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A CORRELATION OF THE DIMENSIONS, PROPORTIONS, AND LOADINGS OF EXISTING SEAPLANE FLOATS AND FLYING-BOAT HULLS

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WASHINGTON

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A CORRELATION OF THE DIMENSIONS, PROPORTIONS, AND LOADINGS OF EXISTING SEAPLANE FLOATS AND FLYING-BOAT HULLS

By Fred W. S. Locke, Jr.

INTRODUCTION

The design of most machines is a series of compromises, and seaplanes and flying boats are no exception. It is the purpose of this study to determine as far as possible what loadings and proportions have been arrived at by designers, and what, if any, interrelations exist between the loadings and proportions. It is believed that the study may be useful for reference. It should be remembered that differences between the designs considered are in part determined by differing requirements and that the designs are not all of equal merit.

The study has been limited generally to seaplanes built in the last decade, although a few interesting older designs have been included. Only seaplanes built in America, Britain, and Germany have been included. It would have been desirable to include Russian and Japanese planes, but no information was readily obtainable. Correlations are presented between certain of the major items. Additional correlations, involving other items, are no doubt possible.

The source of data is mainly the magazine "Aero Digest," supplemented by other American and British trade journals, as well as certain NACA publications. Information was obtained for 75 flying boats and 23 seaplanes. It was possible, in most instances, to make the data fairly complete by careful analysis.

DATA

The method used consisted of making tables of all the published particulars and specifications, and then with the aid of the three-view drawings (usually published in trade journals with a description of the aircraft) scaling off the

missing items. Certain ones of these items were measured regardless of whether or not a figure for them had been published. This permitted a check on the scaling process.

It was found that areas usually checked to within ±5 percent and lengths to within ±2 percent. It was very difficult to get any check on the angles measured off these small drawings, but it is believed that the dead rise is within ±1° and the afterbody angle within ±1/2°. If the drawing was too small, it was enlarged photostatically so that the wing span on the drawing came to about 6 inches.

The longitudinal location of the center of gravity was determined by dropping a perpendicular to the tangent to the forebody keel from the 25 percent mean aerodynamic chord. The vertical location is a pure guess based on the looks of the airplane. The vertical location is not so important, in any case, since the component of force exerting a moment, resistance, is only about one-fifth of the displacement.

Tables I to VI give the tabulated data for all the planes considered.

NOTATION

The following notation and nondimensional coefficients are used:

Initial load coefficient, $C_{\Delta_o} = \Delta_o/wb^3$

Get-away speed coefficient, $C_{V_G} = V_G/\sqrt{gb}$

Brake horsepower coefficient, $C_P = 550\ bhp/wb^3\sqrt{gb}$

Forebody length coefficient, f.b./b

Afterbody length coefficient, a.b./b

Over-all length coefficient, L/b

where

Δ_o initial load on the water, pounds

w specific weight of water, pounds per cubic foot (usually taken as 64 for sea water)

b beam at the main step, feet

V_G get-away speed, feet per second (taken as 10 percent above stalling in the present instance)

f.b. forebody length defined as the distance from the forward perpendicular to the main step at the keel, feet

a.b. afterbody length defined as the distance from the main step to the second step or stern post, whichever is shorter, feet

h height of the main step, percent beam

β mean angle of dead rise at the main step, degrees

α angle between forebody and afterbody keels, degrees

CORRELATIONS

Beam
(fig. 1)

It is generally conceded that the fundamental length characteristic of a seaplane hull is the beam at the main step. Figure 1 shows the beam against the gross weight Δ for flying boats and against $\Delta/2$ for twin-float seaplanes. It is quite similar to a chart prepared by Sottorf (reference 1) although it contains more data.

On this figure contours of the load coefficient C_{Δ_o} are used as parameters. $C_{\Delta_o} = 0.25$ and $C_{\Delta_o} = 2.00$ are approximately the limits, which means that the limiting beams of float systems that have been built for equal loads are in the ratio of 1:2.

There seems to be a small, though noticeable, trend toward lower values of C_{Δ_o} with increasing gross weight. It may be that this trend will reverse in the near future when more powerful engines become available.

It will also be noted that float seaplanes have somewhat higher values of C_{Δ_o} than flying boats, although actually the two groups overlap very considerably.

Get-away Speed
(fig. 2)

Diehl (reference 2) showed that there was a connection between the static load coefficient and the get-away speed coefficient of the form:

$$C_{V_G} = 7.4\, C_{\Delta_o}^{\frac{1}{3}} \qquad (1)$$

A logarithmic chart was prepared of the present information and is shown in figure 2. The mean line is given by:

$$C_{V_G} = 8.7\, C_{\Delta_o}^{\frac{1}{3}} \qquad (2)$$

It should be pointed out that for the present study, the get-away speed was taken as 10 percent above the stalling speed, and that the stalling speeds were calculated for all airplanes included in this study, since the published figures are almost invariably optimistic. Adding 10 percent to Diehl's constant gives 8.1, which is not so far from the present, and probably more modern, information. It is not known how Diehl defined get-away.

Forebody Length
(fig. 3)

The forebody length can be related to the static load coefficient as shown in figure 3. The equation of the mean line is:

$$\frac{f.b.}{b} = 3.5\ C_{\Delta_o}^{\frac{1}{3}} \qquad (3)$$

The primary purpose of having considerable length to the forebody is to provide flotation at rest and to prevent nosing under when taking off or alighting. It does not seem likely that the length of the forebody can have much effect at planing speeds, except insofar as the length affects the shape in the region of the step.

Taking the limits of the cluster of points, it is found that forebody lengths in the ratio of 1:1.6 have been used for the same load and beam. This is quite a wide variation. It is not known whether the length given by equation (3) is the best one - it is merely a mean.

Afterbody Length
(fig. 4)

There seems to be slightly more confusion regarding the proper length of the afterbody. Hydrodynamically, the afterbody serves two functions - to assist getting over the hump and to provide flotation at rest. At high speed its effect is quite often detrimental. The requirements are, therefore, conflicting - a long afterbody at low speeds and a short one at high speeds. The average of contemporary opinion is that:

$$\frac{a.b.}{b} = 2.5\ C_{\Delta_o}^{\frac{1}{3}} \qquad (4)$$

The data obtained is shown in logarithmic form in figure 4. The limits indicate that for equal load and beam, afterbody lengths in the ratio 1:1.9 have been built.

Hull Length
(fig. 5)

Equations (3) and (4) may be added together to give:

$$\frac{L}{B} = 6.0\ C_{\Delta_o} \qquad (5)$$

The actual data are shown in figure 5, which is similar in nature to one prepared by Richardson (reference 3). The mean line (fig. 5) actually makes the constant 6.05 in equation (5).

This is a rather minor point; a more important one, however, is that for a given beam and load the maximum variation of the hull length is in the ratio of 1:1.3. This indicates that there was reasonable certainty in the minds of the designers as to what length to make the hull; but much less as to where to locate the step.

Center of Gravity
(fig. 6)

Figure 6 shows the location of the center of gravity nondimensionally. At first glance it would appear that here is a major difference between float seaplanes and flying boats. However, it must be remembered that the vertical location of the center of gravity is about one-fifth as important as the longitudinal.

Actually the most important thing brought out by this figure is that the center of gravity averages about 0.4 of the beam forward of the step. It is believed that the best location for proper hump and planing characteristics will depend on the forebody shape and should be determined by model test in early stages of a design.

Brake Horsepower Necessary
(fig. 7)

Having proportioned the hull it is very desirable to know whether sufficient power is available to lift the airplane off the water. A brake horsepower coefficient has been plotted against the product of C_{Δ_o} and C_{V_G} (fig. 7). After the plot had been prepared, a line was drawn to show the minimum brake horsepower available. As an afterthought, for those hulls with published take-off time, the load for infinite take-off time was computed by Diehl's method (reference 4); and then C_{Δ_o} and C_{V_G} were recomputed.

Plotting the new product of C_{Δ_o} and C_{V_G} against the old value of C_P gave the startling result that none of these points fell above the line previously drawn. It appears, therefore, that the brake horsepower available should be greater than the relation:

$$C_P = 0.273\ C_{\Delta_o} \times C_{V_G} \tag{6}$$

The brake-horsepower coefficient was defined as:

$$C_P = \frac{550\ \text{bhp}}{wb^3\sqrt{gb}}$$

This coefficient is dimensionally in accordance with the other NACA nondimensional seaplane coefficients. It contains no propeller efficiency nor the rate at which thrust changes with speed. As long as the limitations are recognized, it is simple and ought to be useful. Since it is most likely to be used for the full-size seaplane which operates in sea water, the coefficient may be reduced to:

$$C_P = \frac{1.52\ \text{bhp}}{b^{\frac{7}{2}}}$$

This is a sort of power-available coefficient. The product of C_{Δ_o} and C_{V_G} might be considered a power-required coefficient.

Experimental Towing Tank,
Stevens Institute of Technology,
Hoboken, N. J.

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2. Diehl, Walter Stuart: Engineering Aerodynamics. The Ronald Press Co., rev. ed., 1936.

3. Richardson, Holden C.: Aircraft Float Design. The Ronald Press Co., 1928.

4. Diehl, W. S.: The Estimation of the Maximum Load Capacity of Seaplanes and Flying Boats. Rep. No. 453, NACA, 1932.

TABLE I.- AMERICAN FLYING BOATS

Manufacturer	Model	Gross weight (lb)	Power (hp)	Wing Span (ft)	Wing Area (ft^2)	Tail Span (ft)	Tail Area (ft^2)	Tail Length (ft)	Beam (ft)	Fore-body length (ft)	After-body length (ft)	Step depth (in.)	Dead-rise angle (deg)	After-body angle (deg)	c.g. Forward step (ft)	c.g. Above keel (ft)	Get-away (mph)	Take-off time (sec)	C_{Δ_o}	C_{V_G}
Amphibians	Neptune	4,900	425	40.0	376	14.2	60	------	5.5	12.8	9.5	-----	20	13.5	-------	-----	66	--------	0.46	7.28
Do---------	Privateer P-I	1,520	90	38.0	198	10.5	-----	------	4.2	10.5	6.5	-----	0	10.5	-------	-----	53	--------	.32	6.68
Do---------	Privateer P-II	2,100	110	38.0	198	10.5	46	------	4.2	10.5	6.5	-----	0	11.0	-------	-----	61	--------	.44	7.70
Do---------	Privateer P-III	3,200	165	42.5	224	10.1	36	19	4.0	10.4	8.7	3	0	12.0	1.9	3.5	73	--------	.78	9.44
Argonaut	Pirate	2,250	125	42.0	225	10.5	38	16	4.6	9.8	3.8	-----	11	4.0	1.6	2.5	61	--------	.36	7.35
Applegate	P-1-C	1,500	75	34.5	174	9.6	29	12.4	3.35	9.4	12.7	-----	19	8.5	.8	2.5	55	--------	.62	7.76
Boeing	Totem	4,000	300	45	310	----	-----	------	5.9	-----	-----	-----	----	-----	-------	-----	68	--------	.30	7.23
Do---------	PB-1	24,000	1600	-----	1302	----	-----	------	9.2	25.7	8.0	4½	22½	5.3	4.1	8.3	77	--------	.48	6.55
Do---------	204	5,000	425	39.6	470	12.5	55	------	4.35	13.0	14.7	-----	14	7.5	1.2	4.5	62	--------	.95	7.69
Do---------	314	82,500	6000	152	2867	46	355	56	12.5	46.0	26.5	6	23½	6.5	6.3	11.0	86	60	.64	6.29
Casey Jones	----------	2,000	100	37.3	226	11.4	37	16	3.5	10.3	14.0	-----	23	9.0	-------	-----	52	--------	.73	7.17
Consolidated	Commodore	17,600	1150	100	1110	22.5	146	37	8.42	25.0	15.5	-----	22½	6.5	4.7	6.0	70	--------	.46	6.23
Do---------	P2Y-3	24,000	1400	100	1514	24.3	175	35	8.0	25.0	15.5	-----	20½	7.5	5.7	8.0	71	--------	.73	6.47
Do---------	28	27,400	2100	104	1400	24.5	163	32	10.0	25.0	15.0	-----	24	8.5	5.0	6.5	76	--------	.43	6.22
Do---------	31	50,000	4000	110	1100	22.5	155	42.5	9.25	28.5	22.5	-----	----	6.5	------	-----	95	--------	1.02	8.08
Do---------	PB2Y-1	70,000	4200	115	1780	38.5	335	36.0	10.5	29.5	23.1	-----	26	8.5	------	-----	90	--------	.95	7.20
Curtiss	Duckling	1,300	75	39.5	176	----	-----	------	2.75	-----	-----	-----	----	-----	------	-----	52	--------	1.02	8.10
Do---------	N.C.-4	28,000	1600	-----	----	----	-----	------	10.0	27.6	17.2	3¾	22½	5.0	4.80	9.70	75	--------	.44	6.14
Curtiss Wright	CA-1	4,700	365	40.0	335	14.5	36	15	4.3	12.5	11.1	4	19	7.0	.8	4.5	69	--------	.92	8.60
Douglas	Dolphin	7,800	600	60.0	565	17.5	76	25	4.75	16.5	13.0	4	20	10.0	2.1	4.5	69	--------	1.14	8.19
Do---------	DF	28,500	1700	95	1295	31.0	235	39	9.0	29.0	16.8	-----	20	8.0	3.3	7.0	78	35	.61	6.71
Eastman	E2A	2,750	185	36.0	243	12.0	38	15	4.5	10.5	13.3	-----	17	10.5	------	-----	63	--------	.47	7.66
Fairchild	A-942	9,700	750	56.0	483	18.0	85	23	6.1	17.2	13.0	3¼	21	7.5	2.0	5.0	75	36	.67	7.85
Fleetwings	Sea Bird	3,850	300	40.5	235	11.0	35	17.5	4.2	13.3	10.6	-----	19½	10.0	1.7	4.0	75	--------	.81	9.45
Fokker	F-X1	7,200	575	59.0	550	17.0	87	26	6.2	17.3	10.7	4	24	6.5	3.0	5.5	66	--------	.47	6.85
General	FLB-51	11,200	1100	74.2	754	----	-----	------	7.17	-----	-----	-----	----	-----	------	-----	68	--------	.48	6.56
Grumman	G-21	8,000	800	49.0	375	15.8	73	18.0	5.0	14.5	12.5	3	27	6.5	1.0	4.0	79	18	1.00	9.13
Do---------	Widgeon	4,500	400	40.0	245	13.3	52	16.5	4.35	12.6	9.6	2	20	7.5	1.0	4.0	75	--------	.85	9.29
Hall	PH-3	16,150	1500	72.8	1170	28.5	211	27.5	8.35	23.5	13.7	3⅓	22½	7.0	4.6	6.0	66	--------	.44	5.90
Do---------	XP2H-1	42,500	2400	112	2608	----	-----	------	11.5	-----	-----	-----	----	-----	------	-----	71	--------	.44	5.41
Keystone	Commuter	4,150	300	40.0	437	13.0	59	------	4.1	14.0	7.8	-----	20	13	2.7	4.5	58	--------	.94	7.40
Do---------	Air Yacht	6,300	525	46.8	517	15.2	70	20.0	5.0	16.0	10.2	-----	20	12	3.0	6.5	65	--------	.79	7.50
Martin	P3M-1	23,100	1720	100	1204	----	-----	------	8.42	25.41	15.46	3.85	21½	6.25	4.16	6.55	76	--------	.60	6.76
Do---------	130	52,000	3300	130	2315	40	375	52.5	11.0	37.5	18.2	-----	22	8.0	7.8	8.5	81	--------	.62	6.30
Do---------	156	63,000	3300	157	2300	38.5	360	51.5	11.0	37.5	18.2	3¼	22	8.0	6.8	8.5	90	--------	.74	7.00
Do---------	XPBM-1	40,000	----	-----	----	----	-----	------	----	-----	-----	-----	----	-----	------	-----	----	--------	----	----
Do---------	PBM-3	-------	----	-----	----	----	-----	------	-----	-----	-----	-----	----	-----	------	-----	----	--------	----	----
Do---------	XPB2M-1	140,000	8000	200	----	----	-----	------	13.5	-----	-----	-----	----	-----	------	-----	----	--------	.89	----
Spencer-Larsen	SL-12C	2,200	----	40	164	12.5	27.5	------	3.75	14.0	7.5	-----	15	-----	------	-----	69	--------	.65	9.20
Do---------	SL-15	2,830	180	40	200	----	29.0	------	3.75	-----	-----	-----	20	5.0	------	-----	71	--------	.84	9.46
Sikorsky	S-38	10,480	840	71.6	720	18.0	70	23.5	6.8	16.5	13.0	3½	17	9.0	2.3	5.5	71	15	.52	7.04
Do---------	S-39	4,000	300	52	350	16.0	49	17.4	4.5	12.0	10.0	-----	22½	6.0	1.2	4.0	64	--------	.69	7.80
Do---------	S-40	34,000	2300	114.2	1875	37.0	-----	44	10.42	29.50	18.50	4.0	22	6.55	2.47	8.50	76	40	.47	6.08
Do---------	S-41	12,500	1150	78.8	729	20.7	90	21.1	6.8	18.5	12.2	3½	19	6.5	1.5	5.5	77	--------	.62	7.63
Do---------	S-42	42,000	3000	118.2	1340	34.2	128.1	35	9.60	28.5	19.0	4	18½	5.5	2.50	8.0	89	--------	.74	7.43
Do---------	S-43	17,800	1500	86	781	22.0	127.6	26.5	7.5	21.5	16.0	-----	20	8.0	2.2	7.0	82	30	.66	7.74
Do---------	S-44	57,500	4200	124	1670	31.5	169	44	9.5	32.0	24.0	-----	20	6.5	5.4	7.5	95	--------	1.05	7.95
Towle	TA-3	6,200	450	56	406	14.5	77	22.5	6.0	14.3	13.6	-----	26	8.0	1.1	7.0	70	17	.45	7.37
Viking	V-2	3,300	250	42.3	359	----	59.5	------	-----	-----	-----	-----	----	-----	------	-----	54	--------	----	----

*Magazine abbreviations. A.C.- Aircraft Circular, A.D.- Aero Digest, Ae.- Aeroplane, Av.- Aviation, Fl.- Flight, Mu.- Munroe, NACA T.N.- NACA Technical Note.

Manufacturer	Model	Fore-body beam	After-body beam	Step height (% b)	Dead-rise (deg)	After-body angle (deg)	c.g. Forward beam	c.g. Above beam	Wing loading (lb/ft²)	Power loading (lb/hp)	Aspect ratio Wing	Aspect ratio Tail	C_P	$C_{\Delta_C} \times C_{V_G}$	$\frac{C_{\Delta_G}}{C_{V_G}^2}$	References Mag.*	Date	Page
Amphibians	Neptune	2.33	1.73	---	20	13.5	----	----	13.1	11.5	B**	3.37	0.605	3.34	0.0087	A.D.	4/31	76
Do----------	Privateer P-I	2.50	1.65	---	0	10.5	----	----	7.7	16.9	7.30	----	.88	2.13	.0072	A.D.	5/30	138
Do----------	Privateer P-II	2.50	1.65	---	0	11.0	----	----	10.6	19.1	7.30	2.40	1.07	3.38	.00745	A.D.	4/31	74
Do----------	Privateer P-III	2.60	2.17	6.2	0	12.0	0.47	0.88	14.3	19.4	8.10	2.84	2.01	7.37	.00875	A.D.	3/32	52
Argonaut	Pirate	2.14	.80	---	11	4.0	.35	.54	10.0	18.0	7.85	2.90	.91	2.65	.0067	A.D.	3/37	54
Applegate	P-1-C	2.80	3.80	---	19	8.5	.24	.75	8.6	20.0	6.85	3.14	.605	4.75	.0097	A.D.	3/40	110
Boeing	Totem	----	----	---	---	-----	----	----	12.9	13.3	6.55	----	.915	2.17	.00575	Mu.		81
Do----------	PB-1	2.80	.87	4.1	22½	5.3	.45	.90	18.4	15.0	B	----	1.03	3.20	.0112	NACA T.N. No. 576		
Do----------	204	3.00	3.37	---	14	7.5	.27	1.04	10.7	11.8	B	2.84	.88	7.30	.0161	A.D.	4/31	78
Do----------	314	3.87	2.11	4.0	23½	6.5	.50	.88	28.7	13.8	8.00	6.00	1.31	4.03	.0162	A.D.	3/40	70
Casey Jones	----------	2.95	4.00	---	23	9.0	----	----	8.75	20.0	-----	----	1.88	5.22	.0142	Av.	3/37	35
Consolidated	Commodore	2.95	1.82	---	22½	6.5	.55	.71	15.8	15.2	9.00	3.47	1.01	2.85	.0118	A.D.	4/31	84, Schuettel
Do----------	P2Y-3	3.13	1.94	---	20½	7.5	.71	1.00	16.0	17.2	6.63	3.39	1.01	4.71	.0175	A.D.	3/37	100
Do----------	28	2.50	1.50	---	24	8.5	.50	.65	19.5	13.1	7.75	3.69	1.01	2.67	.0111	A.D.	3/40	72
Do----------	31	3.08	2.44	---	---	6.5	----	----	45.5	12.5	11.0	----	2.53	8.25	.0157	Av.	6/30	39,
																Fl.	7/10/41	
Do----------	PB2Y-1	----	----	---	26	8.5	----	----	-----	----	-----	----	1.70	6.84	.0183	U.S.Pat.Design		130,040
Curtiss	Duckling	----	----	---	---	-----	----	----	7.4	17.4	8.90	----	2.18	8.28	.0156	Mu.		81
Do----------	N.O.-4	2.76	1.72	3.1	22½	5.0	.48	.97	-----	17.5	B	B	.77	2.70	.0117	NACA T.N. No. 566		
Curtiss Wright	CA-1	2.90	2.58	7.5	19	7.0	.18	1.05	14.0	12.9	B	5.89	3.35	7.90	.0124	A.D.	4/35	64
Douglas	Dolphin	3.46	2.74	7.0	20	10.0	.44	.95	13.8	13.0	6.36	4.04	3.92	9.31	.0171	A.D.	4/31	76
Do----------	DF	3.24	1.87	---	20	8.0	.37	.78	22.0	16.8	7.00	4.75	1.18	4.10	.013	A.D.	3/37	66
Eastman	E2A	2.33	2.95	---	17	10.5	----	----	11.4	14.9	B	3.40	1.45	3.60	.0080	A.D.	4/31	92
Fairchild	A-942	2.83	2.14	4.5	21	7.5	.33	.82	20.0	13.0	6.40	4.20	2.01	5.28	.0108	A.D.	3/38	50,
																	5/35	33
Fleetwings	Sea Bird	3.15	2.52	---	19½	10.0	.40	.95	16.4	12.8	7.00	3.60	3.01	7.68	.0091	A.D.	3/40	78
Fokker	F-X1	2.79	1.73	5.4	24	6.5	.48	.89	13.0	12.6	6.33	3.33	1.48	3.22	.0100	A.D.	4/31	100
General	FLB-51	----	----	---	---	-----	----	----	14.8	10.2	7.35	----	1.70	3.15	.0111	Fl.	'34	----
Grumman	G-21	2.90	2.50	5.0	27	6.5	.20	.80	21.4	10.0	6.40	3.30	4.34	9.13	.0120	A.D.	3/40	78
Do----------	Widgeon	2.90	2.20	3.8	20	7.5	.23	.92	18.4	11.3	6.55	3.55	3.56	7.88	.0102	A.D.	3/41	142
Hall	PH-3	2.83	1.65	3.3	22½	7.0	.55	.72	13.8	10.8	B	3.85	1.36	2.60	.0126	A.D.	3/40	142
Do----------	XP2H-1	----	----	---	---	-----	----	----	16.3	17.7	B	----	.71	2.38	.0150	Av.	10/34	317
Keystone	Commuter	3.40	1.90	---	20	13.0	.66	1.10	9.5	13.9	B	2.87	3.26	6.95	.0172	A.D.	4/31	106
Do----------	Air Yacht	3.20	2.05	---	20	12.0	.60	1.30	12.2	12.0	B	3.30	2.77	5.91	.0140	A.D.	4/31	106
Martin	P3M-1	3.00	1.84	3.8	21½	6.26	.49	.78	19.3	13.4	8.30	----	1.50	4.05	.0131	Fl.	3/22/42	286,
																NACA T.N. No. 681		
Do----------	130	3.41	1.65	2.5	22	8.0	.71	.77	22.5	15.7	7.30	4.45	1.42	3.91	.0156	A.D.	1/35	34
Do----------	156	3.41	1.65	---	22	8.0	.62	.77	27.4	19.0	10.7	4.11	1.42	5.19	.0151	A.D.	3/37	80
Do----------	XPBM-1	----	----	---	---	-----	----	----	-----	----	-----	----	-----	----	-------	-----	-------	---
Do----------	PBM-3	----	----	---	---	-----	----	----	-----	----	-----	----	-----	----	-------	-----	-------	---
Do----------	XPB2M-1	----	----	---	---	-----	----	----	-----	----	-----	----	1.34	----	-------	A.D.	8/42	194
Spencer-Larson	SL-12C	3.73	2.00	---	15	-----	----	----	13.4	----	9.80	5.70	-----	5.98	.0077	Av.	7/38	35
Do----------	SL-15	----	----	---	20	5.0	----	----	14.1	15.7	8.00	----	2.67	6.00	.0094	A.D.	3/40	122
Sikorsky	S-38	2.42	1.91	4.3	17	9.0	.34	.81	14.6	12.5	7.11	4.64	1.56	3.66	.0105	A.D.	4/31	116 {AC 79
Do----------	S-39	2.66	2.22	---	22½	6.0	.27	.89	11.4	13.3	7.75	5.23	2.35	5.38	.0113	A.D.	4/31	118 {NACA
Do----------	S-40	2.83	1.77	3.2	22	6.55	.24	.81	18.2	14.8	7.00	----	.95	2.85	.0127	A.D.	9/31	66,
																NACA T.N. No. 512		
Do----------	S-41	2.72	1.80	4.3	19	6.5	.22	.81	17.2	10.8	8.50	4.76	2.15	4.73	.0107	A.D.	4/31	118
Do----------	S-42	2.96	1.98	3.5	18½	5.5	.26	.83	31.4	14.0	10.4	----	1.69	5.50	.0134	A.D.	4/34	56
Do----------	S-43	2.86	2.13	---	20	8.0	.29	.93	22.7	11.8	9.50	3.80	1.93	5.10	.0111	A.D.	7/35	54
Do----------	S-44	3.36	2.43	---	20	6.5	.12	.73	34.5	13.6	9.20	5.90	2.42	8.38	.0166	A.D.	3/40	124
Towle	TA-3	2.38	2.26	---	26	8.0	.18	1.17	15.3	13.8	7.70	2.74	1.29	3.31	.0083	A.D.	4/31	124,
																	2/31	58
Viking	V-2	----	----	---	---	-----	----	----	9.2	13.2	B	----	----	----	-------	A.D.	5/30	120

TABLE II.- BRITISH FLYING BOATS

Manufacturer	Model	Gross weight (lb)	Power (hp)	Wing Span (ft)	Wing Area (ft^2)	Span (ft)	Tail Area (ft^2)	Length (ft)	Beam (ft)	Fore-body length (ft)	After-body length (ft)	Step depth (in.)	Dead-rise angle (deg)	After-body angle (deg)	c.g. Forward step (ft)	c.g. Above keel (ft)	Get-away (mph)	Take-off time (sec)	C_{Δ_o}	C_{V_G}
Blackburn	Perth	38,000	2500	97	2111	30	430	37.0	12.50	26.7	22.5	8	30	5.5	2.2	13.5	78	--------	0.30	5.70
Do---------	Sydney	21,500	1575	100	1500	30	265	36.0	10.0	25.3	20.2	----	30	9.0	2.4	10.0	72	--------	.34	5.88
Saunders-Roe	Cutty Sark	3,500	210	45.0	320	10.9	39	18.8	4.00	12.4	19.5	2½	26	8.5	.5	3.5	63	--------	.85	8.14
Do---------	Flying Cloud	8,100	600	64.0	650	16.5	87	25.5	5.75	18.5	15.5	4	20	6.0	1.4	6.0	66	--------	.67	7.11
Do---------	Lerwick	35,000	3750	81.0	----	25.5	186	32	8.50	28.0	30.0	----	22½	7.5	----	-----	--	--------	.89	----
Short	Calcutta	22,500	1600	93.0	1825	29.0	217	32.5	10.00	22.78	21.93	3.90	21	8.6	1.23	12.50	65	23	.35	5,31
Do---------	Kent	32,500	2330	113.0	2640	34.5	368	40.4	11.25	26.3	25.5	----	24½	7.0	2.0	12.3	66	26	.36	5.09
Do---------	Singapore IIC	27,300	1760	90.0	1760	30.5	262	32.5	10.80	27.39	21.21	6	18.5	7.0	2.90	13.25	75	--------	.34	5.88
Do---------	R24/31	18,500	1550	90.0	1147	24.75	144	----	9.25	-----	-----	----	----	---	----	-----	80	17	.37	6.80
Do---------	Empire	40,500	3180	114	1500	32.0	204	49	10.00	35.0	23.3	----	23	7.5	5.0	9.0	84	24	.63	6.88
Do---------	G	73,500	5500	134.3	2160	38.5	330	60	12.0	39.0	38.5	9	26	8.0	5.2	11.5	95	--------	.66	7.09
Do---------	Sunderland	50,100	4040	112.8	1487	36.5	268	50	9.5	34.0	30.5	----	----	7.5	----	-----	95	--------	.92	7.90
Do---------	Cockle	880	48	-----	200	----	---	----	4.5	-----	-----	----	----	---	----	-----	42	--------	.14	5.14
Supermarine	South Hampton	14,300	----	75.0	1426	24.0	170	16.5	7.6	19.5	17.5	----	21	8.5	2.2	8.5	62	--------	.51	5.80
Do---------	Scapa	16,200	----	75.0	1300	24.0	---	25.5	7.5	20.5	17.0	----	24½	9.0	2.4	8.0	66	--------	.60	6.20
Do---------	Seagull	------	----	-----	----	----	---	----	-----	-----	-----	----	----	---	----	-----	--	--------	----	----
Vickers	Vista	1,000	60	-----	150	----	---	----	3.0	-----	-----	----	----	---	----	-----	50	--------	.58	7.45
Do---------	Vioette	4,000	300	-----	490	----	---	----	4.75	-----	-----	----	----	---	----	-----	54	--------	.65	6.40

Manufacturer	Model	Fore-body beam	After-body beam	Step height (% b)	Dead-rise (deg)	After-body angle (deg)	c.g. Forward beam	c.g. Above beam	Wing loading (lb/ft^2)	Power loading (lb/hp)	Aspect ratio Wing	Aspect ratio Tail	C_P	$C_{\Delta_o} \times C_{V_G}$	$\frac{C_{\Delta_o}}{C_{V_G}^2}$	References Mag.*	Date	Page
Blackburn	Perth	2.13	1.80	6.0	30	5.5	0.18	1.08	18.0	15.2	B	B	0.55	1.71	0.00925	----	--------	----
Do---------	Sydney	2.53	2.02	----	30	9.0	.24	1.00	14.3	13.6	6.67	3.40	.76	1.99	.0099	A.D.	11/31	64
Saunders-Roe	Cutty Sark	3.10	4.87	5.2	26	8.5	.12	.88	10.9	16.7	6.35	3.05	2.50	6.91	.0129	A.C.	No. 105 -	NACA
Do---------	Flying Cloud	3.23	2.70	5.8	20	6.0	.24	1.05	12.4	13.5	6.30	3.14	2.00	4.78	.0132	Fl.	7/25/30	831
Do---------	Lerwick	3.30	3.54	----	22½	7.5	-----	----	----	----	----	----	3.19	----	--------	----	--------	----
Short	Calcutta	2.28	2.19	3.25	21	8.6	.123	1.25	12.3	14.1	B	3.87	.77	1.86	.0124	Ae.	12/16/36	771, NACA T.N. No. 590
Do---------	Kent	2.34	2.27	----	24½	7.0	.18	1.10	12.3	14.0	B	3.24	.75	1.84	.0140	----	--------	----
Do---------	Singapore IIC	2.54	1.96	4.6	18½	7.0	.27	1.22	15.5	15.5	B	3.56	.65	2.00	.0098	NACA T.N. No. 580		
Do---------	R24/31	----	----	----	---	---	-----	----	16.1	11.9	7.09	4.37	.99	2.51	.0080	Fl.	7/11/35	57
Do---------	Empire	3.50	2.33	----	23	7.5	.50	.90	27.0	12.8	8.69	5.00	1.52	4.31	.0133	Ae.	12/16/36	771, A.C. 204, NACA
Do---------	G	3.25	3.21	6.2	26	8.0	.43	.96	34.0	13.4	8.37	4.50	1.40	4.88	.0131	Fl.	7/36	59
Do---------	Sunderland	3.58	3.21	----	---	7.5	-----	----	33.8	12.4	8.60	----	2.33	7.25	.0147	----	--------	----
Do---------	Cockle	----	----	----	---	---	-----	----	4.4	18.4	----	----	.38	.72	--------	Mu.	--------	81
Supermarine	South Hampton	2.57	2.30	----	21	8.5	.29	1.12	10.0	----	B	3.40	----	2.90	.0151	A.C.	No. 25 -	NACA
Do---------	Scapa	2.73	2.27	----	24½	9.0	.32	1.07	12.5	----	B	----	----	3.71	.0158	----	--------	----
Do---------	Seagull	----	----	----	---	---	-----	----	-----	----	B	----	----	----	--------	----	--------	----
Vickers	Vista	----	----	----	---	---	-----	----	6.67	16.7	B	----	1.95	4.33	.0104	Mu.	--------	81
Do---------	Vioette	----	----	----	---	---	-----	----	8.16	13.3	B	----	1.96	4.16	.0159	Mu.	--------	81

*Magazine abbreviations. A.C.- Aircraft Circular, A.D.- Aero Digest, Ae.- Aeroplane, Fl.- Flight, Mu.- Munroe, NACA T.N.- NACA Technical Note.

TABLE III.- GERMAN FLYING BOATS

Manufacturer	Model	Gross weight (lb)	Power (hp)	Wing Span (ft)	Wing Area (ft^2)	Tail Span (ft)	Tail Area (ft^2)	Length (ft)	Beam (ft)	Fore-body length (ft)	After-body length (ft)	Step depth (in.)	Dead-rise (deg)	After-body angle (deg)	c.g. Forward step (ft)	c.g. Above keel (ft)	Get-away (mph)	Take-off time (sec)	C_{Δ_o}	C_{V_G}
Dornier	Libelle	1,480	60	-----	150	----	---	----	3.9	----	----	---	--	----	-----	----	62	----	0.39	8.13
Do--------	Do-J-Wal	25,600	1600	93.8	1540	29.0	245	41.5	10.0	32.5	16.5	8	0	0	6.7	7.5	77	----	.40	6.27
Do--------	Super Do-J-Wal	30,500	2000	93.8	1475	31.4	225	47.0	11.0	34.0	16.5	7	0	0	6.5	7.5	85	----	.37	6.64
Do--------	Do-S	35,200	2560	102.0	2250	31.5	250	46.0	9.0	36.5	16.0	---	0	0	5.9	9.5	73	----	.75	6.29
Do--------	Do-X	123,300	7200	157.5	5232	49.5	495	80.0	15.40	57.5	26.0	---	0	3.0	13.5	17	85	55	.53	5.59
Do--------	Do-18	20,240	1100	77.7	1054	25.0	---	36.5	8.2	25.5	13.5	---	0	0	5.5	7.0	77	----	.58	6.85
Do--------	Do-26	44,100	2450	98.5	1290	----	---	----	8.0	32.5	22.2	3½	10	5.5	-----	----	105	----	1.35	9.60
Heinkel	He-57	5,540	425	52.5	422	15.8	---	21.0	4.4	14.0	12.0	---	18	13.5	2.1	5.0	67	----	1.02	8.25
Rohrbach	Robbe	7,410	460	57.1	431	16.5	48	25.0	4.0	16.0	16.0	---	27	11.0	2.2	4.5	79	----	1.81	10.20
Do--------	Romar	43,300	2250	124.3	1830	32.0	200	37.0	6.82	27.0	22.5	---	25	15.0	-1.0	10.5	89	----	2.13	8.90
Do--------	Rostra	16,700	1050	86.3	958	24.3	121	30.5	5.8	17.8	18.0	---	24	14.0	2.8	7.0	80	----	1.34	8.59
Do--------	Rocco	23,400	----	-----	----	----	---	----	6.40	----	----	---	--	----	-----	----	---	----	1.39	-----

Manufacturer	Model	Fore-body beam	After-body beam	Step height (% b)	Dead-rise (deg)	After-body angle (deg)	c.g. Forward beam	c.g. Above beam	Wing loading (lb/ft^2)	Power loading (lb/hp)	Aspect ratio Wing	Aspect ratio Tail	C_P	$C_{\Delta_o} \times C_{V_G}$	$\frac{C_{\Delta_o}}{C_{V_G}^2}$	References Mag.*	References Date	References Page
Dornier	Libelle	----	----	---	---	----	----	----	9.85	24.6	----	----	1.30	3.17	0.0059	Mu.	-----	81
Do--------	Do-J-Wal	3.25	1.65	6.6	0	0	0.67	0.75	16.7	16.0	5.70	3.44	.77	2.50	.0102	A.D.	12/31	57
Do--------	Super Do-J-Wal	3.09	1.50	5.2	0	0	.59	.68	20.6	15.2	5.95	4.39	.69	2.45	.0091	A.D.	11/31	44
Do--------	Do-S	4.04	1.78	---	0	0	.65	1.06	15.7	13.8	4.64	3.96	1.78	4.71	.0190	A.D.	12/31	57
Do--------	Do-X	3.70	1.68	---	0	3.0	.87	1.10	23.4	17.1	4.74	4.95	.76	2.96	.0170	A.D.	11/31	45
Do--------	Do-18	3.11	1.64	---	0	0	.67	.85	19.2	20.4	5.70	----	1.06	3.97	.0124	A.D.	10/36	58
Do--------	Do-26	4.06	2.77	3.6	10	5.5	----	----	34.2	18.1	7.50	----	2.56	12.95	.0146	----	-----	--
Heinkel	He-57	3.18	2.73	---	18	13.5	.48	1.14	13.1	13.1	6.52	----	3.59	8.45	.0150	A.D.	6/31	82
																A.D.	10/31	79
Rohrbach	Robbe	4.00	4.00	---	27	11.0	.55	1.12	17.2	16.2	7.57	5.70	5.45	18.5	.0174	A.C.	No. 36 - NACA	
Do--------	Romar	3.92	3.27	---	25	15.0	-.14	1.52	23.6	19.2	8.47	5.11	4.09	19.0	.0269	A.D.	4/32	76
Do--------	Rostra	3.07	3.11	---	24	14.0	.49	1.21	17.5	15.8	7.80	4.85	3.40	11.5	.0182	----	-----	--
Do--------	Rocco	----	----	---	--	----	----	----	-----	----	----	----	----	-----	------	----	-----	--

*Magazine abbreviations. A.C.- Aircraft Circular, A.D.- Aero Digest, Mu.- Munroe.

TABLE IV.- AMERICAN FLOAT SEAPLANES

Manufacturer	Model	Gross weight (lb)	Power (hp)	Wing Span (ft)	Wing Area (ft^2)	Tail Span (ft)	Tail Area (ft^2)	Tail Length (ft)	Beam (ft)	Fore-body length (ft)	After-body length (ft)	Step depth (in.)	Dead-rise angle (deg)	After-body angle (deg)	c.g. Forward step (ft)	c.g. Above keel (ft)	Float spacing (ft)	Get-away (mph)	C_{Δ_o}	C_{V_G}
Bellanca	77-320	2 × 9850	3200	76	770	25.3	----	24.0	4.7	16.2	16.5	---	25	8.5	1.3	10.2	18.2	84	1.48	10.0
Curtiss	Seagull	5190	550	36	342	14.3	----	15.0	5.0	14.0	11.8	4	21	9.5	1.5	7.0	----	73	.65	8.45
Grumman	J2F-1	6170	750	39	409	14.5	----	17.7	5.0	14.2	12.5	---	25	7.0	1.8	6.0	----	70	.77	8.10
Heath	Parasol	2 × 275	27	----	-----	----	----	----	1.33	6.0	3.25	1¼	0	2.0	----	-----	4.0	--	----	-----
Luscombe	8-A	2 × 630	65	35	140	9.0	----	13.2	1.75	8.0	6.7	---	23	7.0	.9	5.0	6.0	56	1.84	10.9
Northrup	N-3PB	2 × 4600	1200	48.9	376	17.5	----	16.8	4.0	14.5	13.6	---	25	7.5	1.4	7.5	11.3	86	1.12	11.0
Seversky	2PA-A	2 × 3340	850	41	246	----	----	----	4.4	----	----	---	--	---	----	-----	----	88	.61	10.9
Stearman	S76D-1	2 × 1800	320	32.2	297.4	----	----	----	2.7	----	----	---	--	---	----	-----	----	64	1.43	10.1
Taylorcraft	A	2 × 525	40	36	169	10.0	----	13.0	1.8	6.7	5.6	---	--	9.0	.9	4.5	----	48	1.53	9.40
USN	MK V	3800	----	----	-----	----	----	----	3.50	12.4	8.5	3¼	26	7.5	1.55	7.12	----	61	1.38	8.95
Do--------	MK VI	3800	----	----	-----	----	----	----	3.50	13.4	8.5	3¼	26	7.5	1.55	7.12	----	61	1.38	8.95
Vought	Corsair	3650	425	38	320	----	----	----	3.8	12.4	8.6	3	21	7.5	2.2	7.5	----	60	1.04	7.90
Do--------	O3U-6	--------	550	----	-----	----	----	----	----	----	-----	---	--	---	----	-----	----	65	----	----

Manufacturer	Model	Fore-body beam	After-body beam	Step height (% b)	Dead-rise (deg)	After-body angle (deg)	c.g. Forward beam	c.g. Above beam	Wing loading (lb/ft^2)	Power loading (lb/hp)	Aspect ratio Wing	Aspect ratio Tail	C_P	$C_{\Delta_o} \times C_{V_G}$	$\frac{C_{\Delta_o}}{C_{V_G}^2}$	References Mag.*	Date	Page
Bellanca	77-320	3.45	3.51	---	25	8.5	0.27	2.15	25.5	6.15	----	----	10.75	14.8	0.0148	A.D.	3/41	164
Curtiss	Seagull	2.80	2.35	6.6	21	9.5	.30	1.40	15.8	9.40	B	----	3.00	5.50	.0091	Av.	4/37	43
Grumman	J2F-1	2.85	2.50	---	25	7.0	.36	1.20	15.1	8.22	B	----	4.10	6.22	.0117	A.D.	3/41	174
Heath	Parasol	4.50	2.44	7.8	0	2.0	----	----	----	-----	----	----	7.60	-----	-------	----	----	---
Luscombe	8-A	4.56	3.72	---	23	7.0	.51	2.75	9.00	19.4	----	----	9.18	20.1	.0155	A.D.	2/40	39
Northrup	N-3PB	3.63	3.40	---	25	7.5	.35	1.87	24.5	7.65	----	----	7.11	12.3	.00925	A.D.	3/41	178
Seversky	2PA-A	----	----	---	--	---	----	----	27.0	7.86	----	----	3.71	6.68	.0051	A.D.	3/39	136
Stearman	S76D-1	----	----	---	--	---	----	----	12.1	11.2	B	----	7.53	14.4	.0140	A.D.	3/40	154
Taylorcraft	A	3.72	3.11	---	--	9.0	.51	2.56	6.20	26.0	----	----	4.30	14.4	.0173	Av.	2/39	40
USN	MK V	3.54	2.44	7.8	26	7.5	.43	2.04	-----	-----	----	----	----	12.3	.0173	NACA T.N. No.		563
Do--------	MK VI	3.83	2.44	7.8	26	7.5	.43	2.04	-----	-----	----	----	----	12.3	-------	NACA T.N. No.		563
Vought	Corsair	3.26	2.25	6.6	21	7.5	.58	1.98	11.4	8.59	B	----	6.05	8.20	.0167	A.D.	4/31	126
Do--------	O3U-6	----	----	---	--	---	----	----	-----	-----	B	----	----	-----	-------	A.D.	4/36	118

*Magazine abbreviations. A.C.- Aircraft Circular, A.D.- Aero Digest, Av.- Aviation, NACA T.N.- NACA Technical Note.

TABLE V.- BRITISH FLOAT SEAPLANES

Manufacturer	Model	Gross weight (lb)	Power (hp)	Wing Span (ft)	Wing Area (ft^2)	Tail Span (ft)	Tail Area (ft^2)	Tail Length (ft)	Beam (ft)	Fore-body length (ft)	After-body length (ft)	Step depth (in.)	Dead-rise angle (deg)	After-body angle (deg)	c.g. Forward step (ft)	c.g. Above keel (ft)	Float Spacing (ft)	Get-away (mph)	C_{Δ_o}	C_{V_G}
Armstrong Whitworth	Atlas	2 × 2,350	----	-----	------	----	-----	----	2.86	12.39	10.44	--	----	---	---	----	8.60	---	1.57	-----
Ayro	Tutor	2 × 1,400	----	-----	------	----	-----	----	2.46	10.42	9.42	--	----	---	---	----	7.50	---	1.48	-----
Fairey	III F	2 × 2,675	500	49.7	438.5	14.5	32	20.0	3.21	13.44	10.67	2¼	----	---	---	----	8.25	---	1.26	-----
Do-------	Seal	2 × 2,950	525	45.3	445	----	-----	----	2.8	13.0	10.8	2	37	8.5	1.9	8.0	8.2	70	2.09	10.8
Hawker	Osprey	2 × 2,150	500	37.0	346	----	-----	----	2.7	12.0	11.1	2	34	4.0	1.2	7.0	8.75	66	1.68	10.4
Do-------	Nimrod	2 × 2,150	----	-----	------	----	-----	----	2.71	12.2	10.38	--	----	---	---	----	8.33	---	1.69	-----
Parnall	Pipit	2 × 1,990	500	35.0	361	12.7	45.2	14.3	2.5	10.5	9.4	--	30	7.0	1.4	8.0	7.5	64	1.99	10.5
Short	Valetta	2 × 11,200	1600	107	1382	27.0	200	36.5	4.75	20.0	18.5	3½	24	7.0	1.9	11.7	22.0	72	1.62	8.5
Supermarine	S-6b	2 × 3,000	2300	30	145	----	-----	----	2.75	12.7	9.75	--	32½	8.0	---	----	-----	124	2.25	19.4
Vickers	Vildebeest	2 × 4,170	----	-----	------	----	-----	----	3.275	16.35	12.40	--	----	---	---	----	10.0	---	1.86	-----
Do-------	Do------	2 × 4,050	----	-----	------	----	-----	----	3.33	15.25	12.75	--	----	---	---	----	10.0	---	1.72	-----

Manufacturer	Model	Fore-body beam	After-body beam	Step height (% b)	Dead-rise (deg)	After-body angle (deg)	c.g. Forward beam	c.g. Above beam	Wing loading (lb/ft^2)	Power loading (lb/hp)	Aspect ratio Wing	Aspect ratio Tail	C_P	$C_{\Delta_o} \times C_{V_G}$	$\frac{C_{\Delta_o}}{C_{V_G}^2}$	References Mag.*	Date	Page
Armstrong Whitworth	Atlas	4.33	3.65	----	---	---	----	----	----	-----	----	----	-----	-----	------	R.& M.	No. 1653	
Ayro	Tutor	4.24	3.83	----	---	---	----	----	----	-----	----	----	-----	-----	------	R.& M.	No. 1653	
Fairey	III F	4.20	3.34	5.85	---	---	----	----	12.2	10.7	----	----	-----	-----	------	A.C.	No. 102 - NACA	
Do-------	Seal	4.65	3.85	5.95	37	8.5	0.68	2.75	13.3	11.2	----	----	6.39	22.6	0.0179	-----	------	----
Hawker	Osprey	4.45	4.12	6.2	34	4.0	.44	2.60	12.2	8.44	----	----	10.3	17.4	.0155			
Do-------	Nimrod	4.50	3.83	----	---	---	----	----	----	-----	----	----	-----	-----	------	R.& M.	No. 1653	
Parnall	Pipit	4.20	3.75	----	30	7.0	.56	3.20	11.1	7.97	----	----	11.75	21.0	.0181	A.C.	No. 99 - NACA	
Short	Valetta	4.20	3.90	6.15	24	7.0	.40	2.45	16.1	14.0	----	----	5.20	13.8	.0224	Fl.	7/25/30	827
Supermarine	S-6b	4.65	3.55	----	32½	8.0	----	----	41.3	2.6	----	----	50.6	43.6	.0060			
Vickers	Vildebeest	4.99	3.79	----	---	---	----	----	----	-----	----	----	-----	-----	------	R.& M.	No. 1653	
Do-------	Do------	4.58	3.83	----	---	---	----	----	----	-----	----	----	-----	-----	------	"	"	"

*Magazine abbreviations. A.C.- Aircraft Circular, Fl.- Flight, R.& M.- Reports and Memoranda.

TABLE VI.- GERMAN FLOAT SEAPLANES

Manufacturer	Model	Gross weight (lb)	Power (hp)	Wing Span (ft)	Wing Area (ft^2)	Tail Span (ft)	Tail Area (ft^2)	Tail Length (ft)	Beam (ft)	Fore-body length (ft)	After-body length (ft)	Step depth (in.)	Dead-rise angle (deg)	After-body angle (deg)	c.g. Forward step (ft)	c.g. Above keel (ft)	Float spacing (ft)	Get-away (mph)	C_{Δ_o}	C_{V_G}
Arado	Ar 95	2 × 3,930	880	41	488.2	----	----	----	3.6	12.8	13.5	---	17½	5.0	-----	---	-----	63	1.31	8.55
Blohm und Voss	Ha 139	2 × 17,600	2175	96.9	1399	----	----	----	4.75	22.5	18.0	---	15	---	-----	---	-----	84	2.56	10.0
Junkers	G2AW	2 × 7,170	----	----	------	----	----	----	4.59	----	----	---	--	---	-----	---	-----	--	1.17	-----
Do---------	A2OW	2 × 1,600	----	----	------	----	----	----	2.43	---	----	---	--	---	-----	---	-----	--	1.67	-----

Manufacturer	Model	Fore-body beam	After-body beam	Step height (% b)	Dead-rise (deg)	After-body angle (deg)	c.g. Forward beam	c.g. Above beam	Wing loading (lb/ft^2)	Power loading (lb/hp)	Aspect ratio Wing	Aspect ratio Tail	C_P	$C_{\Delta_o} \times C_{V_G}$	$\frac{C_{\Delta_o}}{C_{V_G}^2}$	References Mag.*	References Date	References Page
Arado	Ar 95	3.55	3.75	----	17½	5.0	-----	-----	16.2	8.90	----	----	7.54	11.2	0.0179	A.E.	11/40	326
Blohm und Voss	Ha 139	4.75	3.80	----	15	---	-----	-----	25.1	16.2	----	----	7.10	25.6	.0256	A.E.	8/41	218
Junkers	G2AW	----	----	----	--	---	-----	-----	----	-----	----	----	----	----	------	----	-----	---
Do---------	A2OW	----	----	----	--	---	-----	-----	----	-----	----	----	----	----	------	----	-----	---

*Magazine abbreviation. A.E.- Aircraft Engineering.

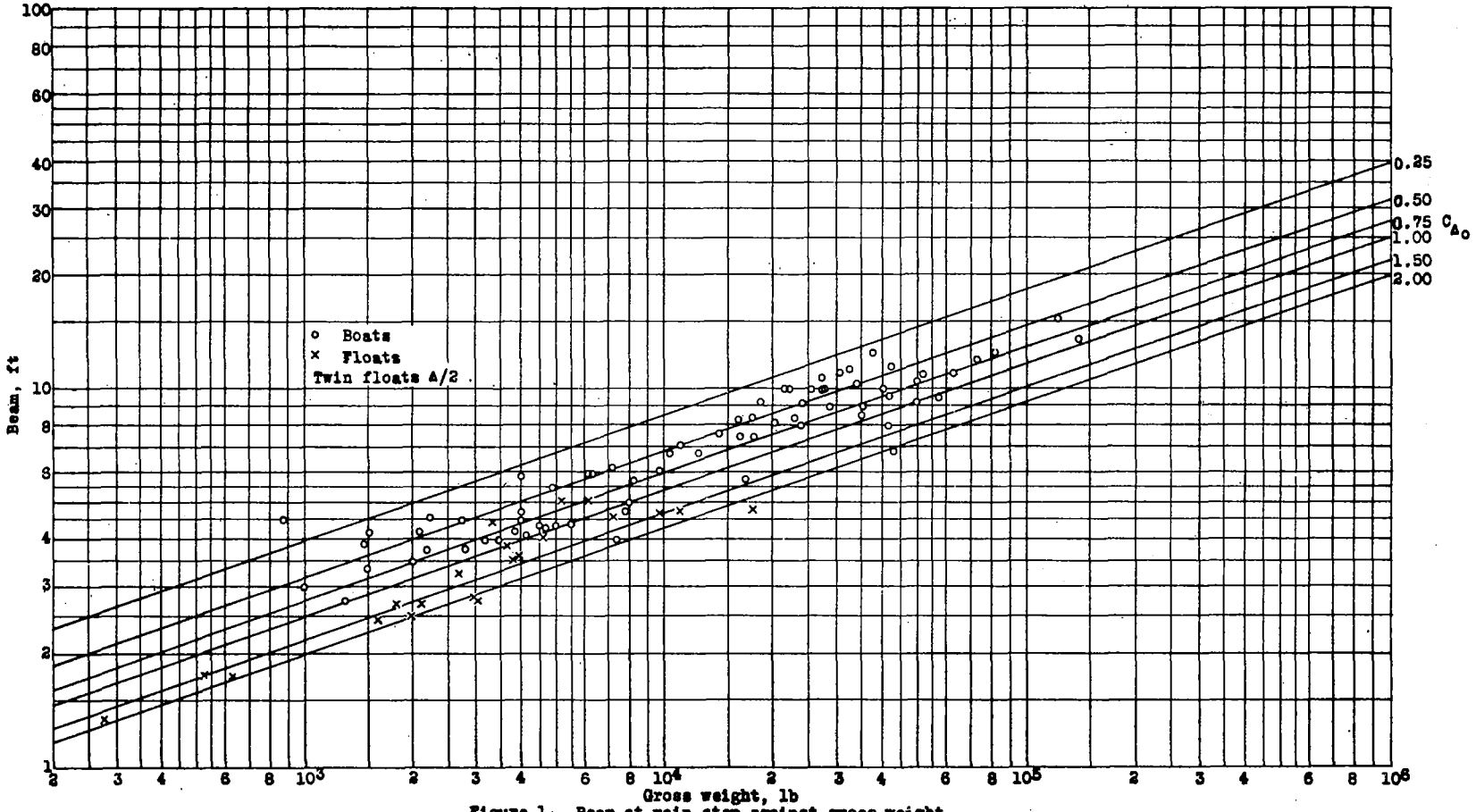

Figure 1.- Beam at main step against gross weight.

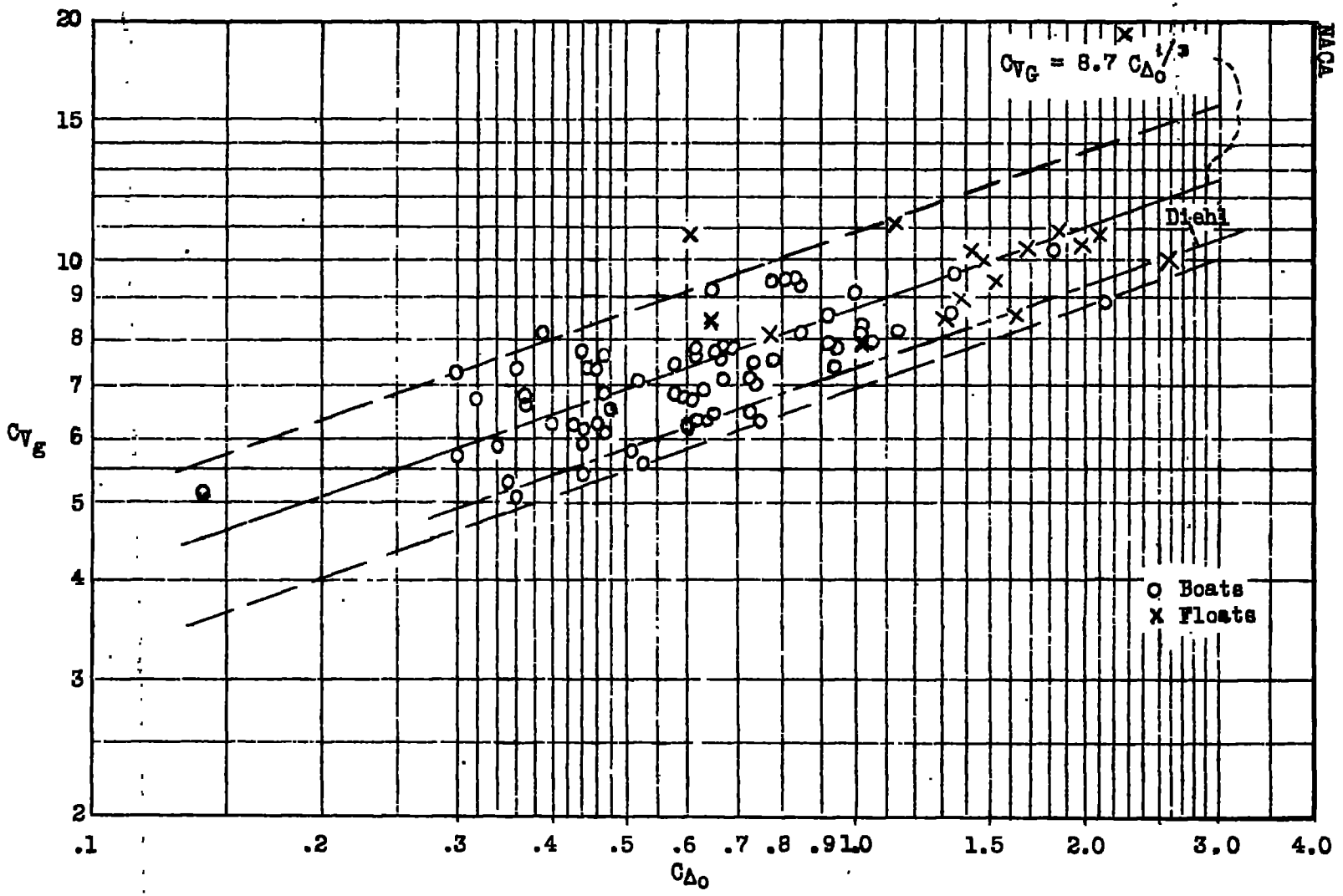

Figure 2.- Getaway speed coefficient plotted against static load coefficient.

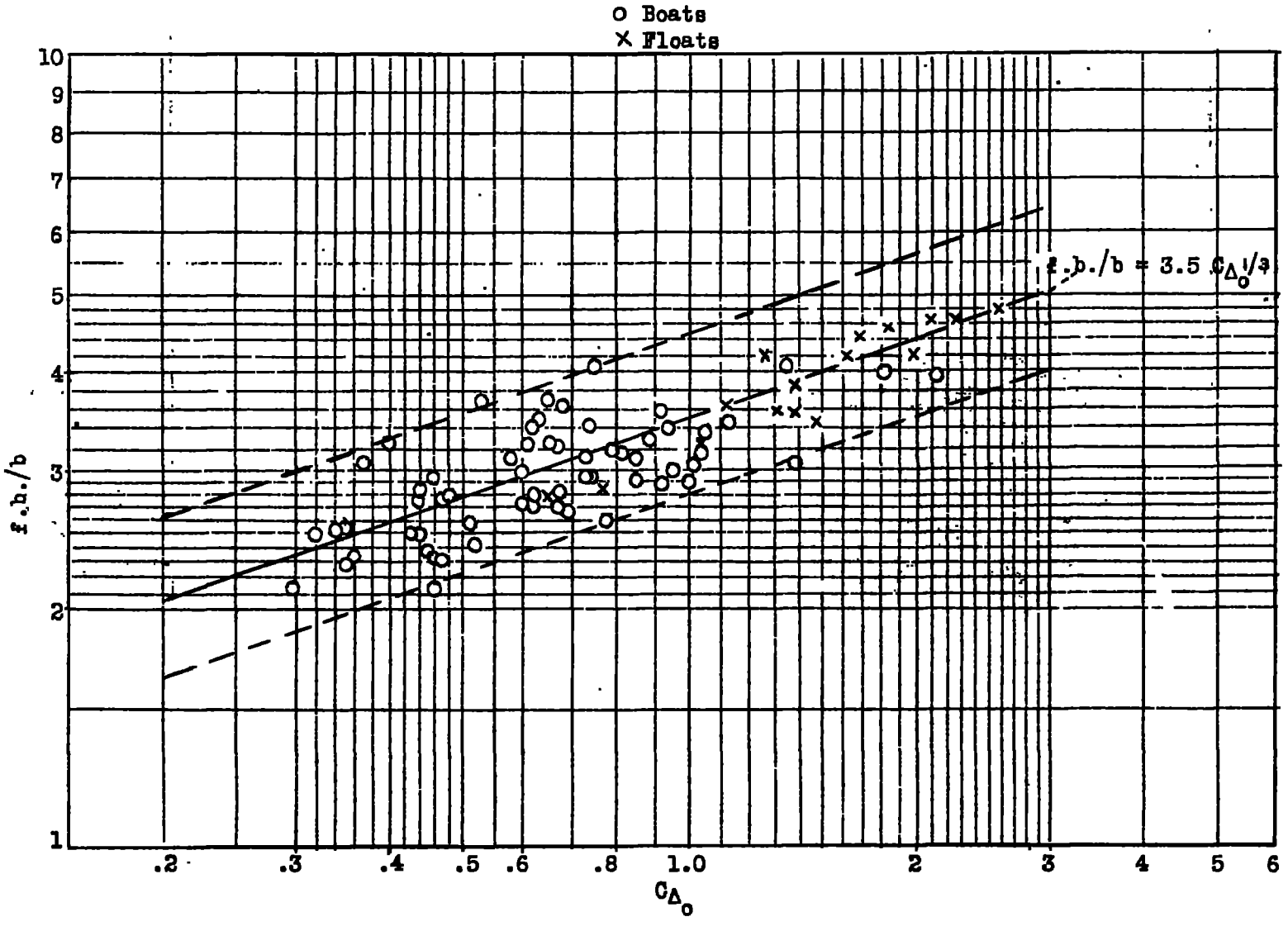

Figure 3.- Forebody length against load coefficient

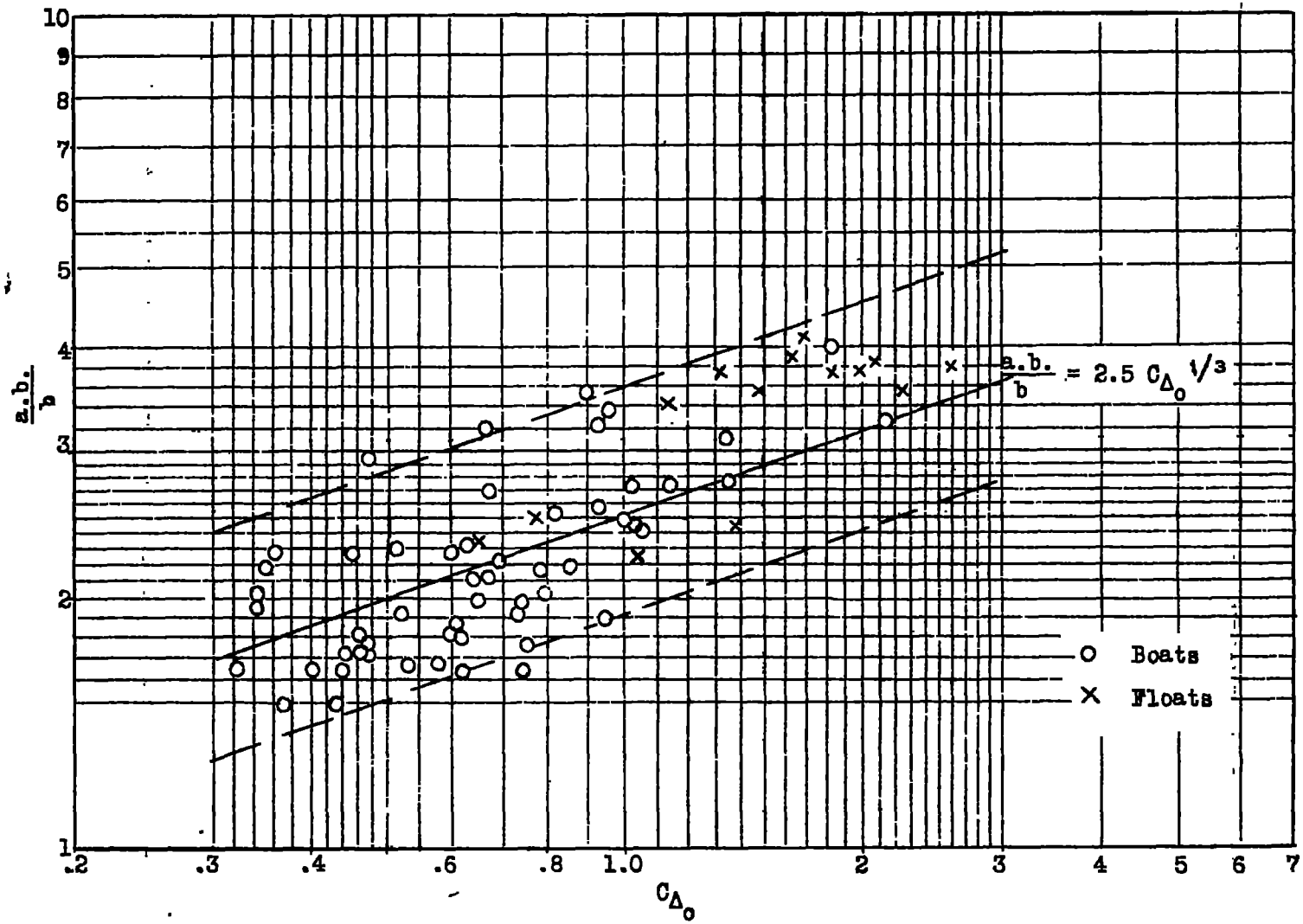

Figure 4.- Afterbody length against load coefficient.

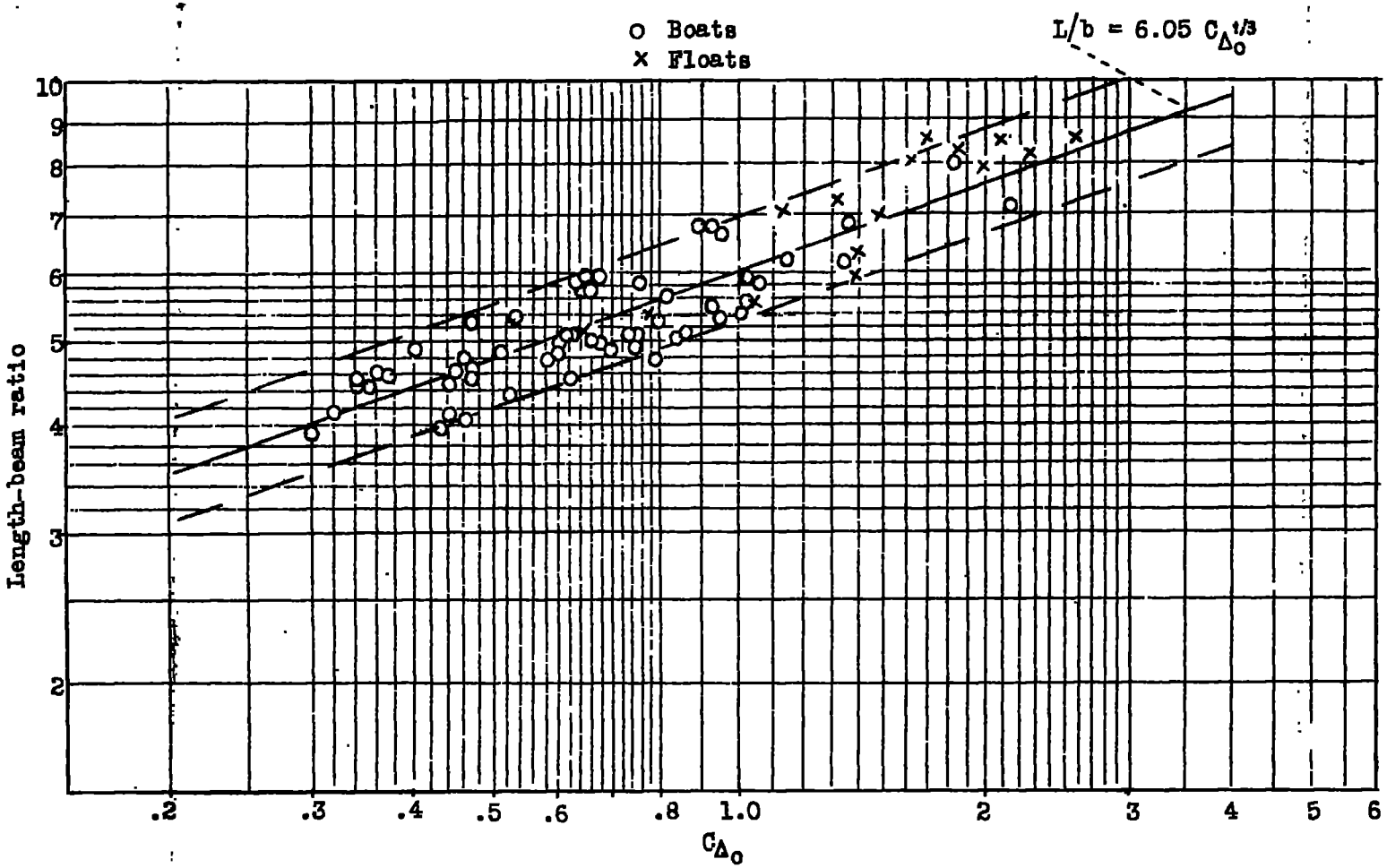

Figure 5.- Hull length against load coefficient.

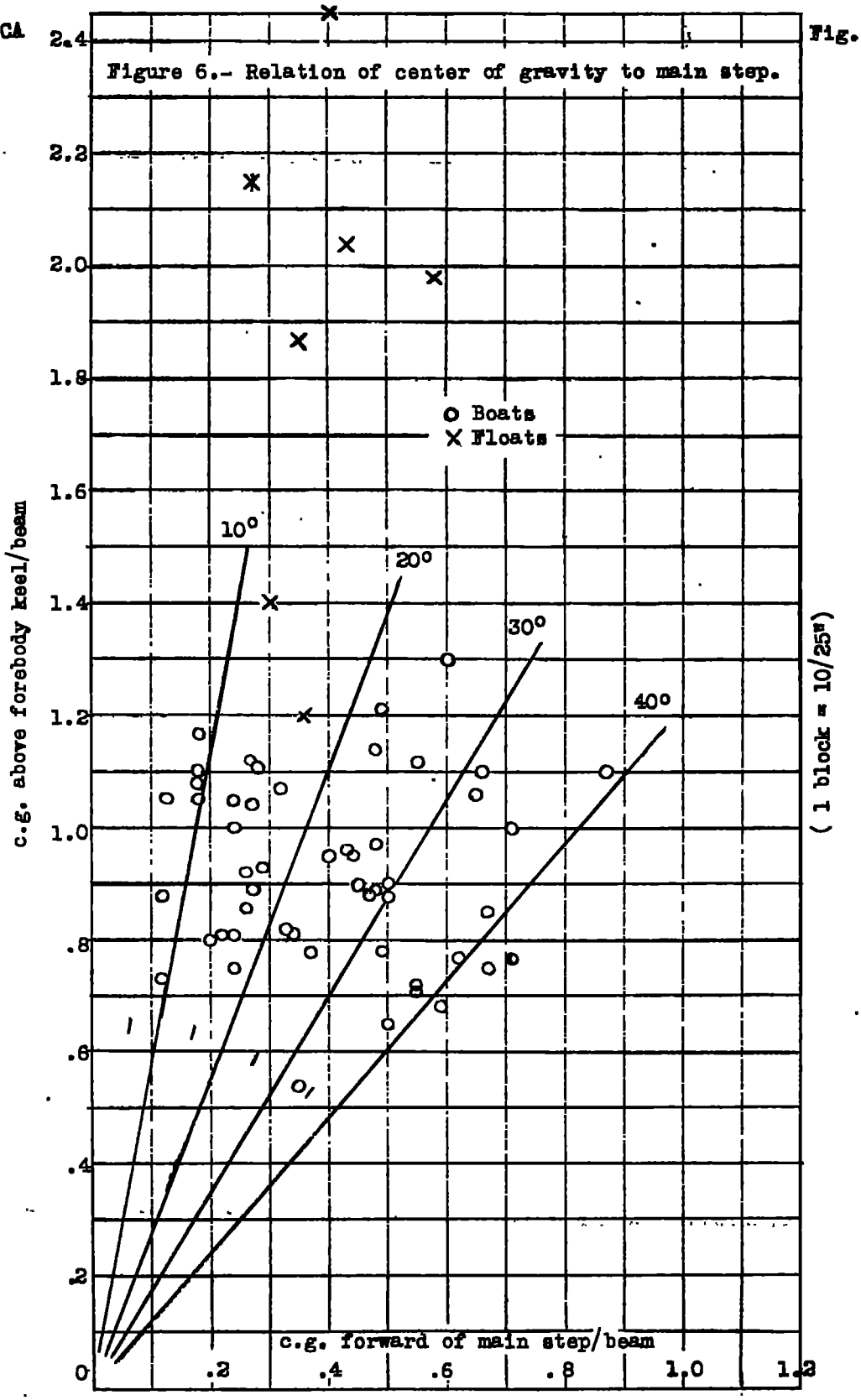

Figure 6.- Relation of center of gravity to main step.

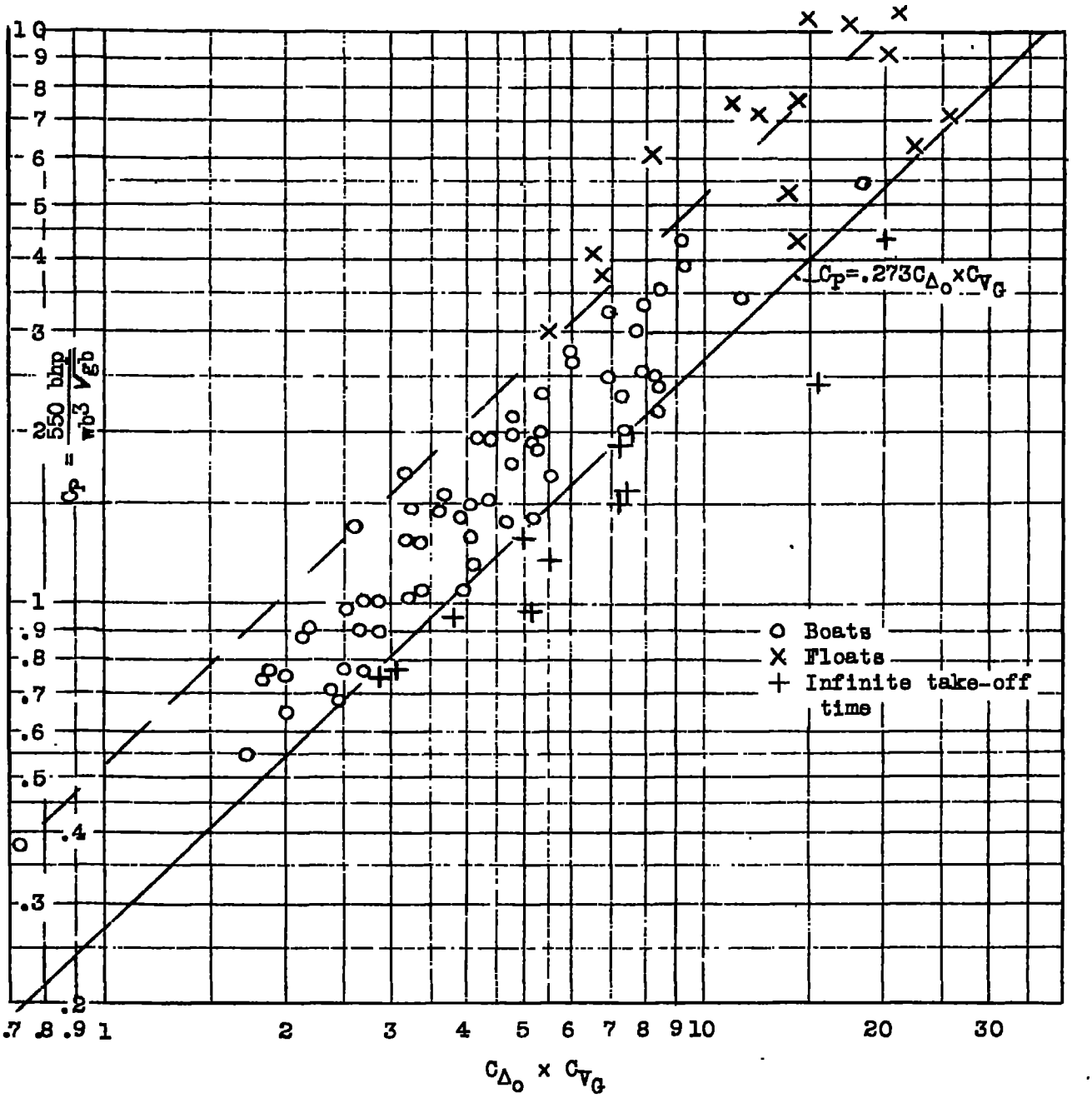

Figure 7.- Brake horsepower available plotted against product of static load and getaway speed coefficients.

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