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Serial No. 2

File No.

Report No. NA-56-450

AD 158508

NORTH AMERICAN AVIATION, INC.

INTERNATIONAL AIRPORT

LOS ANGELES 45, CALIFORNIA

ENGINEERING DEPARTMENT

ESTIMATED WEIGHT AND BALANCE REPORT

FOR

RECONNAISSANCE WEAPON

SYSTEM 118P PHASE III

(N.A.A. DESIGNATION S.O. 2432)

CONTRACT NO. AF33(600)-31243

(E.O. NO. 55-8-118L)

FC BAC

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PREPARED BY

STRUCTURES SECTION

Wm. A. Martin

SUPERVISOR - WEIGHT ESTIMATING

APPROVED BY

G. V. Johnson

G. V. Johnson
Group Leader - Weight Control

R. L. Schleicher
Chief Structures Engineer

No. of Pages 51
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REVISIONS

Date 1 June 1956

DATE	REV BY	PAGES AFFECTED	REMARKS
MAY 21 1958			
58AA		6066	

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58AA 6066

The estimated weight data presented in this report represents a Phase III Reconnaissance Airplane, Weapons System 118P.

The airplane is designed with capabilities for the following missions: Detail Photographic Mission, Search Photographic Mission, Radar Mapping with Coherent Doppler Sidelooking Radar, Radar Mapping with Azimuth Radar and a Ferret Mission.

The Detail Photographic Mission was chosen as the design mission as this mission resulted in the heaviest of the five gross weights.

Appendix A contains the supporting data for the structural estimating techniques used in arriving at the Structural Group weights, with the exception of the Surface Controls Group.

The detail weight statement, AN-9102D, is included in the basic report to give a detail breakdown of the weight allocations in the Propulsion, Equipment, and Surface Controls Groups.

CONDITION		WEIGHT (LBS.)	HORIZONTAL C.G. AFT OF DATUM (INS.)	HORIZONTAL C.G. % M.A.C.	VERTICAL C.G. ABOVE DATUM (INS.)	VERTICAL C.G. BELOW F.R.L. (INS.)
WEIGHT EMPTY		142842	1572.89	55.3	172.65	27.3
USEFUL LOAD		63958	-	-	-	-
TAKE-OFF GROSS WEIGHT - DETAIL PHOTO MISSION	Gear Down	206800	1485.78	48.8	184.39	15.6
	Gear Up		1481.42	48.5	188.86	11.1
ALTERNATE TAKE-OFF GROSS WEIGHTS						
RADAR MAPPING MISSION - COHERENT DOPPLER RADAR	Gear Down	206794	1486.17	48.8	184.23	15.8
	Gear Up		1481.81	48.5	188.70	11.3
RADAR MAPPING MISSION - AZIMUTH RADAR	Gear Down	206588	1487.06	48.9	184.27	15.7
	Gear Up		1482.70	48.5	188.74	11.3
SEARCH PHOTO MISSION	Gear Down	206480	1487.43	48.9	184.27	15.7
	Gear Up		1483.06	48.6	188.75	11.2
FERRET MISSION	Gear Down	206696	1486.34	48.8	184.30	15.7
	Gear Up		1481.97	48.5	188.77	11.2
MOST FORWARD C.G. CONDITION		206800	1481.42	48.5	188.86	11.1
MOST AFT C.G. CONDITION		145087	1558.20	54.2	172.98	27.0

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GROUP WEIGHT STATEMENT

ESTIMATED - [redacted]

(Cross out those not applicable)

CONTRACT NO. AF33(600)-31243

AIRPLANE, GOVERNMENT NO.

AIRPLANE, CONTRACTOR NO.

MANUFACTURED BY North American Aviation Inc.

		MAIN	AUXILIARY
ENGINE	MANUFACTURED BY	Aerojet General	
	MODEL	HATR-2040 Scaled 103.1%	
	NO.	4	
PROPELLER	MANUFACTURED BY		
	DESIGN NO.		
	NO.		

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PREPARED
NAME J W C
DATE 1 June 1956

GROUP WEIGHT STATEMENT
WEIGHT EMPTY

SECRET

MODEL Sys. 118P
REPORT NA-56-450

1	WING GROUP		24343
2	CENTER SECTION - BASIC STRUCTURE		
3	INTERMEDIATE PANEL - BASIC STRUCTURE		
4	OUTER PANEL - BASIC STRUCTURE [redacted]	21733	
5			
6	SECONDARY STRUCTURE (INCL. WINGFOLD MECHANISM LBS.)		
7	AILERONS (INCL. BALANCE WEIGHT LBS.)		
8	FLAPS - TRAILING EDGE		
9	- LEADING EDGE		
10	SLATS		
11	SPOILERS	1710	
12	SPEED BRAKES		
13	TIP-FOLDING WING	650	
14	TAB-TRIM (L.H. WING ONLY)	250	
15	TAIL GROUP		3040
16	STABILIZER - BASIC STRUCTURE (CANARD)	1400	
17	FINS - BASIC STRUCTURE (INCL. DORSAL LBS.) (2)	1640	
18	SECONDARY STRUCTURE (STAB. & FINS)		
19	ELEVATOR (INCL. BALANCE WEIGHT LBS.)		
20	RUDDERS (INCL. BALANCE WEIGHT LBS.)		
21			
22			
23	BODY GROUP		29876
24	FUSELAGE OR HULL - BASIC STRUCTURE		
25	BOOMS - BASIC STRUCTURE		
26	SECONDARY STRUCTURE - FUSELAGE OR HULL		
27	- BOOMS		
28	- SPEEDBRAKES		
29	- DOORS, PANELS & MISC.		
30			
31	ALIGHTING GEAR GROUP - LAND (TYPE: TRICYCLE)		11806

32 / 33	LOCATION	WHEELS, BRAKES TIRES, TUBES, AIR	STRUCTURE	CONTROLS	
34	Main - Wing	2147	8044	825	11016
35	Nose - Fuselage	90	400	300	790
36					
37					
38					
39					

40	ALIGHTING GEAR GROUP - WATER				
41	LOCATION	FLOATS	STRUTS	CONTROLS	
42					
43					
44					
45					

46	SURFACE CONTROLS GROUP		4996
47	COCKPIT CONTROLS	22	
48	AUTOMATIC PILOT		
49	SYSTEM CONTROLS (INCL. POWER & FEEL CONTROLS 1373 LBS.)	4974	
50			
51	ENGINE SECTION [redacted]		306
52	INBOARD		
53	CENTER	306	
54	OUTBOARD		
55	DOORS, PANELS & MISC.		
56			
57	TOTAL (TO BE BROUGHT FORWARD)		74367

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GROUP WEIGHT STATEMENT
WEIGHT EMPTY

SECRET

		AUXILIARY		MAIN		
1	PROPULSION GROUP					56025
2						
3	ENGINE INSTALLATION				15660	
4	AFTERBURNERS (IF PURN. SEPARATELY)					
5	ACCESSORY GEAR BOXES & DRIVES				1010	
6	SUPERCHARGERS (FOR TURBO TYPES)					
7	AIR INDUCTION SYSTEM				25680	
8	EXHAUST SYSTEM - SHROUD				340	
9	COOLING SYSTEM & DRAIN PROV.				280	
10	LUBRICATING SYSTEM (INTEGRAL IN ENGINE)				-	
11	TANKS					
12	COOLING INSTALLATION					
13	DUCTS, PLUMBING, ETC.					
14	FUEL SYSTEM				12755	
15	TANKS - PROTECTED					
16	- UNPROTECTED			6860		
17	PLUMBING, ETC.			5895		
18	WATER INJECTION SYSTEM					
19	ENGINE CONTROLS				300	
20	STARTING SYSTEM (INTEGRAL IN ENGINE)				-	
21	PROPELLER INSTALLATION					
22						
23						
24	AUXILIARY POWER PLANT GROUP					
25	INSTRUMENTS [redacted] GROUP					564
26	HYDRAULIC [redacted] GROUP					5090
27						
28						
29	ELECTRICAL GROUP					815
30						
31						
32	ELECTRONICS GROUP					1438
33	EQUIPMENT				823	
34	INSTALLATION				615	
35						
36	ARMAMENT GROUP (INCL. GUNFIRE PROTECTION LBS.)					
37	FURNISHINGS & EQUIPMENT GROUP					1241
38	ACCOMMODATIONS FOR PERSONNEL				324	
39	MISCELLANEOUS EQUIPMENT				52	
40	FURNISHINGS				400	
41	EMERGENCY EQUIPMENT				465	
42						
43	AIR CONDITIONING & ANTI-ICING EQUIPMENT GROUP					3092
44	AIR CONDITIONING				2880	
45	ANTI-ICING				212	
46						
47	PHOTOGRAPHIC GROUP					
48	AUXILIARY GEAR GROUP					210
49	HANDLING GEAR				210	
50	ARRESTING GEAR					
51	CATAPULTING GEAR					
52	ATO GEAR					
53						
54						
55	MANUFACTURING VARIATION					
56	TOTAL FROM PG. 2					74367
57	WEIGHT EMPTY					142842

AN-910 3-D

NAME J W C

DATE 1 June 1956

GROUP WEIGHT STATEMENT
USEFUL LOAD & GROSS WEIGHT
SECRET

MODEL Sys-118P

REPORT NA-56-450

1	LOAD CONDITIO· TAKE-OFF GROSS WEIGHT			DETAIL PHOTO MISSION
2				
3	CREW (NO. 1)			270
4	PASSENGERS (NO.)			
5	FUEL	Type	Gals.	
6	UNUSABLE	LIQUID H_2	320	187
7	INTERNAL	LIQUID H_2	101330	59278
8				
9				
10	EXTERNAL			
11				
12	BOMB BAY			
13				
14	OIL			
15	TRAPPED		8 Gals.	60
16	ENGINE		12 Gals.	90
17				
18	FUEL TANKS (LOCATION)			
19	WATER INJECTION FLUID (GALS)			
20				
21	BAGGAGE			
22	CARGO			
23				
24	ARMAMENT			
25	GUNS (Location)	Fix. or Flex.	Qty.	Cal.
26				
27				
28				
29				
30				
31				
32	AMMUNITION			
33				
34				
35				
36				
37				
38				
39	INSTALLATIONS (BOMB, TORPEDO, ROCKET, ETC.)			
40	BOMB OR TORPEDO RACKS			
41				
42				
43				
44				
45				
46	EQUIPMENT			
47	PYROTECHNICS			
48	PHOTOGRAPHIC			
49	RECONN. PACKAGE, DETAIL PHOTO MISSION			1958
50	OXYGEN			
51				
52	MISCELLANEOUS			
53	DROP-OFF COWL			2115
54				
55	USEFUL LOAD			63958
56	WEIGHT EMPTY			142842
57	GROSS WEIGHT			206800

*If not specified as weight empty.

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AN-9103-D
NAME J W C
DATE 1 June 1956

GROUP WEIGHT STATEMENT
USEFUL LOAD & GROSS WEIGHT

SECRET

MODEL Sys. 118P
REPORT NA-56-450

				RADAR MAPPING MISSION			
1 LOAD CONDITION	ALTERNATE			DOPPLER RADAR	AZIMUTH RADAR	SEARCH PHOTO MISSION	FERRET MISSION
2							
3 CREW (NO. 1)				270	270	270	270
4 PASSENGERS (NO.)							
5 FUEL	Type	Gals.					
6 UNUSABLE	LIQUID H_2	320		187	187	187	187
7 INTERNAL	LIQUID H_2	101330		59278	59278	59278	59278
8							
9							
10 EXTERNAL							
11							
12 BOMB BAY							
13							
14 OIL							
15 TRAPPED	8 Gals.			60	60	60	60
16 ENGINE	12 Gals.			90	90	90	90
17							
18 FUEL TANKS (LOCATION)							
19 WATER INJECTION FLUID (GALS)							
20							
21 BAGGAGE							
22 CARGO							
23							
24 ARMAMENT							
25 GUNS (Location)	Fix. or Flex.	Qty.	Cal.				
26							
27							
28							
29							
30							
31							
32 AMMUNITION							
33							
34							
35							
36							
37							
38							
39 INSTALLATIONS (BOMB, TORPEDO, ROCKET, ETC.)							
40 BOMB OR TORPEDO RACKS							
41							
42 RECONNAISSANCE PACKAGE				1952	1746	1638	1854
43							
44							
45							
46 EQUIPMENT							
47 PYROTECHNICS							
48 PHOTOGRAPHIC							
49							
50 OXYGEN							
51							
52 MISCELLANEOUS							
53 DROP-OFF COWL				2115	2115	2115	2115
54							
55 USEFUL LOAD				63952	63746	63638	63854
56 WEIGHT EMPTY				142842	142842	142842	142842
57 GROSS WEIGHT				206794	206588	206480	206696

*If not specified as weight empty.

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TE 1 June 1956

GROUP WEIGHT STATEMENT
DIMENSIONAL & STRUCTURAL DATA
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MODEL Sys. 118P

REPORT NA 56-450

LENGTH - OVERALL (FT.) 180.9 | HEIGHT - OVERALL - STATIC (FT.) 33.3

	Main Floats	Aux. Floats	Booms	Fuse or Hull	Nacelles Inboard	Nacelles Center	Nacelles Outboard
LENGTH - MAX. (FT.)				175.00			
DEPTH - MAX. (FT.)				9.04			
WIDTH - MAX. (FT.)				24.00			
WETTED AREA (SQ. FT.) (Including Canopy)				7132			
FLOAT OR HULL DISPL. - MAX (LBS.)							

FUSELAGE VOLUME (CU. FT.) PRESSURIZED TOTAL

	Wing	H. Tail	V. Tail (Ea)
GROSS AREA (SQ. FT.) ø	3410	594	250
WEIGHT/GROSS AREA (LBS./SQ. FT.) ø	7.14	2.36	3.28
SPAN (FT.)	79.90	30.24	14.81
FOLDED SPAN (FT.)			
SWEEPBACK - AT 25% CHORD LINE (DEGREES)	71.0	52.41	52.41
- AT % CHORD LINE (DEGREES)			
THEORETICAL ROOT CHORD - LENGTH (INCHES)	1430.63	392.84	343.34
- MAX. THICKNESS (INCHES)			
CHORD AT PLANFORM BREAK - LENGTH (INCHES)	343.25		
- MAX. THICKNESS (INCHES)			
THEORETICAL TIP CHORD - LENGTH (INCHES)	0	78.57	35.49
- MAX. THICKNESS (INCHES)			

DORSAL AREA, INCLUDED IN (FUSE.) (HULL) (V. TAIL) AREA (SQ. FT.)

TAIL LENGTH - 25% MAC WING TO 25% MAC H. TAIL (FT.) 83.66

AREAS (SQ. FT.)			
Flaps	L.E.	T.E.	
Lateral Controls	Slots	Spoilers 65.29	DEFLECTORS 52.23
Speed Brakes	Wing	Fuse. or Hull	TAB

ALIGHTING GEAR (LOCATION)				
LENGTH - OLEO EXTENDED - ℄ AXLE TO ℄ TRUNNION (INCHES)				
OLEO TRAVEL - FULL EXTENDED TO FULL COLLAPSED (INCHES)				
FLOAT OR SKI STRUT LENGTH (INCHES)				

ARRESTING HOOK LENGTH - ℄ HOOK TRUNNION TO ℄ HOOK POINT (INCHES)

HYDRAULIC SYSTEM CAPACITY (GALS.) 277

FUEL & LUBE SYSTEMS	Location	No. Tanks	****Gals. Protected	No. Tanks	****Gals. Unprotected
Fuel - Internal	Wing				
	Fuse. or Hull			7	101330
- External					
- Bomb Bay					
Oil	Integral - Engine			4	12

STRUCTURAL DATA - CONDITION	Fuel in Wings (Lbs.)	Stress Gross Weight	Ult. L.F.
FLIGHT	-	201100	2.0
LANDING		160227	2.0
MAX. GROSS WEIGHT WITH ZERO WING FUEL			
CATAPULTING			
MIN. FLYING WEIGHT		148371	
LIMIT AIRPLANE LANDING SINKING SPEED (FT./SEC.)	5.5		
WING LIFT ASSUMED FOR LANDING DESIGN CONDITION (%W)			100
STALL SPEED - LANDING CONFIGURATION - POWER OFF (KNOTS)			
PRESSURIZED CABIN - ULT. DESIGN PRESSURE DIFFERENTIAL - FLIGHT (P.S.I.)			7.5

AIRFRAME WEIGHT (AS DEFINED IN AN-W-11) (LBS.)

*Lbs. of sea water @ 64 lbs./cu. ft.
*Parallel to ℄ at ℄ airplane.

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ø Wing Data on Exposed Area

***Parallel to ℄ airplane.
****Total usable capacity.

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DETAIL WEIGHT STATEMENT

ESTIMATED - [redacted]

(Cross out those not applicable)

CONTRACT NO. AF33(600)-31243

AIRPLANE, GOVERNMENT NO.

AIRPLANE, CONTRACTOR NO.

MANUFACTURED BY North American Aviation Inc.

		MAIN	AUXILIARY
ENGINE	MANUFACTURED BY	Aerojet General	
	MODEL	HATR-2040 Scaled 103.1%	
	NO.	4	
PROPELLER	MANUFACTURED BY		
	DESIGN NO.		
	NO.		

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	Center Section	Interm. Panel	Outer Panel	Folding Tip	
1					
2					
3 CODE NO.					
4 UPPER - SPAR CAP - FRONT					
5 - INTERMEDIATE					
6 - REAR					
7 - AUXILIARY					
8 - INTERSPAR COVERING					
9 SPANWISE STIFFENERS					
10 - JOINTS, SPLICES & FASTENERS					
11					
12					
13					
14 LOWER - SPAR CAP - FRONT					
15 - INTERMEDIATE					
16 - REAR					
17 - AUXILIARY					
18 - INTERSPAR COVERING					
19 SPANWISE STIFFENERS					
20 - JOINTS, SPLICES & FASTENERS					
21					
22					
23					
24 SPAR WEB & STIFFENERS - FRONT					
25 - INTERMEDIATE					
26 - REAR					
27 - AUXILIARY					
28 - JOINTS, SPLICES & FASTENERS					
29					
30					
31					
32 INTERSPAR - RIBS					
33 - BULKHEADS					
34 - CHORDWISE STIFFENERS					
35					
36 LEADING EDGE - COVERING					
37 - STIFFENERS					
38 - RIBS					
39 - AUXILIARY SPARS					
40 - JOINTS, SPLICES & FASTENERS					
41					
42					
43 TRAILING EDGE - COVERING					
44 - STIFFENERS					
45 - RIBS					
46 - AUXILIARY SPARS					
47 - JOINTS, SPLICES & FASTENERS					
48					
49					
50 TIPS					
51					
52 FIREWALL (STRUCTURAL)					
53					
54					
55					
56 TOTALS - BASIC STRUCTURE			21733	650	
57 TOTAL (TO BE BROUGHT FORWARD)					22383

		Ailerons		T.E. Flaps		L.E. Flaps or Slats		Spoilers	Speed Brakes	
		Inb'd	Outb'd	Inb'd	Outb'd	Inb'd	Outb'd			
1										
2										
3										
4	CODE NO.									
5	SPARS									
6										
7										
8										
9	RIBS									
10										
11										
12	COVERING & STIFFENERS									
13										
14										
15	T.E. STRIPS									
16										
17	FABRIC & DOPE									
18										
19										
20										
21	TABS									
22										
23										
24										
25	TORQUE TUBES									
26										
27										
28										
29	BALANCE WEIGHTS & SUPPORTS									
30										
31	AERO. SEAL									
32										
33										
34	CONTROL HORNS									
35										
36										
37	ACCESS DOORS (NON STRUCT.)									
38										
39	HINGES & PINS									
40	EXTERIOR FINISH									
41	TOTALS - SURFACE	( )	( )	( )	( )	( )	( )	( )	( )	( )
42										
43	CONTROL SURFACE SUPPORTS									
44	HINGES									
45	BRACKETS									
46	TRACKS									
47	CARRIAGES									
48										
49										
50										
51										
52	TOTALS - SUPPORTS	( )	( )	( )	( )	( )	( )	( )	( )	( )
53	TOTALS (LINES 41 & 52)									
54	TOTALS - CONTROL SURFACES							1710		250
55	TOTAL									1960
56	TOTALS FROM PGS. 2 & 3									22383
57	TOTAL - WING GROUP									24343

1		[redacted]		[redacted]			
2		C.S.	O.P.	Center	Outer	Dorsal	
3	CODE NO.						
4	UPPER - SPAR CAP - FRONT						
5	- INTERMEDIATE						
6	- REAR						
7	- AUXILIARY						
8	- INTERSPAR COVERING						
9	SPANWISE STIFFENERS						
10	- JOINTS, SPLICES & FASTENERS						
11							
12							
13							
14	LOWER - SPAR CAP - FRONT						
15	- INTERMEDIATE						
16	- REAR						
17	- AUXILIARY						
18	- INTERSPAR COVERING						
19	SPANWISE STIFFENERS						
20	- JOINTS SPLICES & FASTENERS						
21							
22							
23							
24	SPAR WEB & STIFFENERS - FRONT						
25	- INTERMEDIATE						
26	- REAR						
27	- AUXILIARY						
28	- JOINTS, SPLICES & FASTENERS						
29							
30							
31							
32	INTERSPAR - RIBS						
33	- BULKHEADS						
34	- CHORDWISE STIFFENERS						
35							
36	LEADING EDGE - COVERING						
37	- STIFFENERS						
38	- RIBS						
39	- AUXILIARY SPARS						
40	- JOINTS, SPLICES & FASTENERS						
41							
42							
43	TRAILING EDGE - COVERING						
44	- STIFFENERS						
45	- RIBS						
46	- AUXILIARY SPARS						
47	- JOINTS, SPLICES & FASTENERS						
48							
49							
50	TIPS						
51							
52							
53							
54							
55	TOTALS						
56	TOTALS - BASIC STRUCTURE	1400			1640		
57	TOTAL ([redacted]						3040

AN 910 2-D
NAME T A M
DATE 1 June 1956

BODY GROUP
BASIC STRUCTURE
SECRET

PAGE 14 of 41
MODEL Sys. 118F
REPORT NA-56-450

1						Fuselage [redacted]			Booms
2				CODE NO.					
3				SECTION					
*4 BULKHEADS & FRAMES		Stations							
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24 MINOR FRAMES									
25 JOINTS, SPLICES & FASTENERS									
26 OVERTURN STRUCTURE									
27									
28 COVERING - UPPER BETWEEN LONGERONS									
29 - SIDE BETWEEN LONGERONS									
30 - LOWER BETWEEN LONGERONS									
31									
32 COVERING LONGITUDINAL STIFFENERS - UPPER BETW. LONG.									
33 - SIDE BETW. LONG.									
34 - LOWER BETW. LONG.									
35									
36									
37 LONGERONS - UPPER									
38 - LOWER									
39									
40									
41 LONGITUDINAL PARTITIONS - (STRUCTURAL)									
42									
43 FLOORING & SUPPORTS - (BASIC STRUCTURE)									
44									
45									
46									
47 FIREWALL - (STRUCTURAL)									
48									
49 KEELSONS									
50 KEEL									
51									
52 CHINE & SPRAY STRIPS									
53 STEP ASSEMBLY									
54 STAIRWAY - (STRUCTURAL)									
55 TOTALS									
56 TOTALS - BASIC STRUCTURE						26776			
57 TOTAL (TO BE BROUGHT FORWARD)									26776

*List all main & watertight bulkheads & frames individually. Minor frames may be combined.

SECRET

AN-9102-D
NAME T A M
DATE 1 June 1956

BODY GROUP
SECONDARY STRUCTURE
SECRET

MODEL Sys. 11BP
REPORT NA-56-450

		Fuselage or Hull				Booms	Speed Brakes
1							
2	CODE NO.						
3	SECTION						
4							
5	ENCLOSURES (EXCLUDING TURRET ENCLOSURES)	750					
6	CANOPY						
7	CANOPY-OPERATING MECHANISM						
8	-RAILS						
* 9	-CYLINDERS, PLUMBING, FLUID						
10							
11	GUNNER - TAIL						
12							
13	BOMBARDIER						
14	SIGHTING BLISTERS						
15							
16	WINDSHIELD (EXCLUDING BULLET PROTECTION)	200					
17							
18	WINDOWS & PORTS INCL. FRAMES						
19							
20							
21							
22							
23							
24							
25							
26							
27							
28	FLOORING & SUPPORTS (SECONDARY STRUCTURE)						
29							
30							
31	STAIRWAYS & LADDERS (FIXED)						
32							
33							
34	STERNPOST & FITTINGS						
35	NOSE BUMPER (HULL)						
36	RUBBING STRIPS						
37							
38							
39							
40	TAIL CONE						
41							
42							
43	SPEED BRAKES - STRUCTURE						
44	- SUPPORTS						
45							
46							
47							
48							
49							
50							
51							
52							
53							
54							
55	TOTALS	950					
56	TOTALS - SECONDARY STRUCTURE	950					
57	TOTAL (TO BE BROUGHT FORWARD)						950

* From main distribution point to actuating unit.

SECRET

AN-9102-D
NAME T A M
DATE 1 June 1956

BODY GROUP
SECONDARY STRUCTURE
(DOORS, PANELS & MISCELLANEOUS)

SECRET

MODEL Sys. 118P
REPORT NA-56-450

		* Location	** Type Power	Area Sq. Ft.	Structure	Operating Mechanism: Mechanism & Controls	Power Trans.	Actuator	Lock Mech.	Emerg.
4	CODE NO.									
5	DOORS & FRAMES									
6	- LANDING									
7	[redacted]				1250					
8	NOSE				90					
9										
10	- BOMB									
11										
12										
13	- GUN									
14										
15	- AMMUNITION									
16										
17	- ROCKET									
18										
19	- LIFE RAFT									
20										
21	- ESCAPE									
22										
23										
24	- WATER TIGHT									
25										
26	- COMPARTMENT									
27										
28	- ENTRANCE									
29										
30										
31	- ACCESS				100					
32										
33										
34										
35	- ENGINE				450					
36										
37	- CAMERA									
38										
39	PANELS - (NON STRUCTURAL)									
40										
41										
42										
43										
44										
45										
46										
47										
48										
49	WALKWAYS, STEPS, GRIPS									
50	MISCELLANEOUS				260					
51	FAIRING & FILLETS									
52	EXTERIOR FINISH									
53										
54	TOTALS				2150					
55	TOTAL - SECONDARY STRUCTURE (DOORS, PANELS, MISC.)					2150				
56	TOTALS FROM PGS. 8 & 9									27726
57	TOTAL - BODY GROUP									29876

*Indicate location for major doors by B - Booms, F or H for Fuselage or Hull.

SECRET

**H - Hydraulic, E - Electrical, P - Pneumatic; power transmission from main distribution point to actuating unit.

1										
2	TYPE: TRICYCLE						*LOCATION			
3							CODE NO.			
4	*LOCATION									
5		No.	Size	No.	Size	No.	Size			
6	WHEELS	4	46 x 14		24 x 5.5					
7	TIRES	4	46 x 14		24 x 5.5					
8	TUBES									
9	AIR									
10	BRAKES									
11	NO. & TYPE	4	Mech							
12	ENERGY CAP. **									
13	ANTI-SKID DEVICE									
14										
15	FLOATS - BULKHEADS									
16	- FRAMES									
17	- COVERING									
18	- COVERING STIFFENERS (LONGITUDINAL)									
19	- KEELSONS									
20	- KEEL									
21	- LONGITUDINAL PARTITIONS									
22	- CHINE & SPRAY STRIP									
23	- STEP ASSEMBLY									
24	- POST ASSEMBLY									
25	- NOSE BUMPER									
26	INSPECTION DOORS									
27	WALKWAYS									
28	EXTERIOR FINISH									
29	SKIDS OR BUMPERS									
30	SKIIS									
31										
32	TOTALS - RUNNING GEAR							(2147)	(90)	( ) ( )
33										
34	STRUTS - DRAG									
35	- SIDE									
36	- FLOAT									
37	PYLON									
38	SHOCK STRUT - STRUT (INCL. LBS. OIL)									
39	- FORK									
40	- AXLE									
41	- TORQUE ARMS									
42	- TRUNNIONS									
43	SHIMMY DAMPER OR SNUBBER									
44										
45	FITTINGS - MAIN ATTACH. - WING									
46	- TAIL									
47	- BODY									
48	- NACELLE									
49										
50	FAIRING									
51										
52										
53										
54										
55	PINS, BOLTS, NUTS, ETC.									
56	TOTALS - STRUCTURE							(8044)	(400)	( ) (
57	TOTALS (LINES 32 & 56) (TO BE BROUGHT FORWARD)							10191	490	

*Descriptive location - Nose, Tail, Main, Outrigger, Bumper, etc.

**Ft. lbs./brake

AN-9102-D
NAME T A M
DATE 1 June 1956

ALIGHTING GEAR GROUP
CONTROLS
SECRET

MODEL Sys. 118F
REPORT NA-56-450

1 / 2	**LOCATION	MAIN			NOSE							
3 / 4		Retract	Brake Oper.	Emerg. Ext.	Steering	Retract	Brake Oper.	Emerg. Ext.	Retract	Emerg. Ext.	Retract	Emerg. Ext.
5	CODE NO.											
6	MECHANICAL OPER. MECH.											
7	CONTROLS											
8	ACTUATORS											
9												
10												
11												
12	ELECTRICAL OPER. MECH.											
13	CONTROLS											
*14	WIRING, CONDUIT, ETC.											
15	OPERATING MOTORS											
16	MECHANISM											
17												
18												
19												
20	HYDRAULIC OPER. MECH.											
21	CONTROLS											
*22	PLUMBING & FLUID											
23	PUMPS											
24	RESERVOIRS											
25	ACCUMULATORS											
26	ACTUATORS											
27	MECHANISM											
28												
29												
30												
31	PNEUMATIC OPER. MECH.											
32	CONTROLS											
*33	PLUMBING											
34	PUMPS											
35	BOTTLES (AIR)											
36	ACTUATORS											
37	MECHANISM											
38												
39												
40												
41	LOCKING MECHANISM											
42	BRACES											
43	LINKS											
44	PARKING BRAKE CONTROL											
45	POSITION INDICATING MECH.											
46												
47												
48	SUPP'TS, GUIDES, ETC. - WING											
49	- TAIL											
50	- BODY											
51	- NACELLE											
52												
53	TOTALS											
54	TOTALS - CONTROLS	825			300							
55	TOTALS FROM PG. 11	10191			490							
56	TOTALS	11016			790							
57	TOTAL - ALIGHTING GEAR GROUP											11806

*From main distribution point to actuating unit.

**Descriptive location - Nose, Tail, Main, Outrigger, Bumper, etc.

SECRET

SECRET

		Cockpit Controls	Autopilot
	CODE NO.		
CONTROL COLUMNS			
CONTROL STICK [redacted] (PILOT)		11	
CONTROL STICK OR COLUMN (ASSIST. PILOT)			
CONNECTING MEMBERS FOR ABOVE			
SUPPORTS			
RUDDER PEDALS			
RUDDER PEDALS, INCLUDING BRAKE TREADLE (PILOT)		11	
RUDDER PEDALS, INCLUDING BRAKE TREADLE (ASSIST. PILOT)			
CONNECTING MEMBERS FOR ABOVE			
SUPPORTS			
INTEGRAL PARKING LOCK			
CONTROL STICK			
RUDDER PEDALS			
SURFACES			
AUTOPILOT OR AUTO. FLIGHT CONTROL (TYPE: INCLUDED IN ELECTRONIC SECTION			
CONTROLLER			
TRANSMITTER			
SERVO AMPLIFIER			
SERVO MOTORS			
GYROS			
SUPPORTS & BRACKETS			
*PLUMBING & FLUID			
*ELECTRIC PANELS, BOXES, SWITCHES, RELAYS, WIRING			
PULLEYS, SPROCKETS, CHAINS, CABLES			
TOTALS - COCKPIT CONTROLS & AUTOPILOT		22	
TOTAL (TO BE BROUGHT FORWARD)			22

*From main distribution point to actuating units.

SECRET

		Ail.	Canard [redacted]	Rud.	Wing Sweep	Wing Incid.	L.E. Flaps or Slats	T.E. Tab [redacted]	Spoilers	Speed Brakes	Stab. Adj.	Wing Tip Fold
1												
2												
3												
4	CODE NO.											
5	MECHANICAL OPER. MECH.		56	60					110			
6	CONTROLS											
7	TENSION REGULATORS											
8	ACTUATORS											
9	TRIM CONTROLS											
10												
11	ELECTRICAL OPER. MECH.							10				15
**12	TYPE											
13	CONTROLS											
*14	WIRINGS, SWITCHES, ETC.											
15	OPERATING MOTORS											
16	MECHANISM											
17	TRIM CONTROLS											
18												
19	HYDRAULIC OPER. MECH.		(1630)	(181)				(71)	(1093)			(375)
**20	TYPE P											
21	CONTROLS											55
*22	PLUMBING [redacted]		1090	46				23	56			82
23	[redacted] MOTORS											108
24	RESERVOIRS											
25	ACCUMULATORS											
26	ACTUATORS & SUPTS		120	100				34	540			60
27	MECHANISM		25	25				10	480			50
28	TRIM CONTROLS											
29	FLUID		395	10				4	17			20
30	PNEUMATIC OPER. MECH.											
**31	TYPE											
32	CONTROLS											
*33	PLUMBING											
34	PUMPS											
35	BOTTLES (AIR)											
36	ACTUATORS											
37	MECHANISM											
38	TRIM CONTROLS											
39												
40	ARTIFICIAL FEEL		30	30					15			
41	BUNGEE											
42	BOB WEIGHT											
43												
44												
45												
46												
47												
48	SUPPORTS, GUIDES, ETC.											
49	WING											
50	TAIL											
51	BODY											
52	NACELLE											
53												
54	TOTALS		1716	271				81	1218			390
55	TOTALS - SYSTEM CONTROLS											3676
56	TOTAL (FROM PG. 13)											22
57	TOTAL - SURFACE CONTROLS GROUP (TO BE BROUGHT FORWARD)											3698

*From main distribution point to actuating units.

SECRET

**Type - add (P) for "Powered Controls"
- or (B) for "Boost Controls"

AN-910 2-D
NAME J. W. C.
DATE 1 June 1956

SURFACE CONTROL GROUP
[redacted]
*POWER CONTROLS

SECRET

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MODEL Sys. 110
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				Hydraulic [redacted]	Hydraulic [redacted]	Pneumatic Utility	Pneumatic Emergency	
			CODE NO.					
PUMPS & COMPRESSORS (4)		Model		244				
REMOTE PUMP DRIVES								
RESERVOIRS	No. 2	Model	Capacity 7 Gals.	30				
AIR BOTTLES ACCUMULATORS	4		100 in.3	95				
FILTERS								
PRESSURE REGULATORS								
VALVES - FILTERS				180				
CONTROLS								
PLUMBING & SUPPORTS				530				
FLUID IN SYSTEM (TYPE OS-45) (29.5 GALS.)				219				
SUPPORTS - WING								
- TAIL								
- BODY								
TOTAL [redacted]				1298				
TOTALS FROM PAGE 13 & 14								3698
TOTAL [redacted] SURFACE CONTROL GROUP								4996
FURNISHES POWER FOR - (ITEMS)				Canard				
				Spoilers				
				Trim Tab				
				Wing Tip Fold				
				AFCS				
				Rudder				
SYSTEM PRESSURE (PSI)								

*Includes system from sources of power to main distribution points

SECRET

ENGINE SECTION [redacted]

SECRET

		Inboard	Center	Outboard	
1					
2					
3	CODE NO.				
4	ENGINE MOUNT				
5					
6	SUPPORT BAY				
7	VIBRATION ABSORPTION DEVICES				
8					
9					
10	NACELLE STRUCTURE				
11	BULKHEADS AND FRAMES				
12	COVERING & STIFFENERS				
13	FITTINGS				
14	LONGERONS				
15	ATTACHING ANGLES, ETC.				
16					
17					
18					
19	PYLONS & STRUTS				
20					
21					
22					
*23	FIREWALL				
24					
25	SHROUDS FOR FIRE PROTECTION				
26					
27	COWLING				
28	ENGINE COWL				
29					
30					
31					
32					
33					
34					
35	BAFFLES				
36	ACCESSORY COWL OR SKIRT				
37	COWL FLAPS				
38	COWL FLAP CONTROLS & OPERATING MECH.				
39					
40					
41					
42					
43					
44					
45	FAIRING - NACELLE TO WING OR PYLON				
46	STEPS & GRIPS				
47	WORKING PLATFORM (BUILT IN)				
48	INTERNAL WALKWAYS				
49					
50					
51	INSTALLATION HARDWARE				
52					
53					
54					
55					
56	TOTALS - SECTIONS OR NACELLES				
57	TOTAL [redacted] ENGINE SECTION				306

*If in nacelle, or non-structural in wing or body.

SECRET

		Auxiliary	Main	
1				
2	CODE NO.			
3	ENGINE INSTALLATION (4) HATR 2040 (SCALED 103.1%)			15660
4	ENGINE (AS INSTALLED)			
5	ENGINE & AFTERBURNER (AS INSTALLED)			
6	REDUCTION GEAR BOX			
7	EXTENSION DRIVE SHAFT			
8				
9				
10	AFTERBURNERS (IF FURNISHED SEPARATELY)			
11	ACCESSORY GEAR BOXES & DRIVES			1010
12	COMPLETE GEAR BOXES (4)		340	
13	- LUBRICATING SYSTEM		330	
14	- SUPPORTS		36	
15	- DRIVE SHAFTS & COUPLINGS		164	
16	- PIPING		-	
17	- CONSTANT SPEED DRIVES (2)		90	
18				
19	AIR INDUCTION SYSTEM			25680
20	INTERCOOLERS AND SUPPORTS			
21	AIR DUCTING		11500	
22	INTAKE DOORS, RAMPS		7945	
23	RAMP MECH & CONTROLS		4105	
24	SCREENS & CONTROLS			
25	BY-PASS PROVISIONS		1210	
26	RAMP BLEED PROVISIONS		630	
27	FAIRING - ENGINE INLET		290	
28				
29				
30				
31	EXHAUST SYSTEM - SHROUD			340
32	EXHAUST STACKS			
33	EXHAUST COLLECTORS			
34	COLLECTOR OR ENGINE SHROUD			
35	TAIL PIPE			
36	TAIL PIPE SHROUD AND INSULATION			
37	TAIL CONE			
38	SILENCING DEVICES			
39	SUPPORTS, BRACKETS, ETC.			
40	AFTERBURNER		340	
41				
42				
43				
44	COOLING SYSTEM			230
45	RADIATOR AND SUPPORTS			
46	SHUTTERS, SCOOP & DUCTS			
47	EXPANSION TANK & SUPPORTS			
48	LIQUID IN SYSTEM(GALS.)			
49	PIPING, VENTS, CLAMPS ETC.			
50	COOLING DUCTS ETC.		240	
51	DRAIN PROVISIONS		40	
52	FANS			
53	CONTROL VANES			
54	FAN DRIVES			
55	CONTROLS & OPERATING MECH.			
56				
57	TOTALS (TO BE BROUGHT FORWARD)			42970

						Auxiliary		Main	
						Lubricating	Fuel	Lubricating	Fuel
					CODE NO.				
TANKS	Type	Location	No.	Vol. Ea. (Gals.)					(686e)
NO. 1	METAL	FUSELAGE	1	13540					912
NO. 2	METAL	FUSELAGE	1	21580					1454
NO. 3	METAL	FUSELAGE	1	21200					1435
NO. 4	METAL	FUSELAGE	1	19660					1351
NO. 5	METAL	FUSELAGE	1	10650					713
NO. 6	METAL	FUSELAGE	1	9360					631
NO. 7	METAL	FUSELAGE	1	5340					364
INTEGRAL TANK SEALS & SEALANT									
BACKING BOARD									
TANK SUPPORTS & PADDING									212
TANK BAY SEALING									
INSULATION PROVISIONS									3617
TANK RELEASE & CONTROLS									
OIL COOLING INSTALLATION									
COOLERS & SUPPORTS (SIZE) (NO.)									
DUCTS & SHUTTERS									
AUTOMATIC OIL TEMP. CONTROL VALVE									
SHUTTER CONTROLS									
FUEL VAPOR RECOVERY									
OIL DILUTION SYSTEM									
FUEL VAPOR INERTION SYSTEM - CYL. & SUPPORTS									
- GENERATOR									
- CONTROLS, ETC.									
PUMP INSTALLATION	No.	Type							
ENGINE DRIVEN									
BOOSTER	4	HYDRAULIC							240
HAND (INCL. CONTROLS)									
TRANSFER									
HYDRAULIC PLUMBING									195
FILLING SYSTEM - GROUND									336
- IN FLIGHT									
DISTRIBUTION SYSTEM									500
TRANSFER SYSTEM									100
VENT SYSTEM									120
PRESSURIZATION SYSTEM									
DUMP SYSTEM									235
ELECTRICAL PROVISIONS									50
TOTALS - LUBRICATING & FUEL SYSTEMS									12755
TOTALS (TO BE BROUGHT FORWARD)									12755

				Auxiliary	Main
1					
2		CODE NO.			
3	WATER INJECTION SYSTEM				
4	TANKS (NO.) (GALS/TANK)				
5	PUMP				
6	METERING UNIT				
7	VALVES & PLUMBING				
8	CONTROLS				
9					
10					
11	ENGINE CONTROLS				300
12	IGNITION				
13	THROTTLE			300	
14	MIXTURE				
15	SUPERCHARGER (SUP. INTEG. WITH ENG.)				
16	AFTERBURNER				
17					
18					
19					
20	STARTING SYSTEM (INTEGRAL IN ENGINE)				
21	STARTER POWER UNIT (TYPE:)				
22	STARTER (TYPE:)				
23	STARTER CONTROLS				
24	CRANK & EXTENSION				
25	PRIMER & PIPING				
26	MESHING SOLENOID				
27	SWITCHES, WIRING & CONDUIT				
28					
29					
30					
31					
32	PROPELLER INSTALLATION (DIA.) (NO.)				
33	PROPELLER				
34	CUFFS				
35	SPINNER				
36	CONTROLS	Type	*Aux.	*Main	
37	SPEED				
38	PITCH				
39	FEATHERING				
40	REVERSING				
41					
42					
43					
44					
45					
46					
**47	OIL (GALS)				
**48	TANK & PLUMBING				
49					
50					
51					
52					
53					
54					
55	TOTALS				300
56	TOTALS FROM PGS. 17 & 18				55725
57	TOTAL - PROPULSION GROUP				56025

*GFP Weight

**When separate oil system used.

1						
* 2	FUNCTIONAL GROUPS & ITEMS	Number	Indicator	Transmitter & Amplifier	Installation	Total
3	CODE NO.					
4	FLIGHT INSTRUMENTS					
5	FLIGHT DISPLAY GROUP					
6	SPEED SITUATION	1	5		2	7
7	ATTITUDE DISPLAY	1	7		2	9
8	HEADING DISPLAY	1	12		4	16
9	VERTICAL SITUATION	1	5		2	7
10	ACCELEROMETER	1	2			2
11	CLOCK	1	1			1
12	CABIN ALTITUDE	1	1			1
13	PITOT SYSTEM			2	38	40
14	AIR DATA COMPUTER SYSTEM			15	5	20
15	WIRING AND MISCELLANEOUS				11	11
16						
17						
18	ENGINE INSTRUMENTS					
19	INTEGRATED ENGINE DISPLAYS	4	20	50	55	125
20	FUEL QUANTITY GUAGES	1	2	170	40	212
21	FUEL FLOWMETER	1	3	30	20	53
22	HYDRAULIC PRESSURE GAUGES	2	4	6	10	20
23	WIRING AND MISCELLANEOUS					40
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						
52						
53	INSTRUMENT POWER SYSTEM (TYPE					
54						
55						
56						
57	TOTAL - INSTRUMENTS [redacted]					564

SECRET

*List items by functional groups (Flight, Engine & Misc.). List sub-groups by crew stations; add supp. pg. 21A if necessary.

AN-910 2-D
NAME [illegible] C
DATE 1 June 1956

*HYDRAULIC [redacted] GROUP

SECRET

MODEL Sys. 11.1
REPORT NA-56-450

	Hydraulic Utility	Hydraulic Emergency	Fuel Pump Power	Pneumatic Utility	Pneumatic Emergency	
PUMPS & COMPRESSORS (CODE NO. / Model)						
6	510					
4			244			
REMOTE PUMP DRIVES						
RESERVOIRS (No. 2; Capacity 20 Gals)	80					
RESERVOIRS (No. 2; Capacity 8 Gals)			20			
AIR BOTTLES						
ACCUMULATORS						
FILTERS						
PRESSURE REGULATORS						
VALVES- , FILTER, REGULATORS AND TEST	350		180			
CONTROLS						
PLUMBING & SUPPORTS	2020		666			
FLUID IN SYSTEM (TYPE OS-45) (105 GALS.)	776					
(TYPE OS-45) (33.0 Gals)			244			
SUPPORTS - WING						
- TAIL						
- BODY						
- NACELLE						
TOTALS	3736		1354			
TOTAL - HYDRAULIC [redacted] GROUP						5090
FURNISHES POWER FOR - (ITEMS)						
SYSTEM PRESSURE (PSI)						

*Includes system from sources of power to main distribution points.

SECRET

						AC		DC	
1									
2									
3				CODE NO.					
4	POWER SUPPLY EQUIPMENT	Driven By	KVA	Amp.	No.		153		
5	GENERATORS - MAIN	ENG. CSD	20		2	110			
6	GENERATOR - EMERG.	HYD	3		1	16			
7	EXCITATION UNIT					7			
8	PROVISIONS					10			
9									
10	REMOTE GENERATOR DRIVES HYDRAULIC					10			
11	BATTERY (AN) (NO.)								
12	BATTERY CONTAINER, OVERFLOW INST. & SUPPORTS								
13									
14	POWER CONVERSION EQUIPMENT	Model			No.				30
15	INVERTER (DC TO AC)								
16	CONVERTER (AC TO DC)								
17	TRANSFORMER							30	
18	RECTIFIER								
19	MOTOR-GENERATOR								
20	PHASE ADAPTER								
21	FREQUENCY CONVERTER								
22									
23									
24	POWER DISTRIBUTION & CONTROL						597		5
25	GENERATOR CONTROL BOXES & PARALLELING PROV.					50			
26	CUTOUTS & VOLTAGE REGULATORS								
27	AMMETERS & VOLTMETERS								
28	SWITCHES, RHEOSTATS, SWITCH PANELS OR BOXES								
29	CIRCUIT BREAKERS & FUSES								
30	JUNCTION, FUSE, DISTRIBUTION BOXES & PANELS					185		5	
31	RECEPTACLES & CONNECTOR PLUGS								
32	RELAYS								
33	WIRING					362			
34	CONDUIT								
35									
36	LIGHTS & SIGNAL DEVICES						30		
37	LIGHTS - INTERIOR								
38	EXTERIOR								
39	- LANDING (INCL. RETRACT MECH.)								
40									
41	SIGNAL DEVICES - LIGHTS								
42	- HORNS								
43	- BELLS								
44									
45									
46	EQUIPMENT SUPPORTS - WING								
47	- TAIL								
48	- BODY								
49	- NACELLE								
50	TOTALS						780		35
51	TOTAL - ELECTRICAL GROUP								815
52	FURNISHES POWER FOR - (ITEMS)								
53									
54									
55									
56									
57									

*Includes system from sources of power to main distribution points.

1 *FUNCTIONAL GROUP	*EQUIPMENT COMPONENTS & PART NUMBERS OR IDENTIFICATION	CODE NO.	Equipment GFP	Equipment CFE	Installation
4 AN/ARC-52	U H F COMMAND		54		15
6 AN/ARA-37	U H F/D F		9		2
8 AN/ANH-5	RECORDER		16		2
10 AN/APX-19	IFF A/G		39		15
12 AN/APX-27	IFF A/A		36		6
14 AN/ART-27	CRASH LOCATOR BEACON		6[illegible]		9
16 FSC	AUTOMATIC FLIGHT AND STABILIZATION SYSTEM			155	135
18	AUTO-NAVIGATOR			414	81
20	STANDBY PLATFORM			25	15
22	CONTROL AND DISPLAYS		15		5
24	RECON. PACKAGE PROVISIONS				250
47 ELECTRONIC INSTALLATION					
48 TABLES					
49 RACK, SHELVES & SUPPORTS					80
50 LOCKERS					
55 SUBTOTALS - EQUIPMENT GFP & CFE			[illegible]	5[illegible]	615
56 TOTALS					
57 TOTAL - ELECTRONIC GROUP					1438

*List components (incl. Radomes, Mts., Antennas, Switches, Relays, Filters, etc.) from main distribution point to unit operated, by functional groups (e.g., Comm., VHF, Search, Navig., Intercomm., etc.). Add supplementary pg. 25A if necessary.

1	CODE NO.									
2	CREW SEATS & PASSENGER CHAIRS									
3 4	Location	No.	Cushions	Seat	Safety Belt	Harness & Inertia Reel	Adj. Mech.	Catapult or Eject. Mech.	Tracks & Supports	
5	PILOT	1								150
6	ASST. PILOT									
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17	HEAD REST (IF NOT INTEGRAL WITH SEAT)									
18	BUNKS (NO.) & SUPPORTS									
19	PERISCOPE INSTALLATION									125
20	LITTER SUPPORTS									
21	BOMBERS & GUNNERS KNEELING PADS (NO.)									
22	PARACHUTE STOWAGE PROVISIONS									
23	TOILETS & RELIEF TUBES									4
24	WASH BASIN & SHOWERS									
25	WATER TANKS & PIPING									
26	DRINKING WATER CONTAINERS & SUPPORTS									
27	LOCKERS FOR - FOOD									
28	- PERSONAL EFFECTS									
29										
30	GALLEY STOVES & HOTPLATES									
31	REFRIGERATOR									
32										
33										
34										
35										
36										
37	ANTI-G SUIT PROVISIONS									
38										
39	OXYGEN INSTALLATION									(45)
*40	BOTTLES - INCL. CHARGE (TYPE) (SIZE) (NO.)									
41										
42	CONVERTOR & LIQUID OXYGEN (SIZE 5 LITER) (NO. 1)									27
*43	REGULATORS (TYPE) (NO.)									
44	SUPPORTS - BOTTLES & REGULATORS									2
45	PLUMBING, ETC.									18
46										
47										
48										
49										
50										
51										
52										
53										
54										
55										
56										
57	TOTAL - ACCOMMODATIONS FOR PERSONNEL (TO BE BROUGHT FORWARD)									324

*If not specified as useful load or special equipment.

	CODE NO.	Misc. Equip.	Furnishings
MISCELLANEOUS EQUIPMENT			
PORTABLE PLATFORMS & LADDERS			
DATA CASES & REPORT OR FORM HOLDERS		5	
MANUALS - FLIGHT & MAINTENANCE			
BALANCE COMPUTER & SUPPORT			
TOOL LOCKERS			
WINDSHIELD WIPER & WASHER INSTALLATION			
RELEASE MECHANISM & FITTINGS - TARGET & GLIDER TOW			
BILGE SYSTEM			
STALL WARNING DEVICES			
REAR VIEW MIRROR			
AUXILIARY FLOORING			
INSTRUMENT BOARDS & SUPPORTS		19	
CONSOLES		28	
CONTROL STANDS			
CARGO HANDLING EQUIPMENT			
RAMPS			
HOISTS & BOOMS			
MONORAILS			
MONORAIL MOTORS			
TIE DOWN FITTINGS			
PYROTECHNIC INSTALLATION			
SIGNAL PISTOL HOLDER			
SIGNAL AMMUNITION HOLDER (CAP.)			
PARACHUTE FLARE - CONTAINERS (NO.)			
- RACKS (CAPACITY)			
- RELEASE MECHANISM			
SMOKE CANDLE (GRENADE) HANDLE			
FLOAT LIGHT RACK & RELEASE MECH. (CAP.)			
FURNISHINGS			
FLOOR COVERING, RUGS, ETC.			
SOUNDPROOFING & THERMAL INSULATION			400
TRIM			
CURTAINS & SCREENS			
CRASH PADDING			
PARTITIONS (NON-STRUCTURAL)			
TOTALS - MISC. EQUIP. & FURNISHINGS		52	400
TOTAL (TO BE BROUGHT FORWARD)			452

*Not specified as special equipment.

1		CODE NO.							
2			Compartments						
3	FIRE EXTINGUISHERS		Engine	Baggage	Fuel				
4	BOTTLES	Type	DBF						
5		Size	50# DB F	AGENT BA					
6		No.	2						
7		Weight	150						
8	CONTROLS		40						
9	PLUMBING		185						
10	BOTTLE SUPPORTS		20						
11									
12									
13	TOTAL - COMPT.		395						395
14	PORTABLE (TYPE) (SIZE) (NO.)								
15									
16									
17									
18	PORTABLE EXTINGUISHER SUPPORTS								
19									
20	FIRE DETECTION SYSTEM								70
21									
22	FIRE RESISTANT PAINT								
23	FIRE CURTAINS								
24									
25	FIRST AID KITS (NO.) & STOWAGE								
26									
27	FLASHLIGHTS (NO.)								
28									
29	STOWAGE - EMERGENCY RATIONS & WATER								
30									
*31	LIFE RAFTS - (TYPE) (NO.)								
32									
33									
34									
35									
36	- SUPPORTS OR CRADLES								
37									
38	DITCHING STATION EQUIPMENT								
39									
40									
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									
51									
52									
53									
54									
55	TOTAL - EMERGENCY EQUIPMENT								465
56	TOTALS FROM PGS. 28 & 29								776
57	TOTAL - FURNISHINGS & EQUIPMENT GROUP								1241

*If not specified as useful load or special equipment.

SECRET

	CODE NO.	Cooling and Pressurization System	Ventilating System	Heating System	Cooling System		
HEAT EXCHANGERS (NO. 4)		250					
HEATERS (BTU CAPACITY) (NO.)							
HEATING FLUID (GALS.)							
COMPRESSORS OR SUPERCHARGERS							
MOTORS		15					
TURBINES							
FANS		35					
TANKS							
WATER SEPARATOR							
REGULATOR							
SCOOPS							
DUCTING		1400					
SHROUDS							
HELIUM TANK AND HELIUM		75					
PLUMBING - HELIUM		750					
PUMP - HELIUM		25					
BOMB BAY HEATING							
CONTROLS - MANUAL							
- ELECTRICAL		30					
- HYDRAULIC							
- PNEUMATIC		50					
SUPPORTS & BRACKETS - WING							
- TAIL							
- BODY							
- NACELLE							
PRESSURIZATION SEALING & TEST		250					
TOTALS							
TOTAL - AIR CONDITIONING (TO BE BROUGHT FORWARD)							2800

If not specified as special equipment.

AIR CONDITIONING & ANTI-ICING EQUIPMENT GROUP
ANTI-ICING

SECRET

			Wing	Tail	Air Induction	Propeller	Canopy & Windshield	Fuel System	
1									
2									
3		CODE NO.							
* 4 HEATERS	No.	BTU Capacity							
5									
6									
7									
8									
9									
10									
* 11 HEAT EXCHANGERS (NO.)					25				
12 BLOWER					30				
13									
14									
15 DUCTING					50		85		
16 SHROUDING									
17									
18									
* 19 BOOTS									
20									
* 21 ATTACHING STRIPS									
22									
23 OIL SEPARATORS									
24									
25 AIR PUMPS									
26									
27 AIR LINES & HOSES									
28									
29 TANKS									
30									
* 31 FLUID (GALS.)									
32									
33									
34									
35 PLUMBING									
36									
37									
38 DISTRIBUTOR - VALVE									
39 - CONTROLS									
40									
41									
42 CONTROLS - MANUAL									
43 - ELECTRICAL					5		5		
44 - HYDRAULIC									
45 - PNEUMATIC					6		6		
46									
** 47 WIRING, SWITCHES, RELAYS									
48									
49 SUPPORTS & BRACKETS - WING									
50 - TAIL									
51 - BODY									
52 - NACELLE									
53									
54 TOTALS					116		96		
55 TOTAL - ANTI-ICING									212
56 TOTAL FROM PG. 31									2880
57 TOTAL - AIR CONDITIONING & ANTI-ICING EQUIPMENT GROUP									3092

*If not specified as special equipment.

SECRET

**From main distribution point to actuating unit.

	Handling	Arrest.	Catapult	ATO
CODE NO.				
HANDLING GEAR				
ANCHOR				
ANCHOR LINE				
PENDANT & CLAMP FITTING				
LIZARD				
SHEAVES				
WINCH - COMPLETE				
WINCH CRANK				
ANCHOR HANDLING RIG OR DAVIT				
WINCH ENGINE OR MOTOR				
HOISTING SLING				
WING HANDLING LINES				
WATER RUDDER				
FITTINGS ~~XXXXXXXXXXXXXX~~ HANDLING GEAR	210			
- BEACHING GEAR ATTACHMENT				
- TIEDOWN				
- JACKING				
- TOWING				
- MOORING & SNUBBING				
- ANCHORAGE				
- LEVELING				
- HOISTING				
ARRESTING OR DECELERATION GEAR				
TRAILING HOOK				
HOOK POINT (TYPE)				
EXTENSION GEAR				
RETRIEVING GEAR				
BUMPER				
SHOCK ABSORBER				
ATTACHMENT FITTINGS				
BARRIER CRASH FITTINGS				
DECELERATION - PARACHUTE				
- CONTAINER & FITTINGS				
- CONTROLS				
CATAPULTING GEAR				
CATAPULT FITTINGS				
CATAPULT HOOKS				
HOLDBACK FITTINGS				
ASSISTED TAKE OFF				
HOOKS				
CONTROLS - FIRING				
- BOTTLE RELEASE				
BOTTLE STOWAGE PROV. (NO. BOTTLES)				
TOTALS	210			
TOTAL - AUXILIARY GEAR GROUP				210

*If not specified as special equipment.

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CHECKED BY: J H W	SECRET	REPORT NO. NA-56-450
DATE: 1 June 1956	WEIGHT EMPTY SUMMARY	MODEL NO. Sys. 118P

ITEM	WEIGHT LBS.	HORIZONTAL C. G. ARM	HORIZONTAL C. G. MOMENT	VERTICAL C. G. ARM	VERTICAL C. G. MOMENT
STRUCTURAL GROUPS					
Wing Group					
Outer Panel	21733	1725	37489425	170	3694610
Spoilers	1710	1880	3214800	166	283860
Tab (Left Hand Only)	250	2130	532500	178	44500
Folding Wing Tip	650	2020	1313000	140	91000
Total - Wing Group	24343		42549725		4113970
Tail Group					
Stabilizer - Basic Structure	1400	221	309400	200	280000
Fin - Basic Structure	1640	2002	3283280	290	475600
Total - Tail Group	3040		3592680		755600
Body Group					
Basic Structure	26776	1405	37620280	183	4900008
Secondary Structure					
Fuselage					
Canopy & Operating Mechanism	750	281	210750	247	185250
Windshield	200	249	49800	232	46400
Doors & Operating Mechanism					
Main Landing Gear	1250	1550	1937500	175	218750
Nose Landing Gear	90	360	32400	185	16650
Access & Miscellaneous	100	1100	110000	200	20000
Engine Access	450	2040	918000	170	76500
Miscellaneous	260	2050	533000	200	52000
Total - Body Group	29876		41411730		5515558
Alighting Gear Group					
Main Gear					
Running Gear	2147	1603	3441641	58	124526
Structure	8044	1605	12910620	100	804400
Controls	825	1573	1297725	180	148500
Total - Main Gear	11016		17649986		1077426

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CHECKED BY: J H W	SECRET	REPORT NO. NA-56-450
DATE: 1 June 1956	WEIGHT EMPTY SUMMARY	MODEL NO. Sys. 118P

ITEM	WEIGHT LBS.	HORIZONTAL C. G. ARM	HORIZONTAL C. G. MOMENT	VERTICAL C. G. ARM	VERTICAL C. G. MOMENT
STRUCTURAL GROUPS (CONT'D)					
Alighting Gear Group (Cont'd)					
Nose Gear					
Running Gear	90	390	35100	118	10620
Structure	400	392	156800	138	55200
Controls	300	370	111000	195	58500
Total - Nose Gear	790		302900		124320
Total - Alighting Gear Group	11806		17952886		1201746
Surface Controls Group					
Cockpit Controls	(22)		(5566)		(4565)
Control Stick	11	262	2882	205	2255
Rudder Pedals	11	244	2684	210	2310
Spoiler Controls	(1218)		(2236380)		(215865)
Mechanical	110	1394	153340	199	21890
Hydraulic	1093	1880	2054840	175	191275
Artificial Feel	15	1880	28200	180	2700
Canard Controls	(1716)		(1385810)		(359500)
Mechanical	56	250	14000	200	11200
Hydraulic	1630	837	1364310	210	342300
Artificial Feel	30	250	7500	200	6000
Rudder Controls	(271)		(506950)		(53900)
Mechanical	60	1250	75000	205	12300
Hydraulic	181	2050	371050	200	36200
Artificial Feel	30	2030	60900	180	5400
Trim Tab Controls	81	2100	170100	180	14580
Wing Tip Folding Mechanism	390	2050	799500	160	62400
Power Control System	(1298)		(2423797)		(237275)
Pumps	244	2000	488000	160	39040
Accumulators	95	1059	100605	215	20425
Reservoirs	30	1950	58500	220	6600
Valves, Filters & Regulators	180	1967	354060	190	34200
Plumbing & Supports	530	1933	1024490	180	95400
Fluid	219	1818	398142	190	41610
Total - Surface Controls Group	4996		7528103		948085
Engine Section	306	2042	624852	194	59364
TOTAL - STRUCTURAL GROUPS	74367		113659976		12594323

ITEM	WEIGHT LBS.	HORIZONTAL C. G. ARM	HORIZONTAL C. G. MOMENT	VERTICAL C. G. ARM	VERTICAL C. G. MOMENT
PROPULSION GROUP					
Engine Installation					
Aerojet General Type HATR 2040 Scaled 103.1% (4)	15660	2042	31977720	194	3038040
Accessory Gear Boxes & Drives					
Gear Boxes (4)	340	1950	663000	151	51340
Drive Shafts & Couplings	164	1990	326360	156	25584
Supports	36	1950	70200	145	5220
Lubricating System	380	1940	737200	152	57760
Constant Speed Drives (2)	90	1925	173250	150	13500
Total Gear Boxes & Drives	1010		1970010		153404
Air Induction System					
Air Inlet Ducts	11500	1583	18204500	126	1449000
Variable Geometry Inlet	12050	1605	19340250	147	1771350
By Pass Provisions	1210	2035	2462350	167	202070
Ramp Bleed Provisions	630	1525	960750	120	75600
Fairing - Engine Inlet	290	1960	568400	182	52780
Total - Air Induction System	25680		41536250		3550800
Shroud - Afterburner	340	2085	708900	200	68000
Cooling & Drain Provisions	280	2025	567000	190	53200
Fuel System					
Fuel Cells - Fuselage	6860	1320	9055200	213	1461180
Fuel Cell Supports	212	1320	279840	213	45156
Insulating Provisions	3617	1358	4911886	200	723400
Boost Pumps	635	1720	1092200	160	101600
Filling System - Single Point	336	1290	433440	175	58800
Distribution System	590	1930	1138700	205	120950
Transfer System	100	1320	132000	177	17700
Vent System	120	1320	158400	260	31200
Dump System & Drains	235	2020	474700	165	38775
Electrical Provisions	50	1320	66000	177	8850
Total - Fuel System	12755		17742366		2607511
Engine Controls	300	1142	342600	215	64500
TOTAL - PROPULSION GROUP	56025		94844846		9535555

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ITEM	WEIGHT LBS.	HORIZONTAL C. G. ARM	HORIZONTAL C. G. MOMENT	VERTICAL C. G. ARM	VERTICAL C. G. MOMENT
EQUIPMENT GROUPS					
Instruments					
Flight Instruments	114	655	74670	195	22230
Engine Instruments	450	1213	545850	205	92250
Total - Instruments	564		620520		114480
Hydraulic Group					
Utility System	(3736)		(6599332)		(728780)
Pumps	510	2000	1020000	160	81600
Reservoirs	80	1950	156000	220	17600
Valves, Filters & Regulators	350	1964	687400	190	66500
Plumbing & Supports	2020	1683	3399660	200	404000
Fluid (105 Gals OS-45)	776	1722	1336272	205	159080
Fuel Pump Power System	(1354)		(2592282)		(242660)
Pumps	244	2000	488000	160	39040
Reservoirs	20	1950	39000	220	4400
Valves, Filters & Regulators	180	1967	354060	190	34200
Plumbing & Supports	666	1881	1252746	180	119880
Fluid (33 Gal. OS-45)	244	1879	458476	185	45140
Total - Hydraulic Group	5090		9191614		971440
Electrical Group					
DC System	(35)		(12250)		(7700)
Power Conversion Equipment	30	350	10500	220	6600
Power Distribution & Control	5	350	1750	220	1100
AC System	(737)		(741686)		(147960)
Alternators	110	2000	220000	160	17600
Alternator Controls	50	350	17500	220	11000
Switches, Boxes, Plugs, Etc.	185	776	143560	210	38850
Wiring & Conduit	362	973	352226	205	74210
Lights & Signal Devices	30	280	8400	210	6300
Emergency System	(43)		(15050)		(9460)
Alternator and Drive	26	350	9100	220	5720
Excitation Unit	7	350	2450	220	1540
Provisions	10	350	3500	220	2200
Total - Electrical Group	815		768986		165120

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ITEM	WEIGHT LBS.	HORIZONTAL C. G. ARM	HORIZONTAL C. G. MOMENT	VERTICAL C. G. ARM	VERTICAL C. G. MOMENT
EQUIPMENT GROUPS (CONT'D)					
Electronics Group					
AN/ARC-52 UHF Command	69				
AN/ARA-37 UHF/DF	11				
AN/ANH-5 Recorder	18				
AN/APX-19 IFF A/G	54				
AN/APX-27 IFF A/A	42		The average arms for		
AN/ART-27 Crash Locator Beacon	69		the Electronics Group		
Automatic Flight and Stability Control	290		have been assumed for the total installation.		
Auto Navigator	495				
Standby Platform	40				
Controls and Displays	20				
Shelves and Supports	80				
Reconnaissance Provisions	250				
Total - Electronics Group	1438	350	503300	210	301980
Furnishings & Equipment Group					
Accommodations for Personnel	(324)		(86200)		(69570)
Pilot's Ejection Seat & Belt	150	280	42000	217	32550
Periscope	125	228	28500	205	25625
Relief Provisions	4	280	1120	205	820
Oxygen Provisions	45	324	14580	235	10575
Miscellaneous Equipment	(52)		(13960)		(10875)
Instrument Board & Supports	19	255	4845	215	4085
Data Case & Form Holders	5	255	1275	210	1050
Consoles	28	280	7840	205	5740
Furnishings	(400)		(144000)		(84000)
Insulation	400	360	144000	210	84000
Emergency Equipment	(465)		(918790)		(96950)
Fire Extinguisher System	395	1978	781310	210	82950
Fire Detector System	70	1964	137480	200	14000
Total Furnishings & Equipment Group	1241		1162950		261395
Air Conditioning					
Pressurising and Cooling System	(2880)	1190	(3427200)	220	(633600)
Heat Exchangers	250				
Helium System	850				
Scoops & Ducts	1450				
Controls	80				
Sealing & Test Provisions	250				

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ITEM	WEIGHT LBS.	HORIZONTAL C. G. ARM	HORIZONTAL C. G. MOMENT	VERTICAL C. G. ARM	VERTICAL C. G. MOMENT
EQUIPMENT GROUPS (CONT'D)					
Air Conditioning (Cont'd)					
Anti-Icing System	212	785	166420	225	47700
Total - Air Conditioning	3092		3593620		681300
Auxiliary Gear Group					
Handling Gear	210	1566	328860	170	35700
Total - Auxiliary Gear Group	210		328860		35700
TOTAL - EQUIPMENT GROUPS	12450		16169850		2531415
RECAPITULATION - WEIGHT EMPTY					
Total - Structural Groups	74367		113659976		12594323
Total - Propulsion Group	56025		94844846		9535555
Total - Equipment Groups	12450		16169850		2531415
TOTAL - WEIGHT EMPTY	142842	1572.89	224674672	172.65	24661293

HORIZONTAL C.G. = $\frac{1572.89 - 834.19}{1335.81}$ = 55.3% M.A.C.

VERTICAL C.G. = 200.0 - 172.7 = 27.3 Inches Below F.R.L.

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PREPARED BY: D D M	NORTH AMERICAN AVIATION, INC.	PAGE NO. 42 OF 51
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DATE: 1 June 1956	USEFUL LOAD	MODEL NO. Sys. 118P

ITEM	WEIGHT LBS.	HORIZONTAL C. G. ARM	HORIZONTAL C. G. MOMENT	VERTICAL C. G. ARM	VERTICAL C. G. MOMENT
USEFUL LOAD					
Non Expendable Items					
Crew					
Pilot	270	273	73710	218	58860
Reconnaissance Package					
Detail Photo Mission	(1958)		(911044)		(397965)
Structure	660	473	312180	175	115500
Cameras and Stab. Mounts	700	487	340900	220	154000
System Controls	348	418	145464	215	74820
Wire and Prev.	215	450	96750	215	46225
Shelves and Supports	35	450	15750	212	7420
Trapped Fuel 320 Gallons	187	1321	247027	167	31229
Trapped Oil 8 Gallons	60	1990	119400	214	12840
Total - Non-Expendable Items	2475		1351181		500894
Expendable Items					
Fuel (101330 Gallons)	(59278)		(78328867)		(12703358)
Fus Tank No. 1, 13540 Gals.	7921	718	5687278	214	1695094
Fus Tank No. 2, 21580 Gals.	12624	1026	12952224	214	2701536
Fus Tank No. 3, 21200 Gals.	12402	1293	16035786	215	2666430
Fus Tank No. 4, 19660 Gals.	11501	1515	17424015	218	2507218
Fus Tank No. 5, 10650 Gals.	6230	1678	10453940	208	1295840
Fus Tank No. 6, 9360 Gals.	5476	1794	9823944	210	1149960
Fus Tank No. 7, 5340 Gals.	3124	1905	5951220	220	687280
Drop-Off Cowl	2115	1287	2722005	117	247455
Engine Oil 12 Gals.	90	2027	182430	213	19170
Total - Expendable Items	61483		81232842		12969963
TOTAL - USEFUL LOAD	63958		82584023		13470877

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PREPARED BY: T A M	NORTH AMERICAN AVIATION, INC.	PAGE NO. 43 OF 51
CHECKED BY: J H W	SECRET	REPORT NO. NA-56-450
DATE: 1 June 1956	LANDING GEAR AND WING TIP MOMENT CHANGE	MODEL NO. Sys. 118P

ITEM	WEIGHT LBS.	HORIZONTAL C. G. ARM	HORIZONTAL C. G. MOMENT	VERTICAL C. G. ARM	VERTICAL C. G. MOMENT
LANDING GEAR MOMENT CHANGE DOWN POSITION					
Main					
Wheels, Brakes, Tires & Tubes	2147	1603	3441641	58	124526
Structure	8044	1605	12910620	100	804400
Controls	825	1573	1297725	180	148500
Nose					
Wheels, Tires, and Tubes	90	390	35100	118	10620
Structure	400	392	156800	138	55200
Controls	300	370	111000	195	58500
TOTAL LANDING GEAR - DOWN POSITION	11806		17952886		1201746
RETRACTED POSITION					
Main					
Wheels, Brakes, Tires and Tubes	2147	1483	3184001	182	390754
Structure	8044	1528	12291232	180	1447920
Controls	825	1573	1297725	175	144375
Nose					
Wheels, Tires and Tubes	90	317	28530	200	18000
Structure	400	346	138400	197	78800
Controls	300	370	111000	195	58500
TOTAL LANDING GEAR - RETRACTED POSITION	11806		17050888		2138349
TOTAL LANDING GEAR MOMENT CHANGE, DOWN TO UP	-		- 901998		+ 936603
WING TIP MOMENT CHANGE					
Up Position	650	2020	1313000	140	91000
Down Position	650	2020	1313000	120	78000
TOTAL WING TIP MOMENT CHANGE UP TO DOWN	-		-		- 13000
TOTAL MOMENT, LANDING GEAR UP AND WING TIP DOWN	-		- 901998		+ 923603
	SECRET				

PREPARED BY: J W C	NORTH AMERICAN AVIATION, INC.	PAGE NO. 44 OF 51
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DATE 1 June 1956	TAKE-OFF GROSS WEIGHT DETAIL PHOTO MISSION	MODEL NO. Sys. 118P

ITEM	WEIGHT LBS.	HORIZONTAL C. G. ARM	HORIZONTAL C. G. MOMENT	VERTICAL C. G. ARM	VERTICAL C. G. MOMENT
TAKE-OFF GROSS WEIGHT - DETAIL PHOTO MISSION - GEAR DOWN					
Weight Empty	142842		224674672		24661293
Useful Load	63958		82584023		13470877
TAKE-OFF GROSS WEIGHT - DETAIL PHOTO MISSION - GEAR DOWN	206800	1485.78	307258695	184.39	38132170
HORIZONTAL C.G. = $\frac{1485.78 - 834.19}{1335.81}$ = 48.8% MAC					
VERTICAL C.G. = 200.0 - 184.4 = 15.6 inches below FRL					
Plus:					
Moment Change Landing Gear Up and Wing Tip Down	-		- 901998		+ 923603
TAKE-OFF GROSS WEIGHT - DETAIL PHOTO MISSION - GEAR UP	206800	1481.42	306356697	188.86	39055773
HORIZONTAL C.G. = $\frac{1481.42 - 834.19}{1335.81}$ = 48.5% MAC					
VERTICAL C.G. = 200.0 - 188.9 = 11.1 inches below FRL					

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DATE: 1 June 1956	TAKE-OFF GROSS WEIGHT - RADAR MAPPING MISSION - COHERENT DOPPLER RADAR	MODEL NO. Sys. 118P

ITEM	WEIGHT LBS.	HORIZONTAL C. G. ARM	HORIZONTAL C. G. MOMENT	VERTICAL C. G. ARM	VERTICAL C. G. MOMENT
TAKE-OFF GROSS WEIGHT - RADAR MAPPING MISSION - COHERENT DOPPLER RADAR - GEAR DOWN					
Take-Off Gross Weight - Detail Photo Mission - Gear Down	206800		307258695		38132170
Less:					
Reconnaissance Package Detail Photo Mission	- 1958		- 911044		- 397965
Plus:					
Reconnaissance Package - Radar Mapping Mission - Coherent Doppler Radar	(1952)		(983660)		(363840)
Structure	980	150	499800	175	171500
Equipment	692	505	349460	195	134940
Wiring & Provisions	210	480	100800	205	43050
Shelves and Supts.	70	480	33600	205	14350
TAKE-OFF GROSS WEIGHT - RADAR MAPPING MISSION - COHERENT DOPPLER RADAR - GEAR DOWN	206794	1486.17	307331311	184.23	38098045
HORIZONTAL C.G. = $\frac{1486.17 - 834.19}{1335.81}$ = 48.8% MAC					
VERTICAL C.G. = 200.0 - 184.2 = 15.8 inches below FRL					
Plus:					
Moment Change Landing Gear Up and Wing Tip Down	-		- 901998		+ 923603
TAKE-OFF GROSS WEIGHT - RADAR MAPPING MISSION - COHERENT DOPPLER RADAR - GEAR UP	206794	1481.81	306429313	188.70	39021648
HORIZONTAL C.G. = $\frac{1481.81 - 834.19}{1335.81}$ = 48.5% MAC					
VERTICAL C.G. = 200.0 - 188.7 = 11.3 inches below FRL					

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DATE: 1 June 1956	TAKE-OFF GROSS WEIGHT - RADAR MAPPING MISSION - AZIMUTH RADAR	MODEL NO. Sys. 118P

ITEM	WEIGHT LBS.	HORIZONTAL C. G. ARM	HORIZONTAL C. G. MOMENT	VERTICAL C. G. ARM	VERTICAL C. G. MOMENT
TAKE-OFF GROSS WEIGHT - RADAR MAPPING MISSION - AZIMUTH RADAR - GEAR DOWN					
Take-Off Gross Weight - Detail Photo Mission - Gear Down	206800		307258695		38132170
Less:					
Reconnaissance Package - Detail Photo Mission	- 1958		- 911044		- 397965
Plus:					
Reconnaissance Package - Radar Mapping Mission - Azimuth Radar	(1746)		(861925)		(334380)
Structure	1020	490	499800	177	180540
Equipment	501	500	250500	215	107715
Wiring and Provisions	175	495	86625	205	35875
Shelves and Supports	50	500	25000	205	10250
TAKE-OFF GROSS WEIGHT - RADAR MAPPING MISSION - AZIMUTH RADAR - GEAR DOWN	206588	1487.06	307209576	184.27	38068585
HORIZONTAL C.G. = $\frac{1487.06 - 834.19}{1335.81}$ = 48.9% MAC					
VERTICAL C.G. = 200.0 - 184.3 - 15.7 inches below FRL					
Plus:					
Moment Change Landing Gear Up and Wing Tip Down			- 901998		+ 923603
TAKE-OFF GROSS WEIGHT - RADAR MAPPING MISSION - AZIMUTH RADAR - GEAR UP	206588	1482.70	306307578	188.74	38992188
HORIZONTAL C.G. = $\frac{1482.70 - 834.19}{1335.81}$ = 48.5% MAC					
VERTICAL C.G. = 200.0 - 188.7 = 11.3 inches below FRL					

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DATE: 1 June 1956	TAKE-OFF GROSS WEIGHT SEARCH PHOTO MISSION	MODEL NO. Sys. 118P

ITEM	WEIGHT LBS.	HORIZONTAL C. G. ARM	HORIZONTAL C. G. MOMENT	VERTICAL C. G. ARM	VERTICAL C. G. MOMENT
TAKE-OFF GROSS WEIGHT - SEARCH PHOTO MISSION-GEAR DOWN					
Take-Off Gross Weight - Detail Photo Mission - Gear Down	206800		307258695		38132170
Less:					
Reconnaissance Package - Detail Photo Mission	- 1958		- 911044		- 397965
Plus:					
Reconnaissance Package - Search Photo Mission	(1638)		(777560)		(314435)
Structure	500	475	237500	183	91500
Cameras and Mounts	550	495	272250	195	107250
System Controls	348	445	154860	195	67860
Wiring and Provisions	205	475	97375	200	41000
Shelves and Supports	35	445	15575	195	6825
TAKE-OFF GROSS WEIGHT - SEARCH PHOTO MISSION - GEAR DOWN	206480	1487.43	307125211	184.27	38048640
HORIZONTAL C.G. = $\frac{1487.43 - 834.19}{1335.81}$	= 48.9% MAC				
VERTICAL C.G. = 200.0 - 184.3 = 15.7 inches below FRL					
Plus:					
Moment Change Landing Gear Up and Wing Tip Down	-		- 901998		+ 923603
TAKE-OFF GROSS WEIGHT - SEARCH PHOTO MISSION - GEAR UP	206480	1483.06	306223213	188.75	38972243
HORIZONTAL C.G. = $\frac{1483.06 - 834.19}{1335.81}$	= 48.6% MAC				
VERTICAL C.G. = 200.0 - 188.8 =	11.2 inches below FRL				

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PREPARED BY: J W C	NORTH AMERICAN AVIATION, INC. SECRET	PAGE NO. 48 OF 51
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DATE: 1 June 1956	TAKE-OFF GROSS WEIGHT - FERRET MISSION	MODEL NO. Sys. 118P

ITEM	WEIGHT LBS.	HORIZONTAL C. G. ARM	HORIZONTAL C. G. MOMENT	VERTICAL C. G. ARM	VERTICAL C. G. MOMENT
TAKE-OFF GROSS WEIGHT - FERRET MISSION - GEAR DOWN					
Take-Off Gross Weight - Detail Photo Mission - Gear Down	206800		307258695		38132170
Less:					
Reconnaissance Package - Detail Photo Mission	- 1958		- 911044		- 397965
Plus:					
Reconnaissance Package - Ferret Mission	(1854)		(872390)		(360573)
Structure	860	480	412800	185	159100
Equipment	(706)		(322790)		(143233)
DLD-1	355	450	159750	200	71000
DLD-2	168	490	82320	203	34104
CW D/F	152	425	64600	207	31464
EHF	31	520	16120	215	6665
Wiring and Provisions	208	475	98800	205	42640
Shelves and Supports	80	475	38000	195	15600
TAKE-OFF GROSS WEIGHT - FERRET MISSION - GEAR DOWN	206696	1486.34	307220041	184.30	38094778
HORIZONTAL C.G. = $\frac{1486.34 - 834.19}{1335.81}$ = 48.8% MAC					
VERTICAL C.G. = 200.0 - 184.3 = 15.7 inches below FRL					
Plus:					
Moment Change Landing Gear Up and Wing Tip Down	-		- 901998		+ 923603
TAKE-OFF GROSS WEIGHT - FERRET MISSION - GEAR UP	206696	1481.97	306318043	188.77	39018381
HORIZONTAL C.G. = $\frac{1481.97 - 834.19}{1335.81}$ = 48.5% MAC					
VERTICAL C.G. = 200.0 - 188.8 = 11.2 inches below FRL					

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PREPARED BY: J W C	NORTH AMERICAN AVIATION, INC.	PAGE NO. 49 OF 51
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DATE: 1 June 1956	EXTREME C.G. CONDITIONS	MODEL NO. Sys. 118P

ITEM	WEIGHT LBS.	HORIZONTAL C. G. ARM	HORIZONTAL C. G. MOMENT	VERTICAL C. G. ARM	VERTICAL C. G. MOMENT
MOST FORWARD C.G. CONDITION					
Take-Off Gross Weight - Detail Photo Mission - Gear Down	206800		307258695		38132170
Plus: Moment Change, Landing Gear Up and Wing Tip Down	-		- 901998		+ 923603
MOST FORWARD C.G. CONDITION GEAR UP	206800	1481.42	306356697	188.86	39055773
HORIZONTAL C.G. = 1481.42 - 834.19 / 1335.81 = 48.5% MAC					
VERTICAL C.G. = 200.0 - 188.9 = 11.1 inches below FRL					
MOST AFT C.G. CONDITION					
Take-Off Gross Weight - Search Photo Mission - Gear Down	206480		307125211		38048640
Less:					
Total Fuel, 101330 Gals.	-59278		-78328407		-12703358
Drop-Off Cowl	- 2115	1287	- 2722005	117	- 247455
MOST AFT C.G. CONDITION GEAR DOWN	145087	1558.20	226074799	172.98	25097827
HORIZONTAL C.G. = 1558.20 - 834.19 / 1335.81 = 54.2% MAC					
VERTICAL C.G. = 200.0 - 173.0 = 27.0 inches below FRL					

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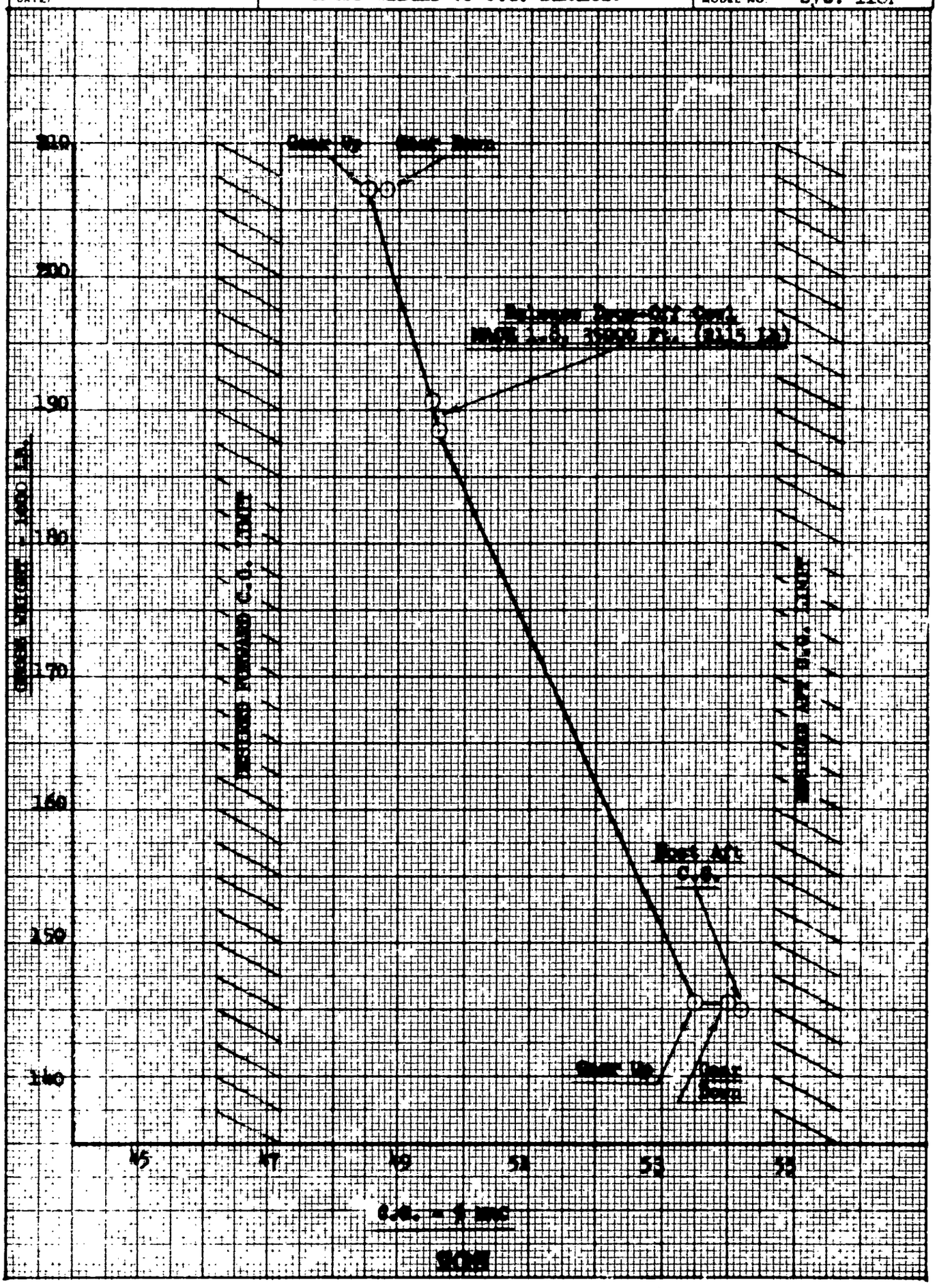
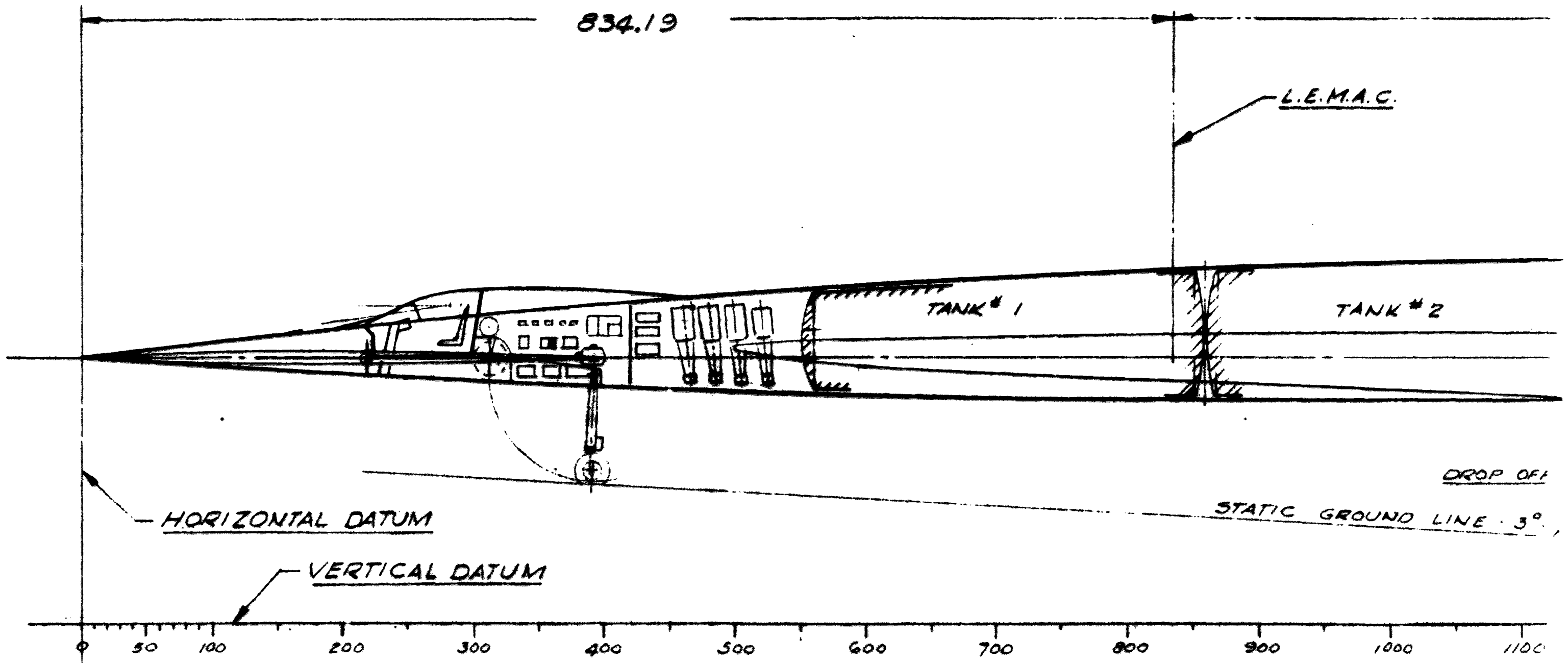
FORM ED-147

PREPARED BY J W C	NORTH AMERICAN AVIATION, INC.	PAGE NO 50 OF 51
CHECKED BY W H L	SECRET	REPORT NO NA-56-450
DATE 1 June 1956	GROSS WEIGHT vs C.G. DIAGRAM	MODEL NO. Sys. 118P




834.19
L.E.M.A.C.
TANK # 1
TANK # 2
DROP OFF
STATIC GROUND LINE · 3°
HORIZONTAL DATUM
VERTICAL DATUM
0
50
100
200
300
400
500
600
700
800
900
1000
1100

1

PREPARED BY: DLK	NORTH AMERICAN AVIA
CHECKED BY: JNK	INTERNATIONAL AIRPORT LOS ANGELE
DATE: 1 June 1956	AIRPLANE DIA

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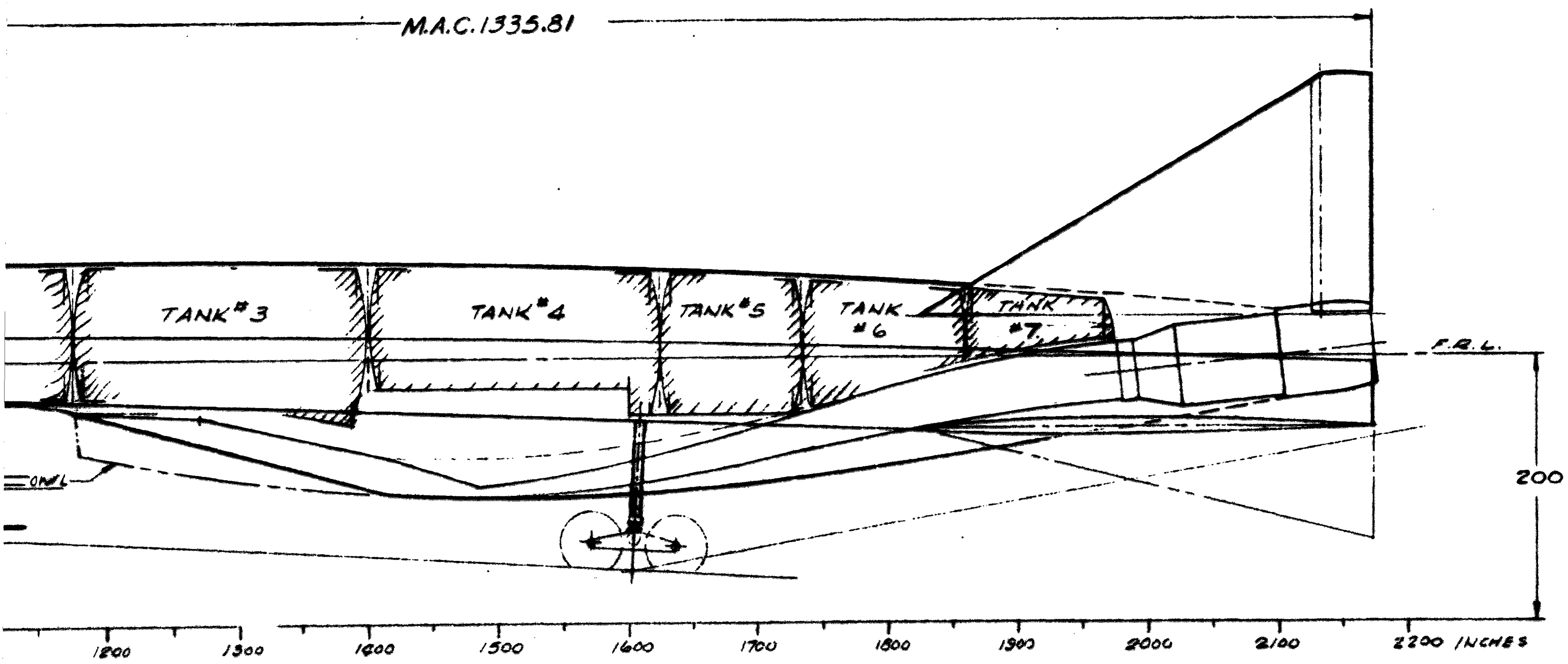

2

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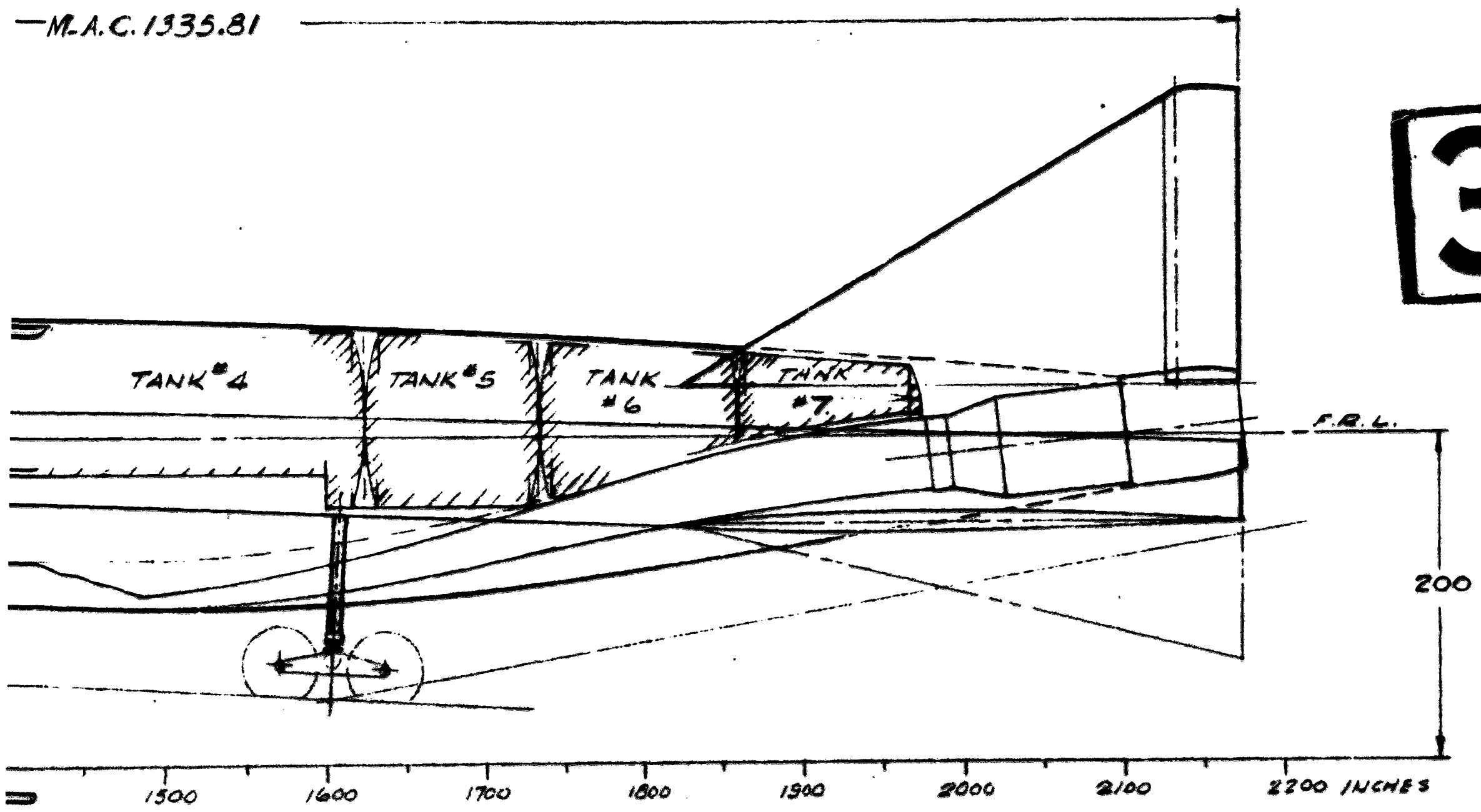
DRAWN BY: DLK	NORTH AMERICAN AVIATION, INC.	PAGE NO. 51 OF 51
CHECKED BY: JWC	INTERNATIONAL AIRPORT LOS ANGELES 45, CALIFORNIA	REPORT NO. NA-56-1670
DATE: 1 June 1956	AIRPLANE DIAGRAM	MODEL NO. Spa. 110P
		SCALE 1" = 80"



3

FUEL	
TANK	GALLONS
1	13540
2	21580
3	21200
4	19660
5	10650
6	9360
7	5340
TOTAL	101330

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APPENDIX I

SUPPORTING DATA

RECONNAISSANCE

WEAPONS SYSTEM 118P

PHASE III

No. of Pages 47

Date: 1 June 1956

STRUCTURAL GROUPS

PART I INTRODUCTION

The purpose of this section is to provide a statement of the Method of Structural Weight Estimation used to produce the data presented in the body of this report. The section is divided into parts which correspond to the outline below.

PART I INTRODUCTION.

PART II WING GROUP WEIGHT.

PART III HORIZONTAL TAIL WEIGHT.

PART IV VERTICAL TAIL WEIGHT.

PART V FUSELAGE GROUP WEIGHT.

PART VI LANDING GEAR GROUP WEIGHT.

PART VII ENGINE SECTION WEIGHT.

PART VIII COMPARISON OF ACTUAL WEIGHT DATA WITH ESTIMATES PRODUCED BY THE METHOD PRESENTED IN THIS SECTION.

PART IX GENERAL CURVES.

PART X REMARKS SECTION.

PART XI SUPPLEMENTAL DATA

In each of the five parts following the introduction an equation is presented which expresses weight in pounds as a function of a set of variables. The variables are defined in the paragraphs immediately following each equation. Some of the variables in the basic equations are defined by mathematical expressions. In such cases the mathematical expressions are shown and in addition general curves representing the variables are presented in Part IX. Following the equations and the definitions there is a discussion of the meaning of a coefficient. The coefficient and the set of increments applied to it in the table following the discussion provide an adjustment to the equation so that it can be made to describe a physical entity. After that, the last unit of each part is a statement of the numerical values assigned to the variables in the equation to produce the weight data shown in the body of the report.

In Part VII there is a statement of the origin of the Engine Section Weight.

In Part VIII there is a set of graphs which give an indication of the performance of the estimation method. There is a graph corresponding to each equation and one corresponding to the sum of all of the equations. The graphs show a series of points representing ratios. The points fall about a line representing the value 1.0. If the estimation method provided an absolutely accurate description of the structural unit the ratio of actual weight to estimated weight represented by points would be unity in all cases. Since the ratio differs from unity the scatter shown on any graph is an indication of the ability of the corresponding equation to provide an approximation of physical reality.

A set of general curves are presented in Part IX. The curves are graphs of some of the variables used in this report that are defined by mathematical expressions.

In the body of this substantiation a set of coefficients are established. The purpose of the coefficients is to provide a relationship between the mathematical model and a reference set of real airplanes. The reference set differs from the projected aircraft that is the subject of the substantiation. The differences usually originate from changes in requirements and in technology. The increments that are applied to compensate for changes of that nature are explained by the remarks in Part X.

PART II. WING GROUP WEIGHT

1. Wing Weight Equation.

$$W_W = \delta_W \left\{ 41.5\, C G^{1/4} S^{3/4} + \left[\frac{AR^{3/2} S^{1/2} N J}{10 K f t \cos^2\Lambda (1 - .2 \sin\Lambda)} \right] \times \left[G - \frac{(\Omega + \omega)(1 + \lambda)\gamma J''}{(\gamma + \lambda) J} \right] \right\} \varphi_W$$

2. Definitions of Symbols.

W_w = Wing Group Weight in pounds.

δ_w = A quantity defined in conjunction with Table 1, page 6.

C = Secondary Structure Factor.

$$= .035 - .0327\, e^{-.00247\sqrt{GN}}$$

G = Design Gross Weight for Stress Analysis, expressed in pounds.

N = The Ultimate Positive Maneuvering Load Factor corresponding to the Design Gross Weight for Stress Analysis.

S = Gross wing area in square feet.

AR = The aerodynamic aspect ratio of the Wing.

$$J = \int_0^1 \frac{[3\lambda + u(1-\lambda)]\,u^2}{[\lambda\sigma + u(1-\lambda\sigma)]}\,du$$

λ = Planform Taper Ratio

$$= \frac{C_t}{C_r} = \frac{\text{Tip Chord in inches.}}{\text{Root Chord in inches.}}$$

$$u = \beta/(b/2)$$

β = Any arbitrary point along the Wing Semi-Span.

b = Wing Span in the same units of length as those used in expressing β.

σ = Thickness Taper Ratio

$$= \frac{t_t}{t_r} = \frac{\text{Tip Thickness in percent of Chord.}}{\text{Root Thickness in percent of Chord.}}$$

K = A ratio of two distances which may be defined as:

(a) The distance, in feet, from the centroid of the upper cap material to the centroid of the lower cap material.

(b) The maximum depth, in feet, of the Airfoil Section.

The ratio is produced by dividing the distance defined in (a) by the distance defined in (b). The numerical value may be computed by the equation below.

$$K = .92 - \frac{AR^{1/2}(1+\lambda)}{S^{1/2} t (1+\lambda\sigma)}\left(.0333 + .000004\, P^{3/4}\right)$$

t = The Root Airfoil Thickness Ratio in the Streamline.

P = The Average Unit Surface Loading, in pounds per foot, caused by bending.

$$= \frac{AR^{3/2}(1+\lambda)\, N\, J'}{22.08\, S^{1/2} t\, T \cos\Lambda}\left[G - \frac{(\Omega+\omega)(1+\lambda)\,\zeta\, J''}{(\zeta+\lambda)\, J'}\right]$$

$$J' = \int_0^1 \frac{u^2[3\lambda + u(1-\lambda)]}{[\lambda\sigma + u(1-\lambda\sigma)][\lambda + u(1-\lambda)]}\, du$$

T = Structural Chord Factor.

$$= \frac{\cos\Lambda}{1 - .2r \sin\Lambda \cos\Lambda\,[1 + 1.2r \sin\Lambda \cos\Lambda]}$$

Λ = The angle of sweep of the 40% chord line of the wing.

r = The rate of taper of the wing.

$$= \frac{4(1-\lambda)}{AR(1+\lambda)}$$

Ω = The deadweight of the wing structure.

ω = The deadweight of the contents of the wing corresponding to

$$J'' = \int_0^1 \frac{u^2\left[\frac{3\lambda}{\gamma} + u\left(1 - \frac{\lambda}{\gamma}\right)\right]}{\left[\lambda\sigma + u(1-\lambda\sigma)\right]\left[\lambda + u(1-\lambda)\right]}\,du$$

f = The average allowable bending stress in pounds per square inch (Aluminum Structure)

$$= \frac{P}{.500 + (1.85 \times 10^{-6})P}$$

$$J'' = \int_0^1 \frac{u^2\left[3\frac{\lambda}{\gamma} + u\left(1 - \frac{\lambda}{\gamma}\right)\right]}{\left[\lambda\sigma + u(1-\lambda\sigma)\right]}\,du$$

γ = A quantity which defines the slope of the Dead Weight Distribution.

$$\varphi_W = \frac{1.080}{(T - 1900)^{.00937}}$$

T = The date of the first weighing of the first airplane of the type. The dates are expressed as years and tenths of years.

3. The Meaning of δ_W.

In deriving the wing weight equation defined in paragraph 1, two distinct phases of development were necessary. The two phases were:

(a) An idealized model of wing structure was constructed.

(b) An idealized model was related to a set of physical data.

In general, the methods utilized in Stress Analysis were followed in executing the first phase of development. In the second phase the numerical values of wing weights produced by the idealized model were compared with actual weight data. The comparison led naturally to an attempt to reduce all of the wings to a common basis. The reduction to a common basis was accomplished by removing from the actual weight data the weight penalty associated with those items which were not common to all airplanes of the reference set. Examples of items for which weight penalties were removed are:

(a) Ailerons
(b) Flaps
(c) Slats
(d) Folding Provisions

For example, the weight increment removed for Slats is the difference between two different types of Leading Edges. One type is a Plain Leading Edge and the other is a Leading Edge with a Slat. The difference in the weights of the two is the penalty due to the Slat. After all such increments have been removed there remains a Basic Wing Weight. The equation presented in paragraph 1 represents the weight of such a Basic Wing. The degree of correspondence between the weights produced by the equation and a number of Actual Wing Weights is indicated by the plot on page 24.

In using the equation to estimate the weight of a slab wing with no Ailerons, Slats, Flaps, Folding Provisions, Heated Leading Edges, etc, a value of S_w = 1.0 would be used. To account for the inclusion of such items or for special design features, positive or negative increments must be added to the value 1.0. Table 1 shows the increments added to the basic value 1.0 to produce the estimate of wing weight for the airplane design which is the subject of this report.

TABLE 1

WING WEIGHT INCREMENTS

Basic			1.000
	See Part I Paragraph		
Increments			
Spoilers		+ .130	
Trailing Edge		+ .040	
Folding Tips and Provisions		+ .030	
Additional Landing Gear Provisions	1	+ .020	
Tab		+ .012	
Delete Wing Center Section & Attach Prov.	2	- .118	
Three Spar Multi-Rib Type Construction	3	- .300	
Stressed Access Covers	4	- .005	

TABLE 1 (CONT'D)

	See Part X Paragraph		
Increments (Cont'd)			
High Strength Alloys	5	- .040	
Temperature Penalty - Secondary Structure	6	+ .030	
Additional Matl. for Torsional Stiffness		+ .013	
The Value of δ_W			.812

4. The Numerical Values assigned to the Variables.

In the estimation process which produced the wing weight shown in this report the values assigned to the variables in the equation were those listed below.

δ_W = .812

C = .0282

G = 201100 pounds.

N = 2.0

S = 6396 square feet.

AR = .6780

J = .4894

λ = .1758

b = 65.85 feet

σ = 1.0

K = .9067

t = .03

P = 16935 pounds per foot.

J' = .6686

τ = 2.0938

Λ = 65.13 degrees.

r = 4.1355

Ω = 24343 pounds.

ω = 2053 pounds.

J''^{N} = .4910

f = 20830 pounds per square inch.

J = .48938

ζ = 3.0

φ_N = 1.0393

T = 1963.5

PART III. HORIZONTAL TAIL WEIGHT.

1. Horizontal Tail Weight Equation.

$$W_H = \delta_H \left[41.5\, C\, TL^{1/4} S^{3/4} + \frac{AR^{3/2} S^{1/2} TL\, J}{8.00 K f t \cos^2\Lambda (1 - .2 \sin\Lambda)} \right] \varphi_N$$

2. Definitions of Symbols.

W_H = Horizontal Tail Weight in pounds.

δ_H = A quantity defined in conjunction with Table 2 page 11.

C = Secondary Structure Factor

$$= .035 - .0327\, e^{-.00275\sqrt{TL}}$$

* TL = Limit critical Horizontal Tail Load, in pounds, for both panels.

* The horizontal tail weight equation has been modified for a factor of safety of 1.25.

S = Horizontal Tail Area in square feet.

(a) If S is Gross Horizontal Tail Area, then the value of δ_M for a Basic Slab Tail is 1.0

(b) If S is Exposed Horizontal Tail Area, then the value of δ_M for a Basic Slab Tail is 1.1.

AR = The Aerodynamic Aspect Ratio of the Horizontal Tail corresponding to S.

$$\delta = \int_0^1 \frac{[3\lambda + u(1-\lambda)]\,u^2}{[\lambda\sigma + u(1-\lambda\sigma)]}\,du$$

λ = Planform Taper Ratio

$$= \frac{C_t}{C_r} = \frac{\text{Tip Chord in Inches}}{\text{Root Chord in Inches}}$$

$$u = \beta/(b/2)$$

β = Any arbitrary point along the Semi-Span of the Horizontal Tail.

b = Horizontal Tail Span in the same units of length as those used in expressing β. The value of must correspond to S.

σ = Thickness Taper Ratio

$$= \frac{t_t}{t_r} = \frac{\text{Tip Thickness in Percent of Chord.}}{\text{Root Thickness in Percent of Chord.}}$$

K = A ratio of two distances which may be defined as:

(a) The distance, in feet, from the centroid of the upper cap material to the centroid of the lower cap material.

(b) The maximum depth, in feet, of the airfoil section

The ratio is produced by dividing the distance defined in (a) by the distance defined in (b). The numerical value may be computed by the equation below.

$$K = .92 - \frac{AR^{1/2}(1+\lambda)}{S^{1/2} t\,(1+\lambda\sigma)}\left(.0333 + .000004\,P^{3/4}\right)$$

t = The Root Airfoil Thickness Ratio, in the Streamline.

P = The Average Unit Surface Loading, in pounds per foot. caused by bending.

$$= \frac{AR^{3/2}(1+\lambda)\,\eta\, J'}{17.66\, S^{1/2} t\, \tau \cos\Lambda}$$

$$J' = \int_0^1 \frac{u^2\left[3\lambda + u(1-\lambda)\right]}{\left[\lambda\sigma + u(1-\lambda\sigma)\right]\left[\lambda + u(1-\lambda)\right]}\,du$$

τ = Structural Chord Factor.

$$= \frac{\cos\Lambda}{1 - .2r\sin\Lambda\cos\Lambda\left[1 + 1.2r\sin\Lambda\cos\Lambda\right]}$$

Λ = The angle of sweep of the 40% chord line of the Horizontal Tail.

r = The rate of taper of the Horizontal Tail.

$$= \frac{4(1-\lambda)}{AR(1+\lambda)}$$

f = The average allowable bending stress in pounds per square inch(Aluminum Structure)

$$= \frac{P}{.500 + (1.85\times10^{-5})P}$$

$$\varphi_H = \frac{11.797}{(T - 1900)^{.596}}$$

τ = The date of the weighing of the first airplane of the type. The dates are expressed as years and tenths of years.

3. The Meaning of δ_H.

The Horizontal Tail Weight Equation is essentially the same as the Wing Weight Equation. The meaning of δ_H is intrinsically the same as that of δ_W. It relates the mathematical model to physical reality. The numerical value of δ_H is computed as shown on Table 2.

TABLE 2

HORIZONTAL TAIL WEIGHT INCREMENTS

Basic			1.100
	See Part X Paragraph		
Increments			
Full Depth Honeycomb Type Construction	7	- .160	
Transfer of Fitting to Fuselage		- .120	
High Strength Alloys	5	- .080	
Temperature Penalty - Primary Structure	8	+ .050	
Temperature Penalty - Secondary Structure	6	+ .072	
Simplified Spindle Provisions		- .122	
Transfer Fairing to Fuselage		- .120	
The Value of δ_H			.620

4. The Numerical Values Assigned to the Variables.

In the estimation process which produced the Horizontal Tail weight shown in this report the values assigned to the variables in the equation were those listed below.

δ_H = .620

C = .0209

n = 93360 pounds.

S = 435 square feet.

AR = 1.439

J = .5335

λ = .2321

b = 25.02 feet.

σ = 1.0

K = .8418

t = .03

D = 25158 pounds per foot.

J' = .7262

τ = 1.0716

Λ = 46.1 degrees.

r = 1.7324

f = 26060 pounds per square inch.

ρ_H = .9933

T = 1963.5

PART IV. VERTICAL TAIL WEIGHT

1. Vertical Tail Weight Equation.

$$W_v = \delta_v \left[83.0\, C\, n^{1/4} S^{3/4} + \frac{AR^{3/2} S^{1/2} n\, J}{K_f\, t \cos^2\Lambda (1 - .2 \sin\Lambda)} \right] \varphi_v$$

2. Definitions of Symbols.

W_v = Vertical Tail Weight in pounds.

δ_v = A quantity defined in conjunction with Table 3 page 16.

C = Secondary Structure Factor

$$= .035 - .0327\, e^{-.00390\sqrt{n}}$$

* n = Limit critical Vertical Tail Load in pounds.

S = Vertical Tail Area in square feet.

AR = The Aerodynamic Aspect Ratio of the Vertical Tail.

$$J = \int_0^1 \frac{[3\lambda + u(1-\lambda)]u^2}{[\lambda\sigma + u(1-\lambda\sigma)]}\, du$$

λ = Planform Taper Ratio

$$= \frac{C_t}{C_r} = \frac{\text{Tip Chord in Inches.}}{\text{Root Chord in Inches.}}$$

$$u = \beta / (b/2)$$

* The vertical tail weight equation has been modified for a factor of safety of 1.25

β = Any arbitrary point along the Semi-Span of the Vertical Tail.

b = Horizontal Span in the same units of length as those used in expressing β. This quantity is approximately twice the distance from the tip to the point of attachment to the fuselage.

σ = Thickness Taper Ratio

$= \dfrac{t_t}{t_r} =$ Tip Thickness in Percent of Chord. / Root Thickness in Percent of Chord.

K = A ratio of two distances which may be defined as:

(a) The distance, in feet, from the centroid of the upper cap material to the centroid of the lower cap material.

(b) The maximum depth, in feet, of the airfoil section.

The ratio is produced by dividing the distance defined in (a) by the distance defined in (b). The numerical value may be computed by the equation below.

$$K = .92 - \frac{AR^{1/2}(1+\lambda)}{S^{1/2}t(1+\lambda\sigma)}\left(.0333 + .00004\,P^{3/4}\right)$$

t = The Root Airfoil Thickness Ratio, in the Streamline.

P = The Average Unit Surface Loading, in pounds per foot, caused by bending.

$$= \frac{AR^{3/2}(1+\lambda)\,TL\,J'}{8.832\,S^{1/2}\,t\,T\cos\Lambda}$$

$$J' = \int_0^1 \frac{u^2[3\lambda + u(1-\lambda)]}{[\lambda\sigma + u(1-\lambda\sigma)][\lambda + u(1-\lambda)]}\,du$$

T = Structural Chord Factor.

$$\tau = \frac{\cos\Lambda}{1-.2r\sin\Lambda\cos\Lambda\left[1+1.2r\sin\Lambda\cos\Lambda\right]}$$

Λ = The angle of sweep of the 40% chord line of the Vertical Tail.

r = The rate of taper of the Vertical Tail.

$$= \frac{2(1-\lambda)}{AR(1+\lambda)}$$

f = The average allowable bending stress in pounds per square inch (Aluminum Structure)

$$= \frac{P}{.500+(1.85\times10^{-5})P}$$

$$\rho_v = \frac{18.843}{(T-1900)^{.886}}$$

T = The date of the weighing of the first airplane of the type. The dates are expressed as years and tenths of years.

3. The Meaning of δ_v.

The Vertical Tail Weight Equation is essentially the same as the Wing Weight Equation. The meaning of δ_v is intrinsically the same as that of δ_w. It relates the mathematical model to physical reality. The numerical value of δ_v is computed as shown on Table 3.

TABLE 3

VERTICAL TAIL WEIGHT INCREMENTS

Basic			1.000
	See Part X Paragraph		
Increments			
Full Depth Honeycomb Type Construction	7	-.100	
Balance Weights		+.157	
Temperature Penalty - Secondary Structure	6	+.066	
Additional Matl. for Torsional Stiffness		+.187	
The Value of δ_v			1.310

NOTE: The value of δ_v as noted in Table 3 applies to one vertical. It must be doubled for two. The value given below is 2.620 since there are two vertical surfaces.

4. The Numerical Values assigned to the Variables.

In the estimation process which produced the Vertical Tail weight shown in this report the values assigned to the variables in the equation were those listed below.

δ_v = 2.620

C = .0132

TL = 10660 pounds.

S = 250 square feet.

AR = .9064

J = .4290

λ = .1034

b = 15.03 feet.

σ = 1.0

K = .8481

t = .03

P = 5830 pounds per foot.

J = .6120

τ = 1.1066

Λ = 45.97 degrees

r = 1.7929

f = 9590 pounds per square inch.

φ_v = .4759

T = 1963.5

PART V. FUSELAGE GROUP WEIGHT.

1. Fuselage Weight Equation.

$$W_F = \delta_F \left[\xi (S_F + S_c)^{7/8} G^{3/8} V^{3/8} N^{3/16} X \left(E^{1/8} + e^{-100E}\right) \right] \left[\eta + .01 \left(\frac{L}{D}\right)^{3/2} \right]^{1/2} \varphi_F$$

2. Definitions of Symbols.

W_F = Fuselage Group Weight in pounds.

δ_F = A quantity defined in conjunction with Table 4 page 19.

ζ = .013 For aircraft having engines within the Fuselage Mold Line.

= .010 For aircraft having no engines within the Fuselage Mold Line.

S_F = Net Fuselage Surface Area in square feet.

S_c = Canopy Surface Area in square feet.

G = Design Gross Weight for Stress Analysis expressed in pounds.

V = The speed, in knots, at sea level that corresponds to a particular value of q, q being dynamic pressure in pounds per square foot. The particular value of q is the design q of the airplane regardless of the altitude at which it occurs.

N = The Ultimate Positive Maneuvering Load Factor corresponding to the Design Gross Weight for Stress Analysis. (The factor of safety for this airplane is 1.25)

E = An integer expressing the number of engines housed within the Fuselage Mold Line.

η = .80 For aircraft having engines within the Fuselage Mold Line.

= .75 For aircraft having no engines within the Fuselage Mold Line.

L = The Fuselage length in feet.

D = The Fuselage mean diameter * at the maximum section. The mean diameter is expressed in feet.

T = The date of the first weighing of the first airplane of the type. The dates are expressed as years and tenths of years.

$$\varphi_F = \frac{2.307}{(T-1900)^{.234}}$$

* The Mean Diameter is defined as:

$$\frac{\text{Maximum Width} + \text{Maximum Depth}}{2}$$

The Width and the Depth occur at the same section.

3. The Meaning of δ_F.

The meaning of δ_F is essentially the same as that of δ_W. It provides an adjustment to the equation defining the weight of a basic fuselage to compensate for design features, variations in design practice, etc. In so doing it causes the equation to describe the piece of hardware under consideration. The numerical value of δ_F is computed as shown in Table 4.

TABLE 4

FUSELAGE WEIGHT INCREMENTS

Basic			1.000
	See Part X Paragraph		
Increments			
Wing Moment Carry thru Structure	2	+ .133	
Transfer of Empennage Ftgs to Fuselage		+ .011	
Baffles & Seals for Equipment Bay Cooling		+ .025	
Temperature Affects for Canopy	9	+ .030	
High Strength Alloys	5	- .060	
Stressed Access Covers & Doors	4	- .100	
Temperature Affects for Primary Structure	8	+ .170	
Transfer of Horiz. Tail Fairing to Fuselage		+ .010	
Fuselage Reallocated to Air Intake Ducts		- .195	
Fuselage Shape Coefficient	10	+ .185	
The Value of δ_F			1.209

4. The Numerical Values Assigned to the Variables.

In the estimation process which produced the Fuselage Weight shown in this report the values assigned to the variables were those listed below.

δ_F = 1.209

ξ = .010

S_F = 7058 square feet.

S_c = 75 square feet.

G = 179196 pounds.

V = 665 knots.

N = 2.0

E = 0

η = .75

L = 165 feet.

D = 21.17 feet.

T = 1963.5

φ_F = .8779

PART VI. LANDING GEAR GROUP WEIGHT.

1. Landing Gear Weight Equation.

$$W_G = \left[\delta_G \varphi_G + \nu\right]\left[.14 e^{.0746\mu} \Gamma^{7/8}\right] \varphi_G$$

2. Definitions of Symbols.

W_G = Landing Gear Group Weight in pounds.

δ_G = A quantity defined in conjunction with Table 5, page 21.

$$\nu = \frac{135599}{(T-1900)^{.2304}}$$

= .15 for any aircraft other than those falling int the catagory specified above.

μ = The length of the Main Gear Strut measured from the center line of the trunnion to the center line of the axle with the Strut extended. The length is expressed in feet.

Γ = The Design Landing Weight in pounds.

T = The date of the first weighing of the first airplane of the type. The dates are expressed as years and tenths of years.

$$\varphi_G = \frac{11.743}{(T-1900)^{.634}}$$

3. The Meaning of δ_q

The meaning of δ_q is essentially the same as that of δ_N. It provides an adjustment to the equation defining the weight of a Basic Landing Gear to compensate for design features, variations in design practice, etc. In so doing it causes the equation to describe the physical item under consideration. The numerical value of δ_q is computed as shown in Table 5.

TABLE 5

LANDING GEAR WEIGHT INCREMENTS

Basic			1.000
	See Part X Paragraph		
Increments			
Wing Lift Relief	11	- .100	
Bogie Type Gear		+ .100	
Temperature Affects	12	+ .053	
High Strength Alloys	5	- .060	
Reduced Sink Speed	13	- .033	
The Value of δ_q			.960

4. The Numerical Values Assigned to the Variables.

In the estimation process which produces the Landing Gear Weight shown in this report the values assigned to the variables were those listed below.

δ_g = .960

ν = .150

μ = 12.5 feet.

Γ = 160227 pounds.

T = 1963.5

ρ_g = .8455

PART VII. ENGINE SECTION WEIGHT.

The weight allowance for the Engine Section was selected by comparison with a series of comparable items for jet aircraft.

SECRET

PART VIII. COMPARISON OF ACTUAL WEIGHT DATA WITH ESTIMATES PRODUCED BY THE METHOD PRESENTED IN THIS SECTION.

A set of graphs is presented in this part of the report that give an indication of the performance of the estimation method. There is a graph corresponding to each equation and one corresponding to the sum of all of the equations. The graphs show a series of points representing ratios. The points fall about a line representing the value 1.0. If the estimation method provided an absolutely accurate description of the structural unit the ratio of the actual weight to the estimated weight represented by the points would be unity in all cases. Since the ratio differs from unity the scatter shown on any graph is an indication of the ability of the corresponding equation to provide an approximation of physical reality.

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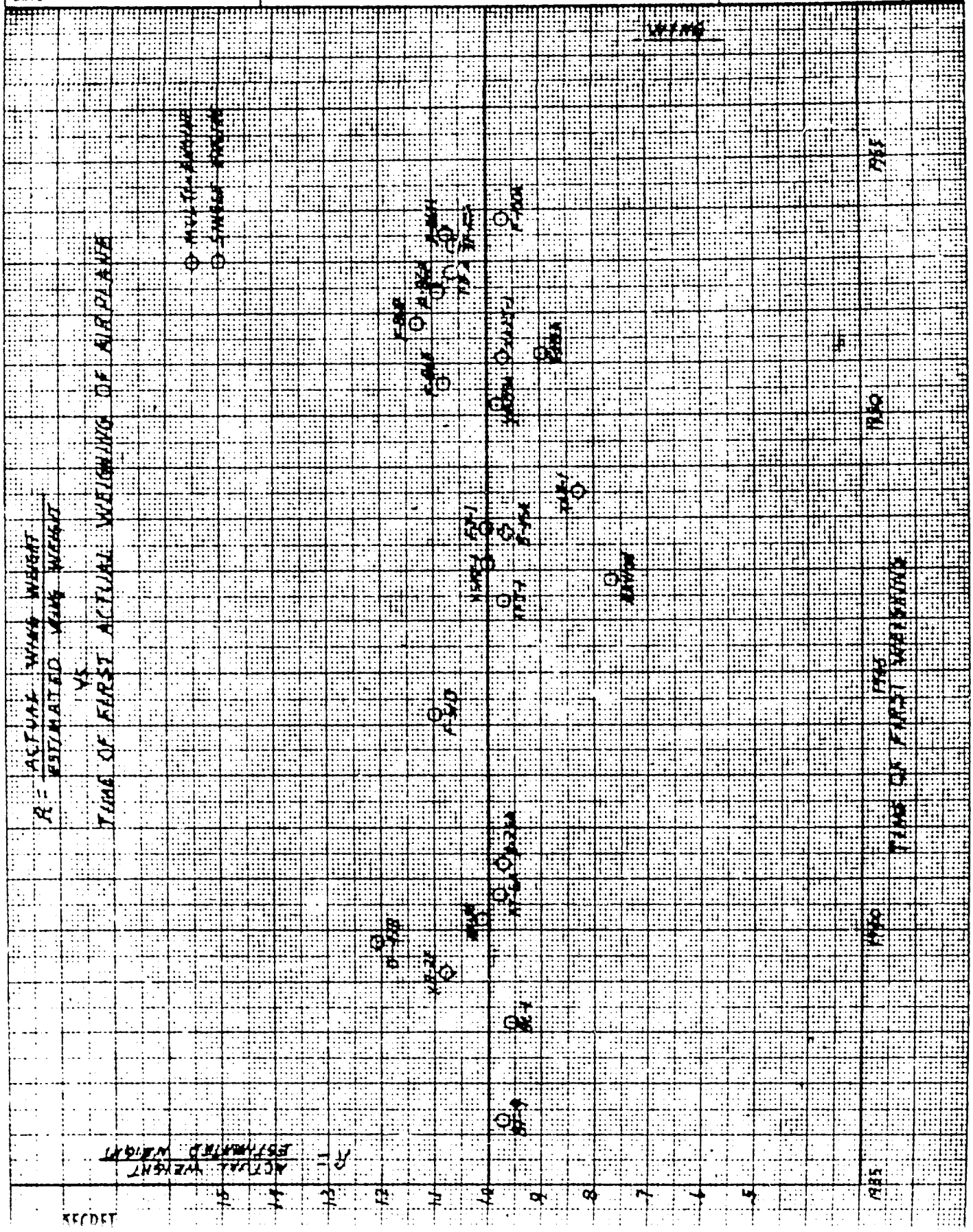
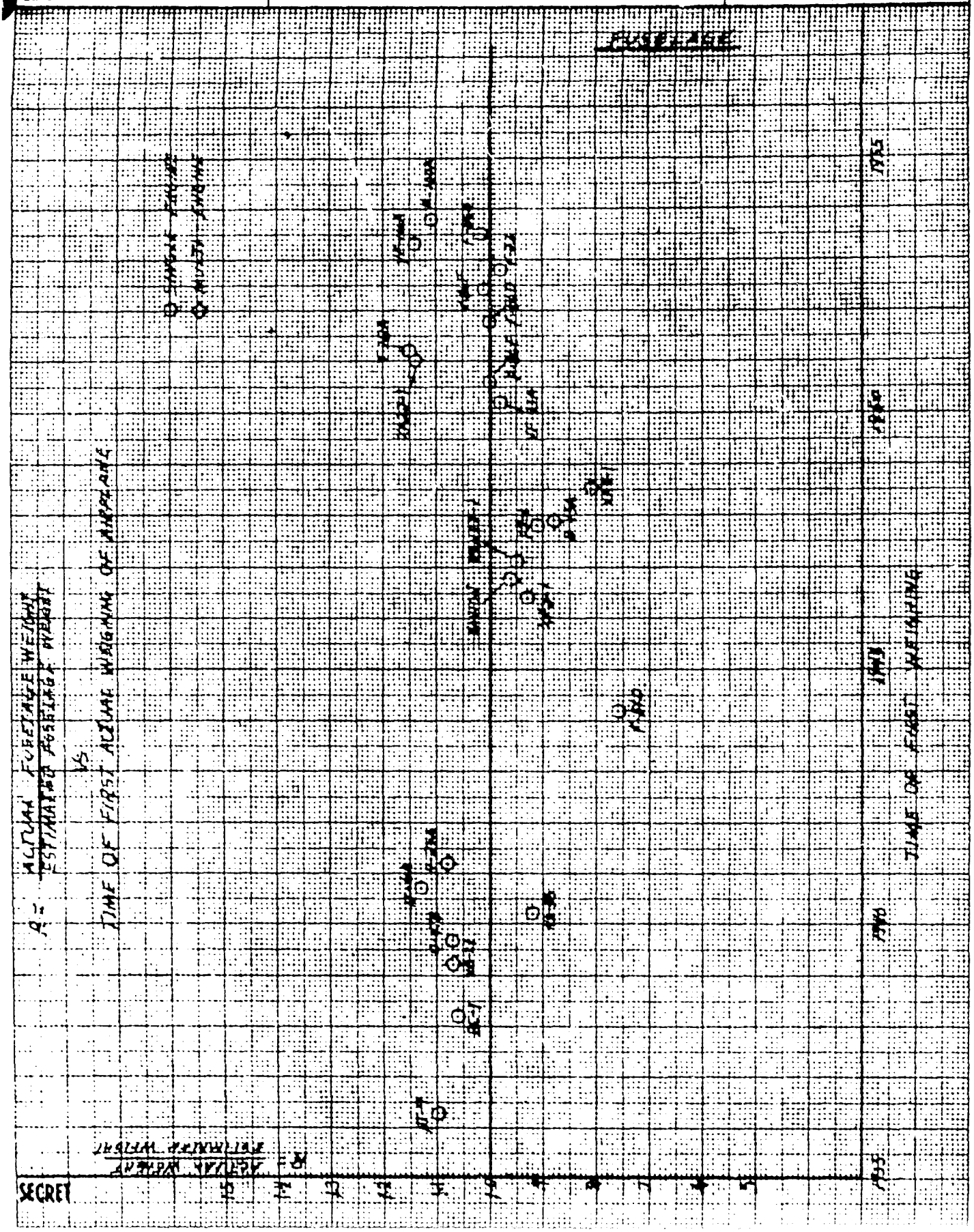

R = ACTUAL WING WEIGHT / ESTIMATED WING WEIGHT
TIME OF FIRST ACTUAL WEIGHING OF AIRPLANE
WYNG
PRE
1950
1955
TIME OF FIRST WEIGHING
ACTUAL WEIGHT / ESTIMATED WEIGHT
1.5
1.4
1.3
1.2
1.1
1.0
.9
.8
.7
.6
.5

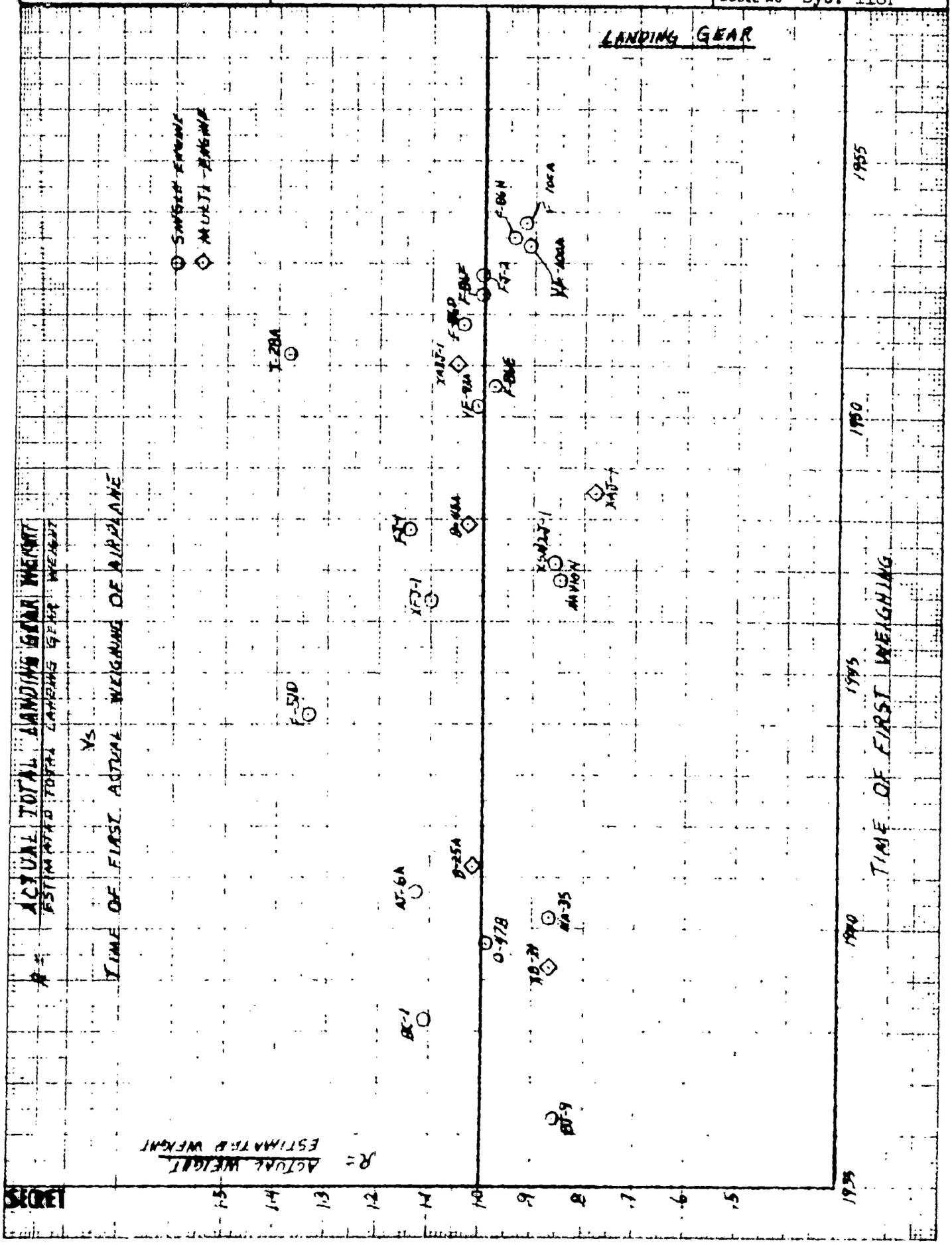
FORM ED-148

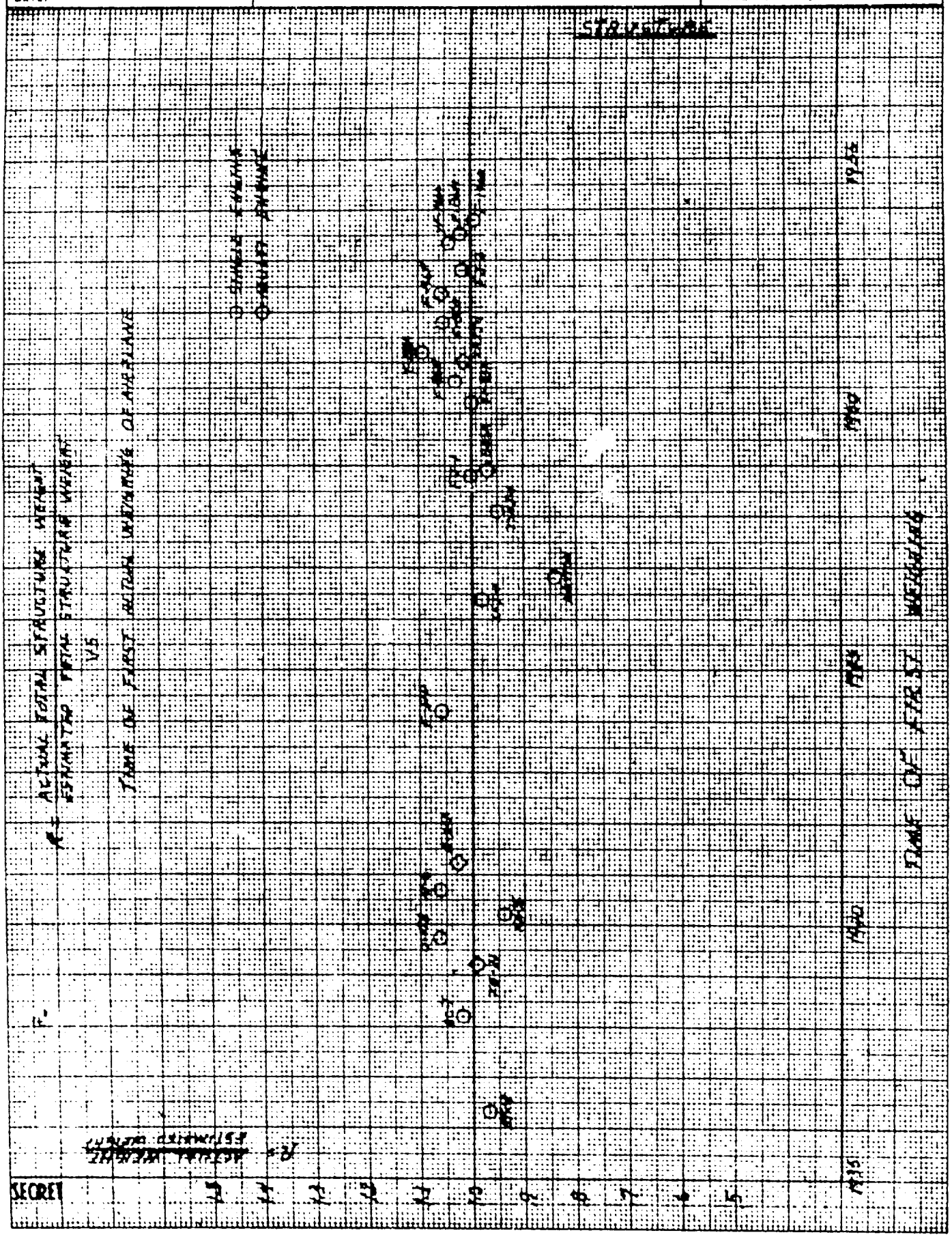
PREPARED BY W A N	NORTH AMERICAN AVIATION, INC.	PAGE NO 25 OF 47
CHECKED BY S S B	SECRET	REPORT NO NA-56-450
DATE 1 June 1956	SUPPORTING DATA	MODEL NO Sys. 118P

FORM ED-148

PREPARED BY: W A W	NORTH AMERICAN AVIATION, INC.	PAGE NO 26 OF 47
CHECKED BY: S S P	SECRET	REPORT NO NA-56-4[illegible]
DATE: 1 June 1956	SUPPORTING DATA	MODEL NO Sys. 11[illegible]


FUSELAGE
SINGLE ENGINE
MULTI ENGINE
1955
1956
1957
1958
1959
TIME OF FIRST WEIGHING
ACTUAL WEIGHT / ESTIMATED WEIGHT
1.5
1.4
1.3
1.2
1.1
1.0
.9
.8
.7
.6
.5


LANDING GEAR
ACTUAL TOTAL LANDING GEAR WEIGHT / ESTIMATED TOTAL LANDING GEAR WEIGHT
TIME OF FIRST ACTUAL WEIGHING OF AIRPLANE
TIME OF FIRST WEIGHING
R = ACTUAL WEIGHT / ESTIMATED WEIGHT
1.5
1.4
1.3
1.2
1.1
1.0
.9
.8
.7
.6
.5
1935
1940
1945
1950
1955
SWEPT ENGINE
MULTI-ENGINE
T-28A
F-51D
XF-6A
B-25A
O-47B
BC-1
BC-9
XFJ-1
B-66A
XB-70
XB-35
XF-84F
YF-84F
F-84F
F-84D
F-84E
F-84N
F-104A
YF-104A
F-5A
XB-47
XB-51
XB-45F-1
XB-45F-4


STRUCTURE
ACTUAL TOTAL STRUCTURE WEIGHT
ESTIMATED TOTAL STRUCTURE WEIGHT
VS
TIME OF FIRST MILITARY WEIGHING OF AIRPLANE
SINGLE ENGINE
MULTI ENGINE
TIME OF FIRST MILITARY WEIGHING
SECRET

PART IX. GENERAL CURVES.

Some of the variables appearing in the basic weight equations are defined by mathematical expressions. Graphs of some of the more complicated functions have been plotted and are presented in this part of the report. The graphs presented are listed below:

(a) C vs $GN \times 10^{-6}$

(b) r vs AR

(c) T vs Λ

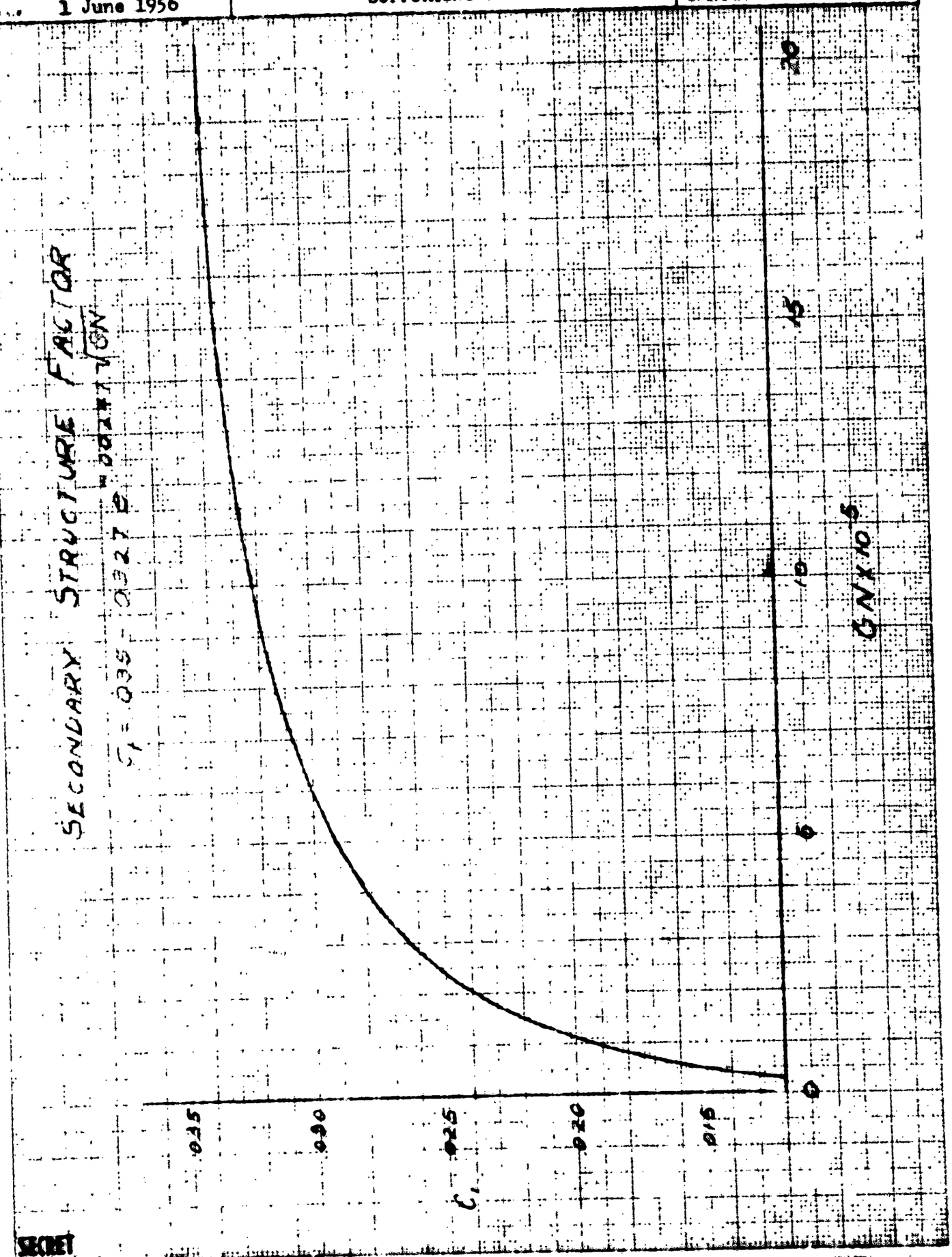
(d) f vs P

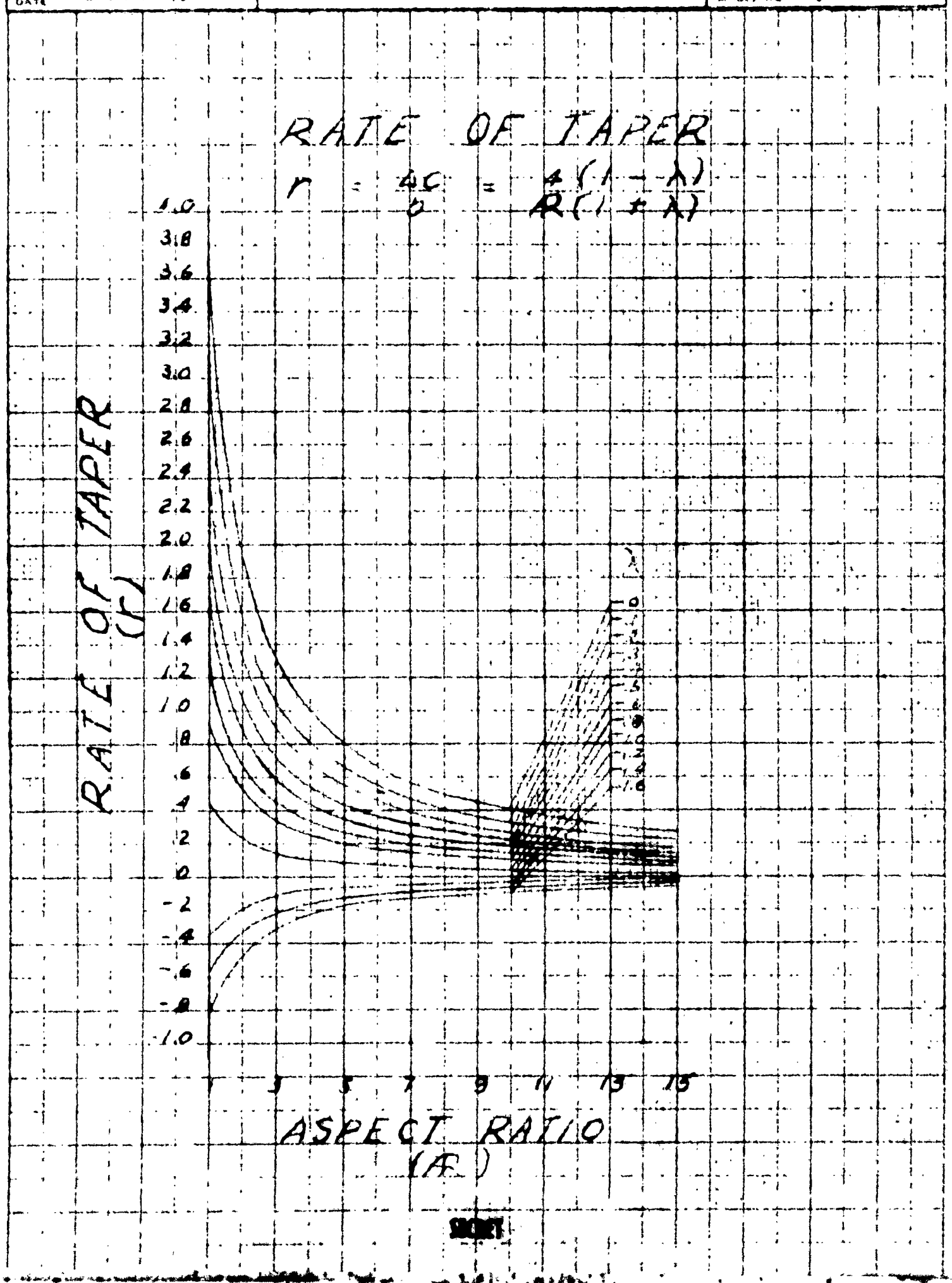
(e) J vs λ

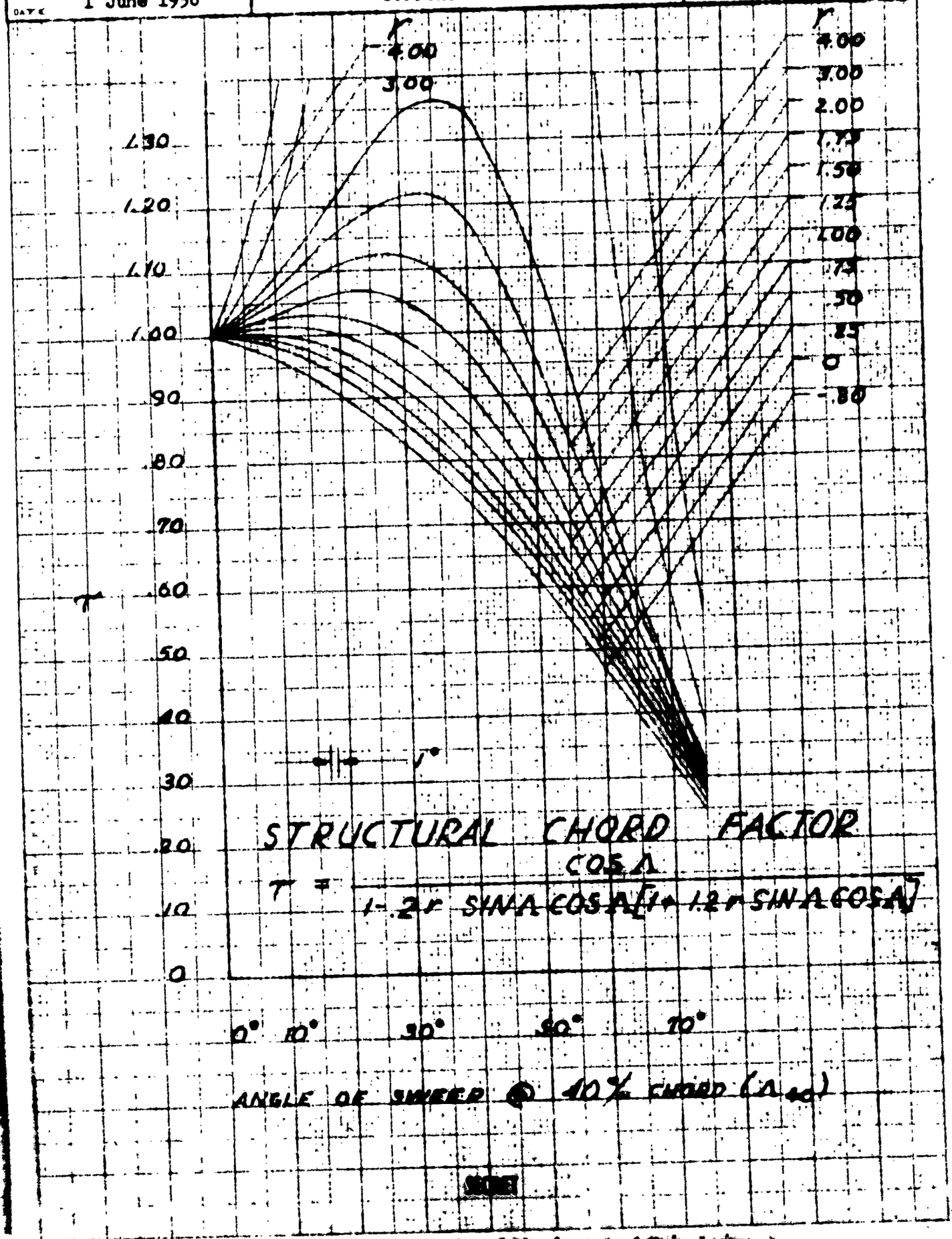
(i) J' vs λ

(g) J'' vs λ

(h) J''' vs λ

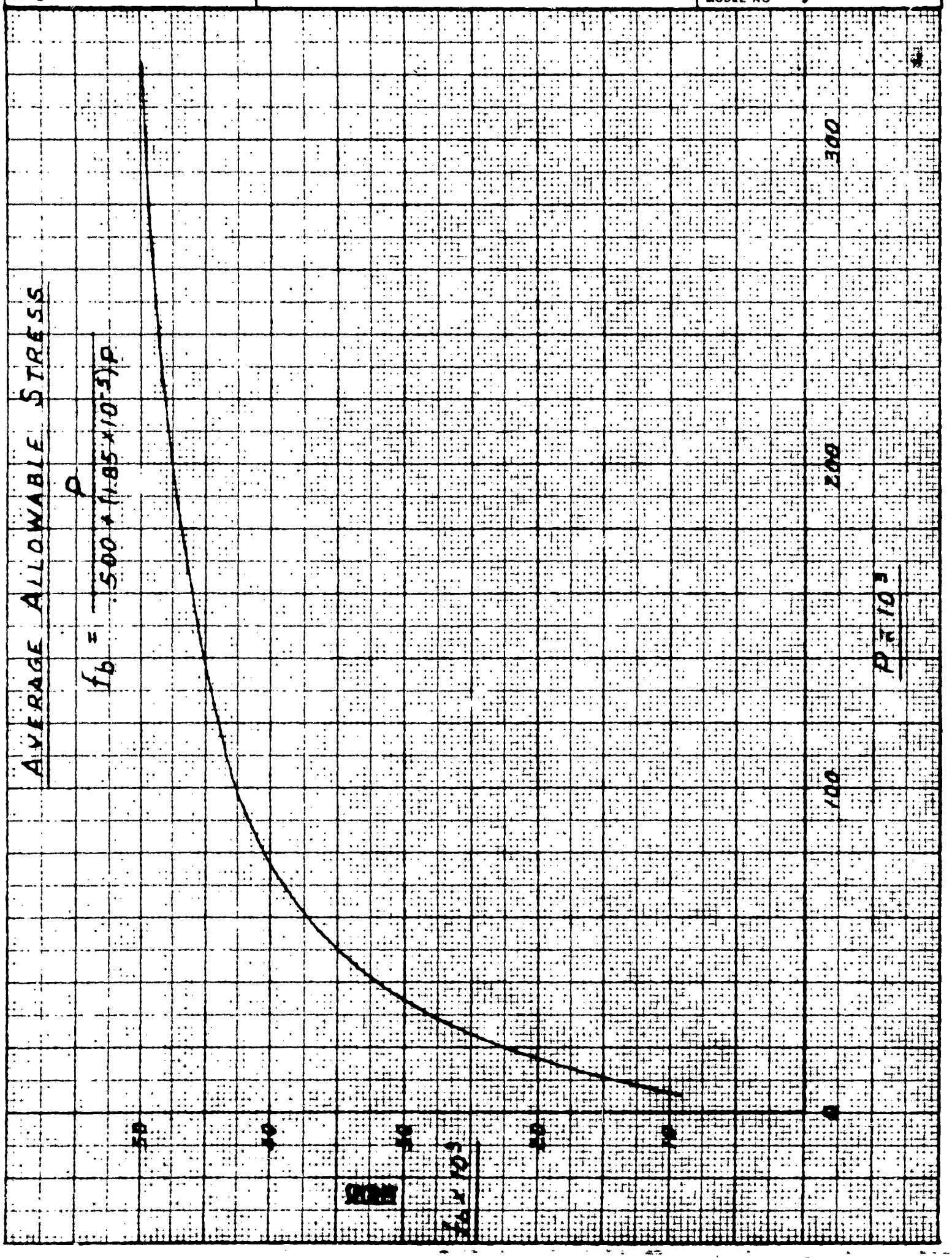

SECONDARY STRUCTURE FACTOR
$\tau = .035 - .0327 \frac{t}{c} - .0027 \sqrt{GN}$
C_1
.035
.030
.025
.020
.015
0
6
12
18
20
GNX10⁻⁶

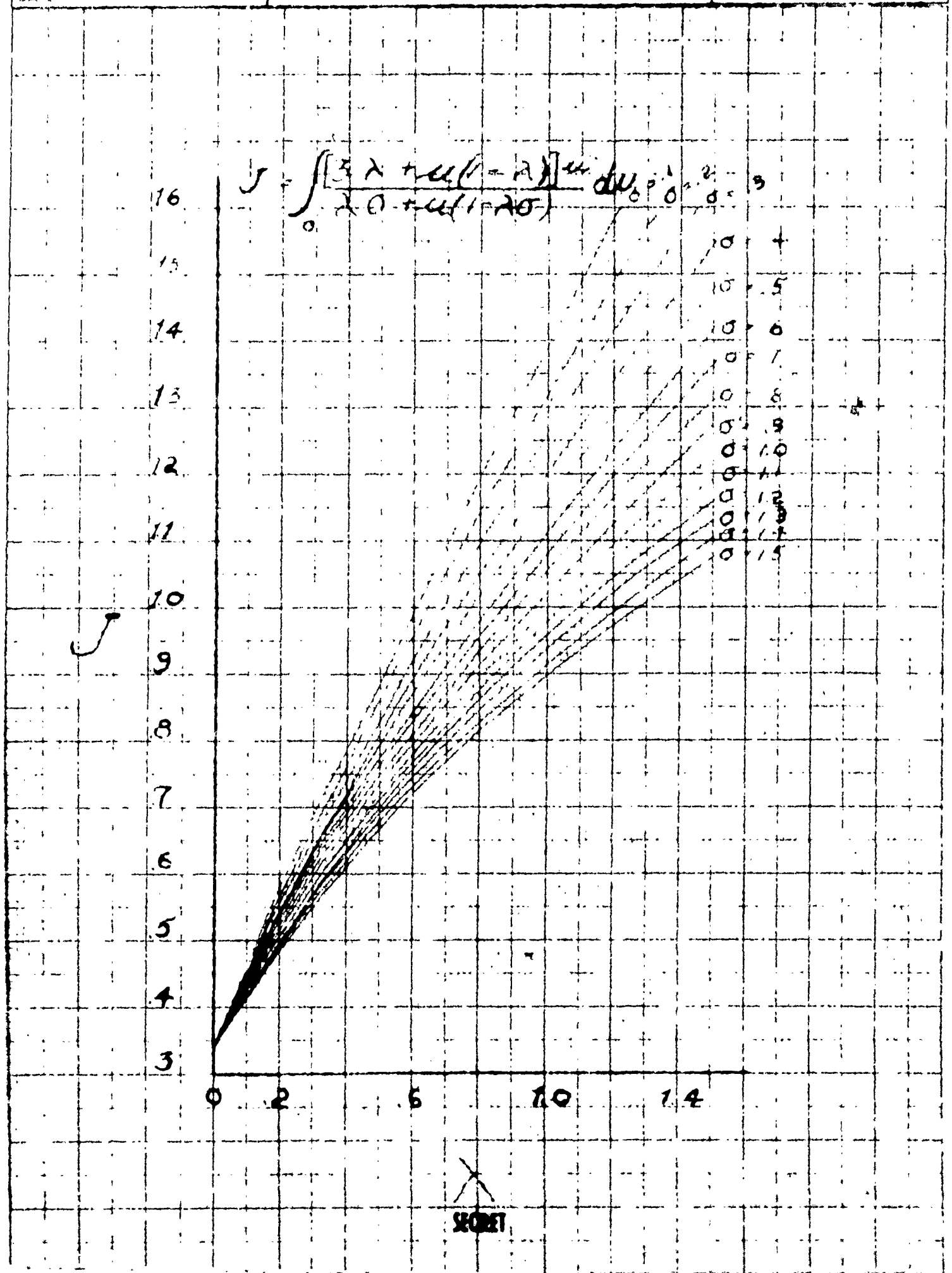

RATE OF TAPER
$r = \frac{4c}{b} = \frac{4(1-\lambda)}{A(1+\lambda)}$
RATE OF TAPER (r)
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
-.2
-.4
-.6
-.8
-1.0
1
3
5
7
9
11
13
15
ASPECT RATIO
(A)
λ
0
.1
.2
.3
.5
.6
.8
1.0
1.2
1.4
1.6



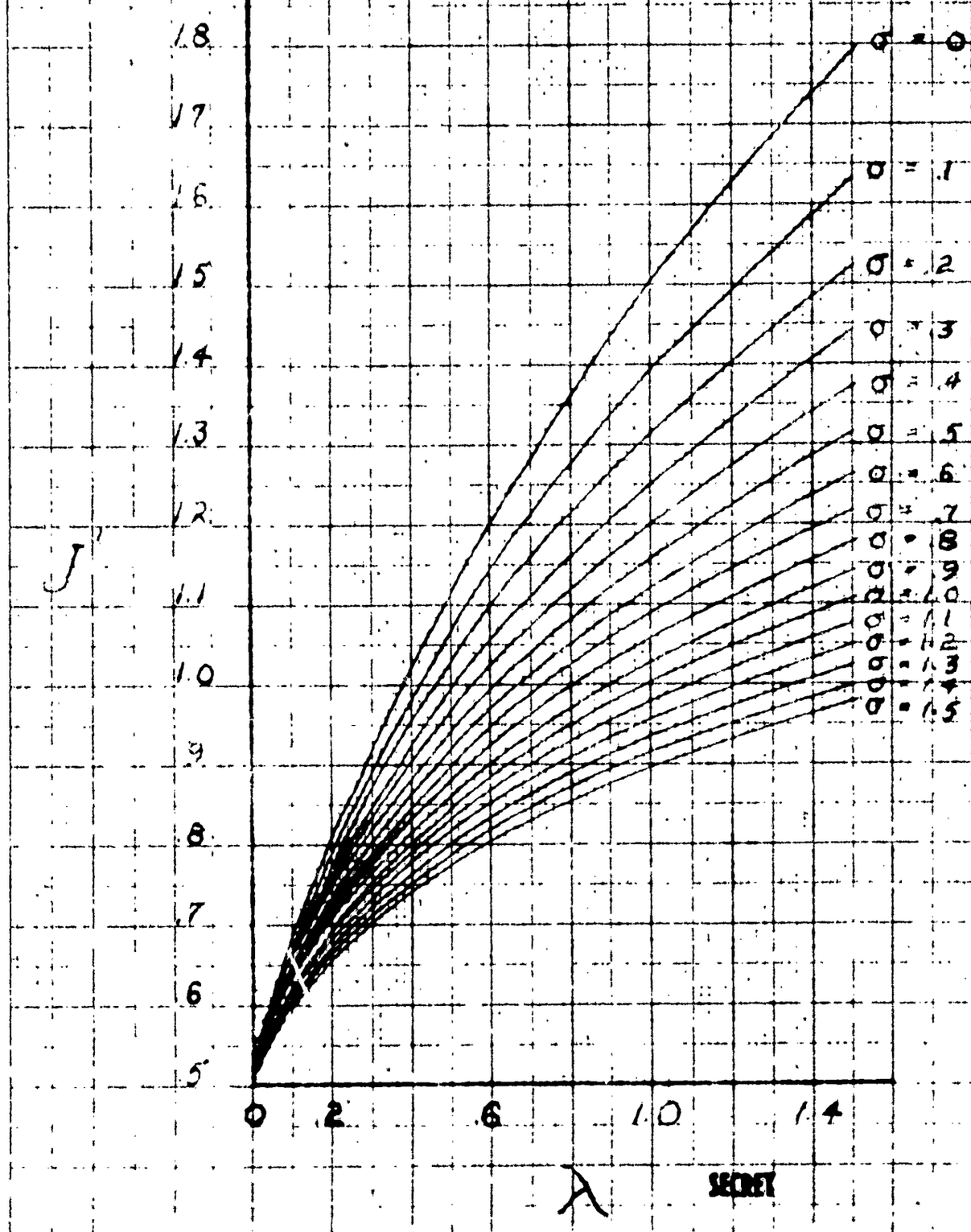
STRUCTURAL CHORD FACTOR

$$\tau = \frac{\cos\Lambda}{1 - 2r\sin\Lambda\cos\Lambda\left[1 + 1.2r\sin\Lambda\cos\Lambda\right]}$$

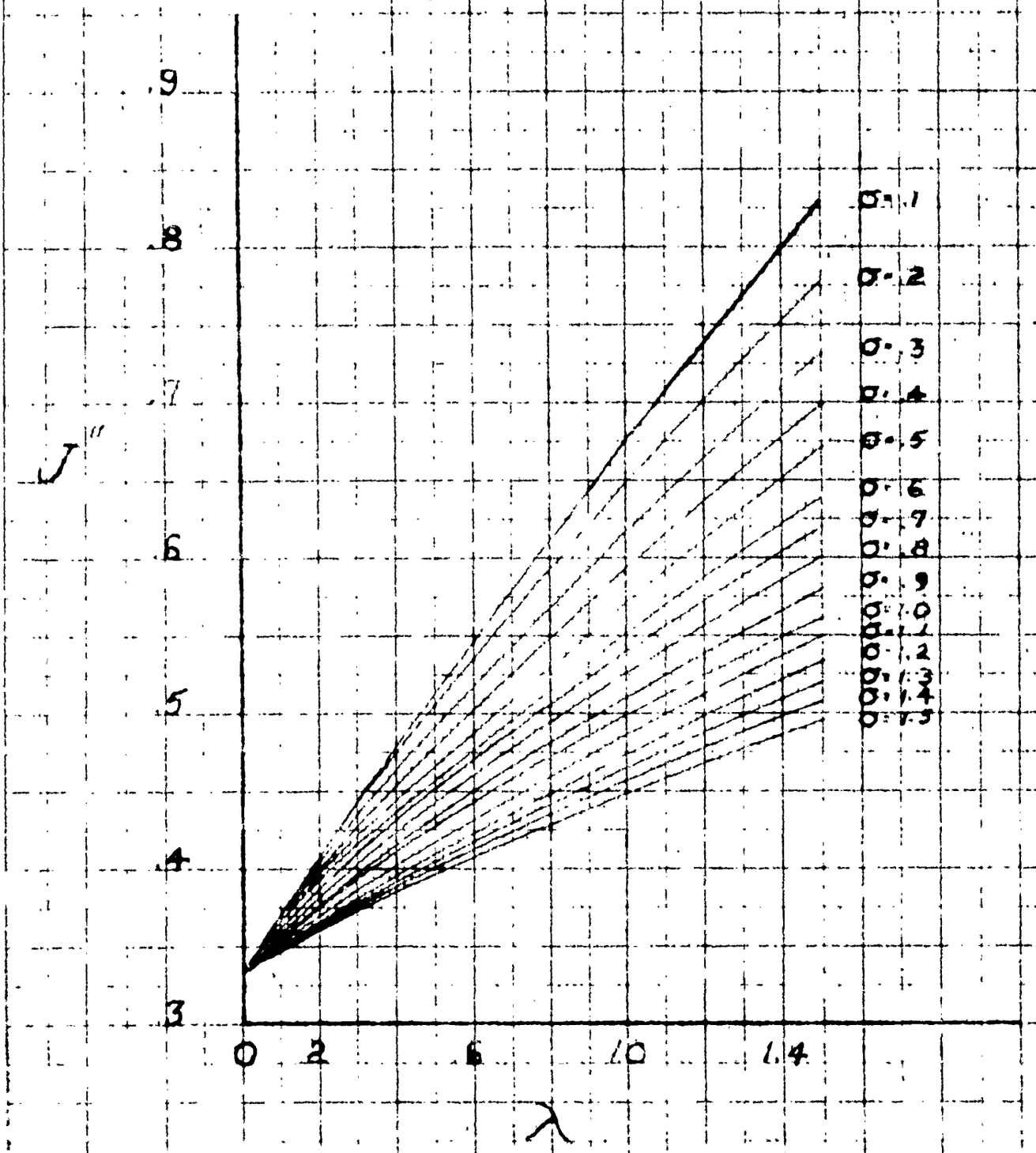

AVERAGE ALLOWABLE STRESS
$f_b = \frac{500 + (1.85 \times 10^{-5})P}{P}$
$P \times 10^3$
100
200
300
$f_b \times 10^3$

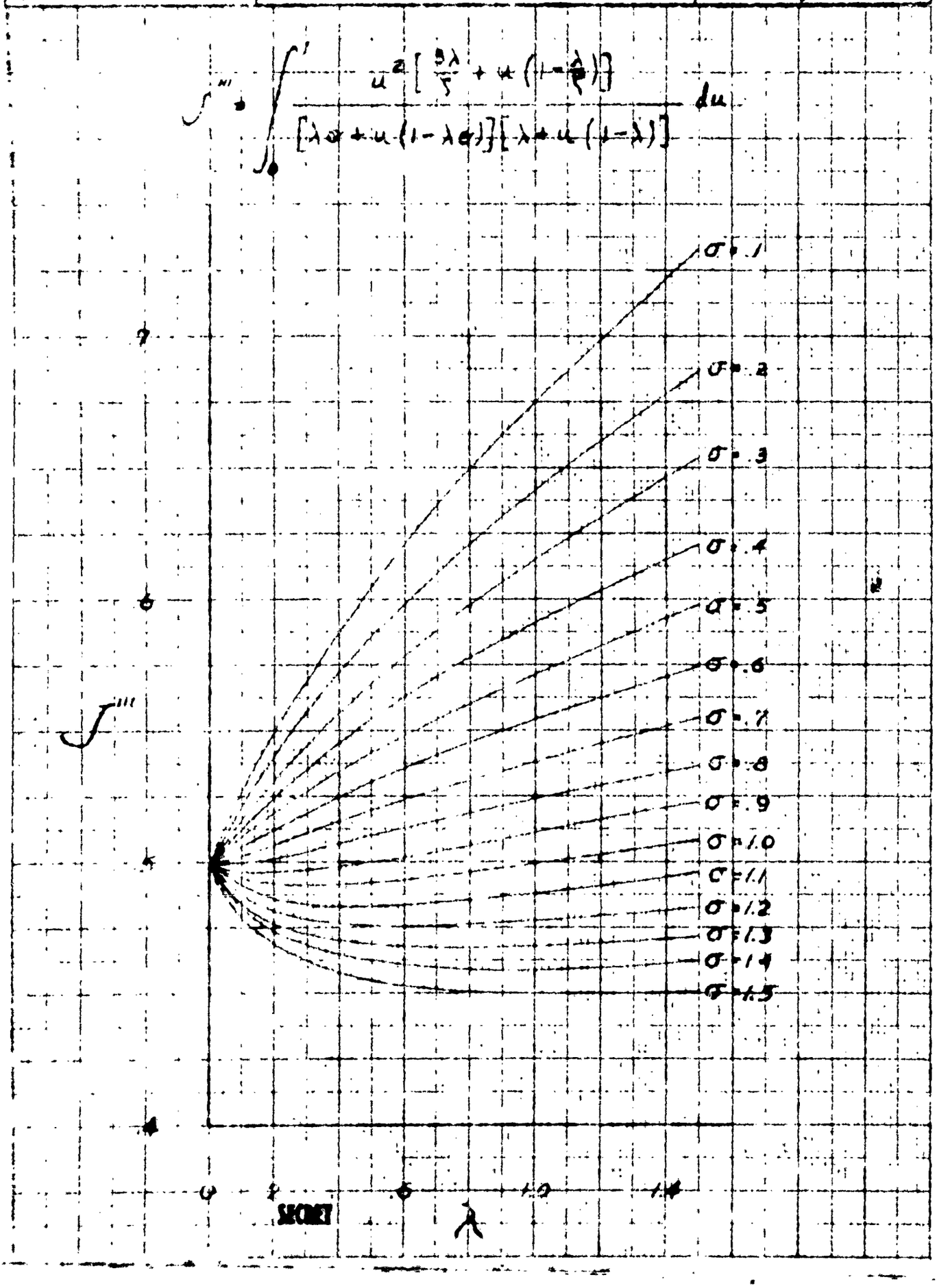

$\zeta = \int_0^1 \frac{[\xi\lambda + u(1-\lambda)]^{u}}{\lambda\sigma + u(1-\lambda\sigma)} du$
$\sigma = .3$
$\sigma = .4$
$\sigma = .5$
$\sigma = .6$
$\sigma = .7$
$\sigma = .8$
$\sigma = .9$
$\sigma = 1.0$
$\sigma = 1.1$
$\sigma = 1.2$
$\sigma = 1.3$
$\sigma = 1.4$
$\sigma = 1.5$
ζ
16
15
14
13
12
11
10
9
8
7
6
5
4
3
0
.2
.6
1.0
1.4
λ

$$J' = \int_0^1 \frac{[3\lambda + u(1-\lambda)]u^2}{[\lambda\sigma + u(1-\lambda\sigma)][\lambda + u(1-\lambda)]}\,du$$



$$J'' = \int_0^1 \frac{u^2\left[\frac{\lambda}{\sigma} + u\left(1 - \frac{\lambda}{\sigma}\right)\right]}{\left[\lambda\sigma + u(1 - \lambda\sigma)\right]}\, du$$




$J''' = \int_0^1 \frac{u^2\left[\frac{3\lambda}{5} + u\left(1-\frac{\lambda}{5}\right)\right]}{\left[\lambda\sigma + u(1-\lambda\sigma)\right]\left[\lambda + u(1-\lambda)\right]}\,du$
J'''
λ
σ = .1
σ = .2
σ = .3
σ = .4
σ = .5
σ = .6
σ = .7
σ = .8
σ = .9
σ = 1.0
σ = 1.1
σ = 1.2
σ = 1.3
σ = 1.4
σ = 1.5

PART X REMARKS SECTION

Introduction - In the body of this substantiation a set of coefficients have been established. The purpose of the coefficients is to provide a relationship between the mathematical model and a set of real airplanes. The reference set differs somewhat from projected aircraft such as the Weapons System 118P. The increments that have been applied to the basic coefficients to compensate for change in requirements and in technology are explained in this section.

1. Additional Landing Gear Provisions (See Table 1 Page 6)
   Additional structure is required to provide adequate load path to the landing gear support structure.

2. Delete Wing Center Section and Attach Provisions (See Table 1 Page 6)
   The wing center section for this airplane is an integral part of the fuselage. Because of the unusually high fuselage width to wing span relationship it was found that the existing fuselage frames could be modified to efficiently provide adequate load path for wing bending moments. Therefore, an increment for the center section is deleted for reallocation to the Fuselage Group.

3. Three Spar Multi-Rib Type Construction (See Table 1 Page 6)
   A relatively low wing loading obtained for this configuration dictates the use of minimum skin gages from a strength standpoint. Since thin skinplates are not efficient in bending it was deemed advisable to provide adequate bending strength through the use of three spar multi-rib type construction. Although torsional rigidity and wing stiffness from a flutter aspect required an increase in skin gage, the three spar multi-rib type construction is the lightest weight internal arrangement for the wing. Reference Report No. NA-56-424.

4. Stressed Access Covers (See Table 1 Page 6)
   In the interest of obtaining the lightest structural weight for this airplane, a deviation from the normal practice of providing as much accessibility to equipment as possible is made. The number of doors permitted for this configuration will be kept to an absolute minimum. In addition, doors that are of the readily removable non-structural type, are to be replaced by the structural load carrying access type door. A weight increment is deleted for minimizing the number of doors and for the inclusion of stressed type access and equipment doors.

5. High Strength Alloys (See Table 1 Page 7)
   In making this estimate, the assumption has been made that super high strength materials will be available and used in structural parts subjected to high stress concentrations, and used wherever weight advantage can be gained.

PART X REMARKS SECTION (CONT'D)

6. Temperature Penalty - Secondary Structure (See Table 1 Page 7)
Stagnation temperatures of approximately 1125° F are expected at the leading edge structures of the wing and empennage. Therefore, an increment is added to account for the drop of material properties at temperature.

7. Full Depth Honeycomb Type Construction (See Table 2 Page 11)
Preliminary studies indicate that the lightest weight internal arrangement for the horizontal and vertical tail is full depth Honeycomb type construction.

8. Temperature Penalty - Primary Structure (See Table 2 Page 11)
Two flight conditions largely instrumental in designing the structural components of this airplane are: A. The subsonic mission (room temperature) at take-off gross weight less 9.6% fuel consumed; and B. The supersonic mission (750° F) at take-off less 43% fuel consumed. Weight estimates were made with loads, temperatures and material properties compatable with the respective missions. Results indicate that major portions of the wing and vertical tail are critical for the subsonic mission, hence no temperature penalty is incurred. The supersonic mission is critical for the horizontal tail and the fuselage. A temperature penalty for the horizontal tail is caused by the drop of material properties due to a turbulent boundary layer temperature of 750 degrees fahrenheit.

9. Temperature Affect For Canopy (See Table 4 Page 19)
A weight increment is added to account for the use of additional glass required due to the expected elevated temperature at the canopy.

10. Fuselage Shape Coefficient (See Table 4, Page 19)
This increment is added to provide increased stiffness in the relatively flat panels of the fuselage.

11. Wing Lift Relief (See Table 5 Page 21)
In the computation of the loads for landing gears designed by this contractor in the past, no wing lift has been considered. Therefore, the basic formula allows no wing lift. In this study wing lift has been introduced. The resulting decrease in loads has allowed the use of lighter struts.

12. Temperature Effect For Tires (See Table 5 Page 21)
A weight increment is added to account for the use of high heat resistant silicone due to the expected elevated temperature in the wheel wells.

13. Reduced Sink Speed (See Table 5 Page 21)
An increment of weight has been removed for a reduction of airplane sink speed from 9 feet per second to 5.5 feet per second.

PART XI SUPPLEMENTAL DATA

The data presented in Part XI of this substantiation is in compliance with Dayton Wire 2202, dated 20 March 1956, requesting the inclusion of additional information. The following is a listing of the required information that is either contained in Part XI or shown in the basic part of this report. Some of the data that is requested by the wire is in reports other than the weight report. In that case, the report numbers have been listed. The data has not been duplicated in this report.

Item 1. Detail Weight Statement
See Pages 10 - 35 of this report

Item 2. Assumed Basic Loads Curves for the Critical Condition

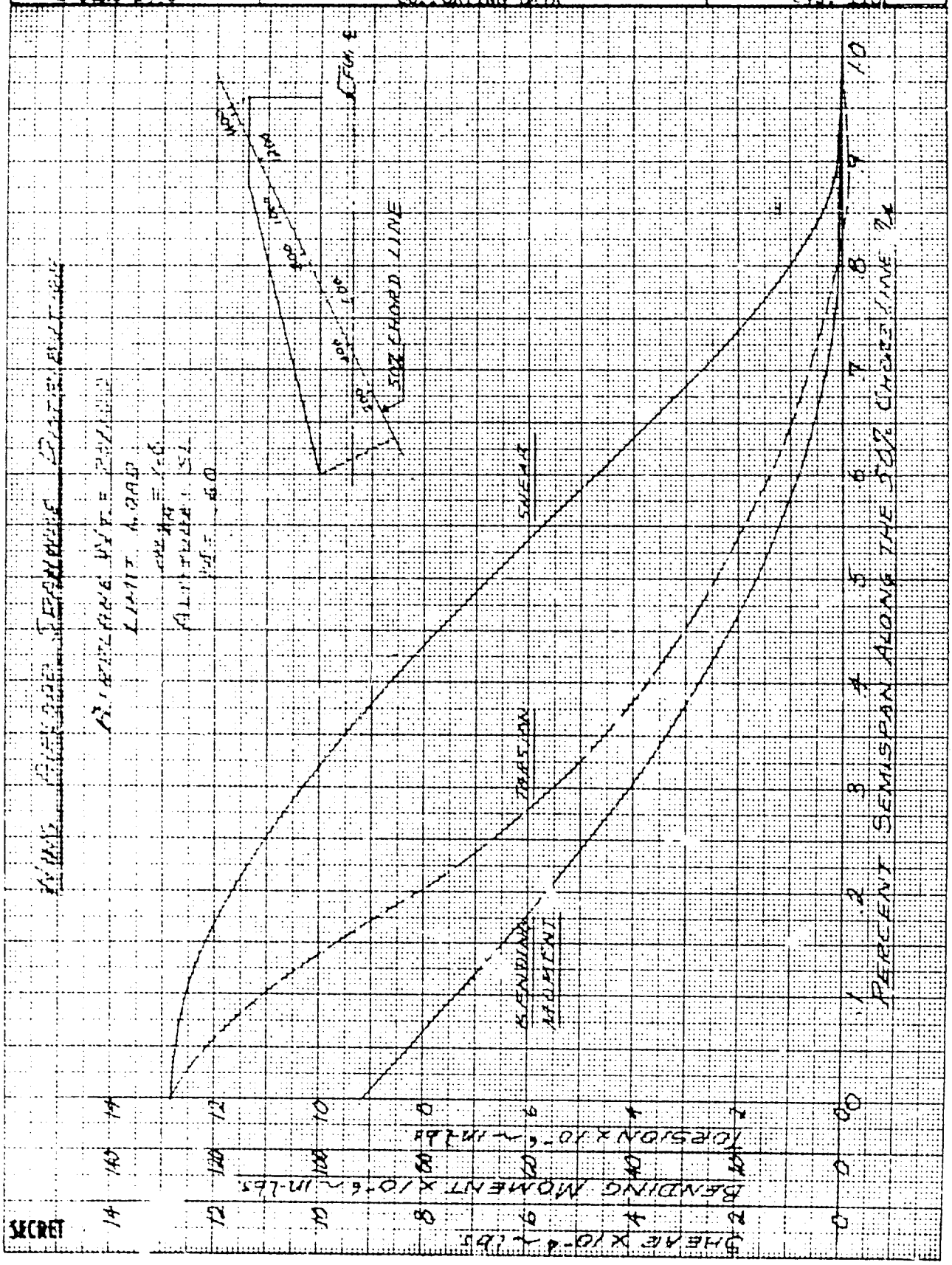
Item 3. Dead Weight Distribution Curves

Item 4. Critical Design Parameters
See Parts I thru VI of this substantiation

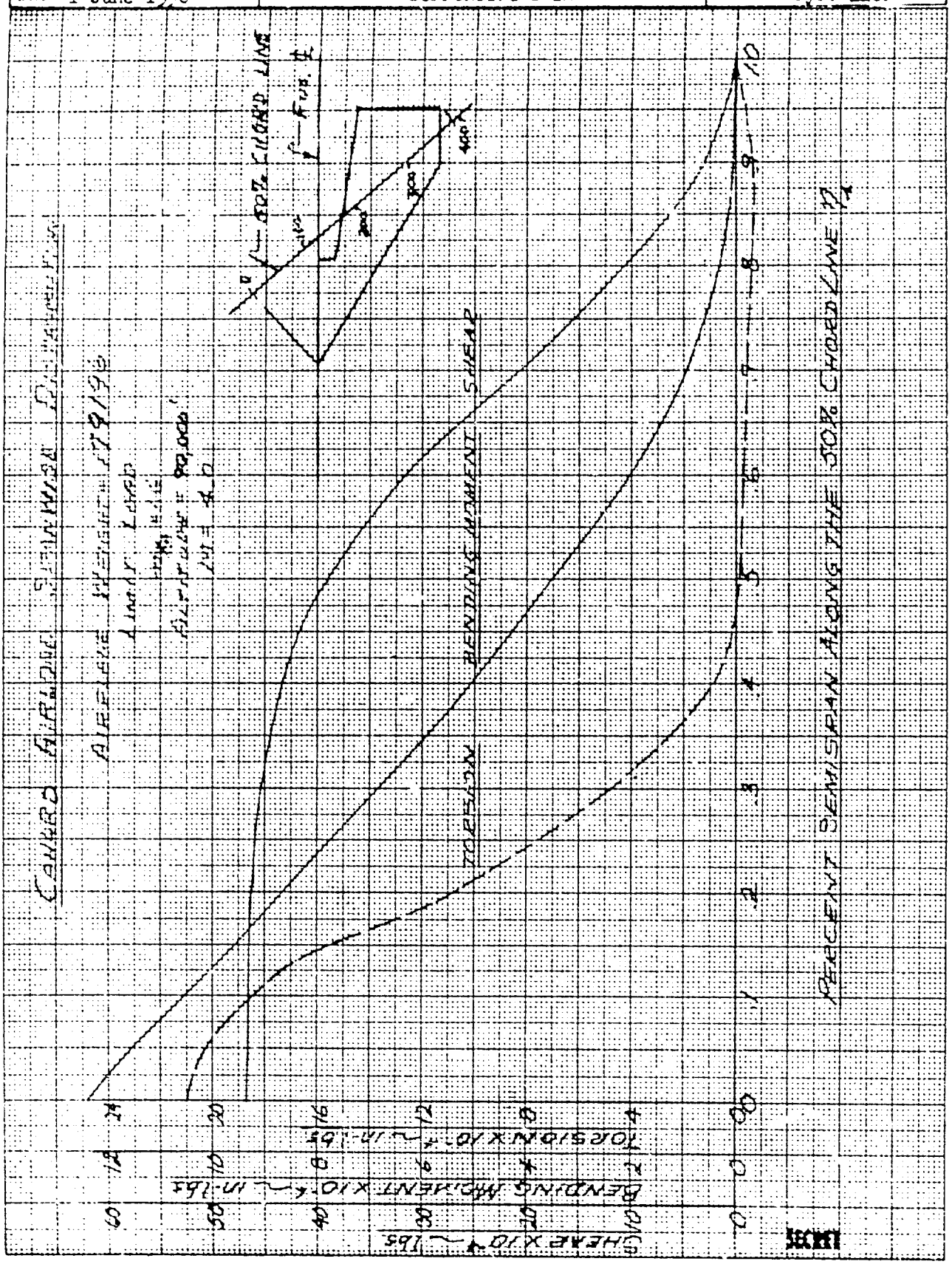
Item 5. Structural Diagram
See Report NA-56-424, Airplane Structure Data for Reconnaissance Weapons System 118P

Item 6. Materials and Material Properties
See Report NA-56-424

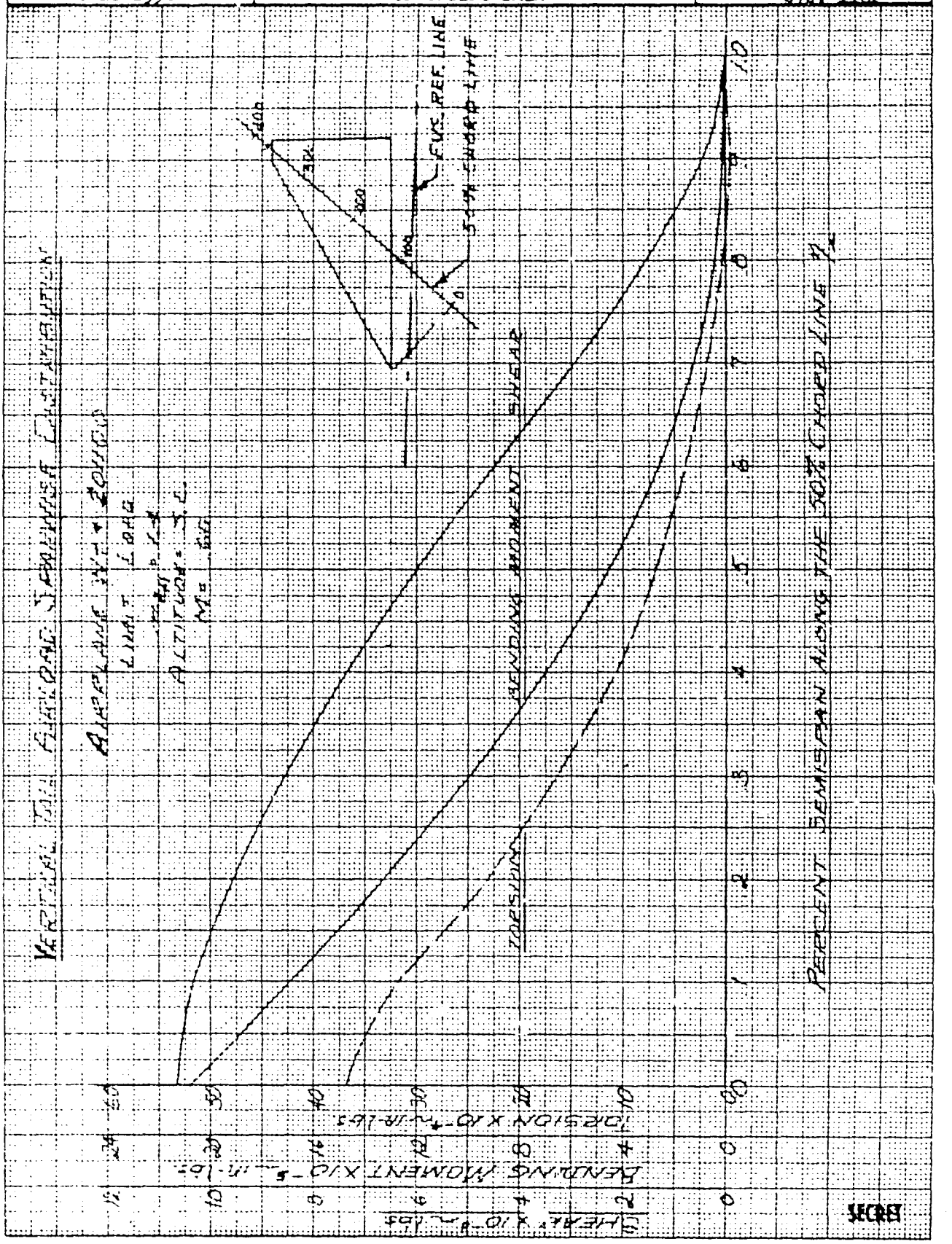
Item 7. An explanation of the Assumed Weight Allocations
See Part X of this substantiation


SHEAR X 10^-4 ~ LBS
BENDING MOMENT X 10^-6 ~ IN-LBS
TORSION X 10^-6 ~ IN-LBS
SCENDIX
INCIDENT
THRUSTON
SWEEP
PERCENT SEMISPAN ALONG THE 50% CHORD LINE
50% CHORD LINE
LIMIT LOAD
SECRET

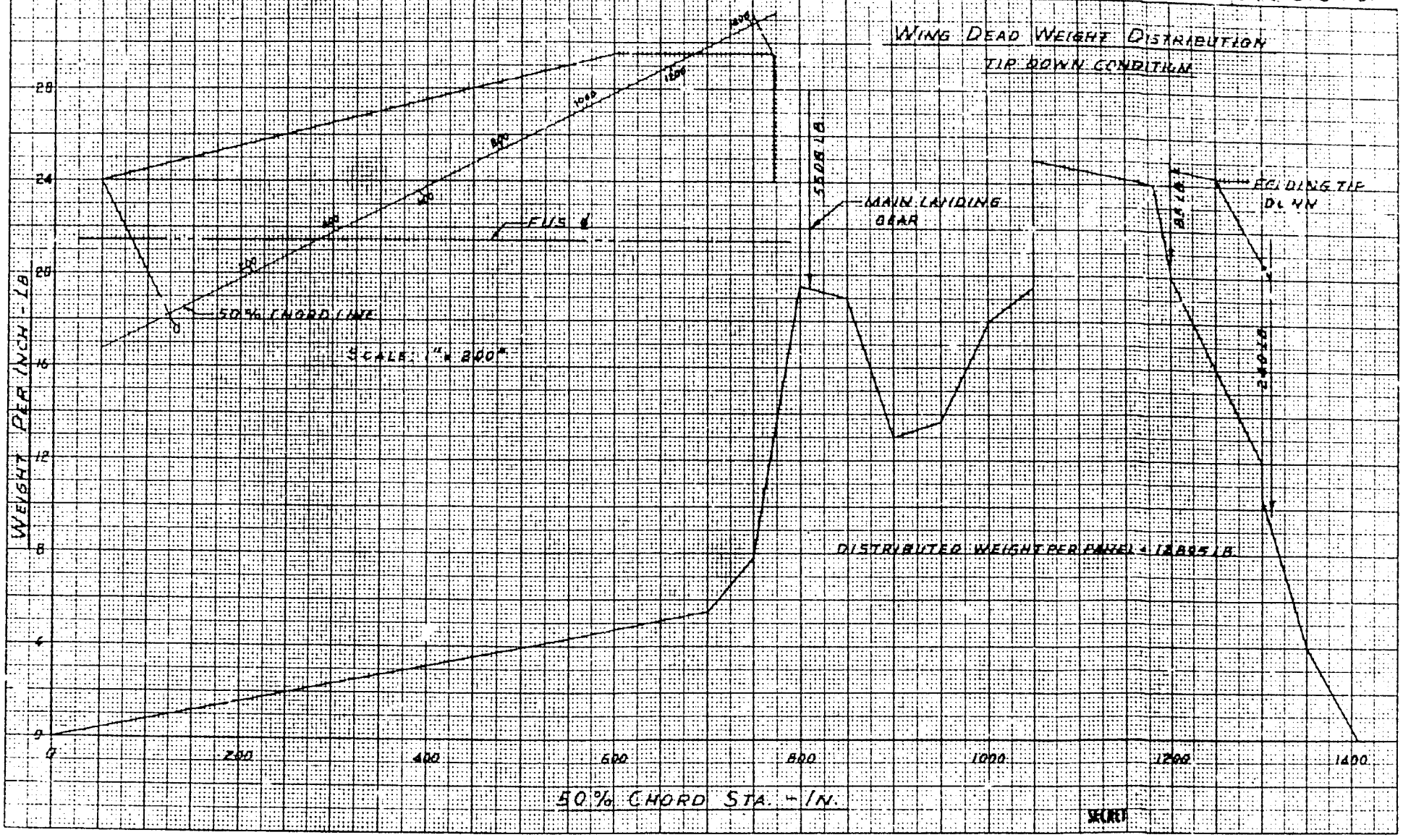
Prepared by: W A M	NORTH AMERICAN AVIATION, INC.	Page 43 of 47
Checked by: S S B	SECRET	Report No. NA-56-450
Date: 1 June 1956	SUPPORTING DATA	Model No. Sys. 118P



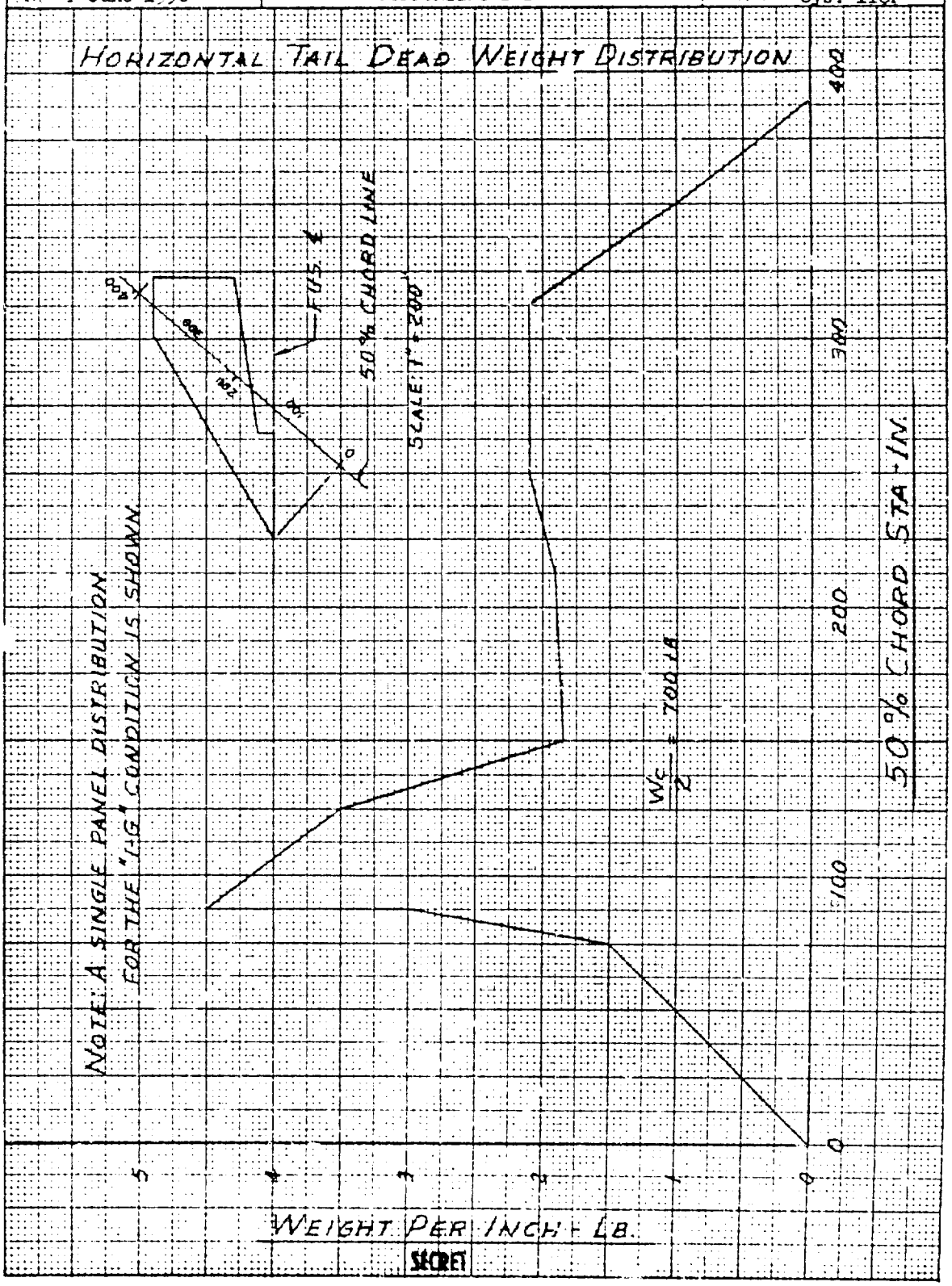
NAM	NORTH AMERICAN AVIATION, INC.	44 47
S B	SECRET	NA-56-450
DATE 1 June 1956	SUPPORTING DATA	MODEL NO. Sys. 118P

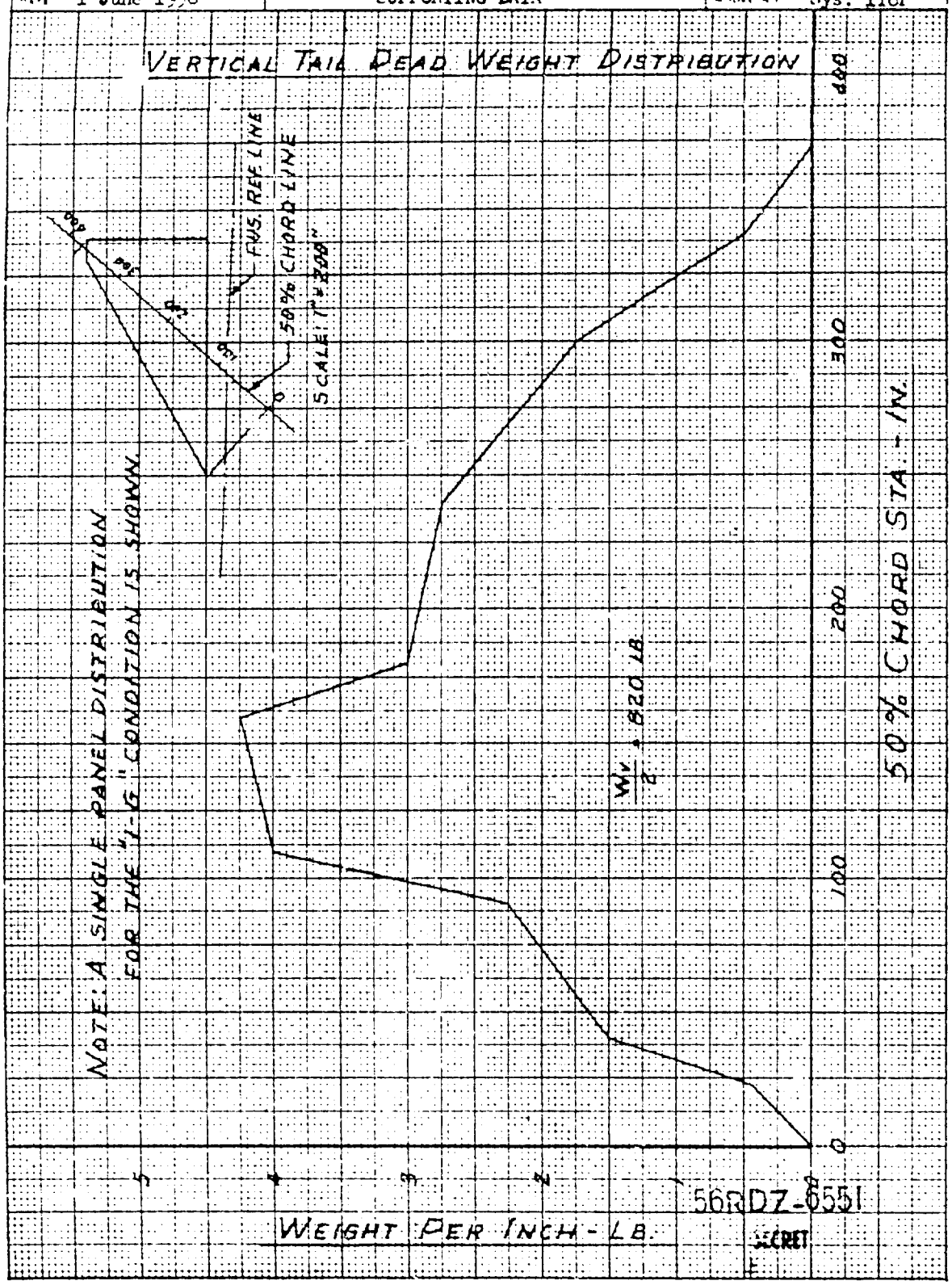


W.A.M.	NORTH AMERICAN AVIATION, INC.	45 47
S.S.B.	SECRET	NA-56-456
1 JUNE 1956	SUPPORTING DATA	SYS 118F



SECRET


HORIZONTAL TAIL DEAD WEIGHT DISTRIBUTION
NOTE: A SINGLE PANEL DISTRIBUTION FOR THE "1-G" CONDITION IS SHOWN
FUS. ℄
50% CHORD LINE
SCALE 1" = 200"
$\frac{W_c}{2}$ = 700 LB
50% CHORD STA - IN.
0
100
200
300
400
WEIGHT PER INCH - LB.
5
4
3
2
1
0


VERTICAL TAIL DEAD WEIGHT DISTRIBUTION
FUS. REF. LINE
50% CHORD LINE
SCALE: 1" = 200"
NOTE: A SINGLE PANEL DISTRIBUTION FOR THE "1-G" CONDITION IS SHOWN.
$\frac{W_V}{2}$ = 820 LB
50% CHORD STA. - IN.
0
100
200
300
400
5
4
3
2
1
WEIGHT PER INCH - LB.

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 88TH AIR BASE WING (AFMC)
WRIGHT-PATTERSON AIR FORCE BASE OHIO

5 February 2008

88 CG/SCCMF
3810 Communications Blvd
Wright-Patterson AFB OH 45433-7802

Defense Technical Information Center
Attn: Ms. Kelly Akers (DTIC-R)
8725 John J. Kingman Rd, Suite 0944
Ft Belvoir VA 22060-6218

Dear Ms. Akers

This concerns Technical Report AD158508, Reconnaissance Weapon System 118P Phase 3 (N.A.A. Designation S.O. 2432) 1 Jun 1956.

Subsequent to WPAFB Freedom of Information Act (FOIA) Control Number 06-652LK, the distribution statement: "*Distribution authorized to DoD only; Administrative/Operational Use; JUN 1956. Other requests shall be referred to Department of the Air Force, Attn: Public Affairs Office, Washington, DC 20330.*" **is no longer applicable**.

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Point of contact is Lynn Kane at (937) 522-3091.

Sincerely

SHEREE COON
Freedom of Information Act Manager
Management Services Branch
Base Information Management Division

Attachments
1. FOIA Request
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3. Full Citation
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