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ENGINEERING REPORT NO.

R107B-004

SUBJECT

MASS MOMENTS OF INERTIA CALCULATIONS

RESTRICTED

MODEL: XC-120

FAIRCHILD AIRCRAFT

Division of

FAIRCHILD ENGINE & AIRPLANE CORPORATION

HAGERSTOWN, MARYLAND

Date: 6 May 1948

Prepared By J. W. O. Baker

No. Pages: 45 (PART I)
21 (PART II)
5 (PART III)
5 (PART IV)

Checked By

Approved By C. F. Comstock

REVISIONS

Date	Pages Affected	By	Remarks
2/14/49	All pages.	J.W.O.Baker	PART I completely revised.
2/14/49	All pages.	J. Myers	PART II completely revised.
2/14/49	All pages.	J.W.O.Baker	PART III completely revised.
2/14/49	Pages 72, 73, 74, 75, 76	J.W.O.Baker	PART IV Added.

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DATE 6 May 1948
REVISED 14 Feb 1949

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P R E F A C E

The purpose of this report is to give a preliminary figure for the Mass Moments of Inertia for airplane model XC-120 to agree with Specification R107-000A.

The airplane was assumed to be composed of six sections. The Outer Wing Panel; the Center Wing Section; the Engine Section, the Nacelle and Boom, which includes the propeller, engine, landing gear, and vertical tail; the Detachable Fuselage; Crew Nacelle; and the Horizontal Tail.

Each section is accompanied by a diagram showing the distributed loads in lbs. per linear inch and concentrated loads shown by arrows. In addition, the distributed and concentrated load center of gravities are shown on either a plan or profile view.

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FAIRCHILD ENGINE AND AIRPLANE CORP., FAIRCHILD AIRCRAFT DIV., HAGERSTOWN, MD. (ENGINEERING REPORT NO. R107B-004)

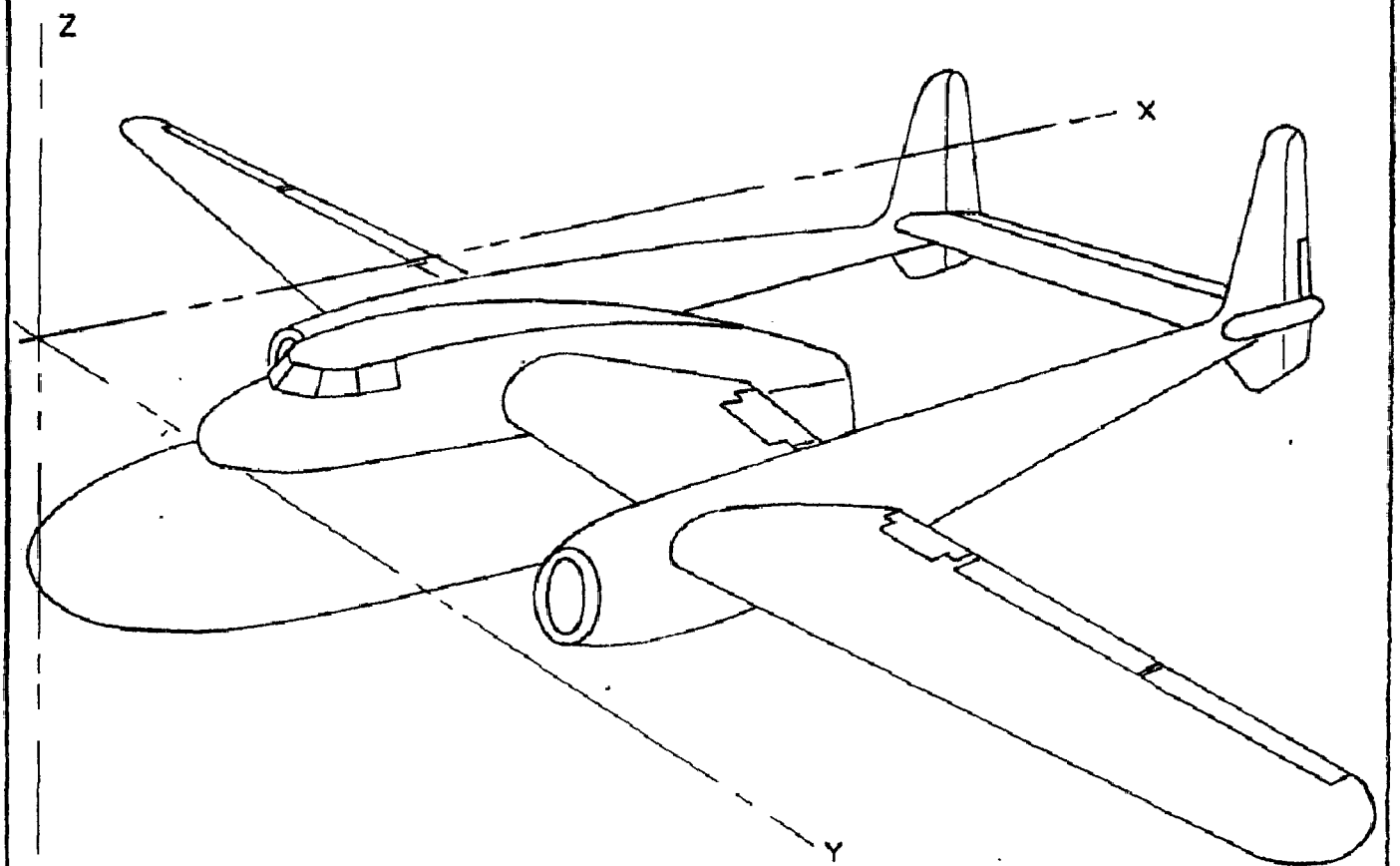
MASS MOMENTS OF INERTIA CALCULATIONS - MODEL XC-120

J.W. O. BAKER; J. MYERS; HAWLEY AND OTHERS 6 MAY'48 (REVISIONS 20 MARCH'50) 90PP. DIAGRS

STRUCTURES (7)
DESIGN AND DETAILS (3)

AIRPLANES - MOMENTS OF INERTIA
AIRPLANES, CARGO
C-120

RESTRICTED



REFERENCE DATA

X-Axis = Parallel to ℄ Fuselage and 172.2" above thrust line.

Y-Axis = Parallel to 40% chord and 370 ahead.

Z-Axis = Perpendicular to ℄ Fuselage 370 inches ahead of 40% chord.

Distance along Y-Axis noted as Y positive left.

Distance along X-Axis noted as X positive aft.

Distance along Z-Axis noted as Z positive down.

I Values given in lb. $\overline{in}^2$.

ITEM	PAGE	W	X		WX/10^3	WX^2/10^6	Y		Z/10	-Z/10	Z	WZ	WZ/10^6	Z(WZ)/10^7	Ix(yy)/10^6	Io(zz)/10^6	Ixx/10^6	Iyy/10^6	Izz/10^6	WXZ/10^6
Col. No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
O.P. Wing - Lt.	12	1739.5	373.[illegible]		649.13	242.83	356.5		620.13	[illegible]	351.[illegible]	[illegible]	36.73	.09	1.90	1.90	282.58	284.46	451.49	98.00
O.P. Wing - Rt.	12	1746.5	373.[illegible]		[illegible]	[illegible]	356.[illegible]		621.73	[illegible]	[illegible]	[illegible]	[illegible]	.09	1.90	1.90	282.70	286.25	489.06	98.53
C.S. Wing - Lt.	16	2346.0	368.4		864.[illegible]	318.99	139.5		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.03	1.97	1.97	[illegible]	370.99	368.33	120.01
C.S. Wing - Rt.	16	2346.0	368.4		864.[illegible]	318.99	139.5		303.75	[illegible]	145.5	[illegible]	[illegible]	.03	1.97	1.97	97.43	370.99	368.33	120.01
Horizontal Tail	27	763.2	926.3		706.98	654.92	[illegible]		[illegible]	5.88	149.7	[illegible]	[illegible]	.10	0.34	0.34	25.34	671.52	664.14	103.04
Nacelle & Boom Lt.	24	9638.5	306.3		2952.75	1179.52	175.0		1662.[illegible]	[illegible]	190.0	1832.30	302.55	5.[illegible]	3.43	3.50	663.14	3545.49	1478.34	544.93
Nacelle & Boom Rt.	24	9638.5	306.3		2952.75	1179.52	175.0		[illegible]	[illegible]	190.0	1832.30	302.55	5.[illegible]	3.43	3.50	663.14	3545.49	1478.34	544.93
Crew Nacelle	44	7125.6	333.5		2376.[illegible]	794.11	0		0	0	132.4	957.70	129.95	9.[illegible]	[illegible]	3.37	133.63	1128.43	[illegible]	[illegible]
* Total - Carrier		35,343.8	340.06		12,018.99	4133.23	0.04		1.5[illegible]	1179.7[illegible]	[illegible]	[illegible]	[illegible]	20.56	15.39	[illegible]	1251.19	6199.62	6328.51	1964.26
Detach Fuse.	34	5121.2	342.44		1753.70	[illegible]	0		0	0	[illegible]	[illegible]	[illegible]	[illegible].03	0.17	0.17	[illegible].28	1025.52	[illegible].27	634.19
* Total - Airplane		40465.0	340.36		13772.69	5674.43	0.04		1.[illegible]	[illegible]	179.[illegible]	[illegible]	[illegible]	21.59	15.56	[illegible]	[illegible]	7225.14	[illegible]	2598.45

* Static Position - For Retraction See Pg. 24
For Fuel Load Outer Panel See Pg. 12
For Fuel Load Center Section See Pg. 16

WEIGHT DISTRIBUTION

(A-) Items in Outer Panel
(B-) Items in Center Section
(C-) Items in Boom and Vertical Tail
(D-) Items in Nacelle and Engine Section
(E-) Items in Detachable Fuselage
(F-) Items in Detachable Fuselage
(G-) Items in Horizontal Tail
(H-) Items in Crew Nacelle
(J-) Items in Crew Nacelle

(1) Wing - C.S.			= 3723.7
B-1	=	2335.5	
B-2	=	52.7	
B-3	=	98.8	
B-4	=	58.8	
B-5	=	43.5	
B-6	=	775.8	
B-7	=	9.9	
B-8	=	7.5	
B-9	=	82.6	
B-10	=	30.0	
B-11	=	122.6	
B-12	=	106.0	
(2) Wing - O.P.			= 2769.5
A-1	=	1972.8	
A-3, 4A, & 4B	=	20.9	
A-5	=	97.7	
A-6	=	400.8	
A-7	=	70.2	
A-8	=	155.8	
A-22	=	51.3	
(3) Tips			
A-2	=	72.0	= 72.0
(4) Ailerons			= 212.2
A-3	=	65.6	
A-4A	=	79.6	
A-4B	=	67.0	
(5) Flaps			= 171.5
A-22	=	86.9	
B-2	=	84.6	

WEIGHT DISTRIBUTION

(6)	Stabilizer - Main		
	G-2	= 444.4	= 444.4
(7)	Stabilizer - Tips		
	G-1	= 71.3	= 71.3
(8)	Elevator		
	G-3	= 209.5	= 209.5
(9)	Fins		
	C-4	= 203.0	= 203.0
(10)	Rudders		
	C-3	= 161.2	= 161.2
(11)	Detachable Fuselage		
	F-1 to F-18	= 4820.1	= 4820.1
(12)	Crew Nacelle		
	H-1 to H-18	= 2372.1	= 2372.1
(13)	Booms		
	C-1	= 180.0	= 955.4
	C-2	= 755.4	
(14)	Main Landing Gear		
	B-17	= 495.2	= 4034.3
	D-24	= 1370.4	
	D-25	= 1292.0	
	D-26	= 289.2	
	D-27	= 375.6	
	D-28	= 34.6	
	J-1	= 177.3	
(15)	Auxiliary Gear - Bwd.		
	D-33	= 310.0	= 1421.6
	D-34	= 269.6	
	D-35	= 240.0	
	D-36	= 90.0	
	D-37	= 270.0	
	D-38	= 242.0	

Subject:— MASS MOMENTS OF INERTIA CALCULATIONS

WEIGHT DISTRIBUTION

(16) Nacelle			= 3213.0
D-1 to D-11	= 3213.0		
(17) Engine			= 7066.0
D-12	= 7066.0		
(18) Engine Accessories			= 505.9
B-13	= 60.0		
D-13	= 354.2		
D-15	= 50.3		
D-16	= 16.0		
D-14	= 25.4		
(19) Power Plant Controls			= 104.8
B-14	= 12.0		
J-2	= 64.2		
J-3	= 28.6		
(20) Propeller and Controls			= 1436.0
D-17	= 1320.0		
D-18	= 37.8		
J-4	= 7.0		
J-5	= 25.0		
J-6	= 42.4		
J-7	= 3.8		
(21) Starting System			= 56.0
D-19	= 56.0		
(22) Lubricating System			= 467.9
D-20	= 203.3		
D-21	= 112.3		
D-22	= 152.3		
(23) Fuel System			= 531.6
A-12	= 245.0		
B-18	= 126.3		
D-23	= 160.3		
(24) Instruments			= 196.5
A-23	= 6.0		
A-24	= 6.0		
B-19	= 6.0		
D-32	= 21.8		
J-8	= 77.2		

WEIGHT DISTRIBUTION

(24) Instruments (cont'd.)			
J-9	= 0		
J-10	= 54.7		
J-11	= 24.8		
(25) Surface Controls		=	944.7
A-9	= 21.7		
A-10	= 50.0		
A-11	= 5.5		
B-15	= 38.4		
G-4	= 38.0		
C-7 to C-12	= 92.7		
J-12 to J-19	= 698.4		
(26) Electrical		=	874.6
B-16	= 53.8		27.1
D-29	= 92.0		901.7
D-31	= 53.5		
E-1	= 27.1		
J-20 to J-27	= 675.3		
(27) Communicating		=	818.7
A-13	= 11.2		4.5
E-2	= 4.5		823.2
J-28 to J-30	= 807.5		
(28) Furnishings - Personnel Accom.		=	401.6
J-31 to J-40	= 401.6		
(29) Furnishings - Emergency Accom.		=	223.3
D-30	= 89.7		8.8
J-41 to J-44	= 133.6		232.1
E-7	= 8.8		
(30) Furnishings - Prov. For Flight		=	184.8
E-3	= 182.6		260.7
E-4	= 56.4		455.5
E-5	= 2.0		
E-6	= 19.7		
J-45 to J-48	= 184.8		

WEIGHT DISTRIBUTION

(31) Furnishings - Air Conditioning Equip.			= 212.0
J-49	=	212.0	
(32) Anti-Icing Equipment			= 704.4
B-20	=	42.0	
B-21	=	50.0	
C-5	=	33.4	
C-6	=	24.0	
J-50	=	331.5	
J-51	=	223.5	
(33) Acc. Power Plant			= 162.0
J-52	=	162.0	
(34) Hoisting Mechanism	=	418.3	= 418.3
(35) TOTAL W.E. less Detachable Fuse.			= 35,343.8
"A" Items	=	3,486.0	
"B" Items	=	4,692.0	
"C" Items	=	1,469.7	
"D" Items	=	17,807.3	
"G" Items	=	763.2	
"H" Items	=	2,372.1	
"J" Items	=	4,753.5	
(36) TOTAL W.E. Detachable Fuse.			= 5,121.2
"E" Items	=	301.1	
"F" Items	=	4,820.1	
(37) TOTAL W.E.			= 40,465.0

Subject:— MASS MOMENTS OF INERTIA CALCULATIONS

OUTBOARD PANEL, AILERONS, OUT'B. FLAPS, TIPS & EQUIPMENT

The following weights were considered:

(A-1) Bending Material consisting of -

Front Spar	=	425.4		
Rear Spar	=	186.2		
Stringers	=	131.1		
Covering	=	1066.6		
Tank Covers	=	75.3		
Rivets, etc.	=	79.8		
Inspection Doors	=	5.8		
Handling Bolts	=	2.6		
		1972.8	x 1/2 =	986.4

(A-2) Tips 72.0 x 1/2 = 36.0

(A-3) Outboard Ailerons

End Reaction	= 3/16 x 65.6	= 12.3		
Fitting	= 1/6 x 20.9	= 3.5		
Inboard		= 15.8	x 1/2 =	7.9
Outboard		= 15.8	x 1/2 =	7.9
Center Reaction	= 5/8 x 65.6	= 41.0		
Fitting	= 1/6 x 20.9	= 3.5		
		44.5	x 1/2 =	22.3

(A-4A) Rt. Inboard Aileron

End Reaction	= 3/16 x 79.6	= 14.9		
Fitting	= 1/12 x 20.9	= 1.7		
Inboard	=	= 16.6	=	16.6
Outboard			=	16.6
Center Reaction	= 5/8 x 79.6	= 49.7		
Fitting	= 1/12 x 20.9	= 1.7		
		51.4	=	51.3

(A-4B) Lt. Inboard Aileron

End Reaction	= 3/16 x 67.0	= 12.6		
Fitting	= 1/12 x 20.9	= 1.7		
Inboard		14.3	=	14.3
Outboard			=	14.3

OUTBOARD PANEL, AILERONS,
OUTB. FLAPS, TIPS & EQUIPMENT

(A-4B) Lt. Inboard Aileron (cont'd.)

Center Reaction = 5/8 x 67.0 = 41.8
Fitting = 1/12 x 20.9 = 1.7
43.5 = 43.5

(A-5) Hinges, etc.
Hinges = 62.9
Fairings = 18.7
Corrugation Fittings = 16.1
97.7 x 1/2 = 48.8

(A-6) Ribs and Formers
Ribs = 386.4
Formers = 14.4
400.8 x 1/2 = 200.4

(A-7) Fuel Cell Liner = 70.2 x 1/2 = 35.1

(A-8) Prov. for Equipment Less (A-7) = 226.0
- 70.2
155.8 x 1/2 = 77.9

(A-9) Controls - Aileron Droop 21.7 x 1/2 = 10.9

(A-10) Controls - Aileron Rods, etc. (24 + 26) 1/2 = 25.0

(A-11) (Lt. Only) Auto-Pilot - Gyro Flux Gate Compass = 5.5

(A-12) Fuel Cells 245.0 x 1/2 = 123.5

(A-13A) Antenna - AN/APN-12 (outb'd.) 5.6 x 1/2 = 2.8

(A-13B) Antenna - AN/APN-12 (inb'd.) 5.6 x 1/2 = 2.8

(A-14) Fuel - Cell No. 5A = 118.7 gal. = 712.2

(A-15) Fuel - Cell No. 5 = 115.6 gal. = 693.6

(A-16) Fuel - Cell No. 6 = 111.4 gal. = 668.4

(A-17) Fuel - Cell No. 7 = 104.1 gal. = 624.6

Subject: MASS MOMENTS OF INERTIA CALCULATIONS

OUTBOARD PANEL, AILERONS,
OUTB. FLAPS, TIPS & EQUIPMENT

(A-18) Fuel - Cell No. 8 = 98.5 gal. = 591.0

(A-19) Fuel - Cell No. 9 = 90.7 gal. = 544.2

(A-20) Fuel - Cell No. 10 = 82.8 gal. = 496.8

(A-21) Fuel - Cell No. 10A = 90.2 gal. = 541.2

(A-22) Flaps & Hinges

Flaps = 1/2 x 86.9 = 43.5
Hinges = 1/2 x 51.3 = 25.7
Inboard 69.2 x 1/2 = 34.6

Outboard = 34.6

(A-23) Instruments - Tank Unit - Inb'd. = 6.0 x 1/2 = 3.0

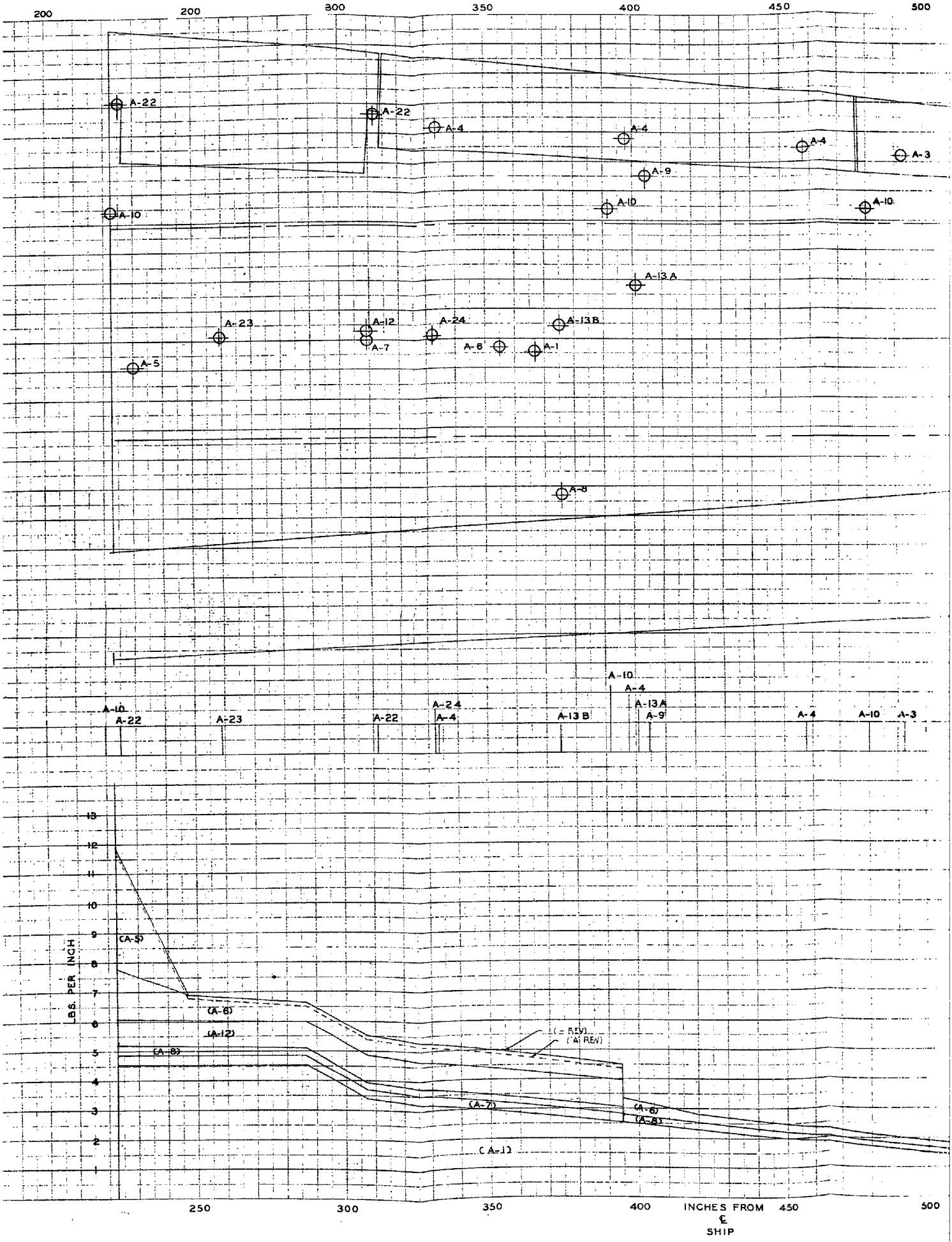
(A-24) Instruments - Tank Unit - Outb'd. = 6.0 x 1/2 = 3.0

*** Fuel Load
** Rt. Side Only
* Lt. Side Only
(a) = Io(xx) = 0.0833 W Δy^2 (b) = Io(yy) = Io(zz) = 0.0833 W Δx^2

REPORT NO. R107B-004	FAIRCHILD AIRCRAFT DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION	45 PAGES	PAGE 12
MODEL YC120	PREPARED BY / CHECKED BY	APPROVED BY	
Subject: MASS MOMENTS OF INERTIA CALCULATIONS		DATE 6 May 1948 / REVISED 21 July 1948 / 14 Feb. 1949	

OUTBOARD PANELS

STATION	AVER. W	W	X	ΔX	WX/10³	WX²/10⁶	Y	ΔY	WY/10³	WY²/10⁶	Z	WZ/10³	WZ²/10⁶	Io(xx)/10⁶	Io(yy)/10⁶	Io(zz)/10⁶	Ixx/10⁶	Iyy/10⁶	Izz/10⁶	WXZ/10⁶
Column No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Operations		2 x 9			3 x 4	4 x 6			3 x 8	8 x 10		3 x 12	12 x 13	(a)	(b)	(b)	11+14+15	7+14+16	7+11+17	6 x 12
645 to 655.6	0.45	4.8	375.5	50.0	1.82	.69	650.3	10.6	3.12	2.02	137.2	0.66	[illegible]	0	0	0	[illegible].12	.76	2.72	.25
614.2 to 645	1.00	30.8	379.5	99.5	11.69	4.44	629.6	30.8	19.39	12.21	138.2	[illegible]	[illegible]	0	.03	.03	12.80	5.06	16.68	1.62
590 to 614.2	1.40	33.9	362.5	96.0	12.29	4.46	602.1	28.2	20.41	12.29	136.7	[illegible]	[illegible]	0	.03	.03	12.95	5.15	16.78	1.72
542 to 590	1.40	67.2	361.6	100.0	24.30	8.79	566.0	48.0	38.04	21.53	141.8	9.53	1.35	.01	.06	.09	22.59	10.22	30.40	3.45
510 to 542	1.61	51.5	361.5	105.0	18.62	6.73	526.0	32.0	27.09	14.25	143.5	7.39	1.06	0	.05	.05	15.31	7.84	21.03	2.67
480 to 510	1.93	57.9	362.0	109.0	20.96	[illegible]	495.0	30.0	[illegible]	14.19	145.0	8.[illegible]	1.22	0	.06	.07	17.41	8.87	21.84	3.04
450 to 480	2.28	68.4	361.5	112.5	24.73	[illegible]	465.0	30.0	31.86	14.79	146.4	[illegible]	1.48	.01	.07	.09	[illegible].28	10.49	23.60	3.62
420 to 450	2.63	78.8	361.5	116.0	28.49	[illegible]	435.0	30.0	34.[illegible]	14.91	146.0	[illegible]	1.73	.01	.09	[illegible]	[illegible].55	12.12	25.30	4.22
394.5 to 420	3.06	78.5	361.3	119.5	28.36	10.23	407.3	25.5	31.27	13.02	149.1	[illegible].70	1.74	0	.09	.14	14.76	12.08	23.36	4.23
370 to 394.5	4.54	111.3	365.0	122.2	40.62	14.83	382.3	24.5	41.[illegible]	8.87	150.2	[illegible]	2.51	.01	.14	.19	11.39	17.48	23.84	6.10
340 to 370	4.82	144.6	364.9	125.5	52.76	19.25	355.0	30.0	51.[illegible]	18.22	151.7	[illegible]	3.33	.01	.19	.24	[illegible].56	22.77	37.66	8.03
307 to 340	5.20	171.6	364.9	129.4	[illegible].62	22.85	323.5	33.0	[illegible]	17.96	153.0	[illegible]	4.02	.02	.24	.16	[illegible].00	27.11	41.05	9.58
286 to 307	5.95	125.0	365.0	123.2	45.63	16.[illegible]	296.5	21.0	37.08	10.[illegible]	154.3	[illegible]	2.96	0	.16	.18	13.97	19.79	27.80	7.04
265 to 286	6.59	138.4	364.8	126.0	50.49	[illegible]	275.5	21.0	38.1[illegible]	10.50	[illegible]	[illegible]	3.53	.01	.15	.17	11.84	21.93	29.10	7.84
246.5 to 265	6.68	123.6	364.6	128.8	45.06	[illegible]	255.8	18.5	31.62	8.09	[illegible]	[illegible]	3.02	0	.17	.[illegible]	11.11	16.62	24.69	7.04
222.6 to 246.5	9.24	220.8	363.9	131.5	80.35	[illegible]	234.6	23.9	51.[illegible]	[illegible]	[illegible]	[illegible]	5.46	.01	.22	[illegible]	17.60	35.00	41.71	12.61
* 608		5.5	372.0		2.05	.76	608.0		[illegible]	[illegible]	[illegible]	.07	.11	0	0	0	.04	.07	2.79	.29
601		7.9	425.2		[illegible]	1.43	601.0		[illegible]	[illegible]	[illegible]	[illegible]	.15	0	0	0	3.00	1.58	4.26	.47
541.5		22.3	429.0		[illegible].57	[illegible].11	541.9		[illegible]	6.55	[illegible]	.10	.49	0	0	0	7.00	4.56	10.66	1.37
541.5		3.0	414.0		1.24	.51	541.5		1.62	.88	[illegible]	[illegible]	.06	0	0	0	.94	.57	1.39	.18
492.5		7.9	432.0		3.41	[illegible]	492.5		3.89	1.92	[illegible]	[illegible]	.17	0	0	0	2.09	1.64	3.39	.49
480.0		3.0	414.0		1.24	[illegible]	480.0		1.44	.69	[illegible]	[illegible]	.06	0	0	0	.75	.57	1.20	.18
* 457.5		14.3	434.5		6.21	[illegible]	457.5		5.54	2.99	[illegible]	[illegible]	.34	0	0	0	3.30	3.02	5.69	.91
404.5		10.9	425.0		4.63	[illegible]	404.5		[illegible]	1.[illegible]	[illegible]	[illegible]	.24	0	0	0	2.02	2.21	3.75	.69
401.0		2.8	387.0		1.08	.42	401.0		1.[illegible]	[illegible]	[illegible]	[illegible]	.06	0	0	[illegible]	.51	.49	.87	.16
* 397.5		43.5	438.0		19.05	8.34	397.5		[illegible]	[illegible].7	[illegible]	[illegible]	.98	0	0	[illegible]	7.85	9.32	15.21	2.85
391.5		13.0	414.0		[illegible].38	2.23	391.5		[illegible]	[illegible].29	[illegible]	[illegible]	.29	0	0	[illegible]	[illegible].28	2.52	4.32	.81
374.8		2.8	374.0		1.05	.39	374.8		1.05	.39	[illegible]	[illegible]	.06	[illegible]	0	0	.45	.45	.78	.16
* 333.5		14.3	442.0		6.32	[illegible]	333.5		4.77	1.59	[illegible]	[illegible]	.33	0	[illegible]	0	1.92	3.12	4.38	.97
332.1		3.0	371.0		1.11	[illegible]	332.1		1.00	.33	[illegible]	[illegible]	.07	0		0	.40	.48	.74	.17
311.5		34.6	446.5		15.45	[illegible]	311.5		10.[illegible]	[illegible]	[illegible]	[illegible]	.79	0	[illegible]	[illegible]	[illegible].04	7.47	9.93	2.30
259.1		3.0	371.0		1.11	.41	259.1		[illegible]	.20	[illegible]	[illegible]	.07	0	[illegible]		.27	.48	.61	.17
225.0		34.6	451.0		15.60	[illegible].81	225.0		[illegible]	[illegible].70	[illegible]	[illegible]	.83	0	[illegible]		[illegible].53	7.64	8.51	2.38
222.6		6.0	414.0		[illegible].48	1.03	222.6		1.[illegible]	.30	[illegible]	[illegible]	.15	0			.45	1.11	1.13	.39
Total Lt. Side		1739.5	373.2		649.13	242.[illegible]	356.5		[illegible]	[illegible]	[illegible]	26.[illegible]	[illegible]	.59	1.70	1.70	[illegible].58	284.16	467.49	98.00
** 457.5		16.6	434.5		7.21	[illegible]	457.5		[illegible]	[illegible]	[illegible]	[illegible]	.36	.0	0	0	3.83	3.49	6.60	1.06
** 397.5		51.3	438.0		22.47	[illegible]	397.5		20.[illegible]	8.[illegible]	[illegible]	[illegible]	1.15	0	0	0	9.26	10.99	17.75	3.37
** 333.5		16.6	442.0		7.34	[illegible]	333.5		5.[illegible]	1.85	[illegible]	[illegible]	.39	0	0	0	2.24	3.63	5.09	1.12
Total Rt. Side		1746.5	373.4		652.52	244.[illegible]	356.0		621.71	242.[illegible]	[illegible]	[illegible]	[illegible]	.02	1.90	1.90	[illegible].70	286.25	469.06	98.53
*** 369.9 to 394.4		311.2	372.5	71.9	201.60	[illegible].10	382.2	24.5	207.[illegible]	79.06	[illegible]	[illegible]	[illegible]	.03	[illegible]	.23	[illegible].30	87.54	154.39	30.28
*** 348.9 to 369.9		496.8	372.5	71.9	185.[illegible]	68.93	359.4	21.0	17[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.02	.21	.23	75.58	80.53	133.31	28.02
*** 327.9 to 348.9		544.2	372.5	71.9	202.71	[illegible].51	338.4	21.0	184.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.02	.23	.23	[illegible].98	88.38	138.06	30.89
*** 306.9 to 327.9		591.0	372.5	71.9	220.15	82.01	317.4	21.0	187.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.02	.25	.25	[illegible].47	96.17	141.60	33.77
*** 285.9 to 306.9		624.6	372.5	71.9	232.66	[illegible].7	296.4	21.0	185.[illegible]	[illegible]	[illegible]	[illegible]	14.68	.02	[illegible]	.27	[illegible].77	101.82	141.81	35.92
*** 264.9 to 285.9		658.4	372.5	71.9	245.98	[illegible]	275.4	21.0	181.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.02	.29	.29	[illegible].85	109.18	143.73	38.69
*** 243.9 to 264.9		693.[illegible]	372.5	71.9	258.37	[illegible]	254.4	21.0	176.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.03	.30	.30	[illegible].89	113.51	141.43	40.41
*** 222.6 to 243.9		712.2	372.5	71.9	265.30	[illegible]	233.3	21.3	166.[illegible]	38.7[illegible]	[illegible]	[illegible]	[illegible].68	.0	.32	.31	[illegible].37	116.71	137.89	41.68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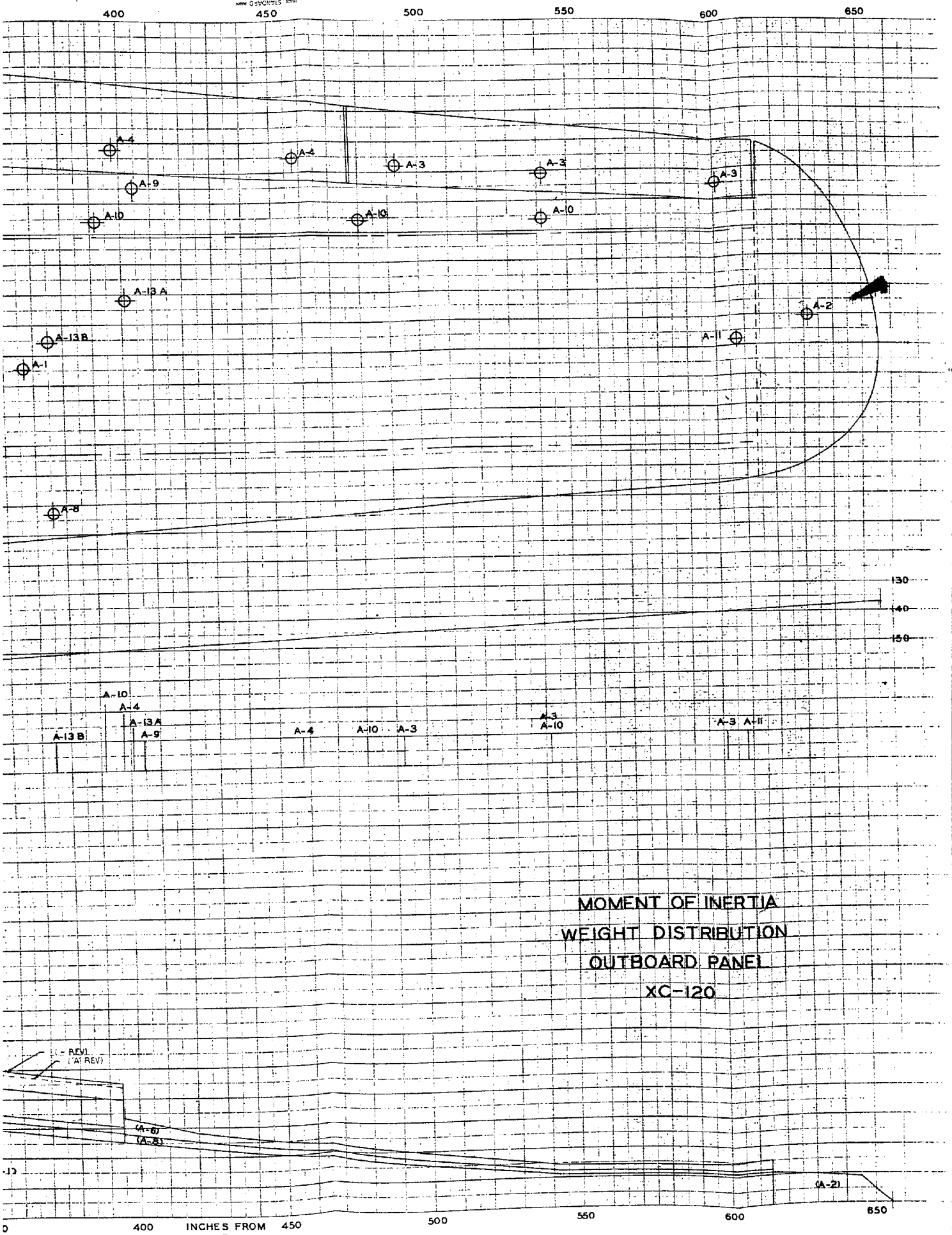

MOMENT OF INERTIA
WEIGHT DISTRIBUTION
OUTBOARD PANEL
XC-120

MODEL XC-120 PREPARED BY CHECKED BY APPROVED BY

DATE 6 May 1948
REVISED 14 Feb. 1949

Subject:— MASS MOMENTS OF INERTIA CALCULATIONS

CENTER SECTION, INB'D. FLAPS AND EQUIPMENT

The following items were considered:

(B-1) Bending Material consisting of -

Front Spar	=	600.0		
Rear Spar	=	352.0		
Stringers	=	26.0		
Covering	=	1088.5		
Tank Covers	=	123.8		
Handling Bolts	=	22.5		
Rivets, Nuts	=	122.7		
		2335.5	x 1/2	= 1167.8

(B-2) Flaps and Hinges

Flaps	= 1/2 x 84.6	= 42.3		
Hinges	= 1/2 x 52.7	= 26.3		
Inboard		68.6	x 1/2	= 34.3
Outboard				= 34.3

(B-3) Misc. at 222.5

Hinges	=	80.6		
Fairing	=	4.6		
Corrugation Fitting	=	13.6		
		98.8	x 1/2	= 49.4

(B-4A)	Fairing Sta. 61	= 34.5	x 1/2	= 17.3
(B-4B)	Fairing Sta. 175	= 24.3	x 1/2	= 12.1
(B-5)	Corr. Fitting at Sta. 2	= 43.5	x 1/2	= 21.8

(B-6) Rib and Formers

Ribs	=	710.6		
Formers	=	65.2		
		775.8	x 1/2	= 387.9

(B-7)	Jack Points	9.9	x 1/2	= 5.0
(B-8)	Misc. Fittings Sta. 2	7.5	x 1/2	= 3.7
(B-9)	Misc. Fittings Sta. 65	82.6	x 1/2	= 41.3
(B-10)	Fuel Cell Liner	30.0	x 1/2	= 15.0
(B-11)	Prov. for Equip. at Nacelle	122.6	x 1/2	= 61.3

MODEL XC-120 PREPARED BY CHECKED BY APPROVED BY

DATE 6 May 1948
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Subject: MASS MOMENTS OF INERTIA CALCULATIONS

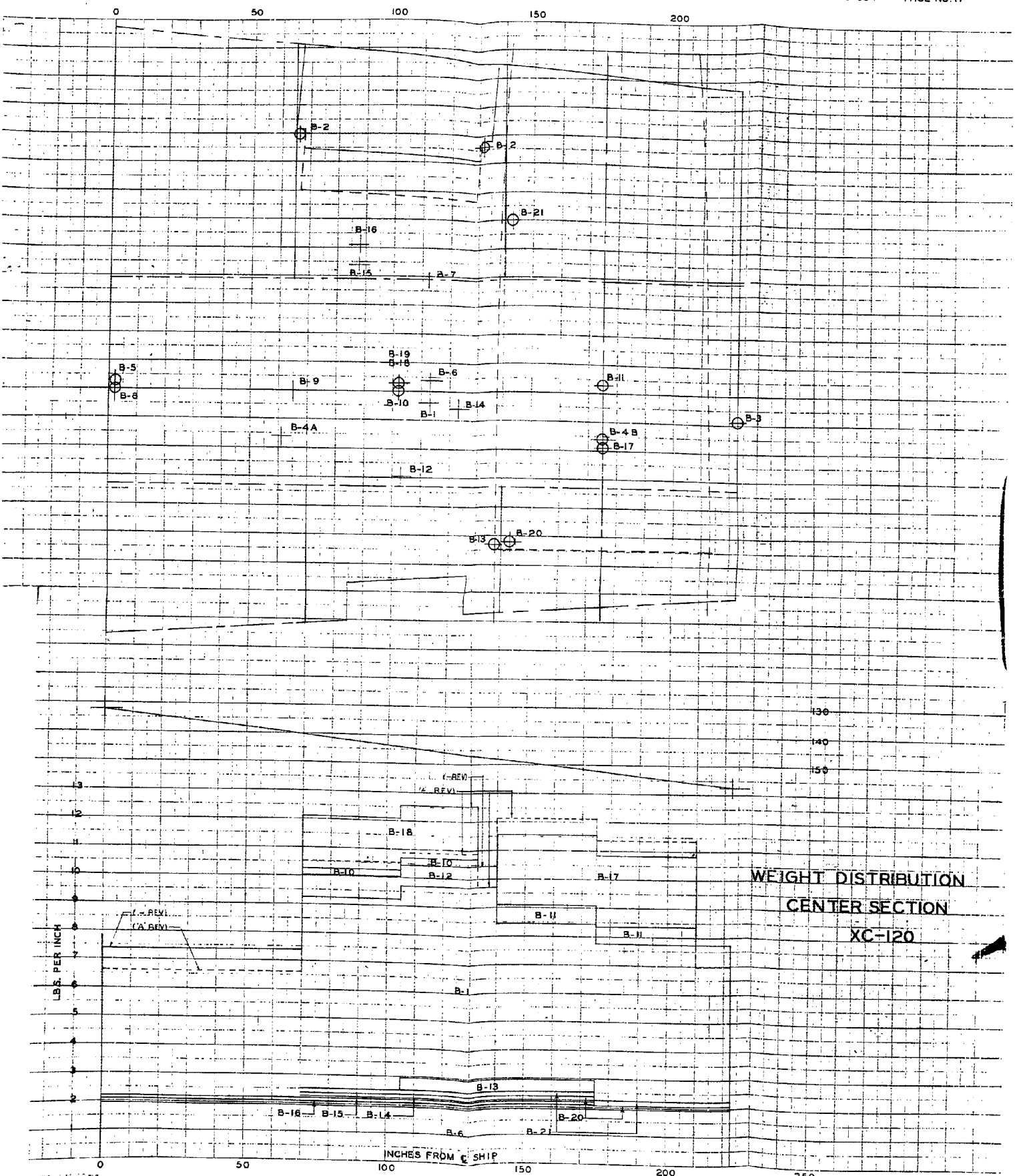
CENTER SECTION, INB'D.
FLAPS AND EQUIPMENT

(B-12)	Prov. for Equipment - Anti-Icing		106.0 x 1/2	=	53.0
(B-13)	Air Intake - Carb.		60.0 x 1/2	=	30.0
(B-14)	Controls - Engine		12.0 x 1/2	=	6.0
(B-15)	Controls - Surface		38.4 x 1/2	=	19.2
(B-16)	Electrical		53.8 x 1/2	=	26.9
(B-17)	Main Landing Gear - Less Brake Oper. Mechanism and Basic Structure				
	M.L.G.	= 4034.3			
	Brake Oper. Mech.	= - 177.3			
	Basic Struct.	= -3361.8			
		495.2	x 1/2	=	247.6
(B-18)	Fuel System				
	Fuel Cells	= 110.4			
	Booster Pumps	= 16.3			
		126.3	x 1/2	=	63.1
(B-19)	Instruments - Tank Unit	= 6.0	x 1/2	=	3.0
(B-20)	Anti-Icing - Ducts - Fwd.	= 42.0	x 1/2	=	21.0
(B-21)	Anti-Icing - Ducts - Aft	= 50.0	x 1/2	=	25.0

Subject: MASS MOMENT OF INERTIA CALCULATIONS

CENTER SECTION

STATION	AVER. w	W	X	ΔX	WX/10^3	WX²/10^6	Y	ΔY	WY/10^3	WY²/10^6	Z	WZ/10^3	WZ²/10^6	Io(xx)/10^6	Io(yy)/10^6	Io(zz)/10^6	Ixx/10^6	Iyy/10^6	Izz/10^6	WXZ/10^6
Column No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Operation						4 x 6			3 x 8	8 x 10		3 x 12	12 x 13				11+14+15	7+14+16	7+11+17	6 x 12
210 to 222.6	7.02	88.5	366.3	72.0	32.59	12.00	216.3	12.6	40.77	8.82	156.8	13.88	2.18	.0	.04	.04	11.00	14.22	20.86	5.11
195 to 210	11.43	171.5	363.9	72.0	62.41	22.71	202.5	15.0	34.73	7.03	155.2	26.62	4.13	.0	.07	.07	11.16	26.91	29.81	9.69
175 to 195	11.43	228.5	363.9	72.0	83.15	30.26	185.0	20.0	42.27	7.82	153.0	34.96	5.35	.01	.10	.10	13.18	35.71	38.18	12.72
160 to 175	12.16	182.4	362.8	72.0	66.17	24.00	167.5	15.0	30.55	5.12	151.2	27.58	4.17	.0	.08	.08	9.29	28.25	29.20	10.00
140 to 160	12.16	243.2	362.8	72.0	88.23	32.01	150.0	20.0	36.48	5.47	149.1	36.26	5.41	.01	.11	.11	10.89	37.53	37.59	13.16
133 to 140	97.2	68.0	361.1	165.0	24.76	9.01	136.5	7.0	9.28	1.27	147.8	10.05	1.49	.0	.15	.15	2.76	10.05	10.43	3.66
120 to 133	10.96	142.5	365.2	140.0	52.04	19.01	126.5	13.0	15.03	2.28	146.7	20.90	3.07	.0	.23	.23	5.35	22.31	21.52	7.63
105 to 120	10.96	164.4	365.2	142.0	60.04	21.93	112.5	15.0	18.50	2.08	145.0	23.84	3.46	.0	.28	.28	5.54	25.67	24.29	8.71
90 to 105	10.53	158.0	366.8	143.0	57.75	21.26	97.5	15.0	14.11	1.50	143.2	22.63	3.24	.0	.27	.27	4.74	24.77	23.03	8.30
70 to 90	10.53	210.6	366.8	157.0	77.25	28.34	80.0	20.0	16.85	1.35	141.3	29.76	4.21	.01	.43	.43	5.57	32.98	30.12	10.92
60 to 70	6.66	66.6	369.0	72.0	24.58	9.07	65.0	10.0	4.33	.26	139.8	9.31	1.30	.0	.03	.03	1.56	10.40	9.56	3.44
50 to 60	6.66	66.6	369.0	72.0	24.58	9.07	55.0	10.0	3.66	.20	138.4	9.22	1.28	.0	.03	.03	1.48	10.38	9.50	3.40
40 to 50	6.66	66.6	369.0	72.0	24.58	9.07	45.0	10.0	3.00	.14	137.3	9.14	1.25	.0	.03	.03	1.39	10.35	9.24	3.37
30 to 40	6.66	66.6	369.0	72.0	24.58	9.07	35.0	10.0	2.33	.08	136.2	9.07	1.24	.0	.03	.03	1.32	10.34	9.18	3.35
20 to 30	6.66	66.6	369.0	72.0	24.58	9.07	25.0	10.0	1.67	.04	136.1	9.00	1.22	.0	.03	.03	1.26	10.32	9.14	3.32
10 to 20	6.66	66.6	369.0	72.0	24.58	9.07	15.0	10.0	1.00	.02	134.5	8.92	1.20	.0	.03	.03	1.22	10.30	9.12	3.29
0 to 10	6.66	66.6	369.0	72.0	24.58	9.07	5.0	10.0	.33	.00	132.9	8.85	1.18	.0	.03	.03	1.19	10.28	9.10	3.27
222.5		49.4	364.0		17.83	6.44	222.5		10.99	2.45	157.4	17.78	1.22				3.67	7.66	5.89	2.51
175.0		12.2	354.0		4.28	1.52	175.0		2.12	.37	152.0	1.84	.28				.65	1.80	1.89	0.65
132.0		34.3	459.0		15.64	7.13	132.0		4.53	.60	147.1	5.05	.74				1.34	7.87	7.73	2.30
112.0		5.0	409.0		2.05	.84	112.0		.56	.06	144.8	0.72	.10				.16	.94	.90	0.30
102.0		3.0	373.0		1.12	.42	102.0		.31	.03	143.6	0.43	.06				.09	.48	.45	0.16
66.0		34.3	460.0		15.78	7.26	66.0		2.26	.15	139.8	4.80	.67				0.82	7.93	7.41	2.21
65.0		41.3	370.0		15.28	5.65	65.0		2.68	.17	139.6	5.77	.81				.98	6.46	5.82	2.13
61.0		17.3	354.0		6.12	2.17	61.0		1.06	.06	139.0	2.40	.33				.39	2.50	2.23	0.85
2.0		21.8	373.0		8.13	3.03	2.0		.04	0	132.6	2.89	.38				.38	3.41	3.03	1.08
2.0		3.7	370.0		1.37	.51	2.0		.01	0	132.5	0.49	.06				.06	.57	.51	0.18
Total Lt. Side		2346.0	368.4		864.25	318.99	129.5		303.75	47.37	145.8	342.16	50.03	.03	1.97	1.97	97.43	370.99	368.33	126.01
Total Rt. Side		2346.0	368.4		864.25	318.99	129.5		303.75	47.37	145.8	342.16	50.03	.03	1.97	1.97	97.43	370.99	368.33	126.01
*** 122.5		1032.0	372.5	71.9	384.42	143.20	122.5	21.0	126.4	15.49	146.0	150.67	22.00	.04	.44	.44	37.53	165.64	159.13	56.12
*** 101.5		1068.0	372.5	71.9	397.83	148.19	101.5	21.0	108.4	11.00	143.7	153.47	22.05	.04	.46	.46	33.09	170.70	159.65	57.17
*** 80.5		1038.0	372.5	71.9	386.66	144.03	80.5	21.0	83.6	6.73	141.3	146.67	20.72	.04	.45	.45	27.49	165.20	151.21	54.64



WEIGHT DISTRIBUTION
CENTER SECTION
XC-120

MODEL XC-120 PREPARED BY CHECKED BY APPROVED BY

DATE 6 May 1948
REVISED 14 Feb. 1949

Subject: MASS MOMENTS OF INERTIA CALCULATIONS

POWER PLANT, NACELLE, LANDING GEAR, BOOMS AND VERTICAL TAIL

(C-1)	Aft Boom (Structure Only)		180.0 x 1/2	= 90.0
(C-2)	Fwd. Boom (Structure Only)		955.4 - 180.0 775.4 x 1/2	= 387.7
(C-3)	Rudders		161.2 x 1/2	= 80.6
(C-4)	Fins		203.0 x 1/2	= 101.5
(C-5)	Anti-Icing Ducts		33.4 x 1/2	= 16.7
(C-6)	Anti-Icing Ducts		24.0 x 1/2	= 12.0
(C-7)	Controls	Sta. 675	1/2 x 5.4	= 2.7
(C-8)	Controls	Sta. 820	1/2 x 14.1	= 7.1
(C-9)	Controls	Sta. 862	1/2 x 5.8	= 2.9
(C-10)	Controls	Sta. 917	1/2 x 36.6	= 18.3
(C-11)	Controls	Sta. 947	1/2 x 4.9	= 2.5
(C-12)	Controls	Sta. 952	1/2 x 25.9	= 12.9
(D-1)	Nacelle Skin, Stringers	=	595.2 x 1/2	= 297.6
(D-2)	Misc. Structure Frames, Fittings, Rivets, etc.	=	204.0 x 1/2	= 102.0
(D-3)	Nacelle Structure & Fr. Landing Gr. Support	=	854.0 x 1/2	= 427.0
(D-4)	Doors and Fittings	=	316.6 x 1/2	= 158.3
(D-5)	Structure at 547	=	20.2 x 1/2	= 10.1
(D-6)	Firewall	=	70.0 x 1/2	= 35.0
(D-7)	Vibration Absorbers	=	145.0 x 1/2	= 72.5
(D-8)	Engine Mount	=	146.0 x 1/2	= 73.0
(D-9)	Engine Flaps & Secondary Cowl	=	282.2 x 1/2	= 141.1
(D-10A)	Primary Cowl	=	317.1 x 1/2	= 158.6
(D-10B)	Support Bay Cowl	=	208.4 x 1/2	= 104.2
(D-11)	Prov. for Equipment	=	54.3 x 1/2	= 27.1
(D-12)	Engine	=	7066.0 x 1/2	= 3533.0

POWER PLANT, NACELLE, LANDING GEAR, BOOMS AND VERTICAL TAIL

(D-13)	Exhaust Collectors	354.2 x 1/2	=	177.1
(D-14)	Vacuum Pump & Lines	25.4 x 1/2	=	12.7
(D-15)	Air Intake System	50.3 x 1/2	=	25.2
(D-16)	Blast Tubes	16.0 x 1/2	=	8.0
(D-17)	Propeller	1320.0 x 1/2	=	660.0
(D-18)	Prop. - Elect. De-Icing Hub Parts	37.8 x 1/2	=	18.9
(D-19)	Starter	56.0 x 1/2	=	28.0
(D-20)	Oil Cooler & Acc.	203.3 x 1/2	=	101.6
(D-21)	Oil Tank & Supports	112.3 x 1/2	=	56.1
(D-22)	Misc. Oil Lines	152.3 x 1/2	=	76.1
(D-23)	Misc. Fuel Lines	160.3 x 1/2	=	80.1
(D-24A)	Main Landing Gr. - Rolling Items (Extended)	= 1370.4 x 1/2	=	685.2
(D-24B)	Main Landing Gr. - Rolling Items (Retracted)			
(D-25A)	Main Landing Gr. - Shock Strut (Extended)	=1292.0 x 1/2	=	646.0
(D-25B)	Main Landing Gr. - Shock Strut (Retracted)	=		
(D-26A)	Main Landing Gr. - Upper Truss (Extended)	289.2 x 1/2	=	144.6
(D-26B)	Main Landing Gr. - Upper Truss (Retracted)			
(D-27A)	Main Landing Gr. - Drag Struts (Extended)	375.6 x 1/2	=	187.8
(D-27B)	Main Landing Gr. - Drag Struts (Retracted)			
(D-28A)	Main Landing Gr. - Basic Structure Less D-24, D-25, D-26, D-27) (Extended)	3361.8		
(D-28B)	Main Landing Gr. - Basic Structure Less D-24, D-25, D-26, D-27) (Retracted)	-3327.2 34.6 x 1/2	=	17.3
(D-29)	Generator	92.0 x 1/2	=	46.0

MODEL XC-120 PREPARED BY CHECKED BY APPROVED BY

DATE 6 May 1948
REVISED 14 Feb. 1949

Subject: MASS MOMENTS OF INERTIA CALCULATIONS

POWER PLANT, NACELLE, LANDING GEAR, BOOMS AND VERTICAL TAIL

(D-30) Fire Extinguisher 89.7 x 1/2 = 44.8

(D-31) Elec. Junction Box 53.5 x 1/2 = 26.7

(D-32) Misc. Instrument Transmitters 21.8 x 1/2 = 10.9

(D-33A) Nose Landing Gear Lower - Truss & Fairing(Extended)
(D-33B) Nose Landing Gear - Truss, Etc. (Retracted) 310.0 x 1/2 = 155.0

(D-34A) Nose Landing Gear - Wheels, Etc. (Extended)
(D-34B) Nose Landing Gear - Wheels, Etc. (Retracted) 269.6 x 1/2 = 134.8

(D-35A) Nose Landing Gear - Oleo Axle & Steer.(Extended)
(D-35B) Nose Landing Gear - Oleo & Steer.(Retracted) 240.0 x 1/2 = 120.0

(D-36) Nose Landing Gear - Retracting Mech. 90.0 x 1/2 = 45.0

(D-37A) Nose Landing Gear - Drag Truss & Extension Struts(Extended)
(D-37B) Nose Landing Gear - Drag Truss & Extension Struts(Retracted) 270 x 1/2 = 135.0

(D-38) Upper Truss - 242.0 x 1/2 = 121.0

Subject: MASS MOMENTS OF INERTIA CALCULATION

NACELLE

I_o of Engine $\qquad W = 3533.0$

From P & W Installation Handbook Sec. III, Supp. F, Page 7, Jan. 1948.

$$I_o(xx) = 0.76 \times 10^6$$

$$I_o(yy) = I_o(zz) = 1.72 \times 10^6$$

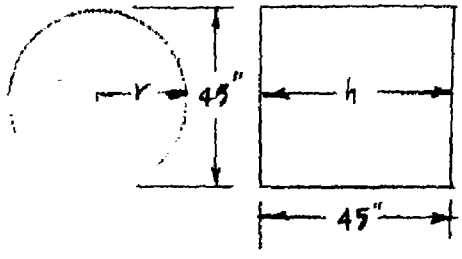
I_o of Propeller $\qquad W = 660.0$

$$I_o(xx) = 0.5\, W\, r^2 = 0.5 \times 660.0 \times \overline{90.5}^2 = 2.71 \times 10^6$$

$$I_o(yy) = I_o(zz) = 0.25\, W\, r^2 = 0.25 \times 660.0 \times \overline{90.5}^2 = 1.35 \times 10^6$$

I_o of Main Landing Gear Rolling Items $\qquad W = 685.2$

$$Io(xx) = I_o(zz) = \frac{W}{12}\,(3r^2 + h^2)$$



$$= \frac{685.2}{12}\,(3\,(22.5)^2 + (45)^2)$$

$$= .20 \times 10^6$$

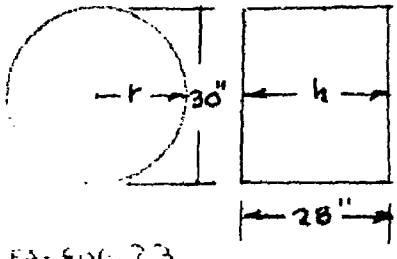
$$I_o(yy) = 0.5\, Wr^2 = 0.5 \times 685.2 \times \overline{22.5}^2 = 0.17 \times 10^6$$

I_o of Auxiliary Landing Gear Rolling Items $\qquad W = 134.8$

$$I_o(xx) = I_o(zz) = \frac{134.8}{12}\,(3\,(15)^2 + (28)^2)$$

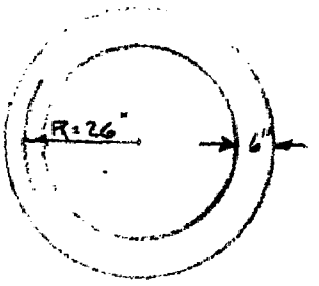
$$= .02 \times 10^6$$

$$I_o(yy) = 0.5 \times 134.8 \times 15^2 = 0.2 \times 10^6$$



NACELLE

I_o of Collector Ring



$$I_{xo} = \frac{W}{4}(4R^2 + 3r^2)$$

$$= \frac{177.1}{4} \quad (4 \times \overline{26}^2) + (3 \times \overline{6}^2)$$

$$= 0.12 \times 10^6$$

$$I_{yo} = I_{zo} = \frac{W}{8}(4R^2 + 5r^2) = \frac{177.1}{8} \quad (4 \times \underline{\quad}_{26^2}) + (5 \times \frac{2}{6})$$

$$= 0.06 \times 10^6$$

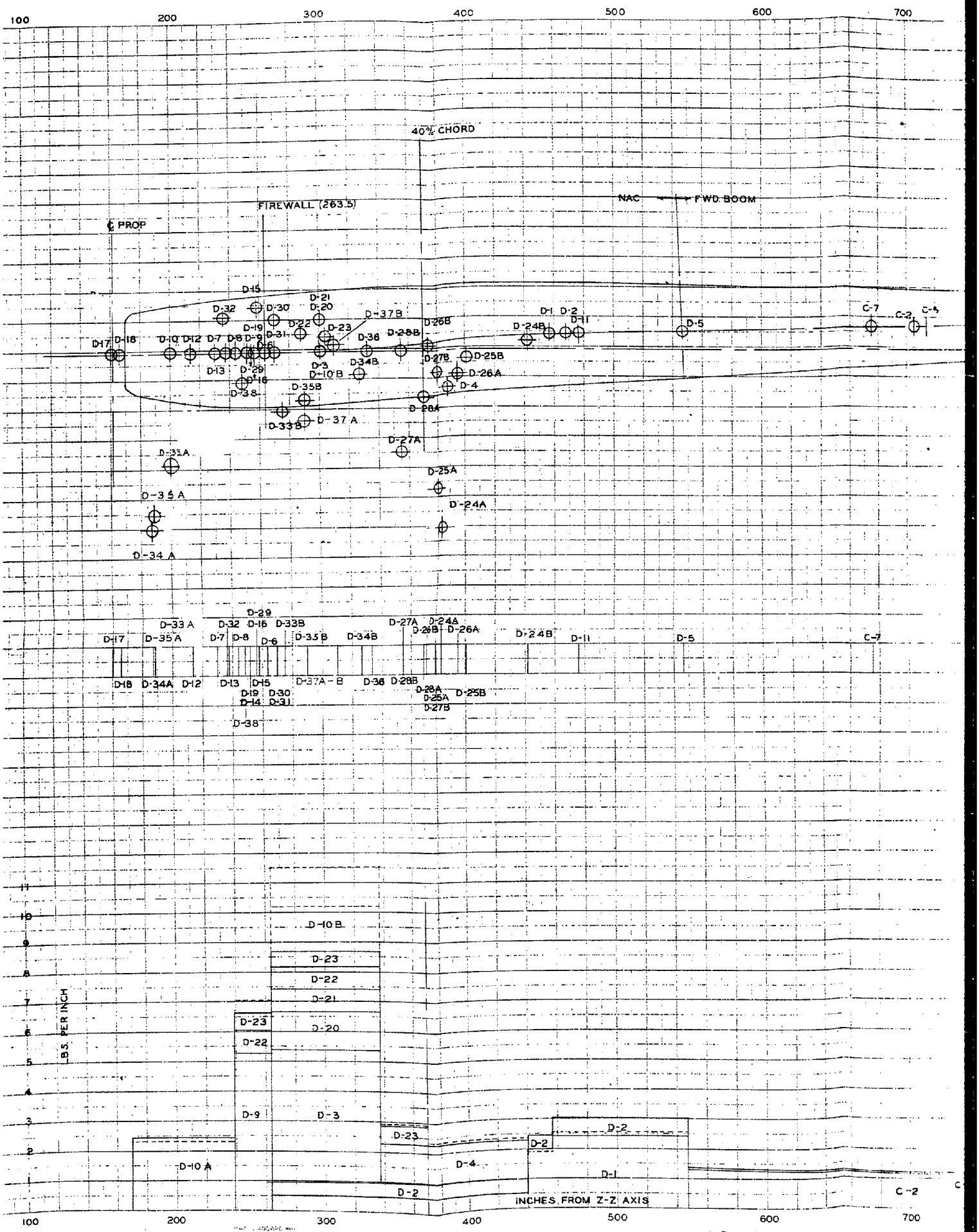
(a) = $I_o(xx) = 0.0833\, W \overline{\Delta Z}^2$ (b) = $I_o(yy) = I_o(zz) = 0.0833\, W \overline{\Delta X}^2$

NACELLE

STATION	AVER. W	W	X	Δ X	WX/10³	WX²/10⁶	Z	Δ Z	WZ/10³	WZ²/10⁶	Y	WY/10³	WY²/10⁶	Io(xx)/10⁶	Io(yy)/10⁶	Io(zz)/10⁶	Ixx/10⁶	Iyy/10⁶	Izz/10⁶	WXZ/10⁶
Column No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Operation		2 x 5			3 x 4	4 x 6			3 x 8	8 x 10		3 x 12	12 x 13	(a)	(b)	(b)	11+14+15	7+11+16	7+14+17	6 x
985 to 994	0.20	1.8	989.5	9.0	1.78	1.76	149.0	10.0	0.27	0.04	175.0	0.32	0.06	.00	.00	.00	.10	1.80	1.82	.27
964 to 985	1.42	29.8	974.5	21.0	29.04	28.30	119.8	135.0	3.57	0.43	175.0	5.22	0.91	.05	.00	.00	1.39	28.73	29.21	3.41
957 to 964	3.95	27.7	960.5	7.0	26.61	25.56	123.8	197.0	3.43	0.42	175.0	4.85	0.85	.09	.00	.00	1.36	25.93	26.41	3.25
947 to 957	4.45	44.5	952.0	10.0	42.36	40.33	122.8	200.0	5.46	0.67	175.0	7.79	1.36	.15	.00	.00	2.18	41.00	41.69	5.21
927 to 947	3.74	74.8	937.0	20.0	70.09	65.67	123.0		9.20	1.13		13.09	2.29	.24	.00	.00	3.66	66.80	67.96	8.62
911 to 927	3.16	50.6	919.0	16.0	46.50	42.73	124.9		6.32	0.79		8.86	1.55	.12	.00	.00	2.46	43.52	44.28	5.81
892 to 911	2.16	41.0	901.5	19.0	36.96	33.32	136.9	90.0	5.61	0.77	175.0	7.18	1.26	.03	.00	.00	2.06	34.09	34.58	5.00
881 to 892	1.42	15.6	886.5	11.0	13.83	12.26	149.3	35.0	2.33	0.35	175.0	2.73	0.48	.00	.00	.00	.83	12.61	12.74	2.00
850 to 881	1.07	33.2	865.5	31.0	28.73	24.87	155.0	38.0	5.15	0.80	175.0	5.81	1.02	.00	.00	.00	1.82	25.67	25.89	4.41
820 to 850	1.10	33.0	835.0	30.0	27.56	23.01	155.0	40.0	5.12	0.79	175.0	5.78	1.01	.00	.00	.00	1.80	23.80	24.02	4.27
790 to 820	1.13	33.9	805.0	30.0	27.29	21.97	155.0	43.0	5.25	0.81	175.0	5.93	1.04	.00	.00	.00	1.85	22.78	23.01	4.21
760 to 790	1.15	34.5	775.0	30.0	26.74	20.72	155.0	45.0	5.35	0.83	175.0	6.04	1.06	.00	.00	.00	1.89	21.55	21.78	4.11
730 to 760	1.18	35.4	745.0	30.0	26.37	19.65	155.0	48.0	5.49	0.85	175.0	6.20	1.09	.00	.00	.00	1.94	20.50	20.74	4.09
700 to 730	1.21	36.3	715.0	30.0	25.95	18.55	155.0	50.0	5.63	0.87	175.0	6.35	1.11	.01	.00	.00	1.99	19.42	19.66	4.04
670 to 700	1.24	37.2	685.0	30.0	25.48	17.45	155.0	52.0	5.77	0.89	175.0	6.51	1.14	.01	.00	.00	2.04	18.34	18.59	3.95
640 to 670	1.27	38.1	655.0	30.0	24.96	16.35	155.0	55.0	5.91	0.92	175.0	6.67	1.17	.01	.00	.00	2.10	17.27	17.52	3.87
610 to 640	1.29	38.7	625.0	30.0	24.19	15.12	155.0	57.0	6.00	0.93	175.0	6.77	1.18	.01	.00	.00	2.12	16.05	16.30	3.75
580 to 610	1.32	39.6	595.0	30.0	23.56	14.02	155.0	58.0	6.14	0.95	175.0	6.93	1.21	.01	.00	.00	2.17	14.97	15.23	3.65
547 to 580	1.35	44.6	563.5	33.0	25.13	14.16	155.0	60.0	6.91	1.07	175.0	7.81	1.37	.01	.00	.00	2.45	15.23	15.53	3.90
520 to 547	2.53	68.3	533.5		36.44	19.44	160.0		10.93	1.75		11.95	2.09	.02	.00	.00	3.86	21.19	21.53	5.83
490 to 520	2.53	75.9	505.0		38.33	19.36	160.00		12.14	1.94		13.28	2.32	.03	.01	.01	4.29	21.31	21.69	6.13
457 to 490	2.53	83.5	473.5		39.54	18.72	160.0		13.36	2.14		14.61	2.56	.03	.01	.01	4.73	20.87	21.29	6.33
440 to 457	1.90	32.3	448.5		14.49	6.50	160.0		5.17	0.83		5.65	0.99	.01	.00	.00	1.83	7.33	7.49	2.32
405 to 440	2.35	82.3	422.5		34.77	14.69	180.2		14.83	2.67		14.40	2.52	.04	.01	.01	5.23	17.37	17.22	6.27
370 to 405	2.35	82.3	387.5		31.89	12.36	180.2		14.83	2.67		14.40	2.52	.04	.01	.01	5.23	15.04	14.89	5.75
337 to 370	2.95	97.4	353.5	33.0	34.43	12.17	176.0		17.14	3.02		17.05	2.98	.05	.01	.01	6.05	15.20	15.16	6.06
300 to 337	11.58	428.0	318.5	37.0	136.32	43.42	165.5		70.83	11.72		74.90	13.11	.21	.05	.05	25.04	55.19	56.58	22.56
264 to 300	11.58	416.6	282.0	36.0	117.48	33.13	165.5		68.95	11.41		72.91	12.76	.20	.04	.04	24.37	44.58	45.93	19.44
239 to 264	7.03	175.8	251.5	25.0	44.21	11.12	169.5		29.80	5.05		30.77	5.38	.08	.01	.01	10.51	16.18	16.51	7.49
210 to 239	2.30	66.7	224.5	29.0	14.97	3.36	172.0		11.47	1.97		12.67	2.04	.03	.00	.00	4.04	5.33	5.40	2.57
190 to 210	2.30	46.0	200.0	20.0	9.20	1.84	172.0		7.91	1.36		8.05	1.41	.02	.00	.00	2.79	3.20	3.25	1.58
170 to 190	2.30	46.0	180.0	20.0	8.28	1.49	172.0		7.91	1.36		8.05	1.41	.01	.00	.00	2.78	2.85	2.90	1.42
952		12.9	952.0		12.28	11.69	148.0		1.91	0.28	175.0	2.26	0.40				0.68	11.97	12.09	1.82
947		2.5	947.0		2.37	2.24	148.0		0.37	0.05	175.0	0.44	0.08				0.13	2.29	2.32	.35
917		18.3	917.0		16.78	15.39	150.0		2.75	0.41	175.0	3.20	0.56				0.97	15.80	15.95	2.52
862		2.9	862.0		2.50	2.16	150.0		0.44	0.07	175.0	0.51	0.09				0.16	2.23	2.25	.38
820		7.1	820.0		5.82	4.77	151.0		1.07	0.16	175.0	1.24	0.22				0.38	4.93	4.99	.88
675		2.7	675.0		1.82	1.23	155.0		0.42	0.07	175.0	0.47	0.08				0.15	1.30	1.31	.28
547		10.1	547.0		5.52	3.02	157.0		1.59	0.25	175.0	1.77	0.31				0.66	3.27	3.33	.87
476		27.1	476.0		12.90	6.14	160.0		4.34	0.69		4.74	0.83				1.52	6.83	6.97	2.06
* 395		144.6	390.0		56.39	21.99	194.0		28.05	5.22		25.31	4.43				9.65	27.21	26.42	10.94
* 384		685.2	374.0		256.26	95.84	286.0		195.97	56.05		119.91	20.98	0.20	0.17	0.20	77.23	152.06	117.02	73.29
* 380		646.0	376.0		242.90	91.33	256.0		165.38	42.34		113.06	19.78				62.12	133.67	111.11	62.18
* 371		17.3	371.0		6.43	2.38	201.0		3.48	0.70		3.03	0.53				1.23	3.08	2.91	1.29
* 355		187.8	348.0		65.35	22.74	238.0		44.70	10.64		32.87	5.75				16.39	33.38	28.49	15.55
333		45.0	313.0		14.09	4.41	172.0		7.74	1.33		7.88	1.38				2.71	5.74	5.79	2.42
270		44.8	270.0		12.10	3.27	147.0		6.59	0.97		7.84	1.37				2.34	4.24	4.64	1.78
270		26.7	270.0		7.21	1.95	170.0		4.54	0.77		4.67	0.82				1.59	2.72	2.77	1.23
264		35.0	264.0		9.24	2.44	170.0		5.95	1.01		6.13	1.07				2.08	3.45	3.51	1.57
258		25.2	258.0		6.50	1.68	140.0		3.53	0.49		4.41	0.77				1.26	2.17	2.45	0.91

Subject:— MASS MOMENTS OF INERTIA CALCULATIONS
NACELLE

STATION	AVER. w	W	X	ΔX	WX/10³	WX²/10⁶	Z	ΔZ	WZ/10³	WZ²/10⁶	Y	WY/10³	WY²/10⁶	Io(xx)/10⁶	Io(yy)/10⁶	Io(zz)/10⁶	Ixx/10⁶	Iyy/10⁶	Izz/10⁶	WXY/10⁶
Column No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Operation						4 x 6				8 x 10		3 x 12								
* 290		135.0	247.0		33.34	8.23	230.4		31.10	7.17	175.0	23.63	4.14				11.31	15.40	12.37	5.83
256		6.0	256.0		2.05	0.52	172.0		1.38	0.24	175.0	1.40	0.25				0.49	0.76	0.77	0.35
236		46.0	256.0		11.78	3.02	172.0		7.91	1.36	175.0	8.05	1.41				2.77	4.38	4.43	2.03
252		28.0	252.0		7.06	1.78	172.0		4.82	0.83	175.0	4.90	0.86				1.69	2.61	2.64	1.21
252		12.7	252.0		3.20	0.81	172.0		2.18	0.37	175.0	2.22	0.39				0.76	1.18	1.20	0.56
248		121.0	248.0		30.01	7.44	192.0		21.18	4.07	175.0	21.18	3.71				7.78	11.51	11.15	5.25
244		73.0	244.0		17.81	4.35	172.0		12.56	2.16	175.0	12.78	2.34				4.50	6.51	6.69	3.12
237		177.1	237.0		41.97	9.95	172.0		30.46	5.24	175.0	30.98	5.42	0.12	0.06	0.06	10.78	15.25	15.43	7.34
236		10.9	236.0		2.57	0.61	128.0		1.40	0.18	175.0	1.91	0.33				0.51	0.79	0.94	0.33
230		72.5	230.0		16.68	3.84	172.0		12.47	2.14	175.0	12.69	2.22				4.36	5.98	6.06	2.87
214		3533.0	210.8		744.76	156.99	172.0		607.68	104.52	175.0	618.28	108.20	0.76	1.72	1.72	213.48	263.23	266.91	130.33
* 200		155.0	200.0		31.00	6.20	248.0		38.44	9.53	175.0	27.13	4.75				14.28	15.73	10.95	5.43
* 189		120.0	189.0		22.68	4.32	261.0		33.72	8.48	175.0	21.00	3.68				13.16	13.77	7.97	3.97
* 187		134.8	187.0		25.21	4.71	291.0		39.22	11.42	175.0	23.59	4.13	0.02	0.02	0.02	15.17	16.15	8.86	4.41
166		18.9	166.0		3.14	.52	172.0		3.25	0.56	175.0	3.31	0.58				1.14	1.08	1.10	0.55
166		660.0	166.0		109.56	18.19	172.0		113.52	19.53	175.0	115.50	20.21	2.72	1.35	1.35	46.45	39.07	39.75	19.17
Total Lt. Side (WH. DN)		9638.5	306.3		2952.75	1179.52	190.0		1824.30	362.50	175.0	1686.81	295.32	5.32	3.47	3.50	663.14	1545.49	1478.34	544.93
Total Rt. Side (WH. DN)		9638.5	306.3		2952.75	1179.52	190.0		1824.30	362.50	175.0	1686.81	295.32	5.32	3.47	3.50	663.14	1545.49	1478.34	544.93
** 442	-	685.2	421.6		288.90	121.80	183.7		125.89	23.13	175.0	119.91	20.98	0.20	0.07	0.20	44.31	145.10	142.98	53.07
** 401		646.0	401.0		259.05	103.86	185.7		119.99	22.28	175.0	113.05	19.78				42.06	126.16	123.66	48.11
** 380		187.8	380.0		71.36	27.12	186.0		34.93	6.50	175.0	32.87	5.75				12.25	33.62	32.87	13.27
** 373		144.6	373.0		53.94	20.12	168.0		24.29	4.08	175.0	25.33	4.43				8.51	24.20	24.55	9.06
** 355		17.3	355.0		6.14	2.18	170.0		2.94	0.50	175.0	3.03	0.53				1.03	2.68	2.71	1.04
** 327		134.8	327.0		44.08	14.41	188.0		25.34	4.76	175.0	23.59	4.13	0.02	0.02	0.02	8.91	19.19	18.56	8.29
** 310		135.0	310.0		41.85	12.97	167.0		22.55	3.77	175.0	23.63	4.14				7.91	16.74	17.11	6.99
** 290		120.0	290.0		34.80	10.09	204.0		24.48	4.99	175.0	21.00	3.68				8.67	15.08	13.77	7.10
** 275		155.0	275.0		42.63	11.72	212.0		32.86	6.97	175.0	27.13	4.75				11.72	18.69	16.47	9.04
Total Lt. Side (WH. UP)		9638.5	317.1		3055.95	1246.10	172.0		1657.50	286.93	175.0	1686.81	295.32	5.32	3.47	3.50	587.57	1536.50	1544.92	518.01
Total Rt. Side (WH. Up)		9638.5	317.1		3055.95	1246.10	172.0		1657.50	286.93	175.0	1686.81	295.32	5.32	3.47	3.50	587.57	1536.50	1544.92	518.01
Diff.(DN. to UP) Lt. Side		0			+103.20	+ 66.58			-166.80	-75.57		0	0	0	0	0	- 75.57	- 8.99	+ 66.58	-26.92
Diff.(DN. to UP) Rt. Side		0			+103.20	+ 66.58			-166.800	-75.57		0	0	0	0	0	- 75.57	- 8.99	+ 66.58	-26.92


100
200
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40% CHORD
FIREWALL (263.5)
℄ PROP
NAC
FWD BOOM
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D-37B
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C-7
C-2
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D-19
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D-28B
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C
INCHES FROM Z-Z AXIS
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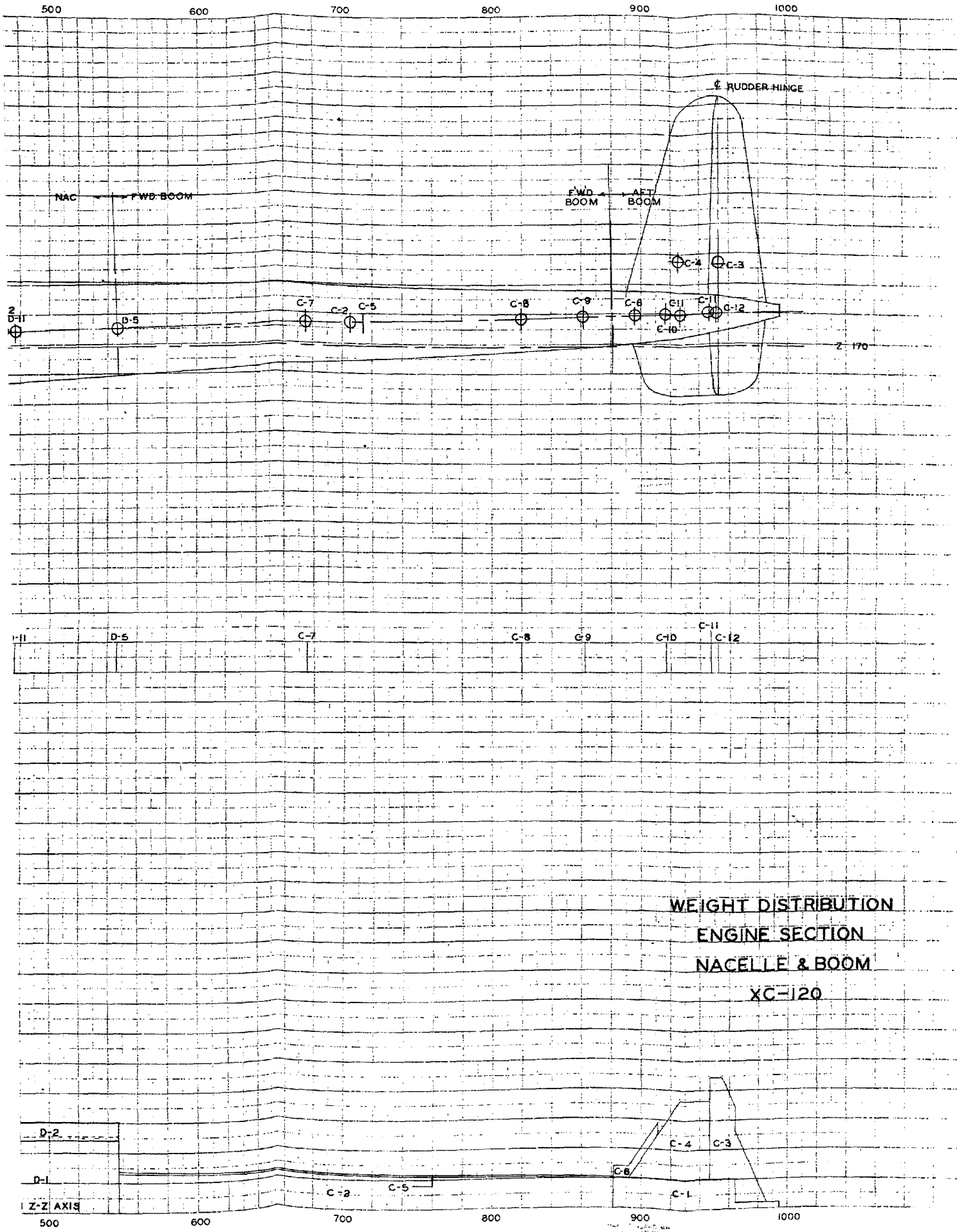


WEIGHT DISTRIBUTION
ENGINE SECTION
NACELLE & BOOM
XC-120

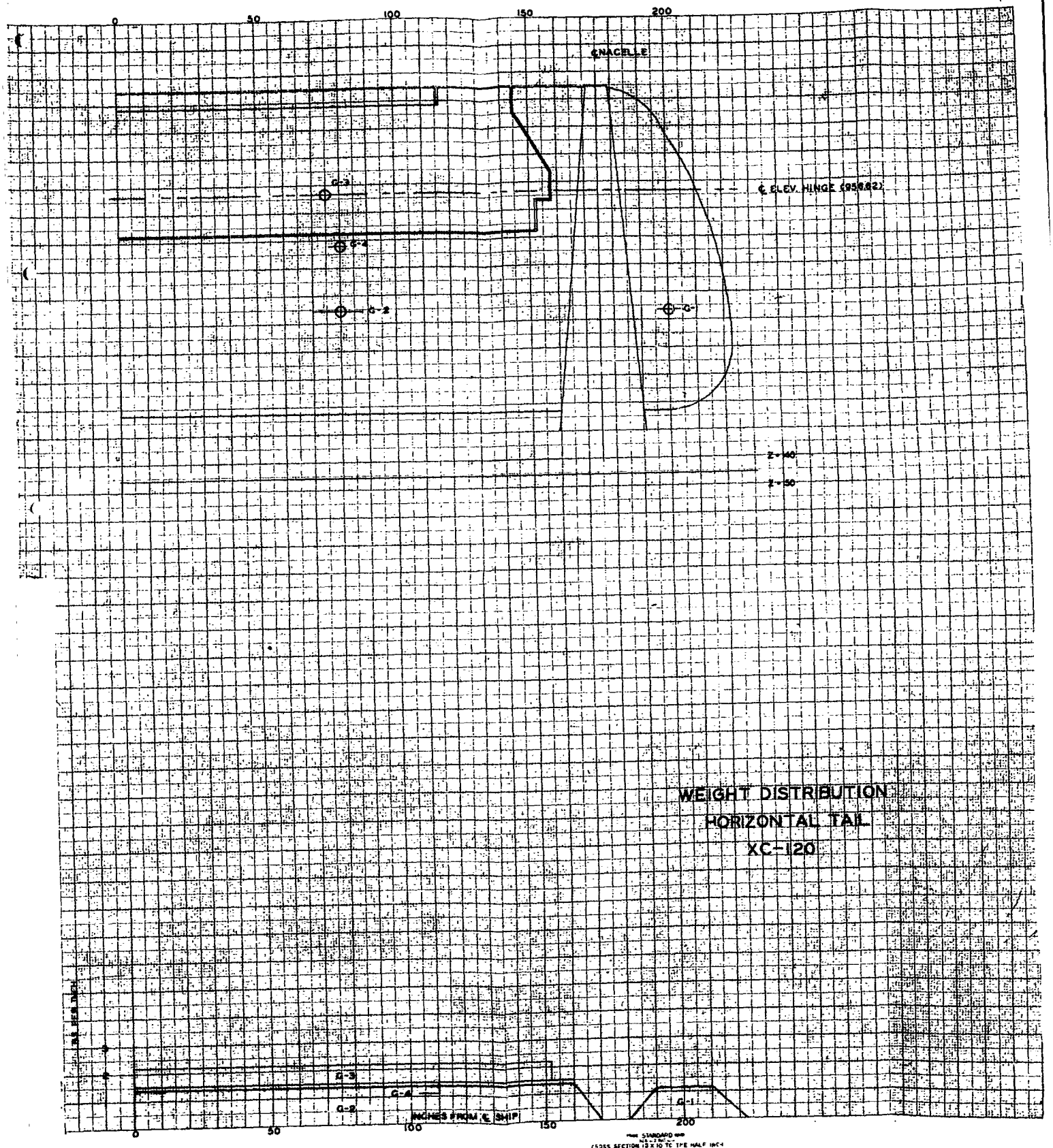
HORIZONTAL TAIL SURFACES & EQUIPMENT

(G-1)	Stabilizer Tips	71.3 x 1/2	=	35.7
(G-2)	Stabilizer	444.4 x 1/2	=	222.2
(G-3)	Elevator	209.5 x 1/2	=	104.7
(G-4)	Controls	(20.5 + 17.5) 1/2	=	19.0

Subject:— MASS MOMENTS OF INERTIA CALCULATIONS
HORIZONTAL TAIL

(a) = $Io(xx) = 0.0833\ W\overline{\Delta Y}^2$ (b) = $Io(yy) = Io(zz) = 0.0833\ W\overline{\Delta Y}^2$

STATION	AVER. W	W	X	Δ X	WX / 10^3	WX^2 / 10^6	Y	Δ Y	WY / 10^3	WY^2 / 10^6	Z	WZ / 10^3	WZ^2 / 10^6	Io(xx) / 10^6	Io(yy) / 10^6	Io(zz) / 10^6	Ixx / 10^6	Iyy / 10^6
Column No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Operation		2 x 9			3 x 4	4 x 6			3 x 8	8 x 10		3 x 12	12 x 13	(a)	(b)	(b)	11+14+15	7+14+16
210 to 223	0.96	7.4	913.5	57.0	6.76	6.17	216.5	13.0	1.60	.35	145.7	1.08	.16	0	0	0	.51	6.34
190 to 210	1.13	22.8	913.5	100.0	20.83	19.02	200.0	20.0	4.56	.91	145.7	3.32	.48	0	.02	.02	1.39	19.53
180 to 190	0.56	5.7	913.5	57.0	5.21	1.76	185.0	10.0	1.05	.19	145.7	0.83	.12	0	0	0	.31	4.88
160 to 170	0.68	6.9	914.4	64.0	6.31	5.77	165.0	10.0	1.14	.19	145.7	1.01	.15	0	0	0	.34	5.92
152 to 160	1.47	11.8	919.4	65.0	10.80	9.89	156.0	8.0	1.84	.29	145.7	1.72	.25	0	0	0	.54	10.14
140 to 152	2.15	26.0	928.4	65.0	24.14	22.41	147.0	12.0	3.82	.56	145.7	3.79	.55	0	.01	.01	1.11	22.97
120 to 140	2.15	43.0	928.4	65.0	39.92	37.06	130.0	20.0	5.59	.73	145.7	6.27	.91	0	.02	.02	1.64	37.99
100 to 120	2.15	43.0	928.4	65.0	39.92	37.06	110.0	20.0	4.73	.52	145.7	6.27	.91	0	.02	.02	1.43	37.99
90 to 100	2.15	21.5	928.4	65.0	19.96	18.53	95.0	10.0	2.04	.19	145.7	3.13	.46	0	.01	.01	.65	19.00
80 to 90	2.15	21.5	928.4	65.0	19.96	18.53	85.0	10.0	1.83	.16	145.7	3.13	.46	0	.01	.01	.62	19.00
70 to 80	2.15	21.5	928.4	65.0	19.96	18.53	75.0	10.0	1.61	.12	145.7	3.13	.46	0	.01	.01	.58	19.00
60 to 70	2.15	21.5	928.4	65.0	19.96	18.53	65.0	10.0	1.40	.09	145.7	3.13	.46	0	.01	.01	.55	19.00
50 to 60	2.15	21.5	928.4	65.0	19.96	18.53	55.0	10.0	1.18	.06	145.7	3.13	.46	0	.01	.01	.52	19.00
40 to 50	2.15	21.5	928.4	65.0	19.96	18.53	45.0	10.0	.97	.04	145.7	3.13	.46	0	.01	.01	.50	19.00
30 to 40	2.15	21.5	928.4	65.0	19.96	18.53	35.0	10.0	.75	.03	145.7	3.13	.46	0	.01	.01	.49	19.00
20 to 30	2.15	21.5	928.4	65.0	19.96	18.53	25.0	10.0	.54	.01	145.7	3.13	.46	0	.01	.01	.47	19.00
10 to 20	2.15	21.5	928.4	65.0	19.96	18.53	15.0	10.0	.32	0	145.7	3.13	.46	0	.01	.01	.46	19.00
0 to 10	2.15	21.5	928.4	65.0	19.96	18.53	5.0	10.0	.11	0	145.7	3.13	.46	0	.01	.01	.46	19.00
Total Lt. Side		381.6	926.3		353.49	327.46	91.9		35.08	4.44	145.7	55.59	8.13	0	0.17	0.17	12.57	335.76
Total Rt. Side		381.6	926.3		353.49	327.46	91.9		35.08	4.44	145.7	55.59	8.13	0	0.17	0.17	12.57	335.76



WEIGHT DISTRIBUTION
HORIZONTAL TAIL
XC-120

REUTTLE & ESSER CO.
NEW YORK
STANDARD
CROSS SECTION 10 X 10 TO THE HALF INCH

DETACHABLE FUSELAGE & CONTENTS

(E-1)	Electrical - Junction Box, Wiring, Lights	=	27.1
(E-2)	Communicating - Jumpmasters Station	=	4.5
(E-3)	Furnishings - Tie Down Rings	=	182.6
(E-4A)	Furnishings - Jacks Nose Supporting	=	28.2
(E-4B)	Furnishings - Jacks Tail Supporting	=	28.2
(E-5)	Furnishings - Driftmeter	=	2.0
(E-6)	Furnishings - Static Lines	=	19.7
(E-7)	Not Used		
(E-8)	Furnishings - First Aid Kit	=	8.8

MODEL XC-120 PREPARED BY CHECKED BY APPROVED BY

DATE 6 May 1948
REVISED 14 Feb. 1949

Subject: MASS MOMENTS OF INERTIA CALCULATIONS

DETACHABLE FUSELAGE & CONTENTS

(F-1)	Floor Beams - Inboard & Outboard	=	223.5
(F-2)	Flooring & Supports - Cargo & Paratainer	=	877.1
(F-3)	Top Beams	=	68.9
(F-4)	Dust Covers	=	33.0
(F-5)	Cargo Windows	=	73.7
(F-6)	Door - Cargo Comp. Hatch	=	20.0
(F-7)	Door - Escape Hatch	=	63.1
(F-8)	Prov. For Paratainer Door	=	43.2
(F-9A)	Fuselage Hoist Fittings - Fore	=	25.0
(F-9B)	Fuselage Hoist Fittings - Aft	=	35.0
(F-10A)	Fuselage Attach. Fittings - Fore	=	28.0
(F-10B)	Fuselage Attach. Fittings - Aft	=	123.2
(F-11A)	Fittings - Ground Handling - Fore	=	50.0
(F-11B)	Fittings - Ground Handling - Aft	=	50.0
(F-12A)	Fittings - Cargo Doors - Fore	=	12.5
(F-12B)	Fittings - Cargo Doors - Aft	=	12.5
(F-13)	Miscellaneous - Finish, Etc.	=	92.8
(F-14)	Provisions For Equipment	=	112.0
(F-15)	Cargo Doors - Fore	=	410.0
(F-16)	Cargo Doors - Aft	=	420.0

Subject:— MASS MOMENTS OF INERTIA CALCULATIONS

DETACHABLE FUSELAGE & CONTENTS

(F-17) Frames

	Sta.	Wt.
106 + 116.5	129.3	108.6
130	148.	8.0
144 & 150	165.	126.8
161.5	179.5	11.4
179	197.	25.3
196.5	214.5	43.1
214.	232	17.3
231.5	249.5	50.9
249.	267.0	16.4
266.5	284.5	57.2
284.	302	17.0
301.5	319.5	43.2
319.	337	57.0
387.	355	6.5
355.	373	51.2
373.	391	19.4
391 + 397	412	177.7
409	427	55.7
426.5	444.5	6.0
444.	462	49.6
461.5	479.5	5.9
479	497	48.5
496.5	514.5	5.8
514.	532	46.3
531.5	549.5	5.6
546.4 & 549	565.7	78.7
	1139.1	= 1139.1

(F-18) Skin & Stringers = 907.5

Subject: MASS MOMENTS OF INERTIA CALCULATIONS

DETACHABLE FUSELAGE

$I_o(xx)$ of Frames

Ratio of I_o to I_x

$I_x = WZ^2 = W\,(216.2)^2$ = 46,742 W

Sta. 124 to 232

$I_o(xx) = \frac{W}{4}\,(4 \times \overline{59}^2) + (3 \times \overline{12}^2)$ = 3,589 W

Ratio = 3589 ÷ 46,742 = 0.08

Sta. 232 to 444.5

$I_o(xx) = \frac{W}{4}\,(4 \times \overline{61}^2) + (3 \times \overline{12}^2)$ = 3,829 W

Ratio = 3829 ÷ 46,742 = 0.08

Sta. 444.5 to 567

$I_o(xx) = \frac{W}{4}\,(4 \times \overline{58}^2) + (3 \times \overline{12}^2)$ = 3,472 W

Ratio = 3472 ÷ 46,742 = 0.07

$I_o(xx)$ of Skin Stringers

$I_{o(xx)} = WR^2 = 907.5 \times \overline{60}^2$

$= 3.27 \times \overline{10}^6$

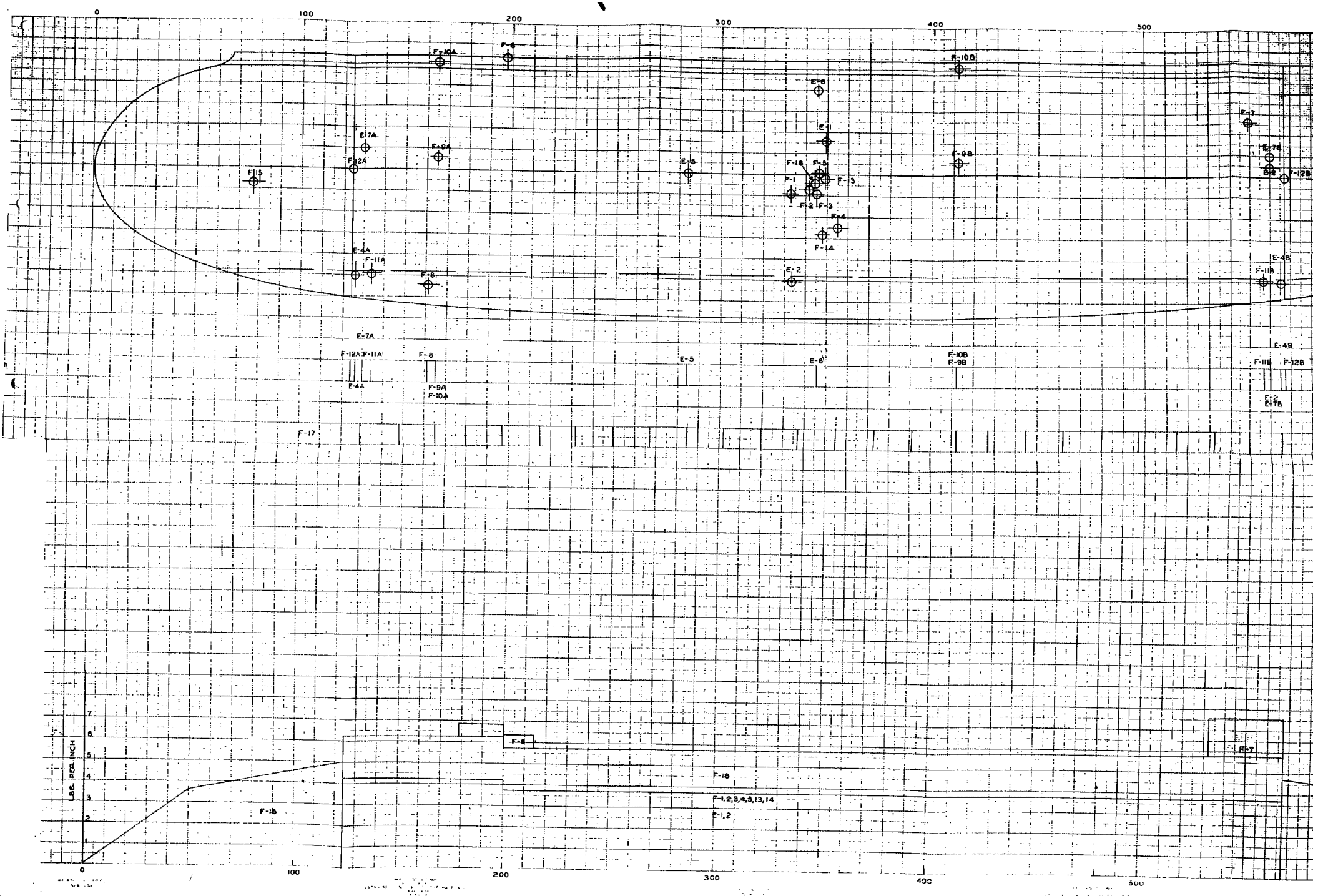
(a) $= I_o(xx) = 0.0833\ W\bar{X}Z^2$ (b) $I_o(yy) = Io(zz) = 0.0833\ W\bar{X}^2$

STATION	AVER. w	W	X	Δ X	WX/10³	WX²/10⁶	Z	Δ Z	WZ/10³	WZ²/10⁶	Y	WY/10³	WY²/10⁶	Io(xx)/10⁶	Io(yy)/10⁶	Io(zz)/10⁶	Ixx/10⁶	Iyy/10⁶	Izz/10⁶	WXZ/10⁶
Column No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Operation		2 x 5			3 x 4	4 x 6			3 x 8	8 x 10		3 x 12	12 x 13	(a)	(b)	(b)	1+14+13	7+11+16	7+14+17	6 x 8
650 to 671.3	3.49	74.3	660.7	21.3	49.09	32.43	220.0	84.0	16.35	3.60	0			0.30	0.00	0.00	3.90	36.03	32.43	10.80
620 to 650	3.82	114.5	635.0	30.0	72.77	46.21	220.0	97.0	25.21	5.55				.46	0.01	.01	6.01	51.77	46.22	16.01
590 to 620	4.22	126.6	605.0	30.0	76.59	46.34	220.0	105.0	27.85	6.13				.51	.01	.01	6.64	52.48	46.35	16.85
567 to 590	4.59	105.6	578.5	23.0	61.09	35.34	220.0	110.0	23.23	5.11				.43	.00	.00	5.54	40.45	25.34	13.44
532 to 567	7.58	265.3	549.5	35.0	145.78	80.11	240.3	114.0	63.75	15.32				1.28	.03	.03	16.60	95.46	80.14	35.03
500 to 532	5.80	185.6	516.0	32.0	95.77	49.42	241.5	117.0	44.82	10.82				.90	.02	.02	11.72	60.26	49.44	23.13
470 to 500	5.81	174.2	485.0	30.0	84.49	40.98	241.5	119.0	42.07	10.16				.85	.01	.01	11.01	51.15	40.99	22.82
440 to 470	5.81	174.2	455.0	30.0	79.26	36.06	241.5	121.0	42.07	10.16				.85	.01	.01	11.01	46.23	36.07	19.14
410 to 440	5.81	174.2	425.0	30.0	74.04	31.47	241.5	122.0	42.07	10.16				.85	.01	.01	11.01	41.64	31.48	17.88
380 to 410	5.81	174.2	395.0	30.0	68.81	27.18	241.5	122.0	42.07	10.16				.85	.01	.01	11.01	37.35	27.19	16.62
350 to 380	5.81	174.2	365.0	30.0	63.58	23.21	241.5	122.0	42.07	10.16				.85	.01	.01	11.01	33.38	23.22	15.35
320 to 350	5.81	174.2	335.0	30.0	58.36	19.55	241.5	122.0	42.07	10.16				.85	.01	.01	11.01	29.72	19.56	14.09
290 to 320	5.81	174.2	305.0	30.0	53.13	16.20	241.5	122.0	42.07	10.16				.85	.01	.01	11.01	26.37	16.21	12.83
260 to 290	5.81	174.2	275.0	30.0	47.91	13.18	241.5	122.0	42.07	10.16				.85	.01	.01	11.01	23.35	13.19	11.57
230 to 260	5.81	174.2	245.0	30.0	42.68	10.46	241.5	121.0	42.07	10.16				.85	.01	.01	11.01	20.63	10.47	10.31
214.5 to 230	5.78	89.6	222.3	15.5	19.92	4.43	240.9	121.0	21.58	5.20				.43	.00	.00	5.63	9.63	4.43	4.80
200.0 to 214.5	6.34	91.9	207.2	14.5	19.04	3.95	240.9	120.0	22.14	5.33				.44	.00	.00	5.77	9.28	3.95	4.59
178.5 to 200	6.84	147.1	189.3	21.5	27.85	5.27	241.5	119.0	35.52	8.58				.71	.01	.01	9.29	13.86	5.28	6.73
160 to 178.5	6.28	116.2	169.2	18.5	19.66	3.33	241.5	118.0	28.06	6.78				.56	.00	.00	7.34	10.11	3.33	4.75
140 to 160	6.28	125.6	150.0	20.0	18.84	2.83	241.5	117.0	30.33	7.32				.61	.00	.00	7.93	10.15	2.83	4.33
124 to 140	5.68	90.9	132.0	16.0	12.00	1.58	223.0	115.0	20.27	4.52				.38	.00	.00	4.90	6.10	1.58	2.68
110 to 124	4.90	68.6	117.0	14.0	8.03	0.94	223.0	114.0	15.30	3.41				.28	.00	.00	3.69	4.35	0.94	1.79
90 to 110	4.55	91.0	100.0	20.0	9.10	0.91	223.0	112.0	20.29	4.52				.38	.00	.00	4.90	5.43	0.91	2.03
80 to 90	4.28	42.8	85.0	10.0	3.64	0.31	223.0	109.0	9.54	2.13				.18	.00	.00	2.31	2.44	0.31	0.81
70 to 80	4.10	41.0	75.0	10.0	3.08	0.23	223.0	107.0	9.14	2.04				.17	.00	.00	2.21	2.27	0.23	0.69
60 to 70	3.91	39.1	65.0	10.0	2.54	0.17	223.0	101.0	8.72	1.94				.16	.00	.00	2.10	2.11	0.17	0.57
50 to 60	3.72	37.2	55.0	10.0	2.05	0.11	223.0	94.0	8.30	1.85				.15	.00	.00	2.00	1.96	0.11	0.46
40 to 50	3.25	32.5	45.0	10.0	1.46	0.07	223.0	88.0	7.25	1.62				.13	.00	.00	1.75	1.69	0.07	0.33
30 to 40	2.53	25.3	35.0	10.0	0.89	0.03	223.0	80.0	5.64	1.26				.10	.00	.00	1.36	1.29	0.03	0.20
20 to 30	1.80	18.0	25.0	10.0	0.45	0.01	223.0	70.0	4.01	0.89				.07	.00	.00	.96	.90	0.01	0.10
10 to 20	1.09	10.9	15.0	10.0	0.16	0.00	223.0	55.0	2.43	0.54				.05	.00	.00	.59	.54	0.00	0.04
0 to 10	0.38	3.8	5.0	10.0	0.02	0.00	223.0	31.0	0.85	0.19				.02	.00	.00	.21	.19	0.00	0.00
		12.5	124.0		1.55	0.19	216.2		2.70	0.58							.58	.77	0.19	0.34
		28.2	126.0		3.55	0.45	266.0		7.50	2.00							2.00	2.45	0.45	0.94
		4.4	130.0		0.57	0.07	206.0		0.91	0.19							0.19	.26	0.07	0.12
		50.0	134.0		6.70	0.90	265.0		13.25	3.51							3.51	4.41	0.90	1.78
		43.2	161.0		6.96	1.12	270.0		11.66	3.15							3.15	4.27	1.12	1.88
		25.0	165.0		4.13	0.68	210.0		5.25	1.11							1.11	1.79	0.68	0.87
		33.6	165.0		5.54	0.91	165.0		5.54	0.91							0.91	1.82	0.91	0.91
		19.7	355.5		7.00	2.49	176.0		3.47	0.61							0.61	3.10	2.49	1.23
		35.0	412.0		14.42	5.94	210.0		7.00	1.47							1.47	7.41	5.94	3.03
		117.6	412.0		48.45	19.96	165.0		19.40	3.20							3.20	23.16	19.96	7.99
		50.0	557.0		27.85	15.51	265.0		13.25	3.51							3.51	19.02	15.51	7.39
		4.5	560.0		2.52	1.41	211.0		0.95	0.20							0.80	1.61	1.41	0.53
		4.4	560.0		2.46	1.38	206.0		0.91	0.19							0.19	1.57	1.38	0.51
		28.2	565.0		15.93	9.00	266.0		7.50	2.00							2.00	11.00	9.00	4.24
		12.5	567.0		7.09	4.02	216.0		2.70	0.58							0.58	4.60	4.02	1.53
		2.0	284.0		0.57	0.16	216.0		0.43	0.09							0.09	.25	0.16	.12
		118.6	129.3		15.33	1.98	238.6		28.30	6.75				**0.16			6.91	8.73	1.96	3.66
		8.0	148.0		1.18	0.17	238.6		1.91	0.46				.01			0.47	.63	0.17	.28
		136.8	165.0		22.57	3.72	238.6		32.64	7.79				.30			8.09	11.51	3.72	5.39

DETACHABLE FUSELAGE

STATION	AVER. w	W	X	Δ X	WX/10^3	WX^2/10^6	Z	Δ Z	WZ/10^3	WZ^2/10^6	Y	WY/10^3	WY^2/10^6	Io(xx)/10^6	Io(yy)/10^6	Io(zz)/10^6	Ixx/10^6	Iyy/10^6	Izz/10^6	WXZ/10^6
Column No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Operation		2 x 5			3 x 4	4 x 6			3 x 8	8 x 10		3 x 12	12 x 13	(a)	(b)	(b)	11+14+15	7+11+16	7+14+17	6 x 20
		11.4	179.5		2.05	0.37	238.6		2.72	0.65				.03			0.68	1.02	0.37	0.49
		25.3	197.0		4.98	0.98	238.6		6.04	1.44				.08			1.52	2.42	0.98	1.19
		43.1	214.5		9.24	1.98	238.6		10.28	2.45				.16			2.61	4.43	1.98	2.20
		17.3	232.0		4.01	0.93	238.6		4.13	0.99				.07			1.06	1.92	0.93	0.96
		50.9	249.5		12.70	3.17	238.6		12.14	2.90				.25			3.15	6.07	3.17	3.03
		16.4	267.0		4.38	1.17	238.6		3.91	0.93				.09			1.02	2.10	1.17	1.05
		57.2	284.5		16.27	4.63	238.6		13.65	3.26				.37			3.63	7.89	4.63	3.88
		17.0	302.0		5.13	1.55	238.6		4.06	0.97				.12			1.09	2.52	1.55	1.22
		43.2	319.5		13.80	4.41	238.6		10.31	2.46				.35			2.81	6.87	4.41	3.29
		57.0	337.0		19.21	6.47	238.6		13.60	3.24				.52			3.76	9.71	6.47	4.58
		6.5	355.0		2.31	0.82	238.6		1.55	0.37				.07			0.44	1.19	0.82	0.55
		51.2	373.0		19.10	7.12	238.6		12.22	2.92				.57			3.49	10.04	7.12	4.56
		19.4	391.0		7.59	2.97	238.6		4.63	1.10				.24			1.34	4.07	2.97	1.81
		157.7	412.0		64.97	26.77	238.6		37.63	8.98				2.14			11.12	35.75	26.77	15.50
		55.7	427.0		23.78	10.15	238.6		13.29	3.17				0.81			3.98	13.32	10.15	5.67
		6.0	444.5		2.67	1.19	238.6		1.43	0.34				.10			0.44	1.53	1.19	0.64
		49.6	462.0		22.92	9.21	238.6		11.83	2.82				.58			3.40	12.03	9.21	5.47
		5.9	479.5		2.83	1.36	238.6		1.41	0.34				.11			0.45	1.70	1.36	0.68
		48.5	497.0		24.10	11.98	238.6		11.57	2.76				.96			3.72	14.74	11.98	5.75
		5.8	514.5		2.98	1.53	238.6		1.38	0.33				.12			0.45	1.86	1.53	0.71
		46.3	532.0		24.63	13.10	238.6		11.05	2.64				1.05			3.69	15.74	13.10	5.88
		5.6	549.5		3.08	1.69	238.6		1.34	0.32				.14			0.46	2.01	1.69	0.73
		78.7	565.7		44.52	25.18	238.6		18.78	4.48				2.01			6.49	29.66	25.18	10.62
* 0 to 671.3														3.27	0	0	3.27	0	0	
TOTAL		5121.2	342.44		1753.70	741.10	235.0		1203.43	284.25	0	0	0	31.03	0.17	0.17	315.28	1025.52	741.27	414.19

* Skin & Stringers
**See P. 32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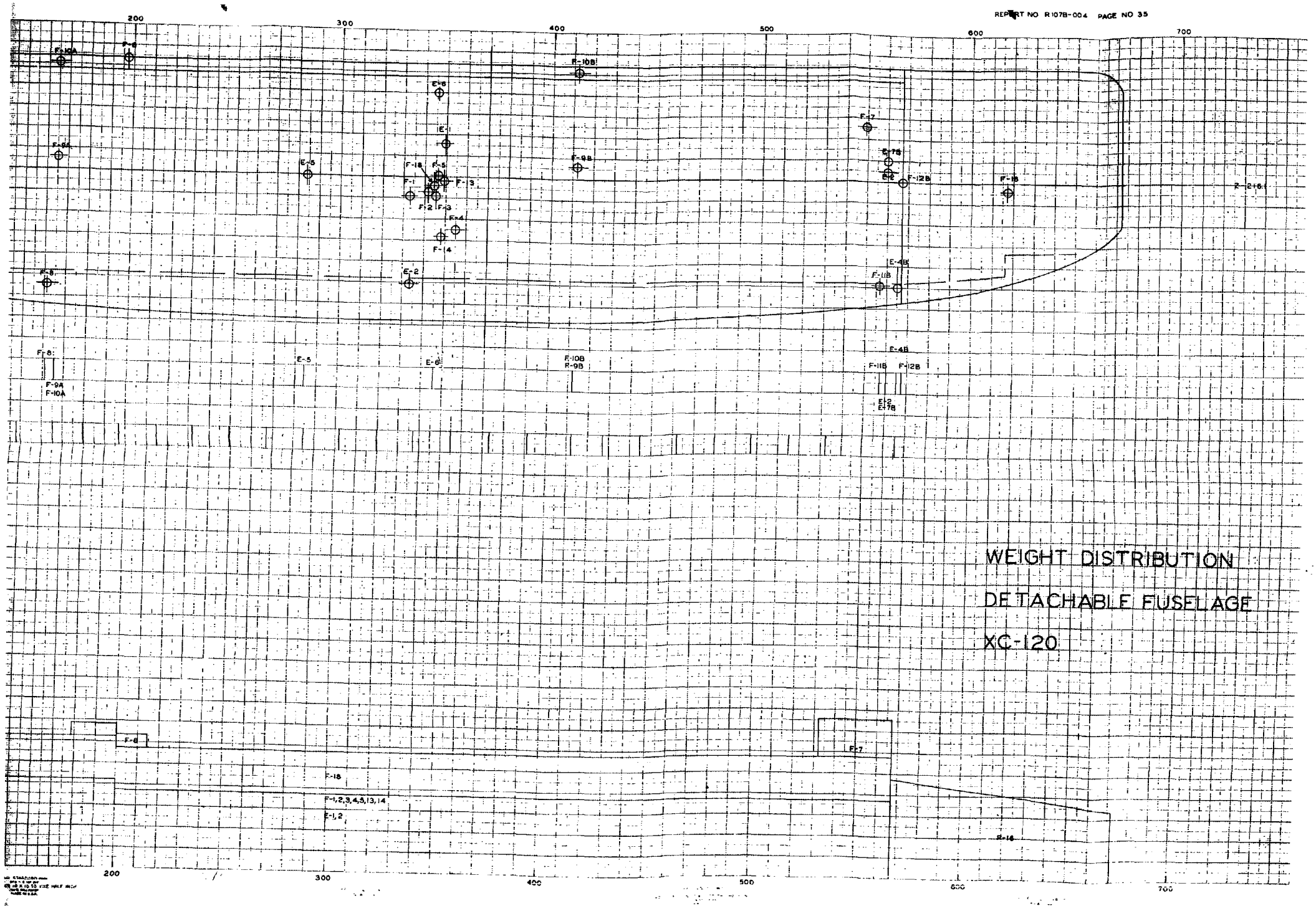


WEIGHT DISTRIBUTION

DETACHABLE FUSELAGE

XC-120

Subject:— MASS MOMENTS OF INERTIA CALCULATIONS

CREW NACELLE AND CONTENTS

(H-1) Frames

Station	Weight
80.0	3.0
90.5	5.0
105.0	4.0
124.0	4.0
143.0	5.0
162.0	46.5
179.5	21.0
197.0	12.0
214.5	12.0
232.0	12.0
248.5	12.0
267.0	12.0
284.3	12.0
302.0	12.0
319.5	12.9
337.0	33.4
335.0	15.0
373.0	15.0
391.0	15.0
409.0	86.3
427.0	10.0
444.5	10.0
462.0	10.0
479.5	10.0
497.0	10.0
514.5	7.0
532.0	7.0
549.5	7.0
567.0	7.0
591.0	7.0
608.0	6.0
624.0	6.0
641.0	5.0
658.0	4.0
671.3	3.0

= 459.1

(H-2A) Wing Attachment - Fr. = 24.4
(H-2B) Wing Attachment - Rr. = 24.5

(H-3) Covering, Stringers, Rivets, Etc. = 881.0

(H-4) Cockpit Flooring = 25.6
= 93.0
= 135.0
= 253.6

(H-5) Equipment Comp. Floor = = 17.2

Subject:— MASS MOMENTS OF INERTIA CALCULATIONS

CREW NACELLE AND CONTENTS

(H-6) Pod Attachment - Fore			= 77.5
(H-7) Pod Attachment - Aft			= 77.5
(H-8) Cockpit Enclosure			= 200.0
(H-9) Navigator's Dome Hatch			= 10.0
(H-10) Windows			= 22.8
(H-11) Life Raft Compartment			= 31.4
(H-12) Door - Cockpit Hatch			= 10.0
(H-13) Grips			= 2.0
(H-14) Prov. for Equipment - Cockpit Section			
Radio	= 25.0		
Electrical	= 9.3		
Controls - Surface	= 83.1		
Controls - Engine	= 4.2		
Instruments	= 1.8		
Crew Seats	= 11.4		= 134.8
(H-15) Prov. for Equipment - Equipment Sect.			
Hydraulic System	= 4.8		
Acc. Power Plant	= 12.3		
Electrical	= 9.3		
Radio	= 5.9		
Anti-Icing	= 1.7		
Pulley Covers	= 12.9		
Oxygen	= 4.8		
Hoisting	= 27.4		= 79.1
(H-16) Upper Rear Hatch			= 27.2
(H-17) Upper Forward Hatch			= 30.0
(H-18) Rear Exit Door			= 10.0

MODEL XC-120 PREPARED BY CHECKED BY APPROVED BY

DATE 6 May 1948
REVISED 14 Feb. 1949

Subject: MASS MOMENTS OF INERTIA CALCULATIONS

CREW NACELLE AND CONTENTS

(J-1)	Brake Operating System	=	177.3
(J-2)	Power Plant Controls - Pedestal	=	64.2
(J-3)	Power Plant Controls - Cables , etc.	=	28.6
(J-4)	Propeller & Controls - Reversing Controls	=	7.0
(J-5)	Propeller & Controls - Two-Engine - Synchronizer	=	25.0
(J-6)	Propeller & Controls - Switches, Relays, & Misc.	=	42.4
(J-7)	Propeller & Controls - De-Icer Timer	=	3.8
(J-8)	Instruments - Instrument Panel	=	77.2
(J-9)	Instruments - Not Used	=	0.
(J-10)	Instruments - Tubing, Etc.	=	54.7
(J-11)	Instruments - Amplifier and Calibration Unit	=	24.8
(J-12)	Surface Controls - Control Column, Supports, Pedals	=	160.3
(J-13)	Surface Controls - Flap Mech.	=	56.7
(J-14)	Surface Controls - Main Sectors	=	50.0
(J-15)	Surface Controls - Cables, Brkts. & Pulleys	=	268.9
(J-16)	Surface Controls - Auto Pilot - Servos, Etc.	=	54.0
(J-17)	Surface Controls - Auto Pilot - Junc. Box, Amplifier, etc.	=	28.0
(J-18)	Surface Controls - Auto Pilot - Instruments	=	5.0
(J-19)	Surface Controls - Auto-Pilot - Wiring & Misc.	=	75.5
(J-20)	Electrical - Battery	=	74.0
(J-21)	Electrical - Inverters	=	134.4
(J-22)	Electrical - Regulators	=	12.6
(J-23)	Electrical - External Power	=	14.8
(J-24)	Electrical - Power Junction Box	=	13.6
(J-25)	Electrical - Main Junction Box	=	15.9

Subject:— MASS MOMENTS OF INERTIA CALCULATIONS

CREW NACELLE AND CONTENTS

(J-26)	Electrical - Nose Junc. Box		= 7.5
(J-27)	Electrical - Wiring & Misc.		= 402.5
(J-28)	Communicating - Pedestal		= 22.7
(J-29)	Communicating - at Cockpit Comp.		= 704.8
(J-30)	Communicating - Equipment - Compartment Floor		= 80.0
(J-31)	Furnishings - Seats, Pilot and Co-Pilot		= 124.0
(J-32)	Furnishings - Seats, Navigator & Crew Chief		= 38.4
(J-33)	Furnishings - Seat, Radio Operator		= 19.2
(J-34)	Furnishings - Safety Belts - Crew		= 15.0
(J-35)	Furnishings - Instrument Board - Pilot		= 34.9
(J-36)	Furnishings - Instrument Board - Navigator		= 4.0
(J-37)	Furnishings - Relief Tube		= 10.0
(J-38)	Furnishings - Lavatory Facilities		= 37.0
(J-39)	Furnishings - Entrance Ladder		= 20.5
(J-40)	Furnishings - Soundproofing - Cockpit		= 98.6
(J-41)	Furnishings - Fixed CO_2 - Fire Extinguisher		= 96.5
(J-42)	Furnishings - Portable CO_2		= 25.5
(J-43)	Furnishings - Portable CCL_4		= 7.2
(J-44)	Furnishings - First Aid Kit		= 4.4
(J-45)	Furnishings - Misc.		
	Radio Tables	= 20.0	
	Radio Shelves & Supports	= 40.0	
	Navigation Table & Shelves	= 39.6	
	Map Cases & Report Holders	= 5.5	
	Stowage for Navigation Equip.	= 6.0	
	Prov. for Driftmeter	= 3.1	
	Prov. for Astrocompass	= 1.5	
			= 115.7

Subject:— MASS MOMENTS OF INERTIA CALCULATIONS

CREW NACELLE AND CONTENTS

(J-46)	Furnishings - Stowage Handcrank		= 0.5
(J-47)	Furnishings - Oxygen Install.		= 60.0
(J-48)	Furnishings - Windshield Wipers		= 8.6
(J-49)	Furnishings - Air Conditioning		= 212.0
(J-50)	Anti-Icing - Heaters	= 303.5	
	Supports	= 28.0	
		331.5	= 331.5
(J-51)	Anti-Icing - Ducting, etc.		= 223.5
(J-52)	Acc. Power Plant		= 162.0
(J-53A)	Hoisting Mechanism - Forward		= 209.2
(J-53B)	Hoisting Mechanism - Aft.		= 209.1

MODEL XC-120 PREPARED BY CHECKED BY APPROVED BY

DATE 6 May 1948
REVISED 14 Feb. 1949

Subject: MASS MOMENTS OF INERTIA CALCULATIONS

CREW NACELLE

$I_{o(xx)}$ of Frames

Ratio of I_o to I_x

$I_x = WZ^2 = W\ (120)^2 = 14{,}400\ W$

$I_{o(xx)} = \frac{W}{4}\ (4 \times 38^2) + (3 \times 3^2) = 1{,}450\ W$

Ratio $= 1450 \div 14400 = 0.10$

$I_{o(xx)}$ of Skin & Stringers

$I_{o(xx)} = WR^2 = 881.0 \times 35^2$

$= 1.08 \times 10^6$

MODEL XC-120 PREPARED BY CHECKED BY APPROVED BY

Subject: MASS MOMENTS OF INERTIA CALCULATIONS CREW NACELLE

DATE 6 May 1948
REVISED 21 July 1948
14 Feb. 1949

* Skin & Stringers

(a) = $I_o(xx) = 0.0833\ W\ \overline{\Delta Z}^2$ (b) = $I_o(yy) = I_o(zz) = 0.0833\ W\ \overline{\Delta X}^2$

STATION	AVER. w	W	X	Δ X	WX/10³	WX²/10⁶	Z	Δ Z	WZ/10³	WZ²/10⁶	V	WY/10³	WY²/10⁶	Io(xx)/10⁶	Io(yy)/10⁶	Io(zz)/10⁶	Ixx/10⁶	Iyy/10⁶	Izz/10⁶	WXZ/10⁸
Column No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Operation		2 x 5			3 x 4	4 x 6			3 x 8	8 x 10		3 x 12	12 x 13	(a)	(b)	(b)	11+14+15	7+11+16	7+14+17	6 x 8
658.0 to 671.3	1.36	18.1	664.7	13.3	12.03	8.00	142.9	20.0	2.59	0.37				.00	.00	.00	0.37	8.37	8.00	1.72
641.0 to 658.0	1.78	30.3	649.5	17.0	19.68	12.78	137.5	25.0	4.17	0.57				.00	.00	.00	0.57	13.35	12.78	2.71
608.0 to 641.0	6.98	230.4	626.5	33.0	143.88	89.85	144.5	32.0	33.29	4.81				.02	.02	.02	4.83	94.68	89.87	20.79
576.0 to 608.0	4.36	139.5	592.0	32.0	82.58	48.89	142.5	40.0	19.68	2.83				.02	.01	.01	2.85	51.73	48.90	11.77
557.0 to 576.0	4.83	43.5	571.5	9.0	24.86	14.21	142.5	15.0	6.18	0.88				.01	.00	.00	0.89	15.09	14.21	3.53
514.0 to 557.0	7.79	412.9	540.5	53.0	[illegible]	[illegible]	[illegible]	[illegible]	58.80	8.37				.09	.10	.10	8.46	129.09	120.72	31.78
497.0 to 514.0	8.27	140.6	505.5	17.0	71.07	35.93	139.8	59.0	19.56	2.75				.04	.00	.00	2.79	38.68	35.93	9.94
462.0 to 497.0	9.75	341.[illegible]	479.[illegible]	35.0	163.[illegible]	78.[illegible]	136.1	59.0	46.44	6.32				.12	.03	.03	6.44	84.80	78.48	22.27
444.5 to 462.0	4.67	81.7	453.[illegible]	17.5	37.[illegible]	16.79	[illegible]	69.0	10.56	1.36				.03	.00	.00	1.39	18.15	16.79	4.78
427.0 to 444.5	4.21	73.7	436.5	17.5	[illegible]	[illegible]	[illegible]	71.0	9.40	1.20				.03	.00	.00	1.23	15.20	14.00	4.10
409.0 to 427.0	5.01	90.2	418.0	18.0	37.70	15.76	125.8	74.0	11.35	1.43				.04	.00	.00	1.47	17.19	15.76	4.74
373.0 to 409.0	5.88	211.7	391.0	36.0	82.77	32.36	126.5	77.0	26.78	3.39				.10	.02	.02	3.49	35.77	32.38	10.47
337.0 to 373.0	5.95	214.2	355.0	36.0	76.04	26.99	127.9	81.0	27.40	3.50				.12	.02	.02	3.62	30.51	27.01	9.73
319.5 to 337.0	8.69	152.1	328.3	17.5	49.93	16.39	126.4	82.0	18.77	2.41				.02	.00	.00	2.50	18.80	16.39	6.41
284.5 to 319.5	12.94	452.9	302.0	35.0	136.75	41.30	125.6	84.0	56.87	7.14				.27	.05	.05	7.41	48.49	41.35	17.18
267.0 to 284.5	13.00	227.5	275.8	17.5	62.74	17.30	125.6	82.0	28.57	3.59				.13	.01	.01	3.73	20.90	17.31	7.88
232.0 to 267.0	12.30	430.5	[illegible]	35.0	107.38	26.79	125.8	84.0	54.14	6.81				.25	.04	.04	7.06	33.[illegible]	26.83	13.51
197.0 to 232.0	12.22	427.6	214.5	35.0	91.72	19.67	125.9	81.0	53.83	6.78				.23	.04	.04	7.01	26.49	19.71	11.55
179.5 to 197.0	12.34	216.0	188.3	17.5	40.[illegible]	7.66	126.1	80.0	27.24	3.43				.12	.01	.01	3.55	11.10	7.67	5.13
162.0 to 179.5	6.00	105.0	170.8	17.5	17.93	3.06	129.1	77.0	14.61	1.03				.05	.00	.00	2.08	5.09	3.06	2.49
143.0 to 162.0	7.98	151.6	152.5	19.0	23.12	3.53	127.7	75.0	19.36	2.47				.07	.00	.00	2.54	6.00	3.53	2.95
124.0 to 143.0	10.30	195.7	133.5	19.0	26.13	3.49	131.0	71.0	25.44	3.36				.08	.01	.01	3.44	6.86	3.50	3.42
105.0 to 124.0	10.30	195.7	114.5	19.0	22.41	2.57	132.0	60.0	25.64	3.26				.06	.01	.01	3.42	5.94	2.58	2.94
97.0 to 105.0	8.45	67.6	101.0	8.0	6.83	0.69	126.2	46.0	8.67	1.11				.01	.00	.00	1.12	1.80	0.69	.88
92.5 to 97.0	5.37	24.2	94.8	4.5	2.29	0.22	141.7	41.0	3.43	0.49				.00	.00	.00	0.49	0.71	0.22	.32
80.0 to 92.5	3.28	41.0	86.3	12.5	3.54	0.31	138.0	36.0	5.66	0.78				.00	.00	.00	0.78	1.09	0.31	.49
68.5 to 80.0	0.56	6.4	74.3	11.5	0.48	0.04	126.0	24.0	0.77	0.09				.00	.00	.00	0.09	0.13	0.04	.06
622.0		13.6	622.0		8.46	5.26	154.0		2.09	0.32							0.32	5.58	5.26	1.30
621		134.4	577.0		77.55	44.75	150.0		20.16	3.02							3.02	47.77	44.75	11.63
600		14.8	600.0		8.88	5.33	155.0		2.29	0.35							0.35	5.68	5.33	1.38
		74.0	600.0		44.40	26.64	151.0		11.17	1.69							1.69	28.33	26.64	6.70
		24.8	577.0		14.31	8.26	142.0		3.52	0.50							0.50	8.76	8.26	3.03
		28.0	576.0		16.13	9.29	142.0		3.98	0.57							0.57	9.86	9.29	2.29
		96.5	576.0		55.58	32.01	130.0		12.55	1.63							1.63	33.64	32.01	7.23
		12.6	453.0		5.71	14.31	125.0		1.58	0.20							0.20	14.51	14.31	.71
		56.7	440.0		24.95	10.98	142.0		8.05	1.14							1.14	12.12	10.98	3.54
		0.5	440.0		0.22	0.10	139.0		0.07	0.01							0.01	0.11	0.10	.03
		50.0	418.0		20.90	8.74	140.0		7.00	0.98							0.98	9.72	8.74	2.93
		54.0	418.0		22.57	9.43	145.0		7.83	1.14							1.14	10.57	9.43	3.27
		3.8	410.0		1.56	0.64	107.0		0.41	0.04							0.04	0.68	0.64	.17
		24.5	410.0		10.05	4.12	110.0		2.70	0.30							0.30	4.42	4.12	1.11
		77.5	410.0		31.78	13.03	159.0		12.32	1.96							1.96	14.99	13.03	5.05
		15.9	406.0		6.46	2.62	107.0		1.70	0.18							0.18	2.80	2.62	.69
		24.4	337.0		8.22	2.77	153.5		3.75	0.58							0.58	3.35	2.77	1.26
		11.4	258.0		2.94	0.76	112.0		1.28	.14							0.14	0.90	0.76	.33
		19.2	2[illegible]		4.79	1.19	137.0		2.63	.36							0.36	1.55	1.19	.65
		0	0		0	0	0		0	0							0	0	0	0
		11.4	273.0		2.[illegible]	0.57	112.0		1.28	.14							0.14	0.71	0.57	.28
		54.7	219.0		11.98	2.62	158.0		8.[illegible]	1.37							1.37	3.99	2.62	1.89
		38.4	214.5		8.24	1.77	137.0		5.[illegible]	.72							0.72	2.49	1.77	1.13

Subject:— MASS MOMENTS OF INERTIA CALCULATIONS
CREW NACELLE

** See Page 41

* Skin & Stringers

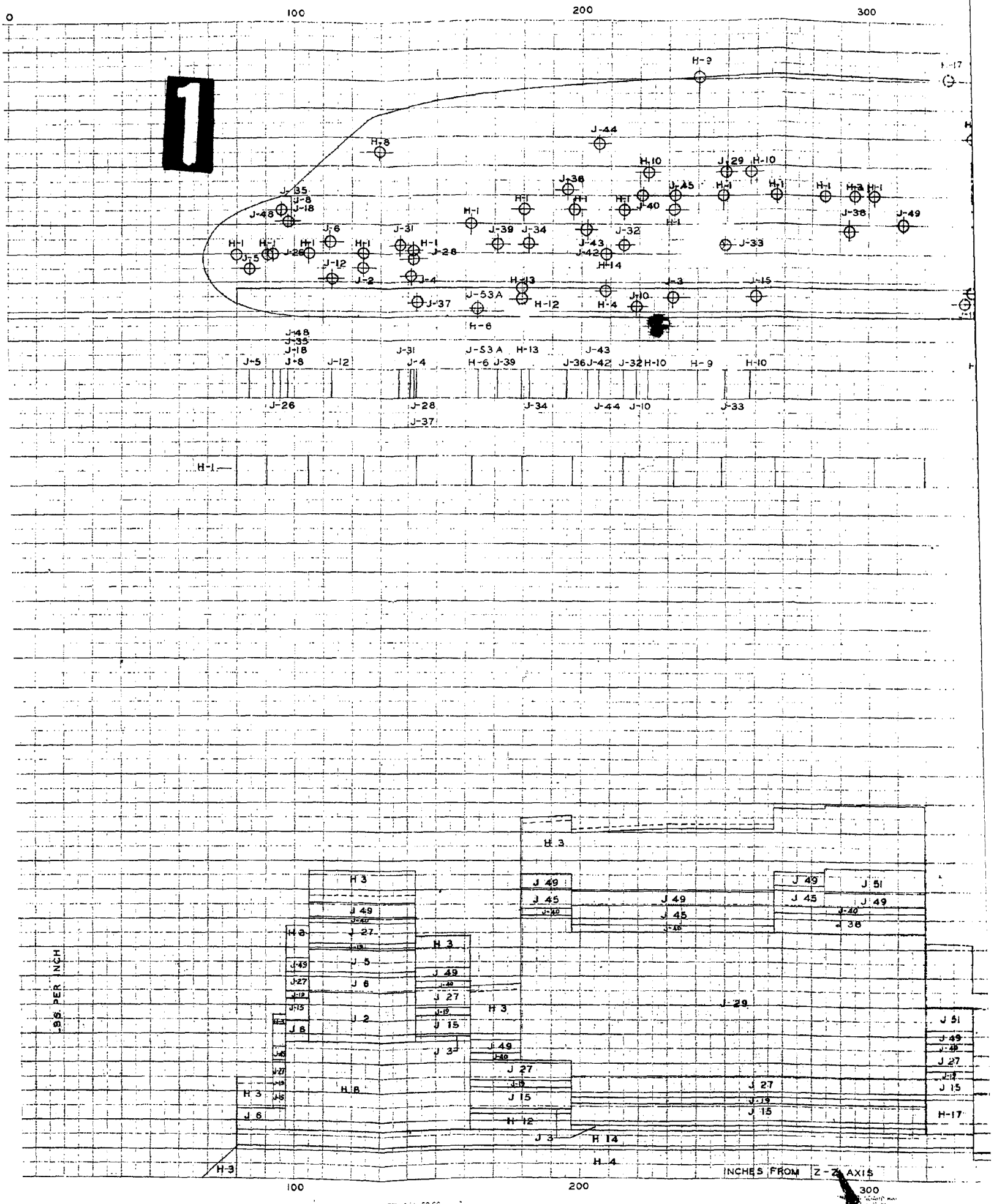
(a) $= I_o(xx) = 0.0833\ W\ \overline{\Delta Z}^2$ (b) $I_o(yy) = I_o(zz) = 0.0833\ W\ \overline{\Delta X}^2$

STATION	AVER. W	W	X	ΔX	WX/10³	WX²/10⁶	Z	ΔZ	WZ/10³	WZ²/10⁶	Y	WY/10³	WY²/10⁶	Io(xx)/10⁶	Io(yy)/10⁶	Io(zz)/10⁶	Ixx/10⁶	Iyy/10⁶	Izz/10⁶	WXY/10⁶
Column No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Operation		2 x 5			3 x 4	4 x 6			1 x 8	8 x 10		3 x 12	12 x 13	(a)	(b)	(b)	11+14+15	7+11+16	7+14+17	6 x 8
		4.4	205.0		0.90	.19	102.0		0.45	0.05				.14			0.05	0.24	0.19	.09
		25.5	202.0		5.15	1.04	132.0		3.37	0.44							0.44	1.48	1.04	.68
		7.2	202.0		1.45	0.29	132.0		0.95	0.13							0.13	0.42	0.29	.19
		4.0	195.0		0.78	0.15	118.0		0.47	0.06							0.06	0.21	0.15	.09
		77.5	179.5		13.91	2.50	159.0		12.32	1.96							1.96	4.46	2.50	2.21
		2.0	179.5		0.36	0.06	152.0		0.30	0.05							0.05	0.11	0.06	.05
		20.5	171.5		3.51	0.60	137.0		2.81	0.38							0.38	0.98	0.60	.48
		10.0	143.0		1.43	0.20	157.0		1.57	0.25							0.25	0.45	0.20	.22
		22.7	142.0		3.22	0.46	142.0		3.22	0.46							0.46	0.92	0.46	.46
		7.0	141.0		0.99	0.14	148.0		1.04	0.15							0.15	0.29	0.14	.15
		124.0	137.0		16.99	2.33	137.0		16.99	2.33							2.33	4.66	2.33	2.33
		160.3	113.0		18.11	2.05	149.0		23.88	3.56							3.56	5.61	2.05	2.70
		77.2	98.0		7.57	0.74	129.0		9.96	1.28							1.28	2.02	0.74	.98
		5.0	98.0		0.49	0.05	129.0		0.65	0.08							0.08	0.13	0.05	.06
		34.9	98.0		3.42	0.34	129.0		4.50	0.58							0.58	0.92	0.34	.44
		6.6	95.0		0.62	0.06	125.0		1.08	0.14							0.14	0.22	0.08	.10
		7.5	92.5		0.69	0.06	120.0		1.05	0.15							0.15	0.21	0.06	.10
		25.0	84.5		2.11	0.18	105.0		3.83	0.53							0.53	0.71	0.18	.31
		15.0	182.0		2.73	0.50	137.0		2.06	0.28							0.28	0.78	0.50	.37
		3.0	671.3		2.01	1.35	152.0		0.46	0.07				.14**			0.21	1.42	1.35	.31
		4.0	658.0		2.63	1.73	150.0		0.60	0.09				.17			0.26	1.82	1.73	.39
		5.0	641.0		3.21	2.06	148.0		0.74	0.11				.21			0.32	2.17	2.06	.48
		6.0	624.0		3.74	2.33	145.0		0.87	0.13				.23			0.36	2.46	2.33	.54
		6.0	608.0		3.65	2.22	145.0		0.87	0.13				.22			0.35	2.35	2.22	.53
		7.0	591.0		4.14	2.45	142.0		0.99	0.14				.25			0.39	2.59	2.45	.59
		7.0	567.0		3.97	2.25	140.0		0.98	0.14				.23			0.37	2.39	2.25	.56
		7.0	549.5		3.85	2.12	137.0		0.96	0.13				.21			0.34	2.25	2.12	.53
		7.0	532.0		3.72	1.98	135.0		0.95	0.13				.20			0.33	2.11	1.98	.50
		7.0	514.5		3.60	1.85	135.0		0.95	0.13				.19			0.32	1.98	1.85	.49
		10.0	497.0		4.97	2.47	133.0		1.33	0.18				.25			0.43	2.65	2.47	.66
		10.0	479.5		4.80	2.30	130.0		1.30	0.17				.23			0.40	2.47	2.30	.62
		10.0	462.0		4.62	2.13	130.0		1.30	0.17				.21			0.38	2.30	2.13	.60
		10.0	444.5		4.45	1.98	125.0		1.25	0.16				.20			0.36	2.14	1.98	.56
		10.0	427.0		4.27	1.82	125.0		1.25	0.16				.18			0.34	1.98	1.82	.53
		86.3	409.0		35.30	14.44	110.0		9.49	1.04				1.44			2.48	15.48	14.44	3.88
		15.0	391.0		5.87	2.30	100.0		1.50	0.15				.23			0.38	2.45	2.30	.59
		15.0	373.0		5.60	2.09	95.0		1.43	0.14				.21			0.35	2.23	2.09	.53
		15.0	355.0		5.33	1.89	95.0		1.43	0.14				.19			0.33	2.03	1.89	.51
		33.4	337.0		11.26	3.79	100.0		3.34	0.33				.38			0.71	4.12	3.79	1.13
		12.9	319.5		4.12	1.32	120.0		1.55	0.19				.13			0.32	1.51	1.32	.49
		12.0	300.0		3.62	1.09	120.0		1.44	0.17				.11			0.28	1.26	1.09	.43
		12.0	284.0		3.41	0.97	120.0		1.44	0.17				.10			0.27	1.14	0.97	.41
		12.0	267.0		3.20	0.85	120.0		1.44	0.17				.09			0.26	1.02	0.85	.38
		12.0	248.5		2.98	0.74	120.0		1.44	0.17				.07			0.24	0.91	0.74	.36
		12.0	232.0		2.78	0.64	125.0		1.50	0.19				.06			0.25	0.83	0.64	.35
		12.0	214.5		2.57	0.55	125.0		1.50	0.19				.06			0.25	0.74	0.55	.32
		12.0	197.0		2.36	0.46	125.0		1.50	0.19				.05			0.24	0.65	0.46	.30
		21.0	179.0		3.77	0.68	125.0		2.63	0.33				.07			0.40	1.01	0.68	.47
		46.5	162.0		7.53	1.22	130.0		6.05	0.79				.12			0.91	2.01	1.22	.98
		5.0	143.0		0.72	0.10	139.0		0.68	0.09				.01			0.10	0.19	0.10	.10

* Skin & Stringers

(a) $I_o(xx) = 0.0833\ W\ \overline{\Delta Y}^2$ (b) $I_o(yy) = I_o(zz) = 0.0833\ W\ \overline{\Delta Y}^2$

STATION	AVER. w	W	X	ΔX	WX/10³	WX²/10⁶	Z	ΔZ	WZ/10³	WZ²/10⁶	Y	WY/10³	WY²/10⁶	Io(xx)/10⁶	Io(yy)/10⁶	Io(zz)/10⁶	Ixx/10⁶	Iyy/10⁶	Izz/10⁶	WXZ/10⁶
Column No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Operation		3 x 4	4 x 6		3 x 4	4 x 6			3 x 8	8 x 10		3 x 12	12 x 13	(a)	(b)	(b)	11+14+15	7+11+16	7+14+17	6 x 8
		4.0	124.0		0.50	0.06	140.0		0.56	0.08				.00			0.08	0.19	0.06	.07
		4.0	105.0		0.42	0.04	140.0		0.56	0.08				.00			0.08	0.12	0.04	.06
		5.0	90.5		0.45	0.04	140.0		0.70	0.10				.00			0.10	0.14	0.04	.06
* 68.5 to 671.3		3.0	80.0		0.24	0.02	140.0		0.42	0.06				.00			0.06	0.08	0.02	.03
		10.0	240.0		2.40	0.58	79.5		0.80	0.06				1.26			1.26	0	0	0
		27.2	602.0		16.37	9.85	124.5		3.39	0.42							0.06	0.64	0.58	.19
		10.0	584.0		5.84	3.41	158.0		1.59	0.25							0.42	10.27	9.85	2.04
		209.2	164.0		34.31	5.62	159.0		33.27	5.29							0.25	3.66	3.41	.92
		209.2	412.0		86.19	35.51	159.0		33.27	5.29							5.27	10.92	5.62	5.47
																	5.29	40.80	35.51	13.70
TOTAL		7125.6	333.4		2376.06	994.11			957.95	129.95	0	0	0	9.58	0.37	0.37	139.63	1124.43	994.48	322.51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H-4
J-10
H-6
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J-26
J-28
J-34
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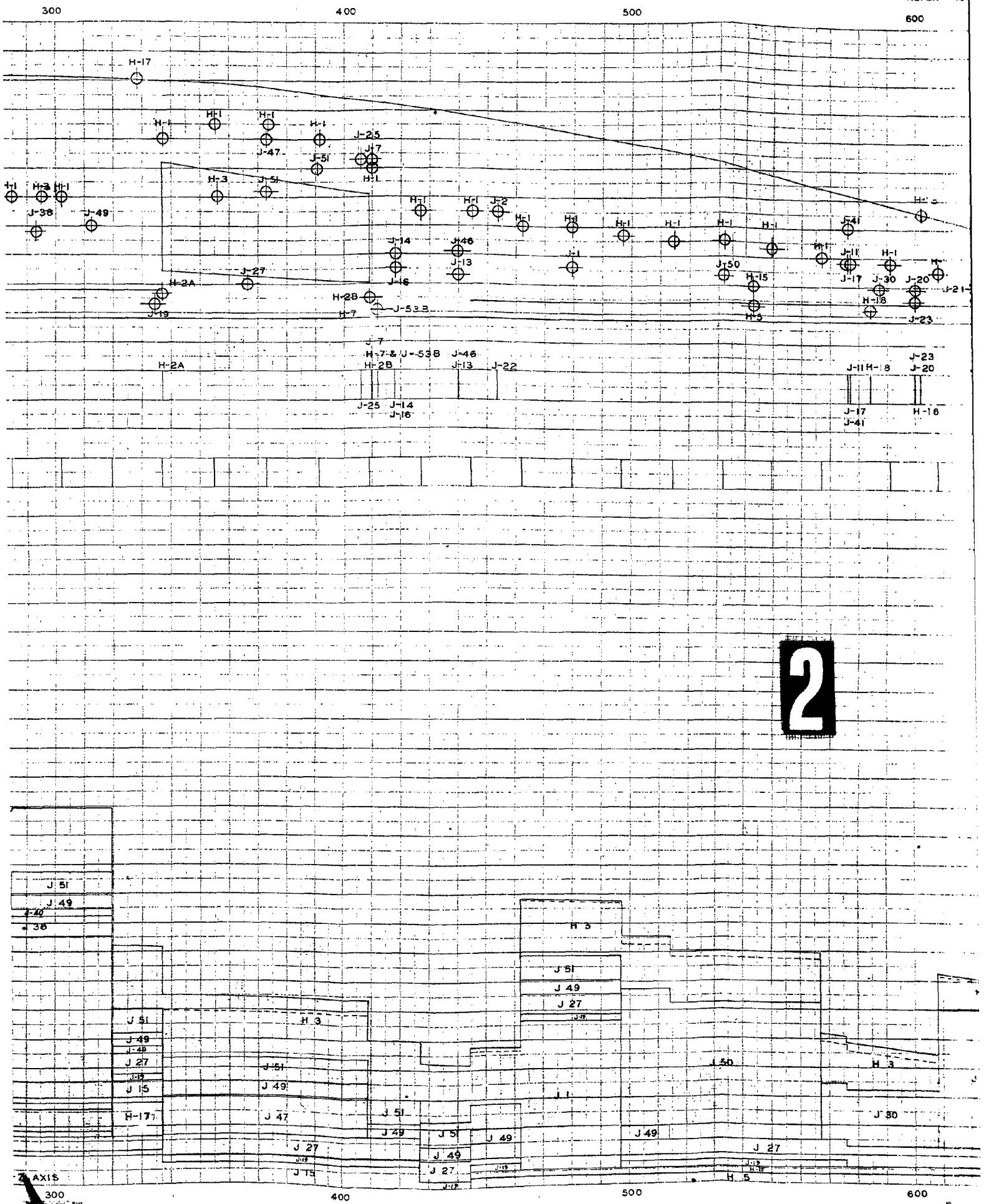
J-10
J-33
J-37
H-1
H-3
J 49
J 45
J 51
J 38
J 27
J 5
J 6
J 2
J 8
J 3
J 15
J 29
H 8
H 12
H 14
H 4
H-17
BS PER INCH
INCHES FROM Z-Z AXIS
100
200
300

REPORT NO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400
500
600
H-17
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H-2B
J-19
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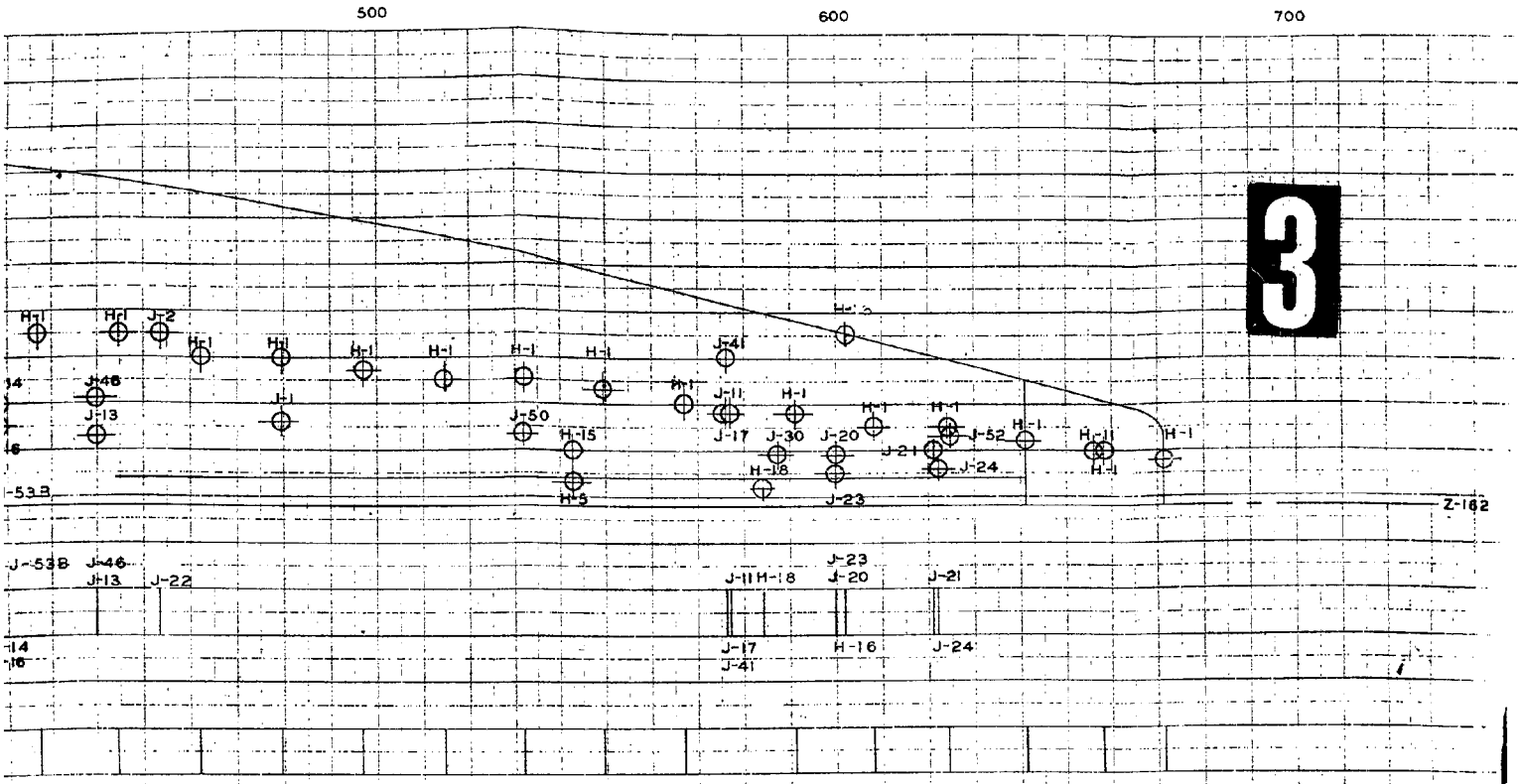
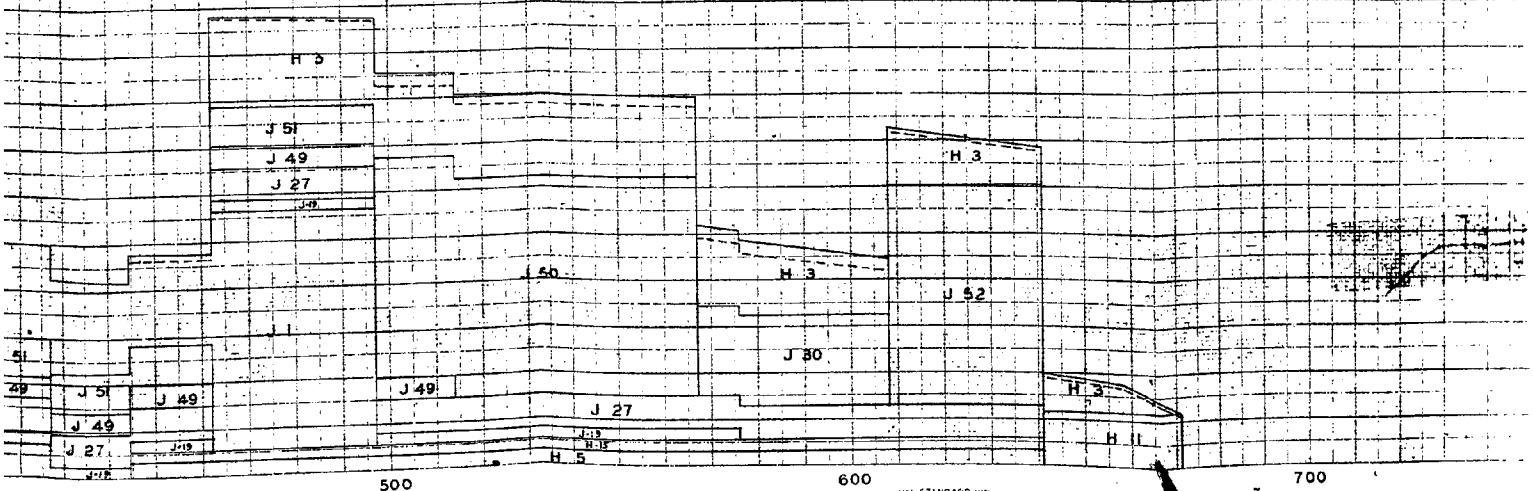
J-53B
J-1
J-50
H-15
H-5
J-41
J-11
J-17
J-30
J-20
J-21
H-18
J-23
H-7 & J-53B
J-22
J-25
J-14
J-16
J-11
H-8
H-16
J-41
2
J 51
J 49
J-40
J 38
H 3
J 27
J-19
J 15
H-17
J 47
J 50
J 1
J 30
H 5
AXIS
300
400
500
600



WEIGHT DISTRIBUTION
CREW NACELLE
XC-120



FRANK STANDARD
CROSS SECTION 10 X 10 TO THE HALF INCH
MADE IN U.S.A.
KEUFFEL & ESSER CO.
NEW YORK

MODEL XC-120 PREPARED BY CHECKED BY APPROVED BY

DATE 21 July 1948
REVISED 14 Feb. 1949

Subject: MASS MOMENTS OF INERTIA CALCULATIONS - PART III

PRODUCT OF INERTIA

Condition No. 1 - Pack On, Full Fuel, Gear Up, G.W. = 64,000 Lbs.

Centroids $\bar{X}$ = 355.3 in.; $\bar{Z}$ = 169.07 in.

Item	Weight Lbs.	X In.	X-Moment In. Lbs.	Z In.	Z-Moment In. Lbs.	K 10^6	Ix 10^6	Iz 10^6
Weight Empty	40,465.0	340.36	13,772,690	176.26	7,132,510	2378.45	2566.47	7069.78
Pilot	200.0	128	25,600	126	25,200	3.23	3.18	3.28
Co-Pilot	200.0	128	25,600	126	25,200	3.23	3.18	3.28
Crew Chief	200.0	158	31,600	124	24,800	3.92	3.08	4.99
Navigator	200.0	268	53,600	124	24,800	6.65	3.08	14.36
Radio Operator	200.0	254	50,800	124	24,800	6.30	3.08	12.90
Trapped Fuel	100.0	372.5	37,250	153	15,300	5.70	2.34	13.88
Trapped Oil	250.0	290.0	72,500	165	41,250	11.96	6.81	21.03
Usable Fuel	16,020.0	372.5	5,967,450	150	2,403,000	895.18	1336.64	3204.82
Usable Oil	900.0	475	427,500	151	135,900	64.55	20.52	203.06
Misc. Equipment	27.0	275	7,425	105	2,835	0.78	0.30	2.04
Cargo	5,238.0	393.4	2,060,792	266.2	1,394,606	548.54	371.18	810.65
TOTAL - Wheels Down	64,000.0	352.08	22,532,807	175.78	11,250,201	3928.49	4319.86	11364.16
MOMENT CHANGE - Wheels Up			+ 206,393		- 333,601	-53.84	-151.14	+133.16
TOTAL - Wheels Up	64,000.0	355.30	22,739,200	170.57	10,916,600	3874.05	4168.72	11497.23

Product of Inertia about Centroid = $3874.65 \times 10^6 - 64{,}000 \times 355.3 \times 170.57$

$= 3874.65 \times 10^6 - 3{,}878{,}63 \times 10^6 = -3.98 \times 10^6$ Lb. In.^{2} *

Ix about Centroid $= 4168.72 \times 10^6 - 64{,}000\ (170.57)^2$

$= 4168.72 \times 10^6 - 1862.02 \times 10^6 = 2306.70 \times 10^6$ Lb. In.^{2}

Iz about Centroid $= 11497.23 \times 10^6 - 64{,}000\ (355.3)^2$

$= 11497.23 \times 10^6 - 8079.24 \times 10^6 = 3417.99 \times 10^6$ Lb. In.^{2}

+ This value is negative due to choice of axes.

MODEL XC-120 PREPARED BY CHECKED BY APPROVED BY

DATE 21 July 1948

Subject: MASS MOMENTS OF INERTIA CALCULATIONS - PART III REVISED 14 Feb. 1949

PRODUCT OF INERTIA

Condition No. 2 - Pack On, 20% Fuel Gear Down G.W. = 52,000 Lbs.

Centroids $\bar{X}$ = 341.86; $\bar{Z}$ = 175.15

Item	Weight Lbs.	X In.	X-Moment In. Lbs.	Z In.	Z-Moment In. Lbs.	K $\frac{}{10^6}$	Ix $\frac{}{10^6}$	Iz $\frac{}{10^6}$
Weight Empty	40,465.0	340.36	13,772,690	176.26	7,132,510	2378.45	2566.47	7069.78
Pilot	200.0	128	25,600	126	25,200	3.23	3.18	3.28
Co-Pilot	200.0	128	25,600	126	25,200	3.23	3.18	3.28
Crew Chief	200.0	158	31,600	124	24,800	3.92	3.08	4.99
Navigator	200.0	268	53,600	124	24,800	6.65	3.08	14.36
Radio Operator	200.0	254	50,800	124	24,800	6.30	3.08	12.90
Trapped Fuel	100.0	372.5	37,250	153	15,300	5.70	2.34	13.88
Trapped Oil	250.0	290	72,500	165	41,250	11.96	6.81	21.03
Usable Fuel	3,204.0	372.5	1,193,490	150	480,600	179.04	267.32	640.96
Usable Oil	255.0	475	121,125	151	38,505	18.29	5.81	57.53
Misc. Equipment	27.0	275	7,425	105	2,835	0.78	0.30	2.04
Cargo	6,699.0	356.0	2,384,873	192.8	1,291,397	459.80	249.01	849.00
TOTAL - Wheels Down	52,000.0	341.86	17,776,553	175.52	9,127,197	3077.35	3113.66	8693.03

Product of Inertia about Centroid $= 3077.35 \times 10^6 - 52{,}000 \times 341.86 \times 175.52$

$= 3077.35 \times 10^6 - 3120.17 \times 10^6 = -42.82 \times 10^6 \frac{\text{Lb.}}{\text{In.}^2}$ *

Ix about Centroid $= 3113.66 \times 10^6 - 52{,}000\,(175.52)^2$

$= 3113.66 \times 10^6 - 1601.98 \times 10^6 = 1511.68 \times 10^6 \frac{\text{Lb.}}{\text{In.}^2}$

Iz about Centroid $= 8693.03 \times 10^6 - 52{,}000\,(341.86)^2$

$= 8693.03 \times 10^6 - 6077.15 \times 10^6 = 2615.88 \times 10^6 \frac{\text{Lb.}}{\text{In.}^2}$

* This value is negative due to choice of axes.

MODEL XC-120 PREPARED BY CHECKED BY APPROVED BY

DATE 21 July 1948
REVISED 14 Feb. 1949

Subject:— MASS MOMENTS OF INERTIA CALCULATIONS - PART III

PRODUCT OF INERTIA

Condition No. 3 - Pack Off, Full Fuel, Gear Up, G.W. = 53,641Lbs.

Centroids $\bar{X}$ = 352.80 In.; $\bar{Z}$ = 153.29 In.

Item	Weight Lbs.	X In.	X-Moment In. Lbs.	Z In.	Z-Moment In. Lbs.	K 10^6	Ix 10^6	Iz 10^6
Weight Empty	35,344.0	340.06	12,018,990	167.75	5,929,080	1964.26	2251.19	6328.51
Pilot	200.0	128	25,600	126	25,200	3.23	3.18	3.28
Co-Pilot	200.0	128	25,600	126	25,200	3.23	3.18	3.28
Crew Chief	200.0	158	31,600	124	24,800	3.92	3.08	4.99
Navigator	200.0	268	53,600	124	24,800	6.65	3.08	14.36
Radio Operator	200.0	254	50,800	124	24,800	6.30	3.08	12.90
Trapped Fuel	100.0	372.5	37,250	153	15,300	5.70	2.34	13.88
Trapped Oil	250.0	290	72,500	165	41,250	11.96	6.81	21.03
Usable Fuel	16,020.0	372.5	5,967,450	150	2,403,000	895.18	1336.64	3204.82
Usable Oil	900.0	475	427,500	151	135,900	64.55	20.52	203.06
Misc. Equipment	27.0	275	7,425	105	2,835	0.78	0.30	2.04
TOTAL - Wheels Down	53,641.0	348.96	18,718,315	161.30	8,652,165	2965.76	3633.40	9812.15
MOMENT CHANGE -- Wheels Up			+ 206,393		- 333,601	- 53.84	-151.14	+133.16
TOTAL WHEELS UP	53,641.0	352.80	18,924,708	155.08	8,318,564	2911.92	3482.26	9945.31

Product of Inertia about Centroid $= 2911.92 \times 10^6 - 53{,}641.0 \times 352.8 \times 155.08$

$= 2911.92 \times 10^6 - 2934.82 \times 10^6 = -22.90 \times 10^6$ Lb.$\overline{\text{In.}}^2$ *

Ix about Centroid $= 3482.26 \times 10^6 - 53{,}641\ (155.08)^2$

$= 3482.26 \times 10^6 - 1290.06 \times 10^6 = 2192.20$ Lb. $\overline{\text{In.}}^2$

Iz about Centroid $= 9945.31 \times 10^6 - 53641\ (352.8)^2$

$= 9945.31 \times 10^6 - 6676.58 \times 10^6 = 3268.73$ Lb. $\overline{\text{In.}}^2$

* This value is negative due to choice of axes.

MODEL XC-120 PREPARED BY CHECKED BY APPROVED BY

DATE 21 July 1948
REVISED 14 Feb. 1949

Subject: MASS MOMENTS OF INERTIA CALCULATIONS - PART III

PRODUCT OF INERTIA

Condition No. 4 - Pack Off; 20% Fuel, Gear Down, G.W. = 40,180 Lbs.

Centroids $\bar{X}$ = 339.42 in.; $\bar{Z}$ = 164.59 In.

Item	Weight Lbs.	X In.	X-Moment In. Lbs.	Z In.	Z-Moment In. Lbs.	K 10^6	Ix 10^6	Iz 10^6
Weight Empty	35,344	340.06	12,018,990	167.75	5,929,080	1964.26	2251.19	6328.51
Pilot	200	128	25,600	126	25,200	3.23	3.18	3.28
Co-Pilot	200	128	25,600	126	25,200	3.23	3.18	3.28
Crew Chief	200	158	31,600	124	24,800	3.92	3.08	4.99
Navigator	200	268	53,600	124	24,800	6.65	3.08	14.36
Radio Operator	200	254	50,800	124	24,800	6.30	3.08	12.90
Trapped Fuel	100	372.5	37,250	153	15,300	5.70	2.34	13.88
Trapped Oil	250	290	72,500	165	41,250	11.96	6.81	21.03
Usable Fuel	3,204	372.5	1,193,490	150	480,600	179.04	267.32	640.96
Usable Oil	255	475	121,125	151	38,505	18.29	5.81	57.53
Misc. Equipment	27	275	7,425	105	2,835	0.78	0.30	2.04
TOTAL - WHEELS DOWN	40,180	339.42	13,637,980	165.07	6,632,370	2203.36	2549.37	7102.76

Product of Inertia about Centroid $= 2203.36 \times 10^6 - 40,180 \times 339.42 \times 165.07$
$= 2203.36 \times 10^6 - 2251.21 \times 10^6 = -47.8$ Lb. In.^{2} *

Ix about Centroid $= 2549.37 \times 10^6 - 40,180\ (165.07)^2$

$= 2549.37 \times 10^6 - 1094.83 \times 10^6 = 1454.54$ Lb. In.^{2}

Iz about Centroid $= 7102.76 \times 10^6 - 40,180\ (339.42)^2$

$= 7102.76 \times 10^6 - 4628.97 \times 10^6 = 2473.79$ Lb. In.^{2}

* This value is negative due to choice of axes.

PART II

MASS MOMENTS OF INERTIA ABOUT AIRPLANE CENTERS OF GRAVITY

MODEL XC-120 PREPARED BY Hawley CHECKED BY Meyer APPROVED BY

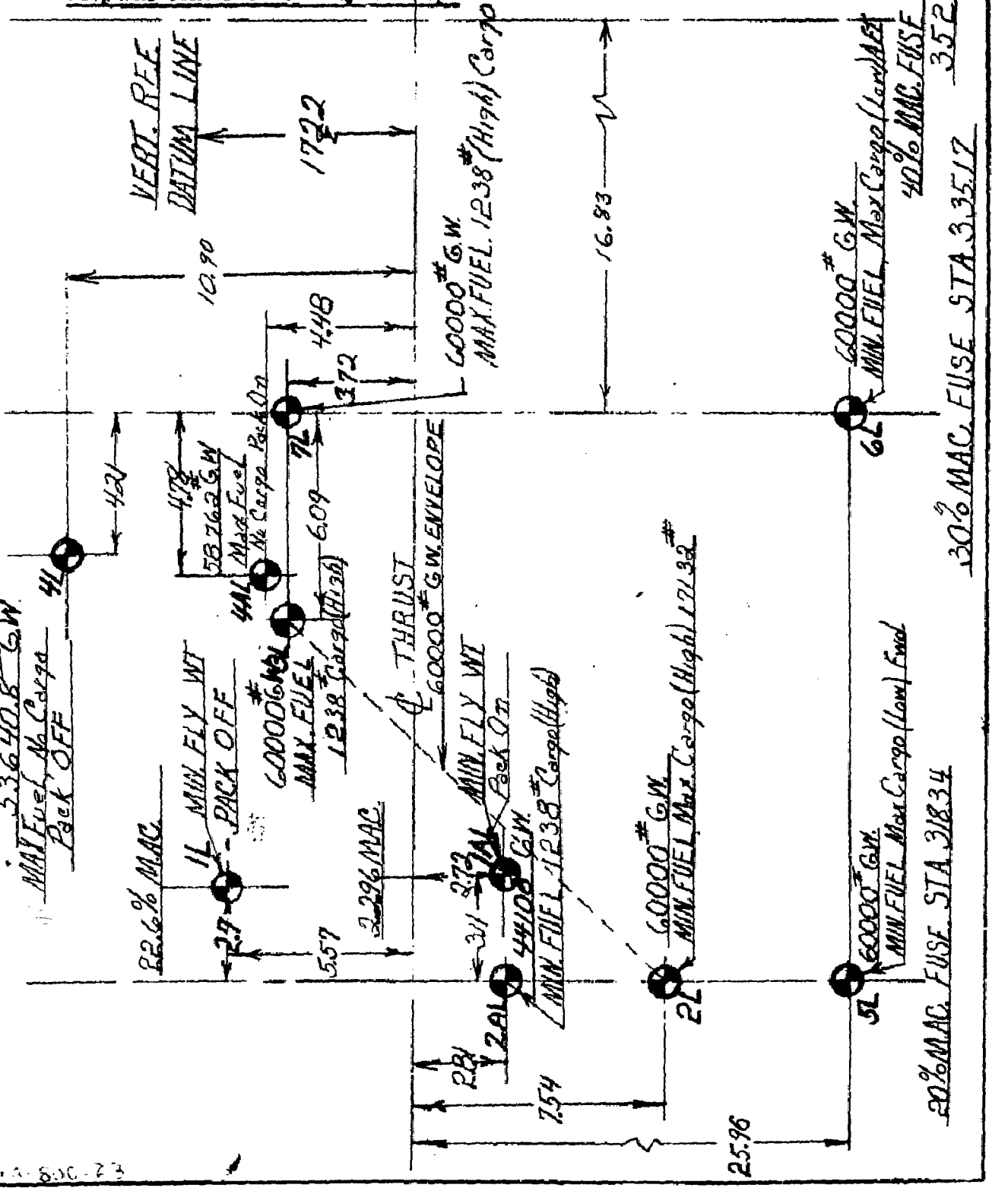
DATE July 9, 1948

REVISED Feb. 14, 1949

Subject:— MASS MOMENTS OF INERTIA - Part II

NORMAL LANDING CONDITIONS

Airplane Center of Gravity Envelope



Ship Empty About Ship Empty c.g.

Gear Up

Item	W	X	Y	Z	WX x 10^{-3}	WY x 10^{-3}	WZ x 10^{-3}
1	2	3	4	5	6	7	8
Total Carrier Gear Down	35343.8	340.06	.04	167.75	12018.99	1.58	5929.08
Moment Changed due to Gear Up					206.4	0	-333.6
Carrier	35343.8	345.90	.04	167.75	12225.39	1.58	5595.48
Plus Pack	5121.2	342.44	0	235.0	1753.7	0	1203.43
Carrier with Pack	40465.0	345.46	.04	176.26	13979.09	1.58	6798.91

Item	WX^2 x 10^{-6}	WY^2 x 10^{-6}	WZ^2 x 10^{-6}	Iox x 10^{-6}	Ioy x 10^{-6}	Ioz x 10^{-6}	Ixx x 10^{-6}	Iyy x 10^{-6}	Izz x 10^{-6}
1	9	10	11	12	13	14	15	16	17
Total Carrier Gear Down	5133.33	1179.73	1050.90	20.56	15.39	15.45	2251.19	6199.62	6328.51
Moment Change Due to Gear Up	133.16	0	-151.14	0	0	0	-151.14	-17.98	133.16
Carrier	5266.49	1179.73	899.76	20.56	15.39	15.45	2100.05	6181.64	6461.67
Plus Pack	741.1	0	284.25	31.03	.17	.17	315.28	1025.52	741.27
Carrier with Pack	6007.59	1179.73	1184.01	51.69	15.56	15.62	2415.33	7207.33	7202.94

$Ixx = Iox + Wy^2 + Wz^2$; $Iyy = Ioy + Wx^2 + Wz^2$; $Izz = Ioz + Wx^2 + Wy^2$

Io About Ship Empty c.g.

Gear up $Iox = Ixx - Wz^2 = 2{,}100{,}050{,}000 - 35{,}343.80(167.75)^2 = 1{,}105.47 \times 10^6$ #in.^{2}

Gear up $Ioy = Iyy - (x^2 + z^2)W = 6{,}181{,}640{,}000 - [(345.9)^2 + (167.75)^2]\,35{,}343.8 = 958.29 \times 10^6$ #in.^{2}

Gear up $Ioz = Izz - Wx^2 = 6{,}461{,}670{,}000 - 35{,}343.8(340.06)^2 = 2{,}374.48 \times 10^6$ #in.^{2}

Gr. up and Pack $Iox = Ixx - Wx^2 = 2{,}415{,}330{,}000 - 40{,}465.0(176.26)^2 = 1{,}158.18 \times 10^6$ #in.^{2}

Gr. up and Pack $Ioy = Iyy - [x^2 + z^2]W = 7{,}207{,}160{,}000 - [(345.46)^2 + (176.26)^2]\,40{,}465.0 = 1{,}120.81 \times 10^6$ #^{2}

Gr. up and Pack $Ioz = Izz - Wx^2 = 7{,}202{,}940{,}000 - (345.46)^2\,40.465 = 2{,}373.74 \times 10^6$ #in.^{2}

FA-800-2-3

Basic Weight about Basic Weight c.g.

Gear Down

Item	W	X	Y	Z	WX x 10-3	WY x 10-3	WZ x 10-3
1	2	3	4	5	6	7	8
Weight Empty Carrier	35,343.8	340.06	.04	167.75	12,018.99	1.58	5,929.08
Trapped Fuel	100	372.5	-175	153.0	37.25	0	15.3
Trapped Oil	250	290.0	-175	165	72.50	0	41.25
Pilot	200	128	18	126.0	25.60	Small	25.2
Co-Pilot	200	128	18	126.0	25.60	Values	25.2
Navigator	200	268	34	124.0	53.60	Neglected	24.8
Radio Operator	200	254	26	124.0	50.8	in this	24.8
Crew Chief	200	158	0	124.0	31.6	Column	24.8
Misc.	27	275	0	105.0	7.43		2.84
Basic Weight of Carrier	36,720.8	335.60	.04	166.48	12,323.37	1.58	6,113.27
Plus Pack	5,121.2	342.44	0	235.0	1,753.70	0	1,203.43
Basic Weight of Carrier with Pack	41,842	336.43	.03	174.86	14,077.07	1.58	7,316.70

Basic Weight about Basic Weight c.g. (Cont.)

Gear Down (Cont.)

Item	WX^2 x 10^{-6}	WY^2 x 10^{-6}	WZ^2 x 10^{-6}	Iox x 10^{-6}	Ioy x 10^{-6}	Ioz x 10^{-6}	Ixx x 10^{-6}	Iyy x 10^{-6}	Izz x 10^{-6}
1	9	10	11	12	13	14	15	16	17
Weight Empty Carrier	5133.33	1179.73	1050.9	20.56	15.39	15.45	2251.19	6199.62	6328.51
Trapped Fuel	13.88	3.06	2.34				5.4	16.22	16.94
Trapped Oil	21.03	7.67	6.81				14.48	27.84	28.70
Pilot	3.28	.03	3.18				3.21	6.46	3.31
Co-Pilot	3.28	.03	3.18				3.21	6.46	3.31
Navigator	14.36	.23	3.08				3.31	17.44	14.59
Crew Chief	12.90	.14	3.08				3.22	15.98	13.04
Radio Operator	4.99	0	3.08				3.08	8.07	4.99
Misc.	2.04	0	.30				.30	2.34	2.04
Basic Weight of Carrier	5209.09	1190.89	1075.95	20.56	15.39	15.45	2287.4	6300.43	6415.43
Plus Pack	741.10	0	284.25	31.03	.17	.17	315.28	1025.52	741.27
Basic Weight of Carrier with Pack	5950.19	1190.89	1360.20	51.59	15.56	15.62	2602.68	7325.95	7156.70

$Ixx = Iox + Wy^2 + Wz^2$; $Iyy = Ioy + Wx^2 + Wz^2$; $Izz = Ioz + Wx^2 + Wy^2$

$Iox = Ixx - Wx^2$ - Carrier $= 2,287.4 \times 10^6 - 36,720.8(166.48)^2 = 1,269.66 \times 10^6$ #in.^{2}

Carrier with Pack $= 2,602.68 \times 10^6 - 41,842(174.86)^2 = 1,323.32 \times 10^6$ #in.^{2}

$Ioy = Iyy - (x^2 - z^2)W$ - Carrier $= 6,300.43 \times 10^6 - [(335.6)^2 + (166.48)^2]\ 36\,720.8 = 1146.92 \times 10^6$ #in.^{2}

Carrier with Pack $= 7,325.95 \times 10^6 - [(336.43)^2 + (174.86)^2]\ 41,842.0 = 1310.70 \times 10^6$ #in.^{2}

$Ioz = Izz - Wx^2$ = Carrier $= 6415.43 \times 10^6 - 36,720.8(335.6)^2 = 2279.66 \times 10^6$ #in.^{2}

Carrier with Pack $= 7156.70 \times 10^6 - 41,842.0(336.43)^2 = 2420.81 \times 10^6$ #in.^{2}

Basic Weight about Basic Weight c.g.

Gear Up

Item	W	X	Y	Z	Wx x 10^{-3}	Wy x 10^{-3}	Wz x 10^{-3}
1	2	3	4	5	6	7	8
Total Basic Weight of Carrier Gear Down	36720.8	335.60	.04	166.48	12323.37	1.58	6113.27
Moment Change Due to Gear Up					206.4		-333.60
Carrier Gear Up	36720.8	341.22	.043	157.39	12529.77	1.58	5779.67
Plus Pack	5121.2	342.44	0	235.0	1753.70	0	1203.43
Carrier with Pack	41842.0	341.37	.038	166.89	14283.47	1.58	6983.10

Item	Wx^2 x 10^{-6}	Wy^2 x 10^{-6}	Wz^2 x 10^{-6}	Iox x 10^{-6}	Ioy x 10^{-6}	Ioz x 10^{-6}	Ixx x 10^{-6}	Iyy x 10^{-6}	Izz x 10^{-6}
1	9	10	11	12	13	14	15	16	17
Total Basic Weight of Carrier Gear Down	5209.09	1190.89	1075.95	20.56	15.39	15.45	2287.40	6300.43	6415.43
Moment Changes Due to Gear Up	133.16	0	-151.14	0	0	0	-151.14	-17.98	133.16
Carrier Gear Up	5342.25	1190.89	924.81	20.56	15.39	15.45	2136.26	6282.45	6548.59
Plus Pack	741.10	0	284.25	31.03	.17	.17	315.28	1025.52	741.27
Carrier with Pack	6083.35	1190.89	1209.06	51.59	15.56	15.62	2451.54	7307.97	7289.86

Ixx, Iyy and Izz - ref. Page 48 for Formula

$Iox = Ixx + Wx^2$, Carrier $= 2136.26 \times 10^6 - 36,720.8(157.39)^2 = 1,226.63 \times 10^6$ #in.^{2}

Carrier with Pack $= 2,451.54 \times 10^6 - 41,842(166.89)^2 = 1,286.15 \times 10^6$ #in^2

$Ioy = Iyy - (x^2 + z^2)W$, Carrier $= 6,282.45 \times 10^6 - [(341.22)^2 + (157.39)^2]36,720.8 = 1097.37 \times 10^6$ #in^2

Carrier with Pack $= 7307.97 \times 10^6 - [(341.37)^2 + (166.89)^2]41,842 = 1,266.58 \times 10^6$ #in.^{2}

$Ioz = Izz - Wx^2$ - Carrier $= 6,548.59 \times 10^6 - 36,720.8\ (341.22)^2 = 2,273.15 \times 10^6$ #in.^{2}

Carrier with Pack $= 7289.86 \times 10^6 - 41,842\ (341.37)^2 = 2,413.87 \times 10^6$ #in.^{2}

Landing Conditions

Airplane c. g. # 1L and #1AL – M.F.W. (Gear Down)

Item	W	X	Y	Z	Wx x 10-3	Wy x 10-3	Wz x 10-3
1	2	3	4	5	6	7	8
Basic Weight	36720.8	335.6	.04	166.48	12323.37	1.58	6113.27
Less							
Navigator	200	268.0	34.0	124.0	-53.6	Small	-24.8
Crew Chief	200	158.0	0	124.0	-31.6	values	-24.8
Radio Operator	200	254.0	26.0	124.0	-50.8	neglec-	-24.8
Misc.	27	275.0	0	105.0	-7.43	ted	-2.84
Plus							
Min.Fuel (5%)	801	372.5	175	144	298.37	0	115.34
Min. Oil (25%)	225	475.0	175	151	106.88	0	33.98
Carrier -c.g. 1L	37119.8	339.04	.0425	166.63	12585.19	1.58	6185.35
Plus Pack	5121.2	342.44	0	235	1753.7	0	1203.43
Carrier with Pack c.g.(1AL)	42241.0	339.45	.037	174.92	14338.89	1.58	7388.78

Wy column is neglected because it is equal distance off each side and adds out.

Landing Conditions

Airplane c.g. #1L and 1AL - M.F.W. (Gear Down)(Cont.)

Item	Wx^2 x 10^{-6}	Wy^2 x 10^{-6}	Wz^2 x 10^{-6}	Iox x 10^{-6}	Ioy x 10^{-6}	Ioz x 10^{-6}	Ixx x 10^{-6}	Iyy x 10^{-6}	Izz x 10^{-6}
1	9	11	11	12	13	14	15	16	17
Basic Weight	5209.09	1190.89	1075.95	20.56	15.39	15.45	2287.40	6300.43	6415.43
Less									
Navigator	-14.36	-.23	-3.08				-3.31	-17.44	-14.59
Crew Chief	-4.99	0	-3.08				-3.08	-8.07	-4.99
Radio Operator	-12.90	-.14	-3.08				-3.22	-15.98	-13.04
Misc.	-2.04	0	-.30				-.30	-2.34	-2.04
Plus									
Min. Fuel (5%)	111.14	24.53	16.61				41.14	127.75	135.67
Min. Oil (25%)	50.77	6.89	5.13				12.02	59.90	57.66
Carrier c.g. 1L	5336.71	1221.94	1088.15	20.56	15.39	15.45	2330.65	6444.25	6574.1
Plus Pack	741.1	0	284.25	31.03	.17	.17	315.25	1025.52	741.27
Carrier with Pack c.g. 1AL	6077.81	1221.94	1372.40	51.59	15.56	15.62	2645.93	7469.77	7315.37

Ixx, Iyy and Izz - Ref. page 48 for Formula

$Iox = Ixx - Wx^2$ carrier $= 2330.65 \times 10^6 - 37119.8\,(166.63)^2 = 1300.0 \times 10^6$ #in.^{2}

Carrier with Pack $= 2645.93 \times 10^6 - 42241\,(174.92)^2 = 1353.48 \times 10^6$ #in.^{2}

$Ioy = Iyy - (x^2 + z^2)W$ -Carrier $= 6444.25 \times 10^6 - [(339.04)^2 + (166.63)^2]\,37119.8 = 1146.75 \times 10^6$ #in.^{2}

Carrier with Pack $= 7469.77 \times 10^6 - [(339.45)^2 + (174.92)^2]\,42241.0 = 1310.05 \times 10^6$ #in.^{2}

$Ioz = Izz - Wx^2$ Carrier $= 6574.1 \times 10^6 - 37119.8\,(339.04)^2 = 2307.25 \times 10^6$ #in.^{2}

Carrier with Pack $= 7315.37 \times 10^6 - 42,241.0\,(339.45)^2 = 2448.1 \times 10^6$ #in.^{2}

LANDING CONDITION

Airplane c.g. #2L - 60,000 # Gross Weight, Max. Cargo (high)
Min. Fuel Gear Down.

Determination of Cargo c.g.

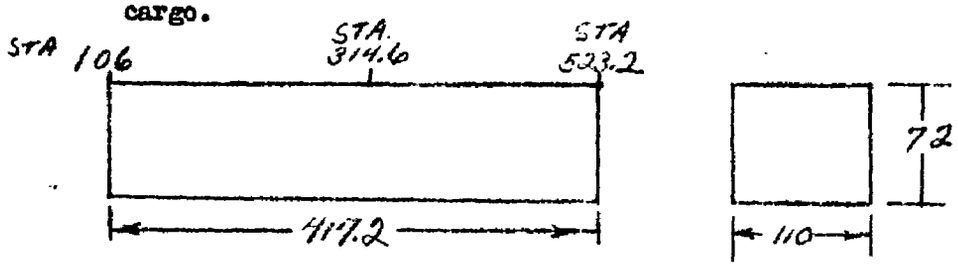
Item	W	x	z	Wx $\times 10^{-3}$	Wz $\times 10^{-3}$
Basic Weight	41,842	336.43	174.86	14077.07	7136.70
Min. Fuel	801	372.5	144.0	298.37	115.34
Min. Oil	225	475.0	151.0	106.88	33.98
**Cargo Dist	17,132	x	*204.2	17.132x	3498.35
	60,000	336.34	179.74	14482.32 + 17.132x	10,784.37

* Cargo c.g. assumed 60" above pack floor.
** 20% M.A.C.

$$\frac{14,482,320 + 17.132x}{60,000} = 336.34 = \text{(Station 318.34)}$$

$$x = \frac{60,000\ (336.34) - 14,482,320}{17132} = 332.6 = \text{Station } 314.6$$

Assumed cargo distribution and moment of inertia for distributed cargo.



$$I_{ox} = \frac{17132}{12}\left(\overline{110}^2 + \overline{72}^2\right) = 24.676 \times 10^6\ \#\text{in.}^2$$

$$I_{oy} = \frac{17132}{12}\left(\overline{417.2}^2 + \overline{72}^2\right) = 255.898 \times 10^6\ \#\text{in.}^2$$

$$I_{oz} = \frac{17132}{12}\left(\overline{417.2}^2 + \overline{72}^2\right) = 265.768 \times 10^6\ \#\text{in.}^2$$

LANDING CONDITIONS

Airplane c.g. #2L (Cont'd) Gear Down

Item	W	Ixx 10^{-6}	Iyy $x10^{-6}$	Izz $x10^{-6}$
Basic Weight	41,842	2,602.82	7325.95	7156.7
Min. Fuel	801	41.14	127.75	135.67
Min. Oil	225	12.02	59.90	57.66
Cargo (dist.)	17,132	* 739.04	2865.45	* 2160.96
	60,000	3,395.02	10,379.05	9,510.99

*Cargo Moments of Inertia

$$I_{xx} = I_{ox} + Wz^2 = 24.676 \times 10^6 + 17132\,(204.2)^2 = 739.04 \times 10^6 \#in.^2$$

$$I_{yy} = I_{oy} + W(z^2 + x^2) = 255.898 \times 10^6 + 17132\,(332.6^2 + 204.2^2) = 2,865.45 \times 10^6 \#in.^2$$

$$I_{zz} = I_{oz} + Wx^2 = 265.76 \times 10^6 + 17132\,(332.6)^2 = 2,160.957 \times 10^6$$

Airplane Moments of Inertia

$$I_{ox} = I_{xx} - Wz^2 = 3,395.02 \times 10^6 - 17132 \times (179.74)^2 = 2,841.55 \times 10^6 \#in.^2$$

$$I_{oy} = I_{yy} - W(z^2 + x^2) = 10,379.05 \times 10^6 - 17132\,(\overline{179.74}^2 + \overline{336.34}^2) = 7867.53 \times 10^6 \#in.^2$$

$$I_{oz} = I_{zz} - W(x^2) = 9,510.99 \times 10^6 - 60,000\,(336.34)^2 = 2,723.51 \times 10^6 \#in.^2$$

LANDING CONDITIONS

Airplane c.g. #2AL-44,106 Gross Weight, Min. Fuel, 1238# Cargo High Gear Down

Determination of Cargo c.g.

Item	W	x	z	Wx x10^{-3}	Wz x10^{-3}
Basic Weight	41,842	336.43	174.86	14077.07	7316.70
Min. Fuel	801	372.5	144.0	298.37	115.34
Min. Oil	225	475.	151.0	106.88	33.98
Cargo (dist)	1,238	x	*204.2	1.238x	252.80
	44,106	** 336.34	175.01	14482.32 +1.238x	7718.82

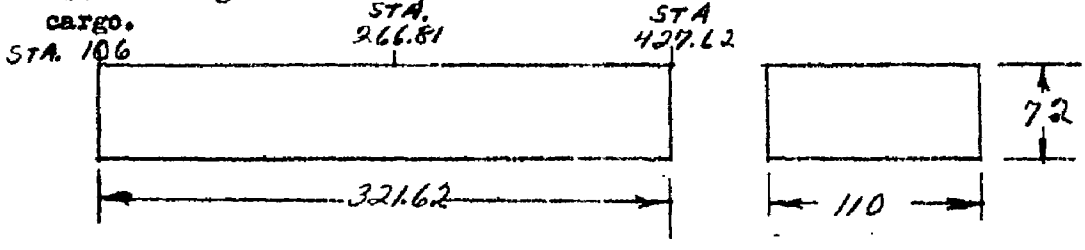
* Cargo c.g. assumed 60" above pack floor
** 20% M.A.C.

$$336.34 = \frac{14,482.32 + 1.238x}{44,106}$$

$$x = \frac{44.106\ (336.34) - 14,482.00}{1.238} = \frac{14,834.6 - 14482.0}{1.238} =$$

$$\frac{352.6}{1.238} = 284.81 \qquad \text{Station} = 266.81$$

Assumed Cargo distribution and moments of inertia for distributed cargo.



$$I_{ox} = \frac{1,238}{12}\ (110^2 + 72^2) = 1.78 \times 10^6 \#\text{in.}^2$$

$$I_{oy} = \frac{1238}{12}\ (321.62^2 + 72^2) = 11.21 \times 10^6 \#\ \text{in.}^2$$

$$I_{oz} = \frac{1238}{12}\ (321.62^2 + 110^2) = 11.92 \times 10^6\ \#\text{in.}^2$$

LANDING CONDITIONS

Airplane c.g. #2AL (cont'd) (Gear Down)

Item	W	Ixx x10^{-6}	Iyy x10^{-6}	Izz x10^{-6}
Basic Weight	41,842	2,602.82	7325.95	7156.7
Min. Fuel	801	41.14	127.75	135.67
Min. Oil	225	12.02	59.90	57.66
Cargo dist.	1,238	* 53.4	*163.25	112.34
	44,106	2,709.38	7676.85	7462.37

* Cargo Moments of Inertia

$$I_{xx} = I_{ox} + Wz^2 = 1.78 + 1.238\ (204.2)^2 = 53.4 \times 10^6 \#in.^2$$

$$I_{yy} = I_{oy} + W\ (z^2 + x^2) = 11.21 \times 10^6 + 1{,}238\ \left(\frac{\quad^2}{204.2} + \frac{\quad^2}{284.81}\right) = 163.25 \times 10^6 \#in.^2$$

$$I_{zz} = I_{oz} + W\ (x^2) = 11.92 \times 10^6 + 1{,}238\ (284.81)^2 = 112.34 \times 10^6 \#in.^2$$

Airplane Moments of Inertia

$$I_{ox} = I_{xx} - Wz^2 = 2709.38 \times 10^6 - 1238\ \left(\frac{\quad^2}{175.01}\right) = 2671.46 \times 10^6 \#in.^2$$

$$I_{oy} = I_{yy} - W(z^2 + x^2) = 7676.85 \times 10^6 - 1238\ \left(\frac{\quad^2}{175.01} + \frac{\quad^2}{336.34}\right) = 7498.88 \times 10^6 \#in.^2$$

$$I_{oz} = I_{zz} - W(x^2) = 7{,}462.37 \times 10^6 - 44{,}106\ (336.34^2) = 2472.9 \times 10^6 \#in.^2$$

LANDING CONDITONS

Airplane c.g. #3L - 60,000# gross weight, Full Fuel, 1,238# Cargo (High) Gear (Down)

Determination of Cargo c.g.

Item	W	x	z	Wx x10^{-3}	Wz x10^{-3}
Basic Weight	41842	336.43	74.86	14077.07	7316.70
Full Fuel	16020	372.5	150.0	5967.5	2403.2
Full Oil	900	475	151.0	427.5	135.9
*Cargo Dist.	1238	284.81	204.26	352.59	252.8
	60,000	347.08	168.47	20824.66	10108.61

*Reference to page 56

Item	Ixx x10^{-6}	Iyy x10^{-6}	Izz x10^{-6}
Basic Weight	2602.82	7325.95	7156.7
Full Fuel	1336.6	2590.8	3204.8
Full Oil	***20.52	***223.58	***203.06
Cargo (Dist.)	***31.62	***152.04	***100.42
	4011.56	10292.37	10664.98

Item	Wx^{2}x10^{-6}	Wy^{2}x10^{-6}	Wz^{2}x10^{-6}
Full Oil	203.06	0	20.52
Cargo (dist)	100.42	0	51.62

***($I_{xx} = I_{ox} + W_y^2 + W_z^2$
($I_{yy} = I_{oy} + W_x^2 + W_z^2$
($I_{zz} = I_{oz} + W_x^2 + W_y^2$

Airplane moments of Inertia

$$I_{ox} = I_{xx} - W(z^2) = 4011.56 \times 10^6 - 60{,}000(168.47)^2 = 2308.63 \times 10^6 \#in.^2$$

$$I_{oy} = I_{yy} - W(x^2+z^2) = 10292.37 \times 10^6 - 60{,}000(168.47^2 + 347.08^2) = 1361.57 \times 10^6 \#in.^2$$

$$I_{oz} = I_{zz} - W(x^2) = 10{,}664.98 \times 10^{-6} - 60{,}000(347.08^2) = 3437.11 \times 10^6 \#in.^2$$

Landing Conditions

Airplane c.g. #4L and 4AL - Full Fuel, No. Cargo (Gear Down)

Item	W	X	Y	Z	Wx x 10^{-3}	Wy x 10^{-3}	Wz x 10^{-3}
1	2	3	4	5	6	7	8
Basic Weight	36720.8	335.6	.04	166.48	12323.37	1.58	6113.27
Full Oil	900	465	0	151.0	427.5	0	135.9
Full Fuel *	16020	372.5	0	144	5967.5	0	2403.2
Carrier - c.g. 4L	53640.8	348.96	.04	161.3	18718.37	1.58	8652.37
Plus Pack	5121.2	342.44	0.	235.0	1753.7	0	1203.43
Carrier with Pack c.g. 4AL	58762	348.39	.04	167.72	20472.07	1.58	9855.8

Item	Wx^2 x 10^{-6}	Wy^2 x 10^{-6}	Wz x 10^{-6}	Iox x 10^{-6}	Ioy x 10^{-6}	Ioz x 10^{-6}	Ixx x 10^{-6}	Iyy x 10^{-6}	Izz x 10^{-6}
1	9	10	11	12	13	14	15	16	17
Basic Weight	5209.09	1190.89	1075.95	20.56	15.39	15.45	2287.4	6300.43	6415.45
Full Oil	203.06	0	20.52	0	0	0	20.52	223.53	203.06
Full Fuel							1336.6	2590.8	3204.8
Carrier - c.g. 4L	5412.15	1190.89	1096.47	20.56	15.39	15.45	3644.52	9114.81	9823.29
Plus Pack	741.1	0	284.25	31.03	.17	.17	315.28	1025.52	741.27
Carrier with Pack c.g. 4AL	6153.25	1190.89	1380.72	51.59	15.56	15.62	3959.80	10140.33	10564.56

*Full Fuel Ref. Page 58

Carrier 4L

$Iox = Ixx - Wz^2 = 3644.52 \times 10^6 - 53640.8(161.3)^2 = 2248.91 \times 10^6$ #in.^{2}

$Ioy = Iyy - W(x^2 + z^2) = 9114.81 \times 10^6 - 53640.8(161.3^2 + 348.96^2) = 1187.19 \times 10^6$ #in.^{2}

$Ioz = Izz - W(x^2) = 9823.29 \times 10^6 - 53640.8(348.96^2) = 3291.28 \times 10^6$ #in.^{2}

Carrier with Pack 4AL

$Iox = Ixx - Wz^2 = 3959.80 \times 10^6 - 58762(167.72)^2 = 2306.83 \times 10^6$ #in.^{2}

$Ioy = Iyy - W(x^2 + z^2) = 10140.33 \times 10^6 - 58762(167.72^2 + 348.39^2) = 1355.08 \times 10^6$ #in.^{2}

$Ioz = Izz - Wx^2 = 10564.56 \times 10^6 - 58762(348.39)^2 = 3432.29 \times 10^6$ #in.^{2}

LANDING CONDITIONS

Airplane c.g. #5L - 60,000# gross weight, Max. Cargo (low)
Min. Fuel (Gear Down)

Determination of cargo c.g.

Item	W	x	z	Wx $\times 10^{-3}$	Wz $\times 10^{-3}$
Basic Weight	41842	336.43	174.86	14077.07	7316.7
Min. Fuel	801	372.5	144	298.37	115.34
Min. Oil	225	475.0	151	106.88	33.98
Cargo	17132	x	258.2	17.132x	4423.48
	60,000	336.34	198.16	14482.32 +17.132x	11889.5

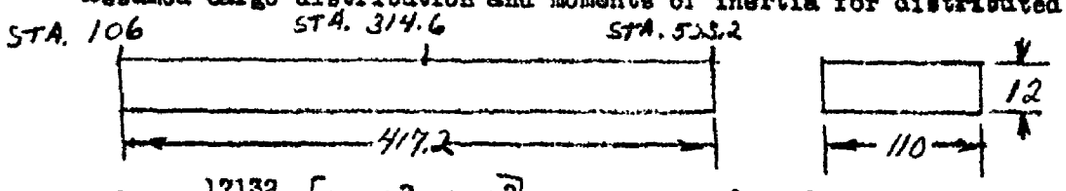
$$336.34 = \frac{14,482.32 + 17,132x}{60,000}$$

$$x = \frac{336.34\ (60,000) - 14,482.32 \times 10^3}{17,132} = \frac{20,180.4 \times 10^3 - 14,482.32 \times 10^3}{17,132}$$

$$= \frac{5698.08 \times 10^3}{17132}$$

$x = 332.6$ station $= 314.6$

Assumed cargo distribution and moments of inertia for distributed cargo.



$$I_{ox} = \frac{17132}{12}\left[(110)^2 + (12)^2\right] = 17.48 \times 10^6 \#in.^2$$

$$I_{oy} = \frac{17132}{12}\left[(417.2)^2 + (12)^2\right] = 248.70 \times 10^6 \#in.^2$$

$$I_{oz} = \frac{17132}{12}\left[(417.2)^2 + (110)^2\right] = 265.78 \times 10^6 \#in.^2$$

$$I_{xx} = I_{ox} + Wz^2 = 17.48 \times 10^6 + 17123(258.2)^2 = 1159.62 \times 10^6 \#in.^2$$

$$I_{yy} = I_{oy} + W(x^2 + z^2) = 248.7 \times 10^6 + 17132(\overline{332.6}^2 + \overline{258.2}^2) = 3,286.03 \times 10^6 \#in.^2$$

$$I_{zz} = I_{oz} + W(x^2) = 265.78 \times 10^6 + 17132(332.6)^2 = 2,160.97 \times 10^6 \#in.^2$$

LANDING CONDITIONS

Airplane c.g. #5L (cont'd) - 60,000# G. W., Max. Cargo (low), Min. Fuel (Gear Down)

Item	W	$I_{xx} \times 10^{-6}$	$I_{yy} \times 10^{-6}$	$I_{zz} \times 10^{-6}$
Basic Weight	41842	2602.68	7325.95	7156.70
Min. Fuel	801	41.14	127.75	135.67
Min. Oil	225	12.02	59.9	57.66
Cargo (Dist.)	17132	* 1159.62	* 3286.03	* 2160.97
Total	60000	3815.46	10799.63	9511.0

* Cargo Moments of Inertia

Airplane moments of inertia about c.g. $\#5_L$

$$I_{ox} = I_{xx} - Wz^2 = 3815.46 \times 10^6 - 60{,}000\,(198.16)^2 = 1459.42 \times 10^6 \#''^2$$

$$I_{oy} = I_{yy} - W(x^2+z^2) = 10{,}799.13 \times 10^6 - 60{,}000\,(336.34^2 + 198.16^2) = 1{,}656.11 \times 10^6 \#''^2$$

$$I_{oz} = I_{zz} - Wx^2 = 9{,}511.0 \times 10^6 - 60{,}000\,(336.34)^2 = 2{,}723.52 \times 10^6 \#''^2$$

LANDING CONDITIONS

Airplane c.g. #6L - 60,000# Gross Weight, Min. Fuel and Oil, Max. Cargo Aft (low)

(Gear Down)

Item	W	X	Z	WX $\times 10^{-3}$	WZ $\times 10^{-3}$
Basic Weight	41842	336.43	174.86	14077.07	7316.7
Min. Fuel	801	372.5	144	298.37	115.34
Min. Oil	225	475.0	151	106.88	33.98
Cargo (dist.)	17132	x	258.2	17.132x	4423.48
Total	60000	353.17	198.16	14482.32 +17.132 x	11889.5

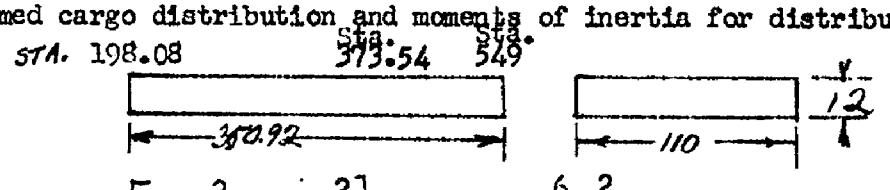
30% M.A.C.

$$353.17 = \frac{17132\,x + 14{,}482.32 \times 10^3}{60{,}000}$$

$$x = \frac{60{,}000\,(353.17) - 14482320}{17132} = 391.54$$

$$= \text{Sta. } 373.54$$

Assumed cargo distribution and moments of inertia for distributed cargo



$$I_{ox} = \frac{17132}{12}\left[(110)^2 + (12)^2\right] = 17.48 \times 10^6 \#''^2$$

$$I_{oy} = \frac{17132}{12}\left[(350.92)^2 + (12)^2\right] = 176.02 \times 10^6 \#''^2$$

$$I_{oz} = \frac{17132}{12}\left(350.92^2 + 110^2\right) = 193.08 \times 10^6 \#''^2$$

$$I_{xx} = I_{ox} + W_z^2 = 17.48 \times 10^6 + 17132\,(258.2)^2 = 1159.62 \#''^2$$

$$I_{yy} = I_{oy} + W(x^2+z^2) = 176.02 \times 10^6 + 17132\,(258.2^2 + 391.54^2) = 3{,}944.56 \times 10^6 \#''^2$$

$$I_{zz} = I_{oz} + W_x^2 = 193.08 \times 10^6 + 17132\,(391.54)^2 = 2{,}819.48 \times 10^6 \#''^2$$

LANDING CONDITIONS

Airplane c.g. #6L (cont'd) 60,000# Gross Weight, Min. Fuel and Oil
Max. Cargo Aft (low) (Gear Down)

Item	W	$I_{xx} \times 10^{-6}$	$I_{yy} \times 10^{-6}$	$I_{zz} \times 10^{-6}$
Basic Weight	41842	2602.68	7325.95	7156.70
Min. Fuel	801	41.14	127.75	135.67
Min. Oil	225	12.02	59.9	57.66
Cargo	* 17132	* 1159.62	* 3944.56	* 2819.48
	60000	3815.46	11458.16	10169.51

* Cargo moments of inertia

Airplane moments of inertia about c.g. #6L

$$I_{o_x} = I_{xx} - Wz^2 = 3815.46 \times 10^6 - 60,000\,(198.16)^2 = 1,459.42 \times 10^6 \#''^2$$

$$I_{o_y} = I_{yy} - W(x^2+z^2) = 11458.16 \times 10^6 - 60,000(198.16^2+353.7^2) = 1618.37 \times 10^6 \#''^2$$

$$I_{o_z} = I_{zz} - W x^2 = 10,169.51 \times 10^6 - 60,000\,(353.17)^2 = 2,685.77 \times 10^6 \#''^2$$

LANDING CONDITIONS

Airplane c.g. #7L - 60,000# Gross Weight, Full Fuel and Oil, Cargo (high) Aft (Gear Down)

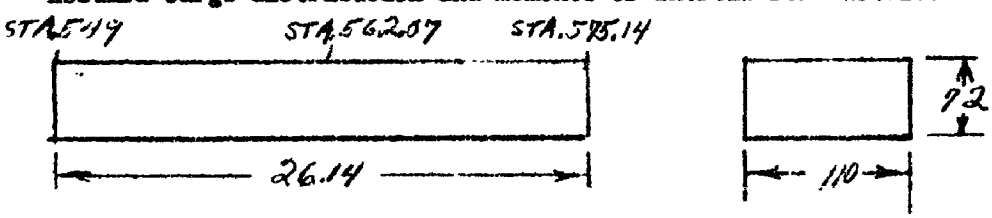
Item	W	X	Z	WX $\times 10^{-3}$	WZ $\times 10^{-3}$
Basic Weight	41842	336.43	174.86	14077.07	7316.7
Full Fuel	16020	372.5	144.0	5967.5	2403.2
Full Oil	900	475	151.0	427.5	135.9
Cargo (dist.)	1238	x	204.2	1.238 x	252.79
Total	60000	353.17	168.48	20472.07 + 1.238 x	10108.59

30% M.A.C.

$$353.17 = \frac{20,472,070 + 1,238\ x}{60,000}$$

$$x = \frac{60,000\ (353.17) - 20,472,070}{1,238} = 580.07 = \text{Sta. } 562.07$$

Assumed cargo distribution and moments of inertia for distributed cargo



$$I_{ox} = \frac{1238}{12}\ \overline{110}^2 + \overline{72}^2 = 1.78 \times 10^6 \#in^2$$

$$I_{oy} = \frac{1238}{12}\ \overline{26.14}^2 + \overline{72}^2 = 0.61 \times 10^6 \#in^2$$

$$I_{oz} = \frac{1238}{12}\ \overline{26.14}^2 + \overline{110}^2 = 1.32 \times 10^6 \#in^2$$

$$I_{xx} = I_{ox} + W_z^2 = 1.78 \times 10^6 + 1238\ (204.2)^2 = 53.40 \times 10^6 \#in^2$$

$$I_{yy} = I_{oy} + W\ (z^2 + x^2) = .61 \times 10^6 + 1238\ (\overline{204.2}^2 + \overline{580.07}^2)$$

$$= 468.8 \times 10^6 \#in^2$$

$$I_{zz} = I_{oz} + W\ (x^2) = 1.32 \times 10^6 + 1238\ (580.07)^2 = 417.88 \times 10^6 \#in^2$$

LANDING CONDITIONS

Airplane c.g. #7L (cont'd) 60000# Gross Weight, Full Fuel, Cargo (high) Aft (Gear Down).

Item	W	I_{xx} x 10^{-6}	I_{yy} x 10^{-6}	I_{zz} x 10^{-6}
Basic Weight	41842	2,602.68	7325.95	7156.70
Full Weight	16020	1,336.6	2590.8	3204.8
Full Oil	900	20.52	223.8	203.06
Cargo	1238	*53.40	*468.8	*417.88
Total	60000	4,013.2	10609.35	10.982.44

*Cargo moments of inertia.

Airplane moments of inertia about c.g. #7L.

$$I_{o_x} = I_{xx} - W(z)^2 = 4013.2 \times 10^6 - 60,000\ (168.48)^2 = 2310.07 \times 10^6 \#''^2$$

$$I_{o_y} = I_{yy} - W(z^2 + x^2) = 10609.35 \times 10^6 - 60000\ (\overline{168.48}^2 + \overline{353.17}^2) = 1522.48 \times 10^6 \#''^2$$

$$I_{o_z} = I_{zz} - W(x^2) = 10982.44 \times 10^6 - 60000\ (353.17)^2 = 3498.7 \times 10^6 \#''^2$$

SUMMARY OF NORMAL GROSS WEIGHT LANDING CONDITIONS

(Gear Down)

c.g. Location	Ref. Page	Condition	I_{o_x} Slug Ft.^{2}	I_{o_y} Slug Ft.^{2}	I_{o_z} Slug Ft.^{2}
1L	53	M.F.W. Pack Off	280,360	247,315	497,600
1AL	53	M.F.W. Pack On	291,900	282,500	527,970
2L	55	G.W. = 60,000# Min. Fuel, Max. Cargo (High)	612,820	1,701,000	587,400
2AL	57	G.W. = 44,106# Min. Fuel, 1238# Cargo (High)	576,100	1,617,200	533,300
3L	58	G.W. = 60,000# Max. Fuel 1238# Cargo (High)	497,900	293,600	741,300
4L	59	G.W. = 53640.8 Max. Fuel No Cargo - Pack Off	485,000	256,000	709,800
4AL	59	G.W. = 58762 Max. Fuel No Cargo - Pack On	497,500	292,200	740,200
5L	61	G.W. = 60,000# Min. Fuel Max. Cargo Aft (low)	314,700	357,160	587,400
6L	63	G.W.=60,000# Min. Fuel Max. Cargo Aft (low)	336,300	349,000	579,200
7L	65	G.W. = 60,000# Max. Fuel 1238# Cargo (High)	498,000	328,300	754,600

PART IV

Iy FOR MANEUVERING HORIZONTAL TAIL LOADS

Iy For Maneuvering Horizontal Tail Loads

20% MAC - Low

Item	Weight Lbs.	X In.	X-Moment In. Lbs.	Z In.	Z-Moment In. Lbs.	Iyy
Weight Empty	40,465.0	340.3	13,772,690	176.3	7,132,510	7225.14
Pilot	200.0	128.	25,600	126.	25,200	6.45
Co-Pilot	200.0	128.	25,600	126.	25,200	6.45
Navigator	200.0	158.	31,600	124.	24,800	8.07
Radio Operator	200.0	268.	53,600	124.	24,800	17.44
Crew Chief	200.0	254.	50,800	124.	24,800	15.98
Trapped Fuel	100.0	372.5	37,250	153.	15,300	16.22
Trapped Oil	250.0	298.	72,500	165.	41,250	27.83
Usable Fuel	16,020.0	372.5	5,967,450	150.	2,403,000	2590.76
Usable Oil	900.0	475.	427,500	151.	135,900	223.58
Misc. Equipment	27.0	275.	7,425	105.	2,835	2.34
Cargo	5,238.0	168.2	881,272	258.2	1,352,452	511.86*
TOTAL - Wheels Down	64,000.0		21,353,287		11,208,047	10,652.12
Change - Wheels Up			+206,393		-333,601	-17.98
TOTAL - Wheels Up	64,000.0	336.87	21,559,680	169.91	10,874,446	10,634.14

$$I_y = 10{,}634.14 \times 10^6 - 64{,}000 \left[(336.87)^2 + (169.91)^2\right] = 1{,}523.69 \times 10^6 \text{ lb. in}^2$$

* Includes 14.47×10^6 Lb. in^2 for Iyo about its centroid assuming low distributed loading $= \frac{5238}{12}\left[(72.0)^2 + (167.2)^2\right]$

Iy For Maneuvering Horizontal Tail Loads

35% MAC - High

Item	Weight Lbs.	X In.	X-Moment In. Lbs.	Z In.	Z-Moment In. Lbs.	Iyy
Weight Empty	40,465.0	340.3	13,772,690	176.3	7,132,510	7225.14
Pilot	200.0	128.	25,600	126.	25,200	6.45
Co-Pilot	200.0	128.	25,600	126.	25,200	6.45
Navigator	200.0	158.	31,600	124.	24,800	8.07
Radio Operator	200.0	268.	53,600	124.	24,800	17.44
Crew Chief	200.0	254.	50,800	124.	24,800	15.98
Trapped Fuel	100.0	372.5	37,250	153.	15,300	16.22
Trapped Oil	250.0	298.	72,500	165.	41,250	27.83
Usable Fuel	16,020.0	372.5	5,967,450	150.	2,403,000	2590.76
Usable Oil	900.0	475.	427,500	151.	135,900	223.58
Misc. Equipment	27.0	275.	7,438	105.	2,835	2.34
Cargo	5,238.0	476.6	2,496,619	204.2	1,069,600	1424.74 *
TOTAL - Wheels Down	64,000.0		22,968,647		10,925,195	11,565.00
Change - Wheels Up			+ 206,393		- 333,601	-17.98
TOTAL - Wheels Up	64,000.0	362.11	23,175,040	165.49	10,591,594	11,547.02

$$Iy = 11{,}547.02 \times 10^6 - 64{,}000 \left[(362.11)^2 + 165.49)^2\right] = 1402.38 \times 10^6 \text{ lb. in}^2$$

* Includes 16.53×10^6 lb. in^2 for Iyo about its centroid assuming distributed loading $= \frac{5238}{12} \left[(72.0)^2 + (180.8)^2\right]$

P A R T III

PRODUCT OF INERTIA - ASSUMED LOADINGS

NOTE: Reference Data page 2.

Iy For Maneuvering Horizontal Tail Loads
Detachable Fuselage - Off

Forward Low

Item	Weight Lbs.	X In.	X-Moment In. Lbs.	Z In.	Z-Moment In. Lbs.	Iyy
Weight Empty	35,344.0	340.1	12,018,990	167.8	5,929,080	6199.62
Pilot	200.0	128.	25,600	126.	25,200	6.45
Co-Pilot	200.0	128.	25,600	126.	25,200	6.45
Navigator	200.0	268.	53,600	124.	24,800	8.07
Radio Operator	200.0	254.	50,800	124.	24,800	17.44
Crew Chief	200.0	158.	31,600	124.	24,800	15.98
Misc. Equipment	27.0	275.	7,425	105.	2,835	2.34
Trapped Fuel	100.0	372.5	37,250	153.	15,300	16.22
Trapped Oil	250.0	290.	72,500	165.	41,250	27.83
TOTAL - Wheels Down	36,721.0	335.59	12,323,365	166.48	6,113,265	6300.40

$$Iy = 6,300.40 \times 10^6 - 36.721 \left[(335.59)^2 + (166.48)^2\right] = 1147.11 \times 10^6 \text{ lb. in}^2$$

MODEL XC-120 PREPARED BY CHECKED BY APPROVED BY

Subject: MASS MOMENTS OF INERTIA CALCULATIONS - PART IV

DATE 14 Feb 1949

REVISED

RESTRICTED

Iy For Maneuvering Horizontal Tail Loads
Detachable Fuselage - Off

Aft - High

Item	Weight Lbs.	X In.	X-Moment In. Lbs.	Z In.	Z-Moment In. Lbs.	Iyy
Weight Empty	35,344.0	340.1	12,018,990	167.8	5,929,080	6199.62
Pilot	200.0	128.	25,600	126.	25,200	6.45
Co-Pilot	200.0	128.	25,600	126.	25,200	6.45
Navigator	200.0	268.	53,600	124.	24,800	8.07
Radio Operator	200.0	254.	50,800	124.	24,800	17.44
Crew Chief	200.0	158.	31,600	124.	24,800	15.98
Misc. Equipment	27.0	275.	7,425	105.	2,835	2.34
Trapped Fuel	100.0	372.5	37,250	153.	15,300	16.22
Trapped Oil	250.0	290.	72,500	165.	41,250	27.83
Usable Fuel	16,020.0	372.5	5,967,450	150.	2,403,000	2590.76
Usable Oil	900.0	475.	427,500	151.	135,900	223.58
TOTAL - Wheels Down	53,641.0		18,718,315		8,652,165	9114.74
MOMENT CHANGE - Wheels Up			+206,393		-333,601	-17.98
TOTAL - Wheels Up	53,641.0	352.80	18,924,708	155.08	8,318,564	9096.76

$$I_y = 9096.76 \times 10^6 - 53{,}641\left[(352.8)^2 + (155.08)^2\right] = 1130.13 \times 10^6 \text{ lb. in}^2$$

ENGINEERING REPORT NO.

R107B-004

SUBJECT

MASS MOMENTS OF INERTIA CALCULATIONS

MODEL: XC-120

FAIRCHILD AIRCRAFT

Division of

FAIRCHILD ENGINE & AIRPLANE CORPORATION

HAGERSTOWN, MARYLAND

Date: 6 May 1948

Prepared By J. W. O. Baker

No. Pages: 45 (PART I)
21 (PART II)
5 (PART III)
5 (PART IV)
9 (PART V)

Checked By

Approved By C. F. Comstock

REVISIONS

Date	Pages Affected	By	Remarks
2/14/49	All pages.	J.W.O.Baker	PART I completely revised.
2/14/49	All pages.	J. Myers	PART II completely revised.
2/14/49	All pages.	J.W.O.Baker	PART III completely revised.
2/14/49	Pages 72, 73, 74, 75, 76	J.W.O.Baker	PART IV Added.
3/14/49	Pgs. 55,57,66 of Part II revised.	Hawley	

REPORT NO. R107B-004	FAIRCHILD AIRCRAFT DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION		PAGES	PAGE
MODEL XC-120	PREPARED BY	CHECKED BY	APPROVED BY	

Subject:- MASS MOMENTS OF INERTIA CALCULATIONS

DATE 6 May 1948

[redacted]

REVISIONS

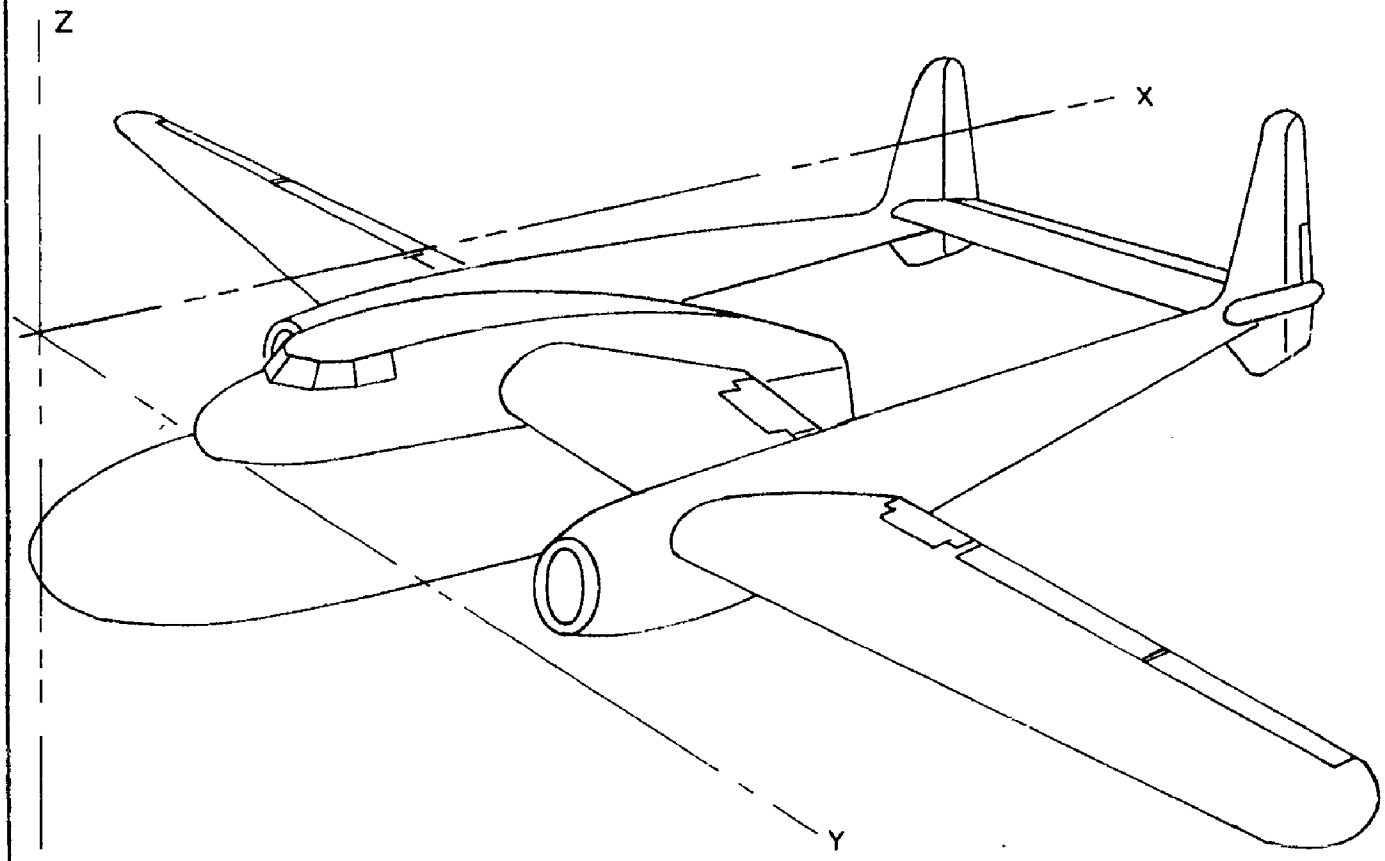
Date	Pages Affected	By	Remarks
5/5/49	Page 2 of Part I Revised.	J.W.O.BAKER	
7/7/49	All pages revised with the exception of Pages 48,49,50 and 51. Page 47.1 added.	J. B. Miller	
7/7/49	Pages 77, 78, 79, 80, 81, 82 83, 84, 85.	S. M. Levin	Part V Added.

MODEL XC-120 | PREPARED BY | CHECKED BY | APPROVED BY

DATE 6 May 1948
REVISED 5 May 1949

Subject: MASS MOMENTS OF INERTIA CALCULATIONS

RESTRICTED



REFERENCE DATA

X-Axis = Parallel to ℄ Fuselage and 172.0" above thrust line.

Y-Axis = Parallel to 40% chord and 370 ahead.

Z-Axis = Perpendicular to ℄ Fuselage 370 inches ahead of 40% chord.

Distance along Y-Axis noted as Y positive left.

Distance along X-Axis noted as X positive aft.

Distance along Z-Axis noted as Z positive down.

I Values given in lb. $\overline{in}^2$.

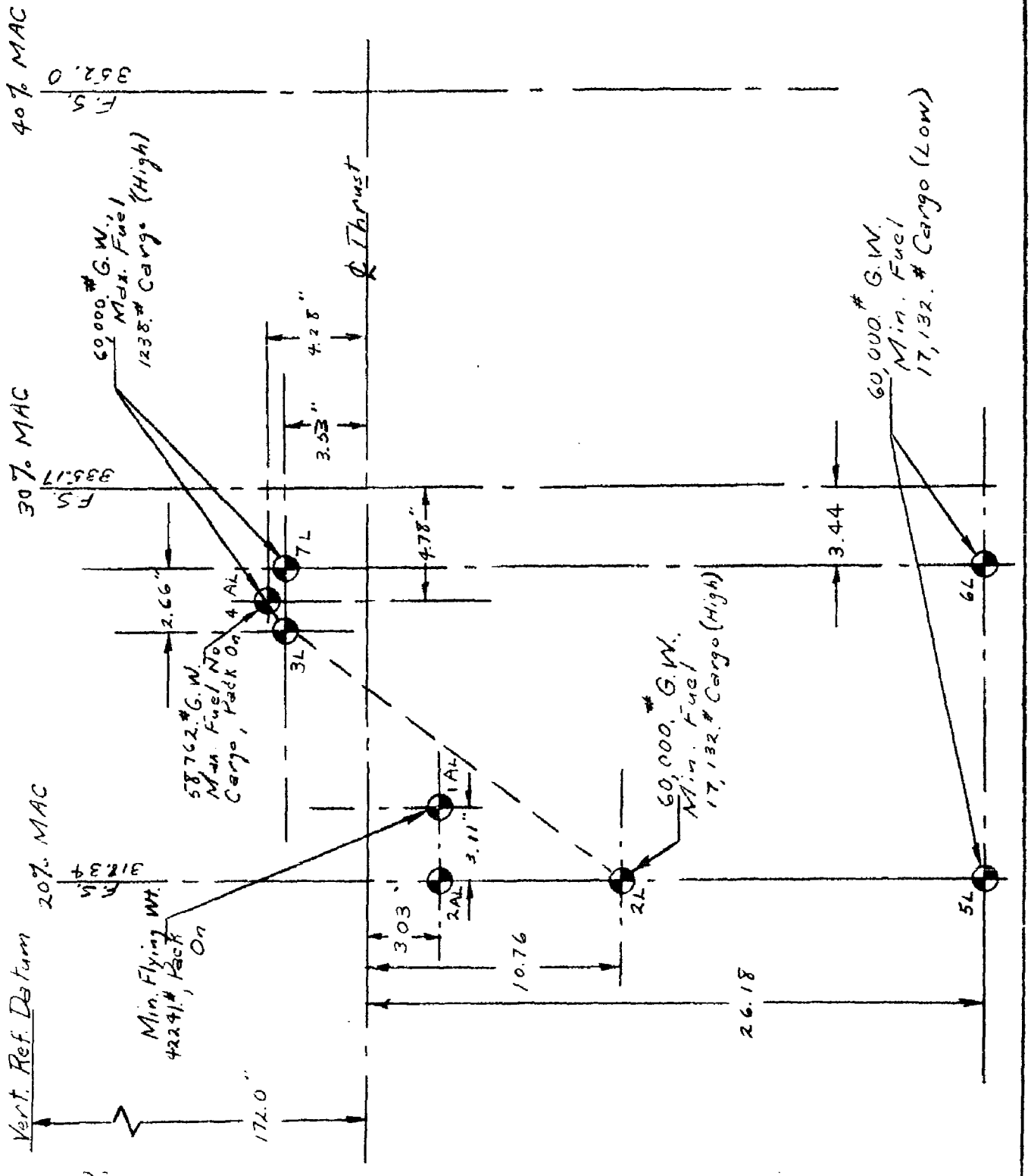
MODEL XC-120 PREPARED BY Miller CHECKED BY APPROVED BY

DATE 7 1949

REVISED

Subject:— MASS MOMENTS OF INERTIA

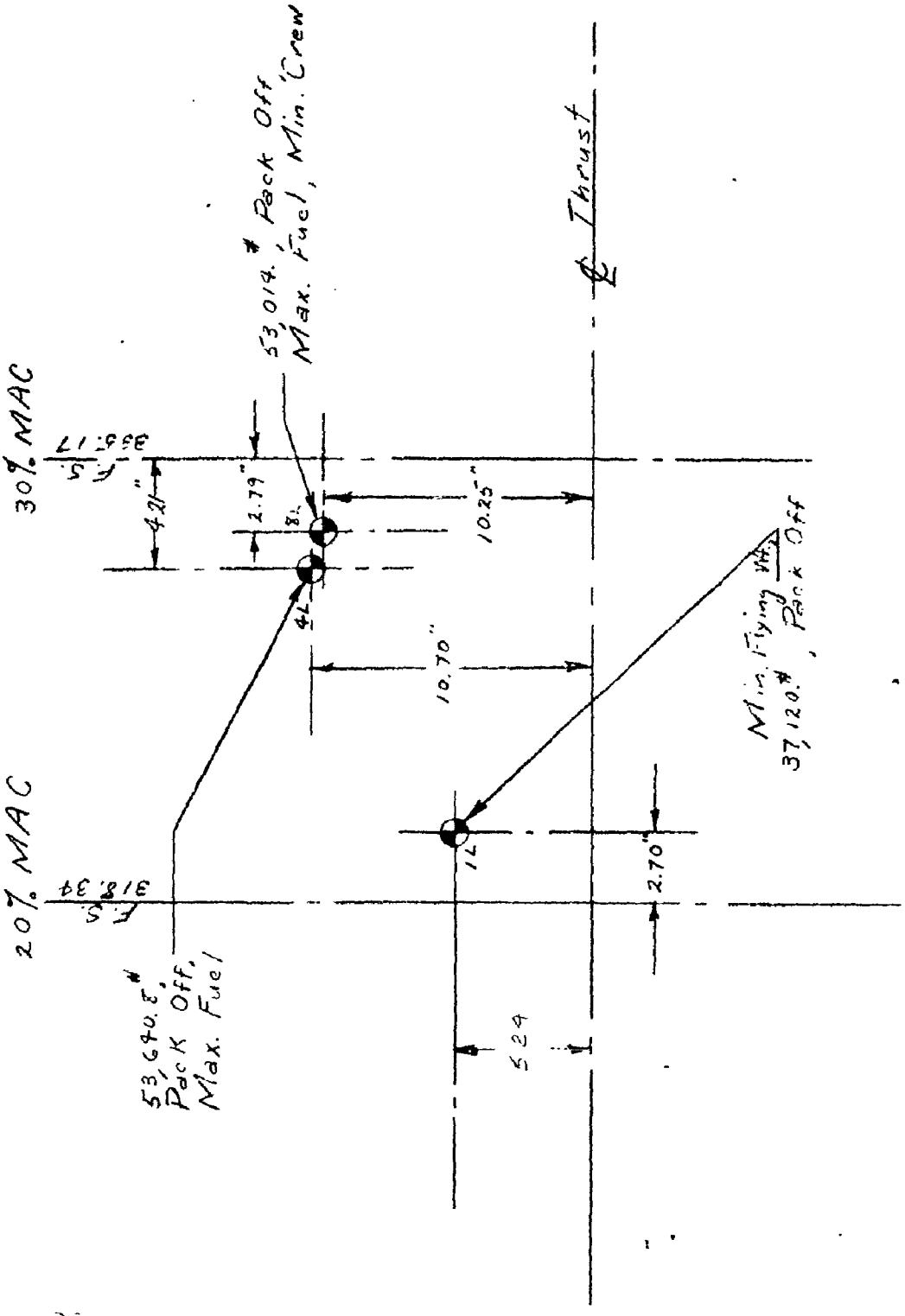
NORMAL LANDING CONDITIONS
Airplane Center of Gravity Envelope



REPORT NO. R107B-004	FAIRCHILD AIRCRAFT DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION		PAGES	PAGE 42, 1
MODEL XC-120	PREPARED BY Miller	CHECKED BY Levin	APPROVED BY	
Subject: MASS MOMENTS OF INERTIA			DATE July 1 1949	
			REVISED	

PACK - OFF LANDING CONDITIONS

Airplane Center of Gravity Envelope



Landing Conditions

Airplane c.g. #1L and #1AL - M.F.W. (Gear Down)

Item	W	X	Y	Z	Wx x 10-3	Wy x10-3	Wz x10-3
1	2	3	4	5	6	7	8
Basic Weight	36720.8	335.6	.04	166.48	12323.37	1.58	6113.27
Less							
Navigator	200	268.0	34.0	124.0	-53.6	Small	-24.8
Crew Chief	200	158.0	0	124.0	-31.6	values	-24.8
Radio Operator	200	254.0	26.0	124.0	-50.8	neglec-	-24.8
Misc.	27	275.0	0	105.0	-7.43	ted	-2.84
Plus							
Min. Fuel (5%)	801	372.5	175	150.0	298.37	0	120.15
Min. Oil (25%)	225	475.0	175	151.0	106.88	0	33.98
Carrier - c.g. 1L	37119.8	339.04	.0425	166.76	12585.19	1.58	6190.16
Plus Pack	5121.2	342.44	0	235	1753.7	0	1203.43
Carrier with Pack c.g.(1AL)	42241.0	339.45	.037	175.03	14338.89	1.58	7393.59

Wy column is neglected because it is equal distance off each side and adds out.

Landing Conditions

Airplane c.g. #1L and 1AL - M.F.W. (Gear Down) (Cont.)

Item	Wx^2 x 10^{-6}	Wy^2 x 10^{-6}	Wz^2 x 10^{-6}	Iox x 10^{-6}	Icy x10^{-6}	Ioz x 10^{-6}	Ixx x 10^{-6}	Iyy x 10^{-6}	Izz x 10^{-6}
1	9	10	11	12	13	14	15	16	17
Basic Weight	5209.09	1190.89	1075.95	20.56	15.39	15.45	2287.40	6300.43	6415.43
Less									
Navigator	-14.36	-.23	-3.08				-3.31	-17.44	-14.59
Crew Chief	-4.99	0	-3.08				-3.08	-8.07	-4.99
Radio Operator	-12.90	-.14	-3.08				-3.22	-15.98	-13.04
Misc.	-2.04	0	-.30				-.30	-2.34	-2.04
Plus									
Min. Fuel (5%)	111.14	24.53	18.02				41.14	127.75	135.67
Min. Oil (25%)	50.77	6.89	5.13				12.02	59.90	57.66
Carrier c.g. 1L	5336.71	1221.94	1089.56	20.56	15.39	15.45	2330.65	6444.25	6574.1
Plus Pack	741.1	0	284.25	31.03	.17	.17	315.25	1025.52	741.27
Carrier with Pack c.g. 1AL	6077.81	1221.94	1373.81	51.59	15.56	15.62	2645.93	7469.77	7315.37

Ixx, Iyy and Izz - Ref. page 48 for Formula

$Iox = Ixx - Wz^2$ carrier $= 2330.65 \times 10^6 - 37119.8\ (166.76)^2 = 1298.39 \times 10^6$ #in^2

Carrier with Pack $= 2645.93 \times 10^6 - 42241\ (175.03)^2 = 1351.86 \times 10^6$ #in.^{2}

$Icy = Iyy - (x^2 + z^2)W$ - Carrier $= 6444.25 \times 10^6 - [(339.04)^2 + (166.76)^2]37119.8 = 1145.14 \times 10^6$ #in.^{2}

Carrier with Pack $= 7469.77 \times 10^6 - [(339.45)^2 + (175.03)^2]\ 42241.0 = 1308.42 \times 10^6$ #in.^{2}

$Ioz = Izz - Wx^2$ Carrier $= 6574.1 \times 10^6 - 37119.8\ (339.04)^2 = 2307.25 \times 10^6$ #in.^{2}

Carrier with Pack $= 7315.37 \times 10^6 - 42,241.0\ (339.45)^2 = 2448.1 \times 10^6$ #in.^{2}

LANDING CONDITION

Airplane c.g. #2L - 60,000 # Gross Weight, Max. Cargo (high)
Min. Fuel Gear Down

Determination of Cargo c.g.

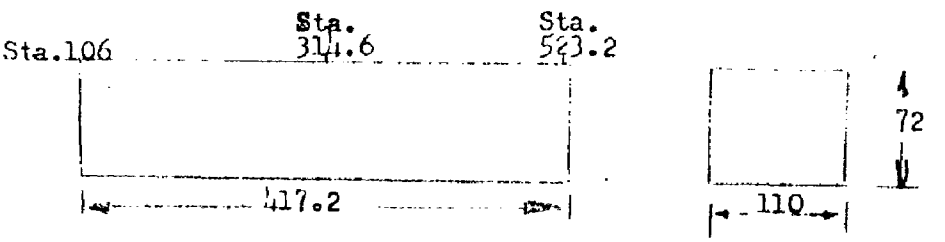
Item	W	x	z	Wx x10^{-3}	Wz x10^{-3}
Basic Weight	41,842	336.43	174.86	14077.07	7316.70
Min. Fuel	801	372.5	150.0	298.37	120.15
Min. Oil	225	475.0	151.0	106.88	33.98
** Cargo Dist	17,132	x	*204.0	17.132x	3494.93
	60,000	336.34	182.76	14482.32 + 17.132x	10965.76

* Cargo c.g. assumed 60" above pack floor.
** 20% M.A.C.

$$\frac{14,482,320 + 17.132x}{60,000} = 336.34 = \text{(Station 318.34)}$$

$$x = \frac{60,000\ (336.34) - 14482,320}{17132} = 332.6 = \text{Station } 314.6$$

Assumed cargo distribution and moment of inertia for distributed cargo.



$$I_{ox} = \frac{17132}{12}\ (\overline{110}^2 + \overline{72}^2) = 24.676 \times 10^6\ \#\text{in.}^2$$

$$I_{oy} = \frac{17132}{12}\ (\overline{417.2}^2 + \overline{72}^2) = 255.898 \times 10^6\ \#\text{in.}^2$$

$$I_{oz} = \frac{17132}{12}\ (\overline{417.2}^2 + \overline{110}^2) = 265.768 \times 10^6\ \#\text{in.}^2$$

LANDING CONDITIONS

Airplane c.g. #2L (Cont'd) Gear Down

Item	W	Ixx 10^{-6}	Iyy $x10^{-6}$	Izz $x10^{-6}$
Basic Weight	41,842	2602.68	7325.95	7156.7
Min. Fuel	801	41.14	127.75	135.67
Min. Oil	225	12.02	59.90	57.66
Cargo (dist.)	17,132	*737.64	2864.05	*2160.96
	60,000	3393.48	10,377.65	9510.99

*Cargo Moments of Inertia

$Ixx = Iox + Wz^2 = 24.676 \times 10^6 + 17132\ (204.0)^2 = 737.64 \times 10^6$ #in.^{2}

$Iyy = Ioy + W(z^2 + x^2) = 255.898 \times 10^6 + 17132\ (332.6^2 + 204.0^2) = 2864.05 \times 10^6$ #in.^{2}

$Izz = Ioz + Wx^2 = 265.768 \times 10^6 + 17132\ (332.6)^2 = 2,160.957 \times 10^6$

Airplane Moments of Inertia

$Iox = Ixx - Wz^2 = 3393.48 \times 10^6 - 60000 \times (182.76)^2 = 1389.41 \times 10^6$ #in.^{2}

$Ioy = Iyy - W\ (z^2 + x^2) = 10,377.65 \times 10^6 - 60,000\ (182.76^2 + 336.34^2 = 1586.10 \times 10^6$ #in.^{2}

$Ioz = Izz - W(x^2) = 9,510.99 \times 10^6 - 60,000\ (336.34)^2 = 2723.51 \times 10^6$ #in.^{2}

LANDING CONDITIONS

Airplane c.g. #2A1-44,106 Gross Weight, Min. Fuel, 1238# Cargo High Gear Down

Determination of Cargo c.g.

Item	W	x	z	Wx x10-3	Wz x10-3
Basic Weight	41,842	336.4	174.86	14075.65	7316.70
Min. Fuel	801	372.5	150.0	298.37	120.15
Min. Oil	225	475.	151.0	106.88	33.98
Cargo (dist)	1,238	x	*204.0	1.238x	252.55
	44,106	** 336.34	175.11	14480.90 +1.238x	7723.38

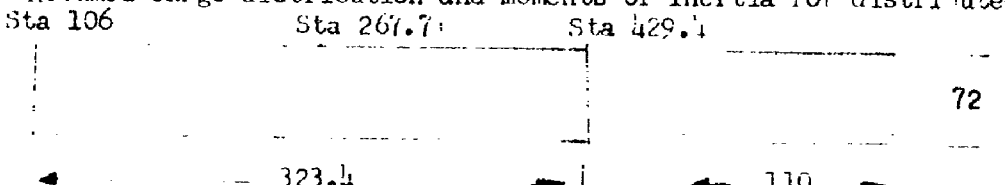
*Cargo c.g. assumed 60" above pack floor
**20% M.A.C.

$$336.34 = \frac{14,482.32 + 1.238x}{44.106}$$

$$x = \frac{44,106\ (336.34) - 14,480,400}{1.238} = \frac{14,834.6 - 14,480.9}{1.238}$$

$$\frac{353.7}{1.238} = 285.7 \qquad \text{Station} = 267.7$$

Assumed cargo distribution and moments of inertia for distributed cargo.



$$I_{ox} = \frac{1,238}{12}\ (110^2 + 72^2) = 1.78 \times 10^6\ \#in.^2$$

$$I_{oy} = \frac{1238}{12}\ (323.4^2 + 72^2) = 11.32 \times 10^6\ \#in.^2$$

$$I_{oz} = \frac{1238}{12}\ (323.4^2 + 110^2) = 12.04 \times 10^6\ \#in.^2$$

LANDING CONDITIONS

Airplane c.g. #2AL (cont'd) (Gear Down)

Item	W	Ixx x10^{-6}	Iyy x10^{-6}	Izz x10^{-6}
Basic Weight	41,842	2,602.68	7325.95	7156.7
Min. Fuel	801	41.14	127.75	135.67
Min. Oil	225	12.02	59.90	57.66
Cargo dist.	1,238	*53.3	*163.89	113.09
	44,106	2,709.14	7677.49	7463.12

*Cargo Moments of Inertia

$$I_{xx} = I_{ox} + Wz^2 = 1.78 \times 10^6 + 1{,}238\ (204)^2 = 53.30 \times 10^6\ \#in.^2$$

$$I_{yy} = I_{oy} + W\ (z^2 + x^2) = 11.32 \times 10^6 + 1{,}238\ (204.0^2 + 285.7^2) = 163.89 \times 10^6\ \#in.^2$$

$$I_{zz} = I_{oz} + W\ (x^2) = 12.04 \times 10^6 + 1{,}238\ (285.7)^2 = 113.09 \times 10^6\ \#in.^2$$

Airplane Moments of Inertia

$$I_{ox} = I_{xx} - Wz^2 = 2709.14 \times 10^6 - 44106\ (175.11)^2 = 1356.70 \times 10^6\ \#in.^2$$

$$I_{oy} = I_{yy} - W\ (z^2 + x^2) = 7677.49 \times 10^6 - 44106\left[(175.11)^2 + (336.34)^2\right] = 1335.57 \times 10^6\ \#in.^2$$

$$I_{oz} = I_{zz} - W\ (x^2) = 7463.12 \times 10^6 - 44{,}106\ (336.34^2) = 2473.65 \times 10^6\ \#in.^2$$

LANDING CONDITIONS

Airplane c.g. #3L - 60,000# gross weight, Full Fuel, 1,238# Cargo (High) Gear (Down)

Determination of Cargo c.g.

Item	W	x	z	Wx $\times 10^{-3}$	Wz $\times 10^{-3}$
Basic Weight	41842	336.4	174.86	14075.65	7316.70
Full Fuel	16020	372.5	150.0	5967.5	2403.0
Full Oil	900	475	151.0	427.5	135.9
*Cargo Dist.	1238	285.7	204.0	353.70	252.55
	60,000	347.07	168.47	20824.45	10108.15

* Reference to page 56

$$\% \text{ MAC} = 100 \frac{(347.07 - 302.69)}{168.28} = 100 \frac{(44.38)}{168.28} = 26.37$$

Item	Ixx $\times 10^{-6}$	Iyy $\times 10^{-6}$	Izz $\times 10^{-6}$
Basic Weight	2602.68	7325.95	7156.7
Full Fuel	1336.64	2590.8	3204.8
Full Oil	*** 20.52	***223.58	***203.06
Cargo (Dist.)	***51.52	***152.57	***101.05
	4011.36	10292.90	10665.61

Item	$Wx^2 \times 10^{-6}$	$Wy^2 \times 10^{-6}$	$Wz^2 \times 10^{-6}$
Full Oil	203.06	0	20.52
Cargo (dist)	101.05	0	51.52

***($Ixx = Iox + Wy^2 + Wz^2$
($Iyy = Ioy + Wx^2 + Wz^2$
($Izz = Ioz + Wx^2 + Wy^2$

Airplane moments of Inertia

$$Iox = Ixx - W(z^2) = 4011.36 \times 10^6 - 60{,}000\,(168.47)^2 = 2308.43 \times 10^6 \text{ \#in.}^2$$

$$Ioy = Iyy - W(x^2 + z^2) = 10292.90 \times 10^6 - 60{,}000\,(168.47^2 + 347.07^2) = 1362.10 \times 10^6 \text{ \#in.}^2$$

$$Ioz = Izz - W(x^2) = 10{,}665.98 \times 10^{-6} - 60{,}000\,(347.07^2) = 3.37.11 \times 10^6 \text{ \#in.}^2$$

Subject:— MASS MOMENTS OF INERTIA - Part II

Landing Conditions

Airplane c.g. #4L and 4AL - Full Fuel, No Cargo (Gear Down)

Item	W	X	Y	Z	Wx x10-3	Wy x10-3	Wz x10-3
1	2	3	4	5	6	7	8
Basic Weight	36720.8	335.6	.03	166.48	12323.37	1.58	6113.28
Full Oil	900	475.0	0	151.0	427.5	0	135.9
Full Fuel	16020	372.5	0	150.0	5967.5	0	2403.0
Carrier-c.g. 4L	53640.8	348.96	.03	161.3	18718.37	1.58	8652.18
Plus Pack	5121.2	342.44	0	235.0	1753.7	0	1203.43
Carrier with Pack c.g. 4AL	58762	348.39	.03	167.72	20472.07	1.58	9855.61

Item	Wx^2 x10-6	Wy^2 x10-6	Wz^2 x10-6	Iox x10-6	Ioy x10-6	Ioz x10-6	Ixx x10-6	Iyy x10-6	Izz x10-6
1	9	10	11	12	13	14	15	16	17
Basic Weight	5209.09	1190.89	1075.95	20.56	15.39	15.45	2287.4	6300.43	6415.43
Full Oil	203.06	0	20.52	0	0	0	20.52	223.58	203.06
Full Fuel							1336.6	2590.8	3204.8
Carrier-c.g. 4L	5412.15	1190.89	1096.47	20.56	15.39	15.45	3644.52	9114.81	9823.29
Plus Pack	741.1	0	284.25	31.03	.17	.17	315.28	1025.52	741.27
Carrier with Pack c.g. 4AL	6153.25	1190.89	1380.72	51.59	15.56	15.62	3959.80	10140.33	10564.56

✱ Full Fuel Ref. Page 58

Carrier 4L

$Iox = Ixx - Wz^2 = 3644.52 \times 10^6 - 53640.8(161.3)^2 = 2248.91 \times 10^6$ #in.^{2}

$Ioy = Iyy - W(x^2 + z^2) = 9114.81 \times 10^6 - 53640.8\ (161.3^2 + 348.96^2) = 1187.19 \times 10^6$ #in.^{2}

$Ioz = Izz - W(x^2) = 9823.29 \times 10^6 - 53640.8\ (348.96^2) = 3291.28 \times 10^6$ #in.^{2}

Carrier with Pack 4AL

$Iox = Ixx - Wz^2 = 3959.80 \times 10^6 - 58762\ (167.72)^2 = 2306.83 \times 10^6$ #in.^{2}

$Ioy = Iyy - W\ (x^2 + z^2) = 10140.33 \times 10^6 - 58762\ (167.72^2 + 348.39^2) = 1355.08 \times 10^6$ #in.^{2}

$Ioz = Izz - Wx^2 = 10564.56 \times 10^6 - 58762\ (348.39)^2 = 3432.29 \times 10^6$ #in.^{2}

$\% MAC = 100 \left(\frac{348.39 - 302.69}{168.28}\right) = 100 \left(\frac{46.70}{168.28}\right) = 27.75$

RES

LANDING CONDITIONS

Airplane c.g. #5L - 60,000# gross weight, Max. Cargo (low)
Min. Fuel (Gear Down)

Determination of cargo c.g.

Item	W	x	z	Wx x10-3	Wz x10-3
Basic Weight	41842	336.43	174.86	14077.07	7316.7
Min. Fuel	801	372.5	150.0	298.37	120.05
Min. Oil	225	475.0	151	106.88	33.98
Cargo	17132	x	258.0	17.132x	4420.06
	60,000	336.34	198.18	14482.32 +17.132x	11890.89

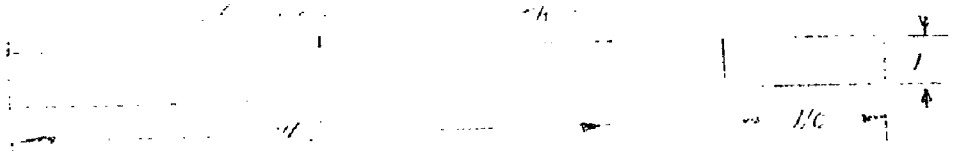
$$336.34 = \frac{14,482.32 + 17.132x}{60,000}$$

$$x = \frac{336.34\ (60,000) - 14,482.32 \times 10^3}{17132} = \frac{20,180.4 \times 10^3 - 14,482.32 \times 10^3}{17132}$$

$$= \frac{5698.08 \times 10^3}{17132}$$

x = 332.6 station = 314.6

Assumed cargo distribution and moments of inertia for distributed cargo.



$$Iox = \frac{17132}{12}\left[(110)^2 + (12)^2\right] = 17.48 \times 10^6\ \#in.^2$$

$$Ioy = \frac{17132}{12}\left[(417.2)^2 + (12)^2\right] = 248.70 \times 10^6\ \#in.^2$$

$$Ioz = \frac{17132}{12}\left[(417.2)^2 + (110)^2\right] = 265.77 \times 10^6\ \#in.^2$$

$$Ixx = Iox + Wz^2 = 17.48 \times 10^6 + 17132\ (258.0)^2 = 1157.85 \times 10^6\ \#in.^2$$

$$Iyy = Ioy + W(x^2 + z) = 248.7 \times 10^6 + 17132\ (332.6^2 + 258.0^2) = 3035.6\ \#in.^2 \times 10^6\ \#in.^2$$

$$Izz = Ioz + W(x^2) = 265.77 \times 10^6 + 17132\ (332.6)^2 = 2,160.96 \times 10^6\ \#in.^2$$

LANDING CONDITIONS

Airplane c.g. #5L (cont'd) - 60,000# G.W., Max. Cargo (low), Min. Fuel (Gear Down)

Item	W	I_{xx} x 10^{-6}	I_{yy} x10^{-6}	I_{zz} x10^{-6}
Basic Weight	41842	2602.68	7325.95	7156.70
Min. Fuel	801	41.14	127.75	135.67
Min. Oil	225	12.02	59.9	57.66
Cargo (Dist.)	17132	*1157.85	*3035.56	*2160.96
Total	60000	3813.69	10549.16	9510.99

* Cargo Moments of Inertia

Airplane moments of inertia about c.g. $\#5_L$

$$I_{ox} = Ixx - Wz^2 = 3813.69 \times 10^6 - 60,000\ (198.18^2) = 1457.17 \times 10^6\ \#in.^2$$

$$I_{o_y} = Iyy - W(x^2 + z^2) = 10,549.16 \times 10^6 - 60,000\ (336.34^2 + 198.18^2) = 1405.17 \times 10^6\ \#in.^2$$

$$I_{oz} = I_{zz} - Wx^2 = 9510.99 \times 10^6 - 60,000\ (336.34)^2 = 2723.51 \times 10^6\ \#in.^2$$

LANDING CONDITIONS

RFS

Airplane c.g. #6L - 60,000# Gross Weight, Min. Fuel and Oil, Max. Cargo Aft (Low)
(Gear Down)

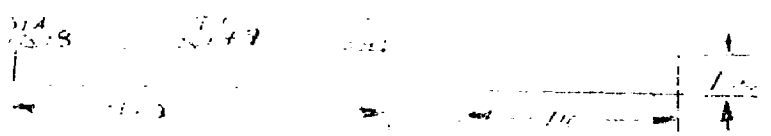
Item	W	X	Z	WX x10-3	WZ x10-3
Basic Weight	41842	336.43	174.86	14077.07	7316.7
Min. Fuel	801	372.5	150.0	298.37	120.15
Min. Oil	225	475.0	151	106.88	33.98
Cargo (dist.)	17132	x	258.0	17.132x	4420.06
Total	60000	349.73	198.18	14482.32 +17,132x	11890.89

$$\% \text{ MAC} = 100 \left(\frac{349.73 - 302.69}{168.28} \right) 100 \left(\frac{47.04}{168.28} \right) = 27.95 \quad \text{(Ref R107B-006A Pg.2)}$$

$$349.73 = \frac{17132\,x + 14482.32 \times 10^3}{60{,}000}$$

$$x = \frac{60{,}000\,(349.73) - 14482320}{17132} = 379.49 = \text{Sta. } 361.49$$

Assumed cargo distribution and moments of inertia for distributed cargo.



$$I_{ox} = \frac{17132}{12}\,(110)^2 + (12)^2 = 17.48 \times 10^6 \text{ \#in.}^2$$

$$I_{oy} = \frac{17132}{12}\,(375.02^2 + 12)^2 = 200.99 \times 10^6 \text{ \#in.}^2$$

$$I_{oz} = \frac{17132}{12}\,(375.02^2 + 110^2) = 218.06 \times 10^6 \text{ \#in.}^2$$

$$I_{xx} = I_{ox} + W_z^2 = 17.48 \times 10^6 + 17132\,(258.0)^2 = 1157.85^2 \times 10^6 \text{ \#in.}^2$$

$$I_{yy} = I_{oy} + W(x^2 + z^2) = 200.99 \times 10^6 + 17132\,(258.0^2 + 379.49^2) = 3809.76 \times 10^6 \text{ \#in.}^2$$

$$I_{zz} = I_{oz} + W_x^2 = 218.06 \times 10^6 + 17132\,(379.58)^2 = 2686.46 \times 10^6 \text{ \#in.}^2$$

LANDING CONDITIONS

Airplane c.g. #6L (cont'd) 60,000# Gross Weight, Min. Fuel and Oil

Max. Cargo Aft (low) (Gear Down)

Item	W	$I_{xx} \times 10^{-6}$	$I_{yy} \times 10^{-6}$	$I_{zz} \times 10^{-6}$
Basic Weight	41842	2602.68	7325.95	7156.70
Min. Fuel	801	41.14	127.75	135.67
Min. Oil	225	12.02	59.9	57.66
Cargo	17132	1157.85	3809.76	2686.46
	60,000	3813.69	11323.36	10036.49

Cargo Moments of Inertia

Airplane Moments of inertia about c.g. #6L

$I_{ox} = I_{xx} - Wz^2 = 3813.69 \times 10^6 - 60,000\ (198.18)^2 = 1457.17 \times 10^6$ #in.^{2}

$I_{oy} = I_{yy} - W(x^2 + z^2) = 11323.36 \times 10^6 - 60,000\ (198.18^2 + 349.73^2) = 1628.18 \times 10^6$ #in.^{2}

$I_{oz} = I_{zz} - Wx^2 = 10036.49 \times 10^6 - 60,000\ (349.73)^2 = 2697.83 \times 10^6$ #in.^{2}

Subject: MASS MOMENTS OF INERTIA - Part II

RES

LANDING CONDITIONS

Airplane c.g. #7L - 60,000# Gross Weight, Full Fuel and Oil, Cargo (high) Aft (Gear Down)

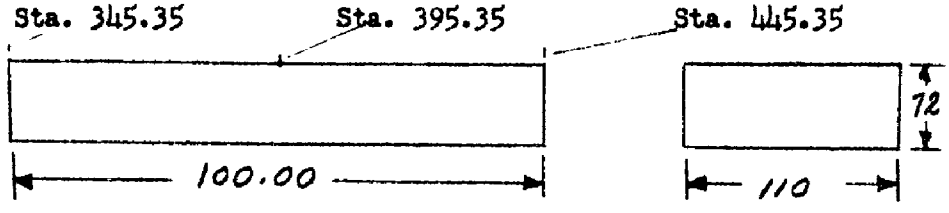
Item	W	X	Z	WX $\times 10^{-3}$	WZ $\times 10^{-3}$
Basic Weight	41842	336.43	174.86	14077.07	7316.7
Full Fuel	16020	372.5	150.0	5967.5	2403.0
Full Oil	900.0	475	151.0	427.5	135.9
Cargo (dist.)	1238	x	204.0	1.238 x	252.55
Total	60000	349.73	168.47	20472.07 +1.238 x	10108.15

$$\% \text{ MAC} = 100 \left(\frac{349.73 - 302.69}{168.28}\right) = 27.95 \text{ (Ref. Pg. 62)}$$

$$349.73 = \frac{20{,}472{,}070 + 1{,}238\,x}{60{,}000}$$

$$x = \frac{60{,}000\,(349.73) - 20{,}472{,}070}{1{,}238} = 413.35 = \text{Sta. } 395.35$$

Assumed cargo distribution and moments of inertia for distributed cargo



$$I_{ox} = \frac{1238}{12}\left(110^2 + 72^2\right) = 1.78 \times 10^6 \#\text{in}^2$$

$$I_{oy} = \frac{1238}{12}\left(100.00^2 + 72^2\right) = 1.57 \times 10^6 \#\text{in}^2$$

$$I_{oz} = \frac{1238}{12}\left(100.00^2 + 110^2\right) = 2.28 \times 10^6 \#\text{in}^2$$

$$I_{xx} = I_{ox} + W_z^2 = 1.78 \times 10^6 + 1238\,(204.0)^2 = 53.30 \times 10^6 \#\text{in}^2$$

$$I_{yy} = I_{oy} + W\,(z^2 + x^2) = 1.57 \times 10^6 + 1238\,(204.0^2 + 413.35^2)$$

$$= 264.61 \times 10^6 \#\text{in}^2$$

$$I_{zz} = I_{oz} + W\,(x^2) = 2.28 \times 10^6 + 1238\,(413.35)^2 = 213.80 \times 10^6 \#\text{in}^2$$

LANDING CONDITIONS

RESI

Airplane c.g. #7L (cont'd) 60000# Gross Weight, Full Fuel, Cargo (high) Aft

(Gear Down)

Item	W	I_{xx} x 10^{-6}	I_{yy} x 10^{-6}	I_{zz} x 10^{-6}
Basic Weight	41842	2,602.68	7325.95	7156.70
Full Fuel	16020	1,336.6	2590.8	3204.8
Full Oil	900	20.52	223.58	203.06
Cargo	1238	53.30	264.61	213.80
Total	60000	4,013.10	10,404.94	10,778.36

Cargo moments of inertia.

Airpalne moments of inertia about c.g. #7L.

$$I_{ox} = I_{xx} - W(z)^2 = 4013.10 \times 10^6 - 60,000\ (168.47)^2 = 2310.17 \times 10^6 \#''^2$$

$$I_{oy} = I_{yy} - W\ (z^2 + x^2) = 10404.94 \times 10^6 - 60000\ (168.47^2 + 349.73^2) = 1363.35 \times 10^6 \#''^2$$

$$I_{oz} = I_{zz} - W(x^2) = 10778.36 \times 10^6 - 60000\ (349.73)^2 = 3439.7 \times 10^6 \#''^2$$

RES

SUMMARY OF NORMAL GROSS WEIGHT LANDING CONDITIONS

c.g. Location	Ref. Page	Condition	I_{ox} Slug Ft.^{2}	I_{oy} Slug Ft.^{2}	I_{oz} Slug Ft.^{2}
1L	53	M.F.W. Pack Off	280,019	246,968	497,595
1AL	53	M.F.W. Pack On	291,550	282,182	527,972
2L	55	G.W. = 60,000 # Min. Fuel, Max. Cargo (High)	299,648	342,068	587,368
2AL	57	G.W. = 44,106 # Min. Fuel, 1238# Cargo (High)	292,594	288,037	533,482
3L	58	G.W. = 60,000 # Max. Fuel 1238# Cargo (High)	497,850	293,759	741,268
4L	59	G.W. = 53640.8 Max. Fuel No Cargo - Pack Off	485,013	256,036	709,817
4AL	59	G.W. = 58762 Max. Fuel No Cargo - Pack On	497,500	292,200	740,200
5L	61	G.W. = 60,000 # Min. Fuel Max. Cargo Aft (low)	314,262	303,047	587,368
6L	63	G.W. = 60,000 # Min. Fuel Max. Cargo Aft (low)	314,262	351,143	581,830
7L	65	G.W. = 60,000 # Max. Fuel 1238# Cargo (High)	498,225	294,028	741,826

RESTRICTED

PART V

Mass Moments of Inertia - Flight Conditions

REVISED

Flight Conditions

Vertical limits of cargo at 6.0" and 60.0" above pack floor

Airplane C.G.'s - G.W. = 64,000#, Full Outer - Panel Fuel, Gear Up, Cargo C.G. 60.0" above floor

C.G.# 1A: $\bar{x}_{airplane}$ = 20% MAC (= F.S. 318.34)

Item	W (#)	x (from F.S.-18)	z (from vert. ref.)	W x (x 10^{-3})	W z (x10^{-3})
Basic Weight	41,842	340.5	168.42	14,247.20	7,047.03
Fuel	9,744	372.5	154.10	3,629.64	1,501.55
Oil	547	475.0	151.00	259.83	82.60
Cargo	11,867	x	204.00	11.87x	2,420.87
Σ	64,000	336.34	172.69	18,136.67 + 11.87x	11,052.05

$\bar{z}$ cargo = 204.00 (= 60" above floor)

$$\bar{x} \text{ cargo} = \frac{64.0\ (336.34) - 18{,}136.67}{11.87} = 285.53 \text{ (=F.S. 267.53)}$$

$$\bar{z} \text{ airplane} = \frac{11{,}052.05}{64.0} = 172.69 \text{ (=0.69" below ℄ thrust)}$$

C.G.# 2A:

$\bar{x}$ airplane = 30% MAC (F.S. 335.17)

$\bar{z}$ airplane = 172.69 (=0.69" below ℄ thrust) as above

$\bar{z}$ cargo = 204.00 (=60" above floor) as above

$$\bar{x} \text{ cargo} = \frac{64.0\ (353.17) - 18{,}136.67}{11.87} = 376.27 \text{ (=F.S. 358.27)}$$

Subject:— MASS MOMENTS OF INERTIA - Part V

RESTRICTED

CG 3A at 20% M.A.C. , G.W. = 64,000#
Full Outer Panel Fuel Tanks, Gear Up
Cargo C.G. 6.0" above floor

Item	W (#)	x (from F.S.-18)	z (from vert. ref)	W-x ($\times 10^{-3}$)	W-z ($\times 10^{-3}$)
Basic Weight	41,842	340.5	168.42	14,247.20	7,047.03
Fuel	9,744	372.5	154.10	3,629.64	1,501.55
Oil	547	475.0	151.00	259.83	82.60
Cargo	11,867	x	258.00	11.87x	3,061.69
Σ	64,000	336.34	182.70	18,136.67 + 11.87x	11,692.87

Cargo C.G. -

$$\frac{11.87x + 18,136.67}{64.0} = 336.34$$

$$11.87\ x_{cargo} = 21,525.76 - 18,136.67 = 3389.09$$

$$x_{cargo} = 285.53 \ (= \text{F.S. } 267.53)$$

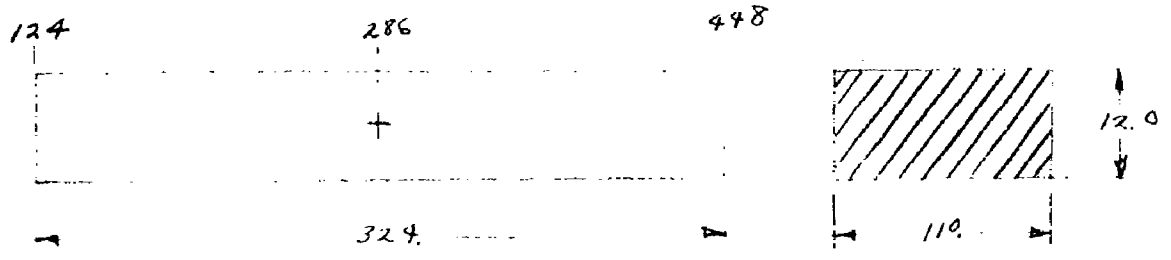
$$z_{cargo} = 258.00 \ (= 6.0'' \text{ above floor})$$

Airplane C.G. -

$$\bar{x}_{airplane} = 336.34 \ (= \text{F.S. } 318.34)$$

$$\bar{z}_{airplane} = 182.70 \ (= 10.70'' \text{ below } ℄ \text{ thrust})$$

Assumed cargo distribution and moments of inertia:-



$$I_{o_x} = \frac{11,867}{12}(110^2 + 12^2) = 12.11 \times 10^6 \text{ lb in}^2$$

$$I_{o_y} = \frac{11,867}{12}(324^2 + 12^2) = 103.95 \times 10^6 \text{ lb in}^2$$

$$I_{o_z} = \frac{11,867}{12}(324^2 + 110^2) = 115.78 \times 10^6 \text{ lb in}^2$$

RESTRICTED

CG 3A at 20% M.A.C., G.W. = 64,000#
Full Outer Panel Fuel Tanks, Gear Up

Item	W (#)	*I_{xx} ($\times 10^{-6}$)	**I_{yy} ($\times 10^{-6}$)	**I_{zz} ($\times 10^{-6}$)
Basic Weight	41,842	2486.01	7,332.28	7,302.07
Fuel	9,744	1117.14	1,583.43	2,237.79
Oil	547	29.22	135.89	140.17
Cargo	11,867	*802.02	*1,861.35	*1,083.27
Σ	64,000	4434.39	10,912.95	10,763.30

$$* \; I_{xx} = 12.11 \times 10^6 + 11{,}867\,(258.00)^2$$

$$= 802.02 \times 10^6 \text{ lb in}^2$$

$$* \; I_{yy} = 103.95 \times 10^6 + 11{,}867\,(258.00^2 + 285.53^2)$$

$$= 1861.35 \times 10^6 \text{ lb in}^2$$

$$* \; I_{zz} = 115.78 \times 10^6 + 11{,}867\,(285.53)^2$$

$$= 1{,}083.27 \times 10^6 \text{ lb in}^2$$

<u>Airplane Moments of Inertia</u>

$$I_{o_x} = I_{xx} - W z^{-2} = 4434.39 \times 10^6 - 64{,}000\,(182.70)^2$$

$$= 4434.39 \times 10^6 - 64{,}000\,(33{,}379.29) = 2298.12 \times 10^6 \text{ lb in}^2$$

$$I_{o_y} = I_{yy} - W\,(\bar{x}^2 + \bar{z}^2) = 10{,}912.95 \times 10^6 - 64{,}000\,(336.34^2 + 182.70^2)$$

$$= 10{,}912.95 \times 10^6 - 64{,}000\,(146{,}504) = 1{,}536.69 \times 10^6 \text{ lb in}^2$$

$$I_{o_z} = I_{zz} - W\,\bar{x}^2 = 10{,}763.30 \times 10^6 - 64{,}000\,(113{,}125)$$

$$= 10{,}763.30 \times 10^6 - 7{,}240 \times 10^6 = 3{,}523.30 \times 10^6 \text{ lb in}^2$$

CG 4A at 30% M.A.C. G.W. = 64,000#
Full Outer-Panel Fuel Tanks, Gear Up

Item	W (#)	x (from F.S. - 18)	z (from 172" above T)	W-x (in-lb x 10^{-3})	W-z (in-lb x10^{-3})
Basic Wt.	41,842	340.5	168.42	14,247.20	7,047.03
Fuel	9,744	372.5	154.10	3,629.64	1,501.55
Oil	547	475.0	151.00	259.83	82.60
Cargo	11,867	x	258.00	11.87x	3,061.69
Σ	64,000	353.17	$\bar{z}$	18,136.67 + 11.87x	11,692.87

Cargo C.G. -

$$\frac{11.87x + 18,136.67}{64.0} = 353.17$$

$$11.87x_{cargo} = 22,602.88 - 18,136.67 = 4466.21$$

$$x_{cargo} = 376.26 \ (= \text{F.S. } 358.26)$$

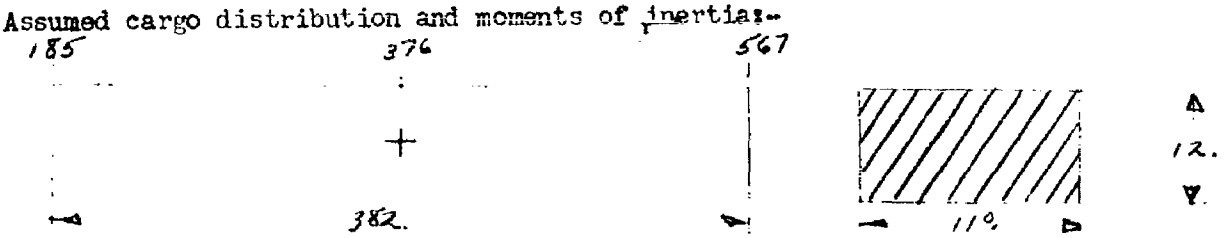
$$z_{cargo} = 258.00 \ (= 6.0" \text{ above floor})$$

Airplane C.G.

$$\bar{z}_{airplane} = \frac{11,692.87}{64,000} = 182.70 \ (= 10.70" \text{ below } ℄ \text{ thrust})$$

$$\bar{x}_{airplane} = 353.17 \ (= \text{F.S. } 335.17)$$

Assumed cargo distribution and moments of inertia:-



$$I_{o_x} = \frac{11867}{12}(110^2 + 12^2) = 12,108,295 \text{ lb-in}^2 = 12.11 \times 10^6 \text{ lb-in}^2$$

$$I_{o_y} = \frac{11867}{12}(382^2 + 12^2) = 144,449,070 \text{ lb-in}^2 = 144.45 \times 10^6 \text{ lb-in}^2$$

$$I_{o_z} = \frac{11867}{12}(382^2 + 110^2) = 156.27 \times 10^6 \text{ lb-in}^2$$

CG 4A at 30% M.A.C. G.W. = 64,000#
Full Outer-Panel Fuel Tanks, Gear Up

RFS

Item	W	I_{xx} (x 10^{-6})	I_{yy} (x 10^{-6})	I_{zz} (x 10^{-6})
Basic Wt.	41,842	2486.01	7332.28	7302.07
Fuel	9,744	1117.14	1583.43	2237.79
Oil	547	29.22	135.89	140.17
Cargo	11,867	802.02	2614.48	1836.39
Σ	64,000	4434.39	11666.08	11516.42

$$I_{xx} = 12.11 \times 10^6 + 11{,}867\ (258.00)^2$$
$$= 12.11 \times 10^6 + 789.91 \times 10^6$$
$$= 802.02 \times 10^6 \text{ lb in}^2$$

$$I_{yy} = 144.45 \times 10^6 + 11{,}867\ (258.00^2 + 376.27^2)$$
$$= 144.45 \times 10^6 + 2470.03 \times 10^6$$
$$= 2614.48 \times 10^6 \text{ lb in}^2$$

$$I_{zz} = 156.27 \times 10^6 + 11{,}867\ (376.27^2)$$
$$= 156.27 \times 10^6 + 1680.12 \times 10^6$$
$$= 1836.30 \times 10^6 \text{ lb in}^2$$

<u>Airplane Moments of Inertia</u>

$$I_{o_x} = I_{xx} - W\bar{z}^2 = 4434.39 \times 10^6 - 64{,}000\ (182.70)^2$$
$$= 4434.39 \times 10^6 - 64{,}000\ (33{,}379.29) = 2298.12 \times 10^6 \text{ lb in}^2$$

$$I_{o_y} = I_{yy} - W\ (\bar{x}^2 + \bar{z}^2) = 11{,}666.08 \times 10^6 - 64{,}000\ (353.17^2 + 182.70^2)$$
$$= 11{,}666.08 \times 10^6 - 64{,}000\ (124{,}729 + 33{,}379) = 1{,}547.17 \times 10^6 \text{ lb in}^2$$

$$I_{o_z} = I_{zz} - W\ (\bar{x}^2) = 11{,}516.42 \times 10^6 - 64{,}000\ (353.17^2)$$
$$= 11{,}516.42 \times 10^6 - 64{,}000\ (124{,}729) = 3{,}533.76 \times 10^6 \text{ lb in}^2$$

CG #1A, G.W. = 74,000#, Gear Up

For a vertical location of the cargo at 60.0" above the floor, find the airplane c.g. with the same wt. distribution as for the cargo at 6.0" above the floor.

Item	W (#)	x (from F.S.-18)	z (from Vert.Ref.)	W-x (in-lbx10^{-3})	W-z (in-lbx10^{-3})
Basic Wt.	41,842	340.50	168.42	14247.20	7047.03
Fuel	11,511	372.50	150.00	4287.85	1726.65
Oil	647	475.00	151.00	307.33	97.70
Cargo	20,000	x	204.00	20.00(x)	4080.00
Σ	74,000	336.34	$\bar{z}$	18842.38 + 20. x	12951.38

$$\bar{x}_{cargo} = \frac{336.34 - 254.63}{.27027} = 302.34$$

(=F.S. 284.34)

$$\bar{z}_{airplane} = \frac{12,951.38}{74} = 175.02$$

(=3.02" below ℄ thrust)

For C.G. #2A same wt. distribution

$$\bar{x}_{cargo} = \frac{353.17 - 254.63}{.27027} = 364.61$$

$$\bar{z}_{airplane} = 175.02$$

(= 3.02" below ℄ thrust)

RES

Flight Conditions

C.G. #3A, 20% M.A.C. - G.W. = 74,000#, Gear Up
Cargo C.G. at 6.0" above floor

Item	W (#)	x (from F.S.-18)	z (from 172" above T)	W-x ($\times 10^{-3}$)	W-z ($\times 10^{-3}$)
Basic Wt.	41,842	340.50	168.42	14247.20	7047.03
Fuel	11,511	372.50	150.00	4287.85	1726.65
Oil	647	475.00	151.00	307.3	97.70
Cargo	20,000	x	254.00	20.00x	5080.00
Σ	74,000	336.34	Z	18842.38 + 20. x	13951.38

$$20.0\,x + 18{,}842.38 = 74.00\,(336.34) = 24{,}889.16$$

$$20.0\,x = 6046.78$$

$$\bar{x}_{cargo} = 302.34 \quad (= \text{F.S. } 284.34)$$

$$\bar{z}_{airplane} = \frac{13{,}951.38}{74.0} = 188.53$$

(= 16.53" below ℄ thrust)

C.G. # 4A, 30% MAC - GW = 74,000#
Gear Up, Cargo at 6.0" above floor

$$20.0\,x + 18{,}842.38 = 74.0\,(353.17) = 26{,}134.58$$

$$20.0x = 7292.20$$

$$\bar{x}_{cargo} = 364.61 \quad (= \text{FS } 346.61)$$

$$\bar{z}_{airplane} = 188.53 \quad (= 16.53'' \text{ below ℄ thrust})$$

RES

Flight Conditions

Summary of Normal Gross Wt. Flight Conditions,

Airplane Moments of Inertia (lb-in^2)

Condition	Airplane C.G.		I_{o_x}	I_{o_y}	I_{o_z}
	* X	** Z	(x 10^{-6})	(x10^{-6})	(x 10^{-6})
C.G. 3A, G.W. = 64,000# Gear Up, Full Fuel, Outer Panel Cargo C.G. at 6.0" above floor	336.34	182.70	2298.12	1536.69	3523.30
C.G. 4A, G.W. = 64,000# Gear Up, Full Fuel, Outer Panel, Cargo C.G. at 6.0" above floor	353.17	182.70	2298.12	1547.17	3533.76

* Referenced to F.S. "-18"

** Referenced to vert. ref. datum, 172.0" above ℄ thrust

ENGINEERING REPORT NO.

R1073-004

SUBJECT

MASS MOMENTS OF INERTIA CALCULATIONS

MODEL: XC-120

FAIRCHILD AIRCRAFT

Division of

FAIRCHILD ENGINE & AIRPLANE CORPORATION

HAGERSTOWN, MARYLAND

Date: 6 May 1948

Prepared By J. W. O. Baker

No. Pages: 45 (PART I)
21 (PART II)
5 (PART III)
5 (PART IV)

Checked By

Approved By C. F. Comstock

REVISIONS

Date	Pages Affected	By	Remarks
2/14/49	All pages.	J.W.O.Baker	PART I completely revised.
2/14/49	All pages.	J. Myers	PART II completely revised.
2/14/49	All pages.	J.W.O.Baker	PART III completely revised.
2/14/49	Pages 72, 73, 74, 75, 76	J.W.O.Baker	PART IV Added.
3/14/49	Pgs. 55,57,66 of Part II revised.	Hawley	

LANDING CONDITIONS

Airplane c.g. #2L (Cont'd) Gear Down

Item	W	Ixx 10^{-6}	Iyy $x10^{-6}$	Izz $x10^{-6}$
Basic Weight	41,842	2,602.82	7325.95	7156.7
Min. Fuel	801	41.14	127.75	135.67
Min. Oil	225	12.02	69.90	57.66
Cargo (dist.)	17,132	* 739.04	2865.45	* 2160.96
	60,000	3,395.02	10,379.05	9,510.99

*Cargo Moments of Inertia

$$Ixx = Iox + Wz^2 = 24.676 \times 10^6 + 17132\ (204.2)^2 = 739.04 \times 10^6 \#in.^2$$

$$Iyy = Ioy + W(z^2 + x^2) = 255.898 \times 10^6 + 17132\ (332.6^2 + 204.2^2) = 2,865.45 \times 10^6 \#in.^2$$

$$Izz = Ioz + Wx^2 = 265.76 \times 10^6 + 17132\ (332.6)^2 = 2,160.957 \times 10^6$$

Airplane Moments of Inertia

$$Iox = Ixx - Wz^2 = 3,395.02 \times 10^6 - 60000 \times (179.74)^2 = 1,456.63 \times 10^6 \#in.^2$$ C

$$Ioy = Iyy - W(z^2 + x^2) = 10,379.05 \times 10^6 - 60000\ \left(\frac{179.74}{}^2 + \frac{336.34}{}^2\right) = 1653.19 \times 10^6 \#in.^2$$ C C

$$Ioz = Izz - W(x^2) = 9,510.99 \times 10^6 - 60,000\ (336.34)^2 = 2,723.51 \times 10^6 \#in.^2$$

LANDING CONDITIONS

Airplane c.g. #2AL (cont'd) (Gear Down)

Item	W	Ixx $x10^{-6}$	Iyy $x10^{-6}$	Izz $x10^{-6}$
Basic Weight	41,842	2,602.82	7325.95	7156.7
Min. Fuel	801	41.14	127.75	135.67
Min. Oil	225	12.02	59.90	57.66
Cargo dist.	1,238	* 53.4	*163.25	112.34
	44,106	2,709.38	7676.85	7462.37

* Cargo Moments of Inertia

$$I_{xx} = I_{ox} + Wz^2 = 1.78 + 1.238\ (204.2)^2 = 53.4 \times 10^6 \#in.^2$$

$$I_{yy} = I_{oy} + W\ (z^2 + x^2) = 11.21 \times 10^6 + 1{,}238\ \left(\frac{\ }{204.2}^2 + \frac{\ }{284.81}^2\right) = 163.25 \times 10^6 \#in.^2$$

$$I_{zz} = I_{oz} + W\ (x^2) = 11.92 \times 10^6 + 1{,}238\ (284.81)^2 = 112.34 \times 10^6 \#in.^2$$

Airplane Moments of Inertia

$$I_{ox} = I_{xx} - Wz^2 = 2709.38 \times 10^6 - 44106\ \left(\frac{\ }{175.01}^2\right) = 1358.48 \times 10^6 \#in.^2$$ C

$$I_{oy} = I_{yy} - W(z^2 + x^2) = 7676.85 \times 10^6 - 44106\left(\frac{\ }{175.01}^2 + \frac{\ }{336.34}^2\right) = 1336.48 \times 10^6 \#in.^2$$ C C

$$I_{oz} = I_{zz} - W(x^2) = 7{,}462.37 \times 10^6 - 44{,}106\ (336.34^2) = 2472.9 \times 10^6 \#in.^2$$

SUMMARY OF NORMAL GROSS WEIGHT LANDING CONDITIONS

(Gear Down)

C.G. Location	Ref. Page	Condition	I_{o_x} Slug Ft.^{2}	I_{o_y} Slug Ft.^{2}	I_{o_z} Slug Ft.^{2}	
1L	53	M.F.W. Pack Off	280,360	247,315	497,600	
1AL	53	M.F.W. Pack On	291,900	282,500	527,970	
2L	55	G.W. = 60,000# Min. Fuel, Max. Cargo (High)	314,146	356,536	587,400	C
2AL	57	G.W. = 44,106# Min. Fuel, 1238# Cargo (High)	292,980	283,233	533,300	C
3L	58	G.W. = 60,000# Max. Fuel 1238# Cargo (High)	497,900	293,600	741,300	
4L	59	G.W. = 53640.8 Max. Fuel No Cargo - Pack Off	485,000	256,000	709,800	
4AL	59	G.W. = 58762 Max. Fuel No Cargo - Pack On	497,500	292,200	740,200	
5L	61	G.W. = 60,000# Min. Fuel Max. Cargo Aft (low)	314,700	357,160	587,400	
6L	63	G.W.=60,000# Min. Fuel Max. Cargo Aft (low)	336,300	349,000	579,200	
7L	65	G.W. = 60,000# Max. Fuel 1238# Cargo (High)	498,000	328,300	754,600	

REPORT NO. R107B-004	FAIRCHILD AIRCRAFT DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION		PAGES	PAGE
MODEL XC-120	PREPARED BY	CHECKED BY	APPROVED BY	
Subject: MASS MOMENTS OF INERTIA CALCULATIONS			DATE 6 May 1948	

REVISIONS

Date	Pages Affected	By	Remarks
5/5/49	Page 2 of Part I Revised.	J.W.O.BAKER	
7/7/49	All pages revised with the exception of Pages 48,49,50 and 51. Page 47.1 added.	J. B. Miller	
7/7/49	Pages 77, 78, 79, 80, 81, 82	S. M. Levin	Part V Added.
	83, 84, 85.		
3/20/50	Added Pages 78a, 84a, 84b,	T. Feaster	
	86, 87, of Part V	T. Feaster	

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MODEL XC-120 PREPARED BY FEHSTER CHECKED BY APPROVED BY

DATE March 20, 1950

REVISED

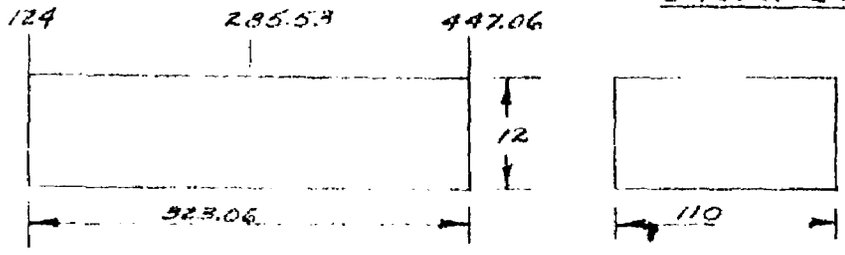
Subject: MASS MOMENTS OF INERTIA

FLIGHT CONDITIONS

C.G. @ 1A, 20% M.A.C. - G.W. = 64000#, GEAR UP

CARGO AT 60.0" ABOVE FLOOR CONT'D FROM PAGE 78

CARGO DISTRIBUTION



$I_{ox} = \frac{11867}{12}[(110)^2 + (12)^2] = 12.108 \times 10^{-6}$ #-in²

$I_{oy} = \frac{11867}{12}[(323.06)^2 + (12)^2] = 103.352 \times 10^{-6}$ #-in²

$I_{oz} = \frac{11867}{12}[(323.06)^2 + (110)^2] = 115.177 \times 10^{-6}$ #-in²

ITEM	W (#)	I_{xx} ($\times 10^{-6}$)	I_{yy} ($\times 10^{-6}$)	I_{zz} ($\times 10^{-6}$)
BASIC WEIGHT	41842	2486.01	7322.28	7302.07
FUEL	9744	1117.14	1583.42	2288.10
OIL	571	29.22	126.89	140.11
CARGO	11867	* 505.97	* 1564.09	* 1082.60
Σ	64000	4138.34	10616.29	10762.69

* $I_{xx} = 12.108 \times 10^{-6} + 11867(204.00)^2 = 505.965 \times 10^{-6}$ #-in²

* $I_{yy} = 103.352 \times 10^{-6} + 11867[(204)^2 + (285.53)^2] = 1564.690 \times 10^{-6}$ #-in²

* $I_{zz} = 115.177 \times 10^{-6} + 11867(285.53)^2 = 1082.608 \times 10^{-6}$ #-in²

AIRPLANE MOMENTS OF INERTIA

$I_{ox} = I_{xx} - W(z^2) = 4138.34 \times 10^{-6} - 64,000(172.69)^2$
$= 4138.34 \times 10^{-6} - 64,000(29,821) = 2229 \times 10^{-6}$ #-in²

$I_{oy} = I_{yy} - W(x^2, z^2) = 10,616.29 \times 10^{-6} - 64,000[\overline{336.34}^2 + \overline{172.69}^2]$
$= 10,616.29 \times 10^{-6} - 64,000(142,346)$
$= 1,467.75 \times 10^{-6}$ #-in²

$I_{oz} = I_{zz} - W(x^2) = 10,762.69 \times 10^{-6} - 64,000(336.34)^2$
$= 10,762.69 \times 10^{-6} - 7,240 \times 10^{-6}$
$= 3,522.69 \times 10^{-6}$ #-in²

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MODEL XC-120 PREPARED BY F. CASTLE CHECKED BY APPROVED BY

DATE Mar. 20, 1950

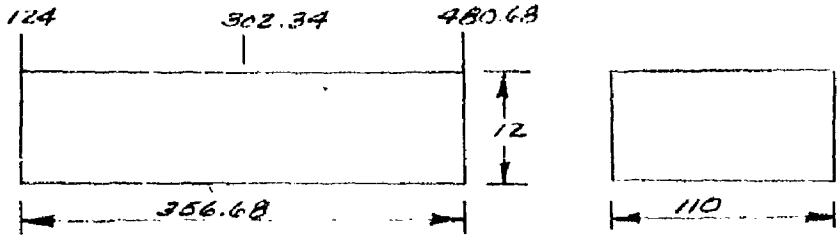
REVISED

Subject:— MASS MOMENTS OF INERTIA

C.G. #3A, 20% M.A.C. - G.W. = 74000#, GEAR UP, CARGO 6.0" ABOVE FLOOR

CONT'D FROM PAGE 84

CARGO DISTRIBUTION



$$I_{ox} = \frac{20,000}{12}\left[(110)^2+(12)^2\right] = 20.407 \times 10^{-6}\ \#\text{in}^2$$

$$I_{oy} = \frac{20,000}{12}\left[(404.78)^2+(12)^2\right] = 212.275 \times 10^{-6}\ \#\text{in}^2$$

$$I_{oz} = \frac{20,000}{12}\left[(356.68)^2+(110)^2\right] = 232.201 \times 10^{-6}\ \#\text{in}^2$$

ITEM	W (#)	I_{xx} ($\times 10^{-6}$)	I_{yy} $\times 10^{-6}$	I_{zz} $\times 10^{-6}$
BASIC WEIGHT	41842	2486.01	7332.28	7302.07
FUEL	11511	1117.14	1593.44	2321.10
OIL	647	29.22	135.89	190.11
CARGO	20000	* 1310.73	* 3330.76	* 2060.39
Σ	74000	4943.10	12382.36	11740.42

$$* \ I_{xx} = 20.407 \times 10^{-6} + 20,000(254.00)^2 = 1,310.73 \times 10^{-6}\ \#\text{in}^2$$

$$* \ I_{yy} = 212.275 \times 10^{-6} + 20,000\left[(302.34)^2+(254)^2\right] = 3,330.76 \times 10^{-6}\ \#\text{in}^2$$

$$* \ I_{zz} = 232.201 \times 10^{-6} + 20,000(302.34)^2 = 2,060.39 \times 10^{-6}\ \#\text{in}^2$$

AIRPLANE MOMENTS OF INERTIA

$$I_{ox} = I_{xx} - W\bar{z}^2 = 4,943.10 \times 10^{-6} - 74,000(188.53)^2$$
$$= 2,312.88 \times 10^{-6}\ \#\text{in}^2$$

$$I_{oy} = I_{yy} - W(\bar{x}^2+\bar{z}^2) = 12,382.36 \times 10^{-6} - 74,000\left[\overline{336.34}^2 + \overline{188.53}^2\right]$$
$$= 1,380.92 \times 10^{-6}\ \#\text{in}^2$$

$$I_{oz}' = I_{zz} - W\bar{x}^2 = 11,740.42 \times 10^{-6} - 74,000(336.34)^2$$
$$= 9,369.20 \times 10^{-6}\ \#\text{in}^2$$

MODEL XC-120 | PREPARED BY FEASTER | CHECKED BY | APPROVED BY

DATE

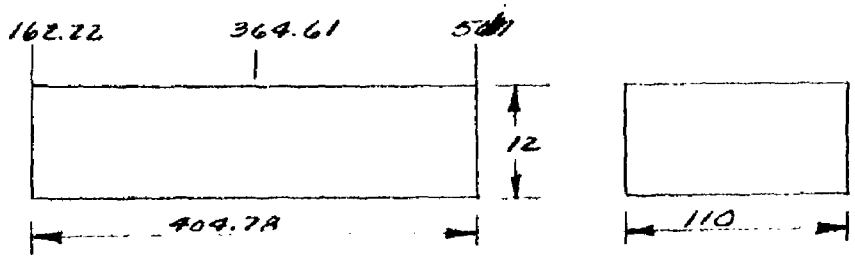
REVISED

Subject: MASS MOMENTS OF INERTIA

C.G. #4A, 30% MAC, - 6.W. = 74000 #, GEAR UP

CARGO AT 6.0" ABOVE FLOOR. CONT'D FROM PAGE 84

CARGO DISTRIBUTION



$$I_{ox} = \frac{20000}{12}\left[(110)^2 + (12)^2\right] = 20.407 \times 10^{-6}\ \#\,in^2$$

$$I_{oy} = \frac{20000}{12}\left[(404.78)^2 + (12)^2\right] = 273.318 \times 10^{-6}\ \#\,in^2$$

$$I_{oz} = \frac{20000}{12}\left[(404.78)^2 + (110)^2\right] = 293.244 \times 10^{-6}\ \#\,in^2$$

ITEM	W (#)	I_{xx} ($\times 10^{-6}$)	I_{yy} $\times 10^{-6}$	I_{zz} $\times 10^{-6}$
BASIC WEIGHT	41842	2486.01	7332.28	7302.07
FUEL	11511	1117.14	1583.43	2237.79
OIL	647	29.22	135.89	140.17
CARGO	20000	* 1310.73	* 4232.44	* 2952.04
Σ	74000	4943.10	13284.04	12632.02

$$* \ I_{xx} = 20.407 \times 10^{-6} + 20000(254.00)^2 = 1{,}310.73 \times 10^{-6}\ \#\,in^2$$

$$* \ I_{yy} = 273.318 \times 10^{-6} + 20{,}000\left[(364.61)^2 + (254)^2\right] = 4{,}232.44 \times 10^{-6}\ \#\,in^2$$

$$* \ I_{zz} = 293.244 \times 10^{-6} + 20000(364.61)^2 = 2{,}952.04 \times 10^{-6}\ \#\,in^2$$

AIRPLANE MOMENTS OF INERTIA

$$I_{ox} = I_{xx} - W\bar{z}^2 = 4{,}943.10 \times 10^{-6} - 74{,}000\,(188.53)^2$$
$$= 2{,}312.88 \times 10^{-6}\ \#\,in^2$$

$$I_{oy} = I_{yy} - W(\bar{x}^2 + \bar{z}^2) = 13{,}284.04 \times 10^{-6} - 74{,}000\left[\overline{353.17}^2 + \overline{188.53}^2\right]$$
$$= 1{,}423.8 \times 10^{-6}\ \#\,in^2$$

$$I_{oz} = I_{zz} - W\bar{x}^2 = 12{,}632.02 \times 10^{-6} - 74{,}000\,(353.17)^2$$
$$= 3{,}402.07 \times 10^{-6}\ \#\,in^2$$

RESTRICTED

MODEL XC-120 PREPARED BY FEMSTER CHECKED BY APPROVED BY

DATE Mar. 20, 1950

REVISED

Subject:— MASS MOMENTS OF INERTIA
GROUND HANDLING CONDITION

AIRPLANE JACKING CONDITION
G.W. = 64000#
GEAR DOWN - FULL FUEL AND OIL
CARGO C.G. 60" ABOVE FLOOR FWD

ITEM	W (#)	X	Z	WX $\times 10^{-3}$	WZ $\times 10^{-3}$
BASIC WEIGHT	41842	336.4	174.86	14075.65	7316.49
FULL FUEL	16020	372.5	150.00	5967.5	2403.0
FULL OIL	900	475.0	151.00	427.5	135.9
CARGO	5238	168.2	258.20	881.0	1352.5
Σ	64000	333.64	175.12	21351.65	11207.89
NO CARGO	58762	348.36	164.91		

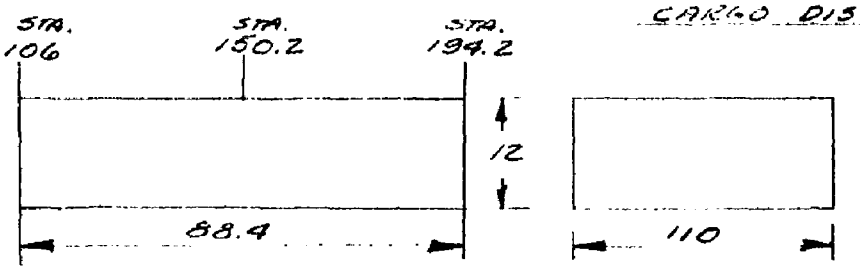
CARGO

$$I_{ox} = \frac{5,238}{12}\left[(110)^2+(12)^2\right] = 5.345 \times 10^{-6}\ \#\text{in}^2$$

$$I_{oy} = \frac{5,238}{12}\left[(88.4)^2+(12)^2\right] = 34.739 \times 10^{-6}\ \#\text{in}^2$$

$$I_{oz} = \frac{5,238}{12}\left[(88.4)^2+(110)^2\right] = 86.927 \times 10^{-6}\ \#\text{in}^2$$

CARGO DISTRIBUTION



ITEM	W (#)	I_{xx} $\times 10^{-6}$	I_{yy} $\times 10^{-6}$	I_{zz} $\times 10^{-6}$
BASIC WEIGHT	41842	2486.01	7332.28	7302.07
FULL FUEL	16020	1336.64	2590.80	3204.80
FULL OIL	900	20.52	223.58	203.06
CARGO	5238	* 354.55	* 532.13	* 235.12
Σ	64000	4197.72	10678.79	10945.05

$$* I_{xx} = 5.345 \times 10^{-6} + 5238(258.2)^2 = 354.548 \times 10^{-6}\ \#\text{in}^2$$

$$* I_{yy} = 34.739 \times 10^{-6} + 5238\left[\overline{258.2}^2 + \overline{168.2}^2\right] = 532.132 \times 10^{-6}\ \#\text{in}^2$$

$$* I_{zz} = 86.927 \times 10^{-6} + 5238(168.2)^2 = 235.117 \times 10^{-6}\ \#\text{in}^2$$

RESTRICTED

MODEL XC-120 PREPARED BY FERSTER CHECKED BY APPROVED BY

DATE Mar. 20, 1950

REVISED

Subject:— MASS MOMENTS OF INERTIA

GROUND HANDLING CONDITION

AIRPLANE JACKING CONDITION

AIRPLANE MOMENTS OF INERTIA

$$I_{0x} = I_{xx} - W\bar{z}^2 = 4,197.72 \times 10^{-6} - 64,000(175.12)^2$$
$$= 2,235.05 \times 10^{-6} \text{ \#in}^2$$

$$I_{0y} = I_{yy} - W(\bar{x}^2 + \bar{z}^2) = 10,678.79 \times 10^{-6} - 64,000[333.64^2 + 175.12^2]$$
$$= 1,592.75 \times 10^{-6} \text{ \#in}^2$$

$$I_{0z} = I_{zz} - W\bar{x}^2 = 10,945.05 \times 10^{-6} - 64,000(333.64)^2$$
$$= 3,821.7 \times 10^{-6} \text{ \#in}^2$$

REPORT NO. R107B-004	FAIRCHILD AIRCRAFT DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION		PAGES	PAGE
MODEL XC-120	PREPARED BY	CHECKED BY	APPROVED BY	
Subject MASS MOMENTS OF INERTIA CALCULATIONS			DATE 6 May 1948 [redacted]	

R E V I S I O N S

Date	Pages Affected	By	Remarks
5/5/49	Page 2 of Part I Revised.	J.W.O.BAKER	
7/7/49	All pages revised with the exception of Pages 48,49,50 and 51. Page 47.1 added.	J. B. Miller	
7/7/49	Pages 77, 78, 79, 80, 81, 82 83, 84, 85.	S. M. Levin	Part V Added.
3/20/50	Added Pages 78a, 84a, 84b, 86, 87, of Part V	T. Feaster T. Feaster	

RESTRICTED

F4-800-2A

MODEL XC-120 PREPARED BY FEHSTER CHECKED BY APPROVED BY

DATE March 20, 1950

REVISED

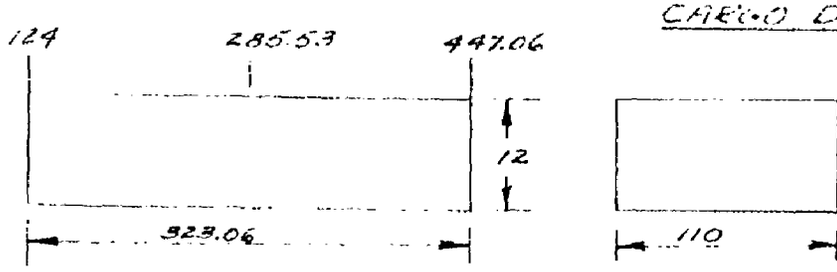
Subject: MASS MOMENTS OF INERTIA

FLIGHT CONDITIONS

C.G. #1A, 20% M.A.C. - G.W. = 64000#, GEAR UP

CARGO AT 60.0" ABOVE FLOOR CONT'D FROM PAGE 75

CARGO DISTRIBUTION



$$I_{cx} = \frac{11,867}{12}\left[(110)^2 + (12)^2\right] = 12.108 \times 10^{-6}\ \#\text{in}^2$$

$$I_{cy} = \frac{11,867}{12}\left[(323.06)^2 + (12)^2\right] = 103.352 \times 10^{-6}\ \#\text{in}^2$$

$$I_{cz} = \frac{11,867}{12}\left[(323.06)^2 + (110)^2\right] = 115.177 \times 10^{-6}\ \#\text{in}^2$$

ITEM	W (#)	I_{xx} ($\times 10^{-6}$)	I_{yy} ($\times 10^{-6}$)	I_{zz} ($\times 10^{-6}$)
BASIC WEIGHT	41842	2486.01	7322.28	7302.07
FUEL	9744	1117.14	1583.43	2251.93
OIL	547	29.22	134.89	140.17
CARGO	11867	* 505.97	* 1564.69	* 1082.66
Σ	64000	4138.34	10616.29	10762.69

$$* \ I_{xx} = 12.108 \times 10^{-6} + 11867\,(204.00)^2 = 505.965 \times 10^{-6}\ \#\text{in}^2$$

$$* \ I_{yy} = 103.352 \times 10^{-6} + 11867\left[(204)^2 + (285.53)^2\right] = 1564.690 \times 10^{-6}\ \#\text{in}^2$$

$$* \ I_{zz} = 115.177 \times 10^{-6} + 11867\,(285.53)^2 = 1082.658 \times 10^{-6}\ \#\text{in}^2$$

AIRPLANE MOMENTS OF INERTIA

$$I_{cx} = I_{xx} - W\bar{z}^2 = 4138.34 \times 10^{-6} - 64,000\,(172.69)^2$$
$$= 4138.34 \times 10^{-6} - 64,000\,(29,821) = 2229 \times 10^{-6}\ \#\text{in}^2$$

$$I_{cy} = I_{yy} - W(\bar{x}^2 + \bar{z}^2) = 10,616.29 \times 10^{-6} - 64,000\left[\overline{336.34}^2 + \overline{172.69}^2\right]$$
$$= 10,616.29 \times 10^{-6} - 64,000\,(142,346)$$
$$= 1,467.75 \times 10^{-6}\ \#\text{in}^2$$

$$I_{cz} = I_{zz} - W\bar{x}^2 = 10,762.69 \times 10^{-6} - 64,000\,(336.34)^2$$
$$= 10,762.69 \times 10^{-6} - 7,240 \times 10^{-6}$$
$$= 3,522.69 \times 10^{-6}\ \#\text{in}^2$$

RESTRICTED

MODEL XC-120 PREPARED BY FERSILE CHECKED BY APPROVED BY

DATE Mar. 20, 1950

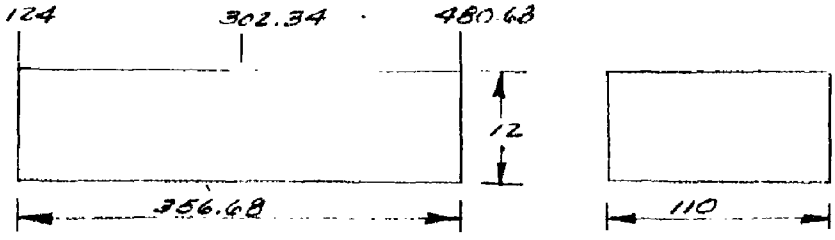
REVISED

Subject:— MASS MOMENTS OF INERTIA

C.G. #3A, 20% M.A.C. - G.W. = 74000#, GEAR UP, CARGO 6.0" ABOVE FLOOR

CONT'D FROM PAGE 84

CARGO DISTRIBUTION



$$I_{ox} = \frac{20,000}{12}\left[(110)^2+(12)^2\right] = 20.407\times10^{-6}\ \#\text{in}^2$$

$$I_{oy} = \frac{20,000}{12}\left[(404.78)^2+(12)^2\right] = 212.275\times10^{-6}\ \#\text{in}^2$$

$$I_{oz} = \frac{20,000}{12}\left[(356.68)^2+(110)^2\right] = 232.201\times10^{-6}\ \#\text{in}^2$$

ITEM	W (#)	I_{xx} ($\times10^{-6}$)	I_{yy} $\times10^{-6}$	I_{zz} $\times10^{-6}$
BASIC WEIGHT	41842	2486.01	7332.28	7302.07
FUEL	11511	1117.14	1583.43	2237.79
OIL	647	29.22	135.89	140.17
CARGO	20000	* 1310.73	* 3330.76	* 2060.39
Σ	74000	4943.10	12382.36	11740.42

$$* \ I_{xx} = 20.407\times10^{-6} + 20,000(254.00)^2 = 1,310.73\times10^{-6}\ \#\text{in}^2$$

$$* \ I_{yy} = 212.275\times10^{-6} + 20,000\left[(302.34)^2+(254)^2\right] = 3,330.76\times10^{-6}\ \#\text{in}^2$$

$$* \ I_{zz} = 232.201\times10^{-6} + 20,000(302.34)^2 = 2,060.39\times10^{-6}\ \#\text{in}^2$$

AIRPLANE MOMENTS OF INERTIA

$$I_{ox} = I_{xx} - W\bar{z}^2 = 4,943.10\times10^{-6} - 74,000(188.53)^2$$
$$= 2,312.88\times10^{-6}\ \#\text{in}^2$$

$$I_{oy} = I_{yy} - W(\bar{x}^2+\bar{z}^2) = 12,382.36\times10^{-6} - 74,000\left[\overline{336.34}^2 + \overline{188.53}^2\right]$$
$$= 1,380.92\times10^{-6}\ \#\text{in}^2$$

$$I_{oz} = I_{zz} - W\bar{x}^2 = 11,740.42\times10^{-6} - 74,000(336.34)^2$$
$$= 3,369.20\times10^{-6}\ \#\text{in}^2$$

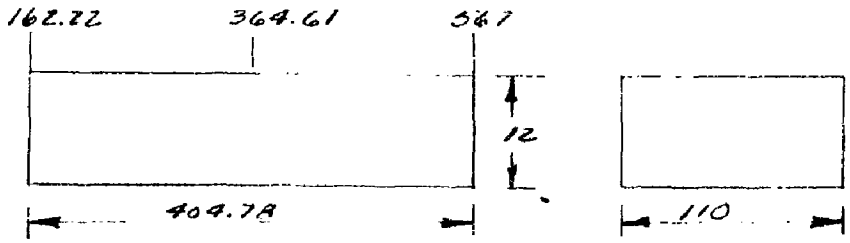
MODEL XC-120 | PREPARED BY FERRARO | CHECKED BY | APPROVED BY

DATE

REVISED

Subject:— MASS MOMENTS OF INERTIA

C.G. #4A, 30% MAC. - G.W. = 24000 #, GEAR UP
CARGO AT 6.0" ABOVE FLOOR. CONT'D FROM PAGE 84
CARGO DISTRIBUTION



$$I_{ox} = \frac{20,000}{12}\left[(110)^2+(12)^2\right] = 20.407\times10^{-6}\ \#\,in^2$$

$$I_{oy} = \frac{20,000}{12}\left[(404.78)^2+(12)^2\right] = 273.318\times10^{-6}\ \#\,in^2$$

$$I_{oz} = \frac{20,000}{12}\left[(404.78)^2+(110)^2\right] = 293.244\times10^{-6}\ \#\,in^2$$

ITEM	W (#)	I_{xx} ($\times10^{-6}$)	I_{yy} $\times10^{-6}$	I_{zz} $\times10^{-6}$
BASIC WEIGHT	41842	2486.01	7332.28	1302.07
FUEL	11511	1117.14	1583.43	2237.79
OIL	647	29.22	135.89	140.17
CARGO	20000	* 1310.73	* 4232.44	* 2952.04
Σ	74000	4943.10	13284.04	12632.02

$$* \ I_{xx} = 20.407\times10^{-6} + 20000(254.00)^2 = 1,310.73\times10^{-6}\ \#\,in^2$$

$$* \ I_{yy} = 273.318\times10^{-6} + 20,000\left[(364.61)^2+(254)^2\right] = 4,232.44\times10^{-6}\ \#\,in^2$$

$$* \ I_{zz} = 293.244\times10^{-6} + 20000(364.61)^2 = 2,952.04\times10^{-6}\ \#\,in^2$$

AIRPLANE MOMENTS OF INERTIA

$$I_{cx} = I_{xx} - W\bar{z}^2 = 4,943.10\times10^{-6} - 74,000(188.53)^2$$
$$= 2,312.88\times10^{-6}\ \#\,in^2$$

$$I_{cy} = I_{yy} - W(\bar{x}^2+\bar{z}^2) = 13,284.04\times10^{-6} - 74,000\left[(353.17)^2+(188.53)^2\right]$$
$$= 1,423.8\times10^{-6}\ \#\,in^2$$

$$I_{cz} = I_{zz} - W\bar{x}^2 = 12,632.02\times10^{-6} - 74,000(353.17)^2$$
$$= 3,402.07\times10^{-6}\ \#\,in^2$$

RESTRICTED

MODEL XC-120 | PREPARED BY F. HASTER | CHECKED BY | APPROVED BY

DATE Mar. 20, 1950

REVISED

Subject:— MASS MOMENTS OF INERTIA
GROUND HANDLING CONDITION

AIRPLANE JACKING CONDITION
G.W. = 64000#
GEAR DOWN - FULL FUEL AND OIL
CARGO C.G. 60" ABOVE FLOOR FWD

ITEM	W (#)	X	Z	WX $\times 10^{-3}$	WZ $\times 10^{-3}$
BASIC WEIGHT	41842	336.4	174.86	14075.65	7316.49
FULL FUEL	16020	372.5	150.00	5967.5	2403.0
FULL OIL	900	475.0	151.00	427.5	135.9
CARGO	5238	168.2	258.20	881.0	1352.5
Σ	64000	333.64	175.12	21351.65	11207.89
NO CARGO	58762	348.36	164.91		

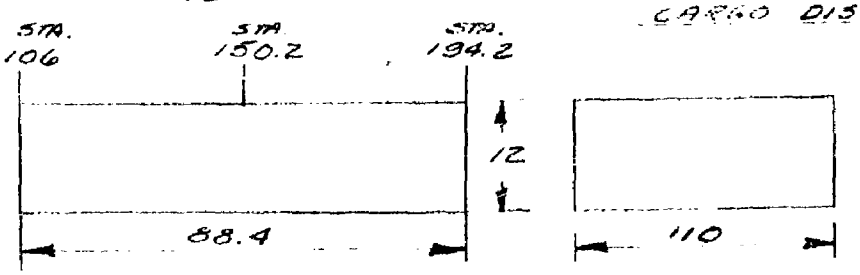
CARGO

$$I_{ox} = \frac{5238}{12}\left[(110)^2+(12)^2\right] = 5.345 \times 10^{-6}\ \#\text{in}^2$$

$$I_{oy} = \frac{5238}{12}\left[(88.4)^2+(12)^2\right] = 34.739 \times 10^{-6}\ \#\text{in}^2$$

$$I_{oz} = \frac{5238}{12}\left[(88.4)^2+(110)^2\right] = 86.927 \times 10^{-6}\ \#\text{in}^2$$

CARGO DISTRIBUTION



ITEM	W (#)	I_{xx} $\times 10^{-6}$	I_{yy} $\times 10^{-6}$	I_{zz} $\times 10^{-6}$
BASIC WEIGHT	41842	2486.01	7332.28	7302.07
FULL FUEL	16020	1336.64	2590.80	3204.80
FULL OIL	900	20.52	223.58	204.06
CARGO	5238	* 354.55	* 532.13	* 235.12
Σ	64000	4197.72	10678.79	10945.05

$$* I_{xx} = 5.345 \times 10^{-6} + 5238(258.2)^2 = 354.549 \times 10^{-6}\ \#\text{in}^2$$

$$* I_{yy} = 34.739 \times 10^{-6} + 5238\left[\overline{258.2}^2 + \overline{168.2}^2\right] = 532.132 \times 10^{-6}\ \#\text{in}^2$$

$$* I_{zz} = 86.927 \times 10^{-6} + 5238(168.2)^2 = 235.117 \times 10^{-6}\ \#\text{in}^2$$

Subject: MASS MOMENTS OF INERTIA

GROUND HANDLING CONDITION

AIRPLANE JACKING CONDITION

AIRPLANE MOMENTS OF INERTIA

$$I_{cx} = I_{xx} - W\bar{z}^2 = 4,197.72 \times 10^{-6} - 64,000(175.12)^2$$
$$= 2,235.03 \times 10^{-6} \text{ \#in}^2$$

$$I_{cy} = I_{yy} - W(\bar{x}^2 + \bar{z}^2) = 10,618.79 \times 10^{-6} - 64,000[333.64^2 + 175.12^2]$$
$$= 1,592.75 \times 10^{-6} \text{ \#in}^2$$

$$I_{cz} = I_{zz} - W\bar{x}^2 = 10,945.05 \times 10^{-6} - 64,000(333.64)^2$$
$$= 3,821.7 \times 10^{-6} \text{ \#in}^2$$

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FAIRCHILD ENGINE AND AIRPLANE CORP., FAIRCHILD AIRCRAFT DIV., HAGERSTOWN, MD. (ENGINEERING REPORT NO. R107B-004)

MASS MOMENTS OF INTERTIA CALCULATIONS - MODEL XC-120

J.W. O. BAKER; J. MYERS; HAWLEY AND OTHERS 6 MAY'48
(REVISIONS 20 MARCH'50) 90PP. DIAGRS

STRUCTURES (7) AIRPLANES - MOMENTS OF INERTIA
DESIGN AND DETAILS (3) AIRPLANES, CARGO
C-120 AIRCRAFT

EO 10501 dd 5 NOV 53

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5 NOV 1953

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12. (TITLE, REPORT NUMBER, AUTHOR(S)), ETC
Mass Moments of Inertia Calculations - Model XC-120. Revision, 90 pages

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