B); Pipe No's. D.8449Y. 85 (A) & (B) in lieu of A & B; and guard plate No.C.8449Y. 187 (A) & (B). Dowty Mod.AC/3645.	0.50	13
502	Flying controls, aileron and elevator booster, etc.	13.50	–1,283
505	E.C.U.11501, compressor seal vent pipe reinforced	0.50	36
508	Centre fuselage, air intake depression door deleted	2.00	– 106
518	Aileron, skin reinforcement at rib attachments introduced	2.50	318
522	Fire extinguisher switch, improved type introduced	0.25	– 41
523	Electrics, air brake relay control box, relay S.1. Ref.5C/3942 introduced in lieu of type 9B Ref.5CW/5015	0.25	– 36

Mod. No.	Description	Change of Weight (lb.)	Change of Moment (lb. in.)
527	Rear fuselage, jet pipe mounting channels strengthened	0.25	59
532	B.T.H. high energy ignition unit Type C.10TS/3 introduced	– 0.50	– 31
533	Wings, leading edge outer portion extension introduced	43.50	1,914
534	Radio, Rebecca Mk.8 introduced in lieu of Rebecca Mk.7	– 1.25	74
535	Radio, Rebecca Mk.8 D.F. aerials introduced	5.75	– 425
536	Cockpit, leg restraint anchorage introduced to cater for Martin Baker Mod.272 and Mk.3H ejector seat	0.25	– 39
539	Oxygen system, valve Mk.10 introduced	– 0.50	96
543	Fuel system, venting modified	1.50	150
546	Main wheels, tube base support, Dunlop Pt.No. A.E.M.1815 introduced	3.75	101
549	U/C leg, strengthened top fitting introduced	7.00	224
550	Rear fuselage, raised tail cone introduced	– 2.00	– 593
554	Electric hydraulic audio and lamp warning delay introduced (cancelling Mod.381)	0.25	– 53
555	Drop tanks removable parts introduced (Bristol tank 75-01-0001)		
	1) On inboard pylons	300.00	4,920
	2) On outboard pylons	300.00	23,175
556	Electrics, flight instrument circuit, torque switch suppression unit introduced	0.25	– 30
570	Nose wheel door micro-switch and lock inst. improved	0.25	– 54
571	Nose wheel door spigot installation improved	0.25	– 53
572	Front fuselage, miscellaneous attachments improved	1.00	– 203
573	Nosewheel door lock override increased	0.25	– 53
574	Outboard pylon, electrics revised to cater for drop tank low level switch	0.25	19
577	Link containers strengthened	2.50	242
579	Hydraulics pressure regulating valve in flap circuit introduced	1.75	12
581	Front fuselage, windscreen de-icing deleted (Cancelling Mods.274, 482, 498 & 558)	– 4.50	915
588	Rebecca type 91 aerials introduced	6.00	150
590	Front fuselage D.M.E. tuning and V.H.F. frequency card holders introduced	0.25	– 33
591	Fuel system, hymatic valve anchorage improved	0.75	– 6
592	Nose U/C rear door anchorage improved	1.50	– 282
598	Front fuselage nosewheel door lock mounting brackets, cable duct and control rod duct reinforced (partly superseding Mod.570)	0.25	– 54
602	Cockpit to introduce 80 ft./sec. gun in lieu of 60 ft./sec. (Martin Baker Mod.271)	10.00	–1,272
605	Flying controls, tailplane actuator Rotax type A.1507 introduced in lieu of A.1606 (Superseding Mod.406)	– 0.75	– 155
608	Fuselage, drop tanks outboard empty warning indication introduced (post Mod.138)	0.25	– 38

Mod. No.	Description	Change of Weight (lb.)	Change of Moment (lb. in.)
616	Avon E.C.U.12101 (Avon Mods.1029, 1030, A.O.1093 & J.P.43) introduced	8.50	– 172
620	Front fuselage, blast tube seal improved and gun bay ventilating louvres introduced	1.25	– 170
622	Compressor seal, vent pipe supports introduced	0.25	17
629	Electrics, flying tail, control circuit revised and protection against ingress of moisture to datum actuator group, introduced	9.00	1,314
645	Front fuselage, inboard case chutes revised	1.50	– 125
64[illegible]	Front fuselage, outboard case chutes revised	4.50	– 356
647	Front fuselage gun blast deflectors introduced	18.00	–3,258
678	Oxygen, demand regulator Mk.17D, Ref.6D/1966 introduced in lieu of Mk.17 Ref.6D/1700 or Mk.17B Ref.6D/1710	0.50	– 81
682	Electrics, vented covers for type J batteries introduced (Post Mod.386)	2.25	– 144
684	Electrics, power controls, aileron indicator circuit and booster micro switch mounting revised. (Fairey Mod.FHB.47) (Post Mod.452)	0.50	52
692	Rudder, mass balance weight mountings strengthened	0.50	146
708	Elevator rear portion strengthened	4.00	1,074
723	Cockpit hood jettison control system improved (Post Mod.281)	0.25	– 32
768	Emergency oxygen control revised	.50	– 73
777	Wing tip, front portion stiffened (Post Mod.533)	0.25	33
781	Aileron, Pt.No's. G.232400 (port) and G.232401 (Stbd.) introduced in lieu of G.217250 (port) and G.217251 (stbd.)	10.00	1,065
824	Main undercarriage, Dunlop wheel Pt.No. A.H.51338 introduced in lieu of A.H.50207 or A.H.50701	4.25	115
834	Flying controls Elevator booster servo valve damper. Spring deleted	– 0.25	– 56

The following modifications have been omitted from the foregoing table because their effect on the weight and C.G. position is considered as nil:-
63, 67, 132, 149, 159, 175, 195, 202, 205, 206, 208, 214, 215, 221, 240, 242, 248, 251, 257, 259, 279, 283, 290, 292, 299, 304, 307, 308, 312, 314, 317, 318, 320, 322, 325, 327, 341, 346, 347, 349, 355, 356, 357, 360, 363, 364, 368, 373, 376, 377, 379, 381, 391, 396, 398, 399, 403, 404, 416, 422, 423, 432, 433, 437, 444, 446, 449, 453, 461, 465, 467, 469, 471, 473, 475, 477, 490, 497, 499, 506, 510, 511, 516, 517, 519, 520, 521, 547, 548, 552, 557, 559, 564, 566, 567, 568, 578, 580, 586, 593, 594, 597, 601, 603, 604, 606, 615, 617, 621, 624, 636, 644, 657, 658, 659, 660, 673, 677, 689, 690, 691, 694, 695, 696, 699, 701, 705, 706, 707, 715, 717, 719, 725, 729, 737, 739, 753, 761, 763, 766, 776, 814, 815, 826, 827, 832, 836, 846, 867, 883.

ENGINE INCLUDED IN GIVEN BASIC WEIGHT

8. The engine included is an Avon to Technical Certificate No.R.R.T./17, Issue No. 1. Weight 2,439 lb. Moment 178,535 lb.in.

CHANGES OF ENGINE

9. Any engine change which introduces an engine to a Technical Certificate other than that given in para.8 must be allowed for as follows:-

Avon Mk.115 to Technical Certificate No.R.R.T./23 Issue No.1.
Weight 2,445 lb. Moment 177,752 lb.in.

TABLE 1

Equipment included in basic weight

Item No.	Description	Weight (lb.)	Arm (in.)	Moment (lb. in.)
1	Radar head	48.50	–226.10	–10,966
2	Camera gun G.45	6.00	–218.80	– 1,313
3	Radar junction box	1.50	–213.10	– 320
4	Radar, ranging unit	26.50	–198.60	– 5,263
5	Clock	0.50	–169.30	– 85
6	Gunsight	9.00	–162.60	– 1,463
7	Camera recorder	2.00	–156.55	– 313
8	Radio, V.H.F. control units	1.50	–146.00	– 219
9	Personal survival pack	33.00	–146.00	– 4,818
10	Radio D.M.E. control unit	2.50	–142.00	– 355
11	Crowbar	1.00	–133.20	– 133
12	Parachute	34.00	–130.50	– 4,437
13	Seat cartridges	0.90	–127.20	– 115
14	Guns and accessories	801.00	–110.00	–91,301
15	Radar I.F.F. control unit	1.80	– 89.20	– 161
16	Radio, D.M.E. trans-receiver	31.50	– 83.20	– 2,621
17	Radio, V.H.F. trans-receiver	52.50	– 71.80	– 3,770
18	Radar, I.F.F. trans-receiver (A.R.I.5131A)	35.50	– 71.00	– 2,520
	AIRCRAFT AT BASIC WEIGHT (These figures are typical and should only be used if R.A.F. Form 4908 is out of date or inaccurate).	12,876		177,648

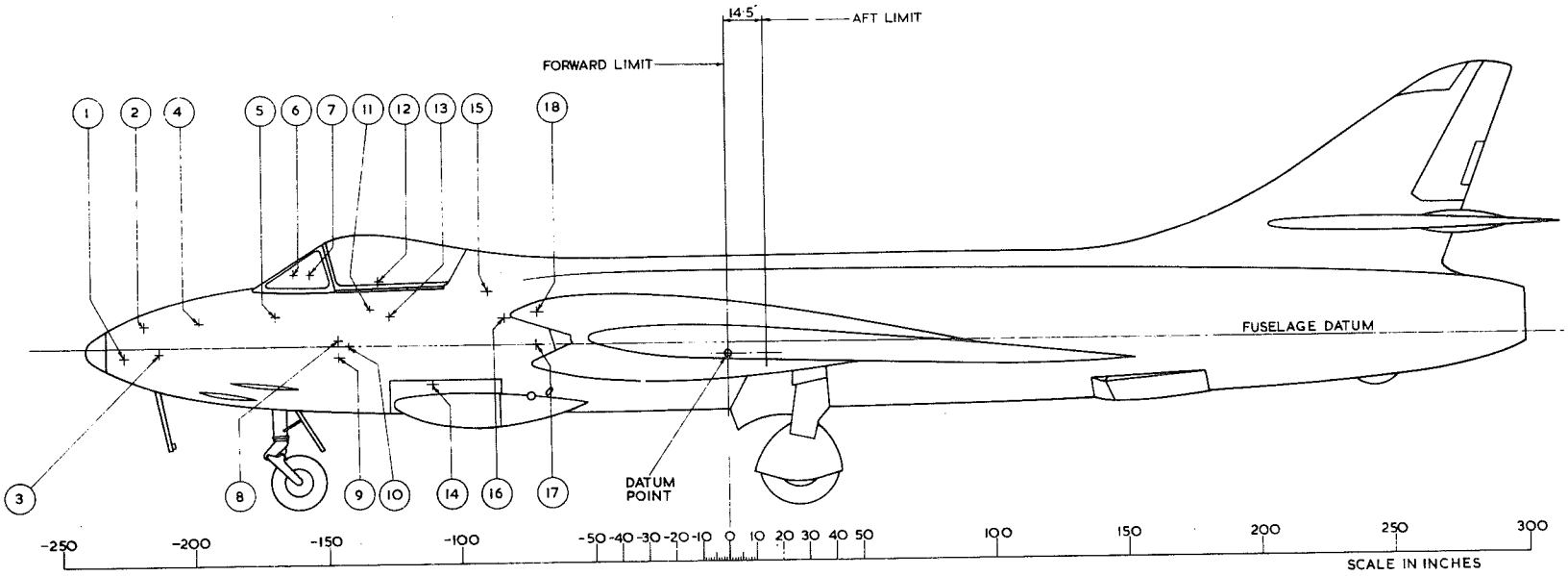

Fig.1 Loading and C.G. diagram for Table 1 items.

TABLE 2 **Operational load items**

Item No.	Description	Weight (lb.)	Arm (in.)	Moment (lb. in.)
1	Pilot	180.0	–145.90	–26,262
2	Two light series carriers	48.0	9.55	458
3	Two inboard pylons	115.0	15.75	1,811
4	Two 100 gallon drop tanks on inboard pylons	300.0	16.40	4,920
5	Spare starter cartridges in stowage	10.5	30.50	320
6	R.P. removable mountings	130.0	70.00	9,100
7	Two outboard pylons	72.0	74.65	5,375
8	Two 100 gallon drop tanks on outboard pylons.	300.0	77.25	23,175

TABLE 3 **Expendable load items**

Item Letter	Description	Weight (lb.)	Arm (in.)	Moment (lb. in.)
A	Ammunition	582	–98.75	–57,473
B	Fuel, front tanks 202 gallons	1,555	–40.50	–62,978
C	Fuel, wing tanks 140 gallons	1,078	–11.50	–12,397
D	Four 25 lb. practice bombs	100	8.80	880
E	Overload fuel in inboard drop tanks	1,540	8.80	13,552
F	Two 1,000 lb. bombs	2,200	10.10	22,220
G	8 R.P., single tier, 60 lb. head.	760	47.55	36,138
H	24 R.P., tripie tier, 25 lb. head	1,440	52.15	75,096
J	24 R.P., triple tier, 18 lb. head	1,272	53.25	67,734
K	16 R.P., double tier, 25 lb. head	960	55.30	53,088
L	16 R.P., double tier, 18 lb. head	848	56.40	47,827
M	8 R.P., single tier, 25 lb. head	480	58.45	28,056
N	24 R.P., triple tier, 12 lb. head	1,128	59.45	67,060
O	8 R.P., single tier, 18 lb. head	424	59.55	25,249
P	16 R.P., double tier, 12 lb. head	752	62.60	47,075
Q	6 H.V.A.R. single tier, 52 lb. head	1,120	63.05	70,616
R	6 H.V.A.R. single tier, 35 lb. head	984	64.65	63,616
S	8 R.P., single tier, 12 lb. head	376	65.75	24,722
T	Overload fuel in outboard drop tanks	1,540	69.65	107,261
U	Fuel, centre tanks 72 gallons	554	13.30	7,368

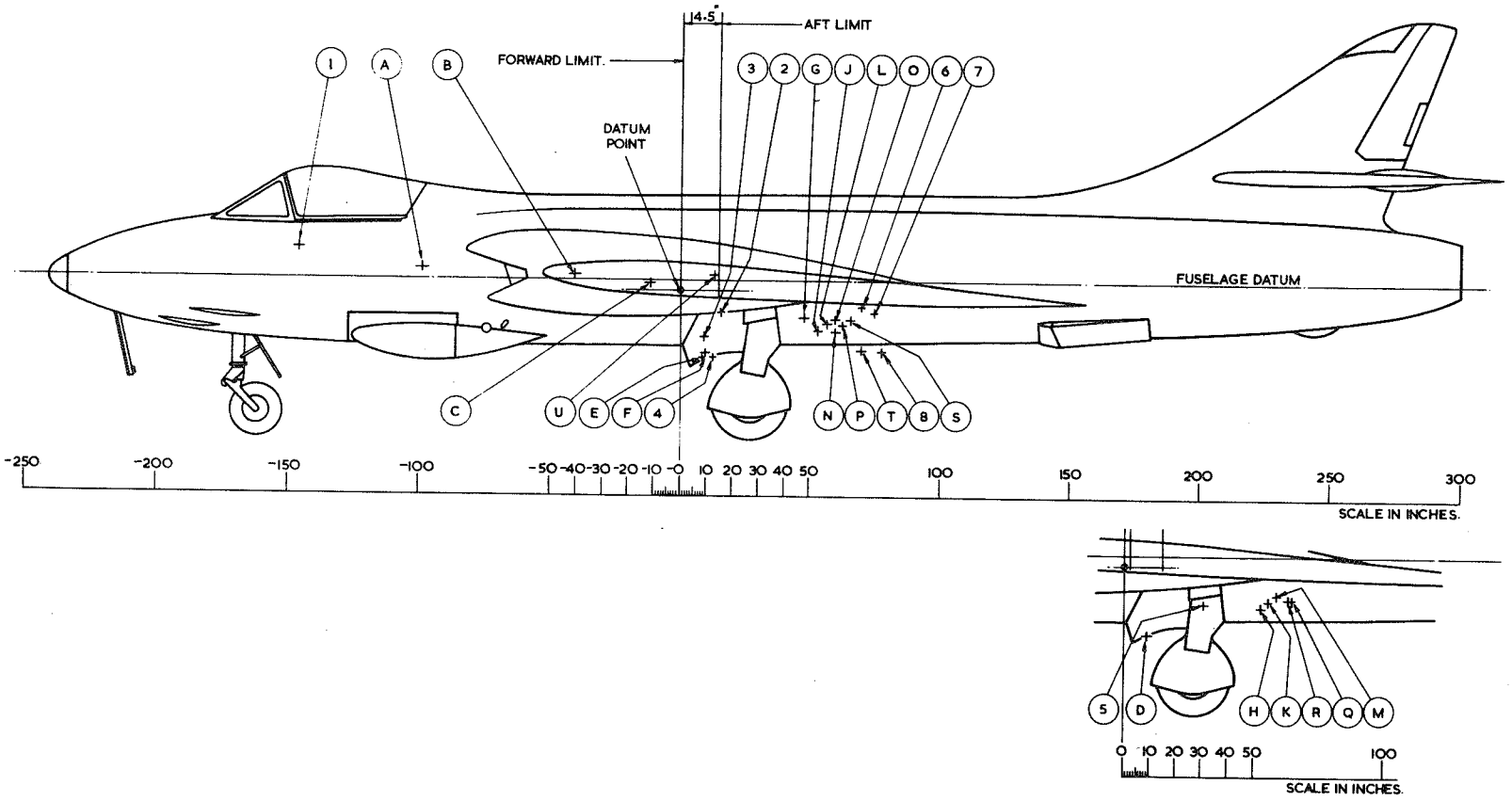

Fig.2 Loading and C.G. diagrams for Table 2 and 3 items.