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Subject:

Tech Report #AD158508

Title:

Reconnaissance Weapon System 118P Phase 3 (N.A.A. Designation S.O. 2432) dated 1 JUN 1956

FOIA Control Number: 06-652 LK

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RECONNAISSANCE WEAPON SYSTEM 118P PHASE 3 (N.A.A. DESIGNATION S.O. 2432)

NORTH AMERICAN AVIATION INC LOS ANGELES CA

01 JUN 1956

AD NUMBER

AD158508

CLASSIFICATION CHANGES

TO

unclassified

FROM

confidential

AUTHORITY

30 Jun 1968, DoDD 5200.9

AD NUMBER
AD158508
CLASSIFICATION CHANGES
TO confidential
FROM secret
AUTHORITY
30 Jun 1959, DoDD 5200.9

UNCLASSIFIED

Serial No. 2

File No. _____ Report No. NA-56-450

NORTH AMERICAN AVIATION, INC.

INTERNATIONAL AIRPORT
LOS ANGELES 45, CALIFORNIA

ENGINEERING DEPARTMENT

AV 15850

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)

PREPARED BY
STRUCTURES SECTION
W. A. Martin
SUPERVISOR - WEIGHT ESTIMATING

APPROVED BY

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G. V. Johnson
Group Leader - Weight Control

F. L. Schleicher
F. L. Schleicher
Chief Structures Engineer

Total Pages 51
Appendix I - 47 Pages

REVISIONS

Date 1 June 1956

DATE	Rev No.	PAGES AFFECTED	REMARKS
MAY 21 1958			

58AA 6066

[redacted] 56RDZ-6551

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 Sideleoking 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.

PREPARED BY J W C | NORTH AMERICAN AVIATION, INC. | PAGE NO 3 OF 51

CHECKED BY W H L | [redacted] | REPORT NO. NA-56-450

DATE 1 June 1956 | SUMMARY | MODEL NO Sys. 118P

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

[redacted]

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.		

[redacted]

CHECKED
NAME J W C
DATE 1 June 1956

GROUP WEIGHT STATEMENT
WEIGHT EMPTY

MODEL Syn. 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				630	
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

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

GROUP WEIGHT STATEMENT
WEIGHT EMPTY

PAGE 6 of 51
MODEL Sys. 118P
REPORT NA-56-450

		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

[redacted] UNCLASSIFIED

AN-910 3-D
NAME J W C
DATE 1 June 1956

GROUP WEIGHT STATEMENT
USEFUL LOAD & GROSS WEIGHT

PAGE 7 of 51
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.

[redacted]

UNCLASSIFIED

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

GROUP WEIGHT STATEMENT
USEFUL LOAD & GROSS WEIGHT
[redacted]

				RADAR MAPPING MISSION			
1 2	LOAD CONDITION ALTERNATE			DOPPLER RADAR	AZIMUTH RADAR	SEARCH PHOTO MISSION	FERRET MISSION
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.

[redacted]
UNCLASSIFIED

-910 3-0
ME J W C
TE 1 June 1956

GROUP WEIGHT STATEMENT
DIMENSIONAL & STRUCTURAL DATA

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	[redacted] 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.)	Gross Weight	Ult. L.F.
FLIGHT	-	201100	2.0
LANDING		160287	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.
ø Wing Data on Exposed Area
***Parallel to ℄ airplane.
****Total usable capacity.

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	~~MATR-2040~~ Scaled 103.1%	
	NO.	4	
PROPELLER	MANUFACTURED BY		
	DESIGN NO.		
	NO.		

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

WING GROUP
BASIC STRUCTURE

	CODE NO.	Center Section	Interm. Panel	Outer Panel	Folding Tip	
UPPER - SPAR CAP - FRONT						
- INTERMEDIATE						
- REAR						
- AUXILIARY						
- INTERSPAR COVERING						
SPANWISE STIFFENERS						
- JOINTS, SPLICES & FASTENERS						
LOWER - SPAR CAP - FRONT						
- INTERMEDIATE						
- REAR						
- AUXILIARY						
- INTERSPAR COVERING						
SPANWISE STIFFENERS						
- JOINTS, SPLICES & FASTENERS						
SPAR WEB & STIFFENERS - FRONT						
- INTERMEDIATE						
- REAR						
- AUXILIARY						
- JOINTS, SPLICES & FASTENERS						
INTERSPAR - RIBS						
- BULKHEADS						
- CHORDWISE STIFFENERS						
LEADING EDGE - COVERING						
- STIFFENERS						
- RIBS						
- AUXILIARY SPARS						
- JOINTS, SPLICES & FASTENERS						
TRAILING EDGE - COVERING						
- STIFFENERS						
- RIBS						
- AUXILIARY SPARS						
- JOINTS, SPLICES & FASTENERS						
TIPS						
FIREWALL (STRUCTURAL)						
TOTALS - BASIC STRUCTURE				21733	650	
TOTAL (TO BE BROUGHT FORWARD)						22383

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

WING GROUP
CONTROL SURFACES

PAGE 12 of 51
MODEL Sys. 118P
REPORT NA-56-450

	CODE NO.	Aileron Inb'd	Aileron Outb'd	T.E. Flaps Inb'd	T.E. Flaps Outb'd	L.E. Flaps or Slats Inb'd	L.E. Flaps or Slats Outb'd	Spoilers	Speed Brakes	
5	SPARS									
9	RIBS									
12	COVERING & STIFFENERS									
15	T.E. STRIPS									
17	FABRIC & DOPE									
21	TABS									
25	TORQUE TUBES									
29	BALANCE WEIGHTS & SUPPORTS									
31	AERO. SEAL									
34	CONTROL HORNS									
37	ACCESS DOORS (NON STRUCT.)									
39	HINGES & PINS									
40	EXTERIOR FINISH									
41	TOTALS - SURFACE									
43	CONTROL SURFACE SUPPORTS									
44	HINGES									
45	BRACKETS									
46	TRACKS									
47	CARRIAGES									
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

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

[redacted]

TAIL GROUP
BASIC STRUCTURE

MODEL Sys. 118?
REPORT NA-56-450

		Control [redacted]		Fins - Vertical [redacted]			
	CODE NO.	C.S.F.	O.P.	Center	Outer	Dorsal	
UPPER - SPAR CAP - FRONT							
- INTERMEDIATE							
- REAR							
- AUXILIARY							
- INTERSPAR COVERING							
SPANWISE STIFFENERS							
- JOINTS, SPLICES & FASTENERS							
LOWER - SPAR CAP - FRONT							
- INTERMEDIATE							
- REAR							
- AUXILIARY							
- INTERSPAR COVERING							
SPANWISE STIFFENERS							
- JOINTS SPLICES & FASTENERS							
SPAR WEB & STIFFENERS - FRONT							
- INTERMEDIATE							
- REAR							
- AUXILIARY							
- JOINTS, SPLICES & FASTENERS							
INTERSPAR - RIBS							
- BULKHEADS							
- CHORDWISE STIFFENERS							
LEADING EDGE - COVERING							
- STIFFENERS							
- RIBS							
- AUXILIARY SPARS							
- JOINTS, SPLICES & FASTENERS							
TRAILING EDGE - COVERING							
- STIFFENERS							
- RIBS							
- AUXILIARY SPARS							
- JOINTS, SPLICES & FASTENERS							
TIPS							
TOTALS							
TOTALS - BASIC STRUCTURE		1400			1640		
TOTAL ([redacted]							3040

[redacted]

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

BODY GROUP
BASIC STRUCTURE

PAGE 14 of 53
MODEL Syd. 119F
REPORT NA-56-450

		Fuselage [redacted]	Booms
1			
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.

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

BODY GROUP
SECONDARY STRUCTURE

PAGE 15 of 51
MODEL Sys. 11HF
REPORT NA-56-450

		Fuselage or Hull				Booms	Speed Brakes
CODE NO.							
SECTION							
ENCLOSURES (EXCLUDING TURRET ENCLOSURES)	750						
CANOPY							
CANOPY-OPERATING MECHANISM							
-RAILS							
-CYLINDERS, PLUMBING, FLUID							
GUNNER - TAIL							
BOMBARDIER							
SIGHTING BLISTERS							
WINDSHIELD (EXCLUDING BULLET PROTECTION)	200						
WINDOWS & PORTS INCL. FRAMES							
FLOORING & SUPPORTS (SECONDARY STRUCTURE)							
STAIRWAYS & LADDERS (FIXED)							
STERNPOST & FITTINGS							
NOSE BUMPER (HULL)							
RUBBING STRIPS							
TAIL CONE							
SPEED BRAKES - STRUCTURE							
- SUPPORTS							
TOTALS	950						
TOTALS - SECONDARY STRUCTURE			950				
TOTAL (TO BE BROUGHT FORWARD)							950

* From main distributing point to actuating unit.

AN-5102-D
NAME T A M
DATE 1 June 1956

BODY GROUP
SECONDARY STRUCTURE
(DOORS, PANELS & MISCELLANEOUS) [redacted]

MODEL Sys. 111P
REPORT NA-56-450

	Location*	Type Power	Area Sq. Ft.	Structure	Operating Mechanism: Mechanism & Controls	Power Trans.	Actuator	Lock Mech.	Emerg.
CODE NO.									
DOORS & FRAMES							3		
- LANDING									
[redacted] MAIN				1250					
NOSE				90					
- BOMB									
- GUN									
- AMMUNITION									
- ROCKET									
- LIFE RAFT									
- ESCAPE									
- WATER TIGHT									
- COMPARTMENT									
- ENTRANCE									
- ACCESS				100					
- ENGINE				450					
- CAMERA									
PANELS - (NON STRUCTURAL)									
WALKWAYS, STEPS, GRIPS									
MISCELLANEOUS				260					
FAIRING & FILLETS									
EXTERIOR FINISH									
TOTALS				2150					
TOTAL - SECONDARY STRUCTURE (DOORS, PANELS, MISC.)					2150				
TOTALS FROM PGS. 8 & 9									27726
TOTAL - BODY GROUP									29876

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

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

AN-9 102-D
NAME T A M
DATE June 1956

ALIGHTING GEAR GROUP

[redacted]

PAGE 17 of 51
MODEL Sys. 118P
REPORT TM-56-450

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	Hook							
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. [redacted]

**Ft. lbs./brake

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

ALIGHTING GEAR GROUP
CONTROLS

	**LOCATION	MAIN			NOSE							
		Actuator	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 or actuating unit.

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

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

SURFACE CONTROLS GROUP
COCKPIT & AUTOPILOT

		Cockpit Controls	Autopilot
	[redacted]		
	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		
*48	PLUMBING & FLUID		
*49	ELECTRIC PANELS, BOXES, SWITCHES, RELAYS, WIRING		
50	PULLEYS, SPROCKETS, CHAINS, CABLES		
56	TOTALS - COCKPIT CONTROLS & AUTOPILOT	22	
57	TOTAL (TO BE BROUGHT FORWARD)		22

*From main distribution point to actuating units.

[redacted]

AN-9102-D
NAME J W C
DATE 1 June 1956

SURFACE CONTROLS GROUP
SYSTEM CONTROLS

MODEL Sys. 118P
REPORT NA-56-450

	CODE NO.	All.	Canard [redacted]	Rud.	Wing Sweep	Wing Invid.	L.E. Flaps or Slats	T.E. Flaps	Spoilers	Speed Brakes	Stab. Adj.	Wing Tip Fold
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								3			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			380
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.

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

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

SURFACE CONTROL GROUP
[redacted] *POWER CONTROLS

	No.	Model	Capacity	Code No.	Hydraulic [redacted]	Hydraulic [redacted]	Utility	Pneumatic Emergency
PUMPS & COMPRESSORS	(4)				244			
REMOTE PUMP DRIVES								
RESERVOIRS	2		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

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

ENGINE SECTION [redacted]

PAGE 22 of 51
MODEL Sym. 118F
REPORT NA-56-450

		Inboard	Center	Outboard	
	CODE NO.				
	ENGINE MOUNT				
	SUPPORT BAY				
	VIBRATION ABSORPTION DEVICES				
	NACELLE STRUCTURE				
	BULKHEADS AND FRAMES				
	COVERING & STIFFENERS				
	FITTINGS				
	LONGERONS				
	ATTACHING ANGLES, ETC.				
	PYLONS & STRUTS				
*23	FIREWALL				
	SHROUDS FOR FIRE PROTECTION				
	COWLING				
	ENGINE COWL				
	BAFFLES				
	ACCESSORY COWL OR SKIRT				
	COWL FLAPS				
	COWL FLAP CONTROLS & OPERATING MECH.				
	FAIRING - NACELLE TO WING OR PYLON				
	STEPS & GRIPS				
	WORKING PLATFORM (BUILT IN)				
	INTERNAL WALKWAYS				
	INSTALLATION HARDWARE				
	TOTALS - SECTIONS OR NACELLES				
	TOTAL [redacted] ENGINE SECTION				306

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

SHEET 2 D M
DATE 1 June 1956

PROPULSION GROUP

PAGE
MODEL GAE. 11
REPORT NA-56-456

		CODE NO.	Auxiliary	Main
1				
2				
3	ENGINE INSTALLATION (4) HATR 2010 (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			380
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 [redacted]			11500
22	INTAKE DOORS [redacted], RAMPS			7945
23	[redacted] 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)	[redacted]		42970

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

PROPULSION GROUP
LUBRICATING & FUEL SYSTEMS

PAGE 24 of 51
MODEL Sya. 118P
REPORT NA-56-450

						Auxiliary		Main	
						Lubricating	Fuel	Lubricating	Fuel
					CODE NO.				
TANKS	Type	Location	No.	Vol. Ea. (Gals.)					(686@)
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					1353
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									581
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	

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

PROPULSION GROUP [redacted]

		CODE NO.	Auxiliary	Main
3	WATER INJECTION SYSTEM			
4	TANKS (NO.) (GAL/TANK)			
5	PUMP			
6	METERING UNIT			
7	VALVES & PLUMBING			
8	CONTROLS			
11	ENGINE CONTROLS			300
12	IGNITION			
13	THROTTLE			300
14	MIXTURE			
15	SUPERCHARGER (SUP. INTEG. WITH ENG.)			
16	AFTERBURNER			
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			
32	PROPELLER INSTALLATION (DIA.) (NO.)			
33	PROPELLER			
34	CUFFS			
35	SPINNER			
36	CONTROLS	Type	*Aux.	*Main
37	SPEED			
38	PITCH			
39	FEATHERING			
40	REVERSING			
47	OIL (GALS)			
48	TANK & PLUMBING			
55	TOTALS			300
56	TOTALS FROM PGS. 17 & 18			55725
57	TOTAL - PROPULSION GROUP			56025

*GTP Weight

**When separate oil system used.

[redacted]

* FUNCTIONAL GROUPS & ITEMS	CODE NO.	Number	Indicator	Transmitter & Amplifier	Installation	Total
FLIGHT INSTRUMENTS						
FLIGHT DISPLAY GROUP						
SPEED SITUATION		1	5		2	7
ATTITUDE DISPLAY		1	7		2	9
HEADING DISPLAY		1	12		4	16
VERTICAL SITUATION		1	5		2	7
ACCELEROMETER		1	2			2
CLOCK		1	1			1
CABIN ALTITUDE		1	1			1
PITOT SYSTEM				2	38	40
AIR DATA COMPUTER SYSTEM				15	5	20
WIRING AND MISCELLANEOUS					11	11
ENGINE INSTRUMENTS						
INTEGRATED ENGINE DISPLAYS		4	20	50	55	125
FUEL QUANTITY GUAGES		1	2	170	40	212
FUEL FLOWMETER		1	3	30	20	53
HYDRAULIC PRESSURE GAUGES		2	4	6	10	20
WIRING AND MISCELLANEOUS						40
					3	
INSTRUMENT POWER SYSTEM (TYPE						
TOTAL - INSTRUMENTS [redacted]						564

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

UNCLASSIFIED

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

*HYDRAULIC [redacted] GROUP

PAGE 27 of [illegible]
MODEL Jys. 11.1
REPORT NA-56-450

	CODE NO.	Model	Hydraulic Utility	Hydraulic Emergency	Fuel Pump Power	Pneumatic Utility	Pneumatic Emergency	
PUMPS & COMPRESSORS								
6			510					
4					244			
REMOTE PUMP DRIVES								
	No.	Model	Capacity					
RESERVOIRS	2		20 Gals	80				
RESERVOIRS	2		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

[redacted] UNCLASSIFIED

AN-9102-D
NAME J W C
DATE 1 June 1956

*ELECTRICAL GROUP [redacted]

		Driven By	KVA	CODE NO. Amp.	No.	AC		DC	
1									
2									
3									
4	POWER SUPPLY EQUIPMENT						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						700		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. [redacted]

AN-9102-D
NAME J W C
DATE 1 June 1956

ELECTRONICS GROUP

PAGE 29 of 51
MODEL Sys. 118P
REPORT NA-56-450

1 / 2 *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		9
16 ASC	AUTOMATIC FLIGHT AND STABILIZATION SYSTEM			155	135
18	AUTO-NAVIGATOR			44	81
20	STANDBY PLATFORM			25	15
22	CONTROL AND DISPLAYS		15		5
24	RECOMM. PACKAGE PROVISIONS				250
47 ELECTRONIC INSTALLATION					
48 TABLES					
49 RACK, SHELVES & SUPPORTS					80
50 LOCKERS					
55 SUBTOTALS - EQUIPMENT GFP & CFE			229	596	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.

[redacted] 25

AN-9102-D
NAME J W C
DATE 1 June 1956

FURNISHINGS & EQUIPMENT GROUP
ACCOMMODATIONS FOR PERSONNEL

PAGE 30 of 53
MODEL Syst. 1107
REPORT NA-56-430

	CODE NO.								
CREW SEATS & PASSENGER CHAIRS									
Location	No.	Cushions	Seat	Safety Belt	Harness & Inertia Reel	Adj. Mech.	Catapult or Eject. Mech.	Tracks & Supports	
PILOT	1								150
ASST. PILOT									
HEAD REST (IF NOT INTEGRAL WITH SEAT)									
BUNKS (NO.) & SUPPORTS									
PERISCOPE INSTALLATION									125
LITTER SUPPORTS									
BOMBERS & GUNNERS KNEELING PADS (NO.)									
PARACHUTE STOWAGE PROVISIONS									
TOILETS & RELIEF TUBES									4
WASH BASIN & SHOWERS									
WATER TANKS & PIPING									
DRINKING WATER CONTAINERS & SUPPORTS									
LOCKERS FOR - FOOD									
- PERSONAL EFFECTS									
GALLEY STOVES & HOTPLATES									
REFRIGERATOR									
ANTI-G SUIT PROVISIONS									
OXYGEN INSTALLATION									(45)
*BOTTLES - INCL. CHARGE (TYPE) (SIZE) (NO.)									
CONVERTOR & LIQUID OXYGEN (SIZE 5 LITER) (NO. 1)									27
*REGULATORS (TYPE) (NO.)									
SUPPORTS - BOTTLES & REGULATORS									2
PLUMBING, ETC.									18
TOTAL - ACCOMMODATIONS FOR PERSONNEL (TO BE BROUGHT FORWARD)									324

*If not specified as useful load or special equipment.

[redacted]-9202-D
AME: J W C
ATE: 1 June 1956

FURNISHINGS & EQUIPMENT GROUP
MISC. EQUIPMENT & FURNISHINGS

	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

[redacted] Items specified as special equipment.

AN-9102-D
NAME J W C
DATE 1 June 1956

FURNISHINGS & EQUIPMENT GROUP
EMERGENCY EQUIPMENT

	CODE NO.	Compartments: Engine	Baggage	Fuel				
FIRE EXTINGUISHERS								
BOTTLES	Type	DRY						
	Size	50 FOR 7	AGENT EA					
	No.	2						
	Weight	150						
CONTROLS		40						
PLUMBING		185						
BOTTLE SUPPORTS		20						
TOTAL - COMPT.		395						395
PORTABLE (TYPE) (SIZE) (NO.)								
PORTABLE EXTINGUISHER SUPPORTS								
FIRE DETECTION SYSTEM								70
FIRE RESISTANT PAINT								
FIRE CURTAINS								
FIRST AID KITS (NO.) & STOWAGE								
FLASHLIGHTS (NO.)								
STOWAGE - EMERGENCY RATIONS & WATER								
*LIFE RAFTS - (TYPE) (NO.)								
- SUPPORTS OR CRADLES								
DITCHING STATION EQUIPMENT								
TOTAL - EMERGENCY EQUIPMENT								465
TOTALS FROM PGS. 28 & 29								776
TOTAL - FURNISHINGS & EQUIPMENT GROUP								1241

*If not specified as useful load or special equipment.

N-91602-D
AMF J W C
ATE 1 June 1956

AIR CONDITIONING & ANTI-ICING EQUIPMENT GROUP
AIR CONDITIONING [redacted] Cooling and

MODEL Sye. 11BP
REPORT NA-56-450

	CODE NO.	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 & [redacted]		250					
TOTALS							
TOTAL - AIR CONDITIONING (TO BE BROUGHT FORWARD)							2080

*Item specified as special equipment.

AR-9 102-D
NAME J W C
DATE 1 June 1956

AIR CONDITIONING & ANTI-ICING EQUIPMENT GROUP
ANTI-ICING

	CODE NO.	No.	BTU Capacity	Wing	Tail	Air Induction	Propeller	Canopy & Windshield	Fuel System	
* HEATERS										
* HEAT EXCHANGERS (NO.)						25				
BLOWER						30				
DUCTING						50		85		
SHROUDING										
* BOOTS										
* ATTACHING STRIPS										
OIL SEPARATORS										
AIR PUMPS										
AIR LINES & HOSES										
TANKS										
* FLUID (GALS.)										
PLUMBING										
DISTRIBUTOR - VALVE										
- CONTROLS										
CONTROLS - MANUAL										
- ELECTRICAL						5		5		
- HYDRAULIC										
- PNEUMATIC						6		6		
** WIRING, SWITCHES, RELAYS										
SUPPORTS & BRACKETS - WING										
- TAIL										
- BODY										
- NACELLE										
TOTALS						116		96		212
TOTAL - ANTI-ICING										212
TOTAL FROM PG. 31										2880
TOTAL - AIR CONDITIONING & ANTI ICING EQUIPMENT GROUP										3092

*If not specified on special equipment.

**From main distribution point to actuating unit.

AN-9102 D
NAME J W C
DATE 1 June 1956

AUXILIARY GEAR GROUP

PAGE 35 of 51
MODEL Sys. 118P
REPORT NA-56-450

	CODE NO.	Handling	Arrest.	Catapult	ATO
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 [redacted] 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.

[redacted]

PREPARED BY: T A M	NORTH AMERICAN AVIATION, INC.	PAGE NO. 36 OF 51
CHECKED BY: J H W	[redacted]	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
[redacted]					

PREPARED BY: T A M	NORTH AMERICAN AVIATION, INC.	PAGE NO. 37 OF 51
CHECKED BY: J H W	[redacted]	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 [redacted]	74367		113659976		12594323

PREPARED BY: D D M	NORTH AMERICAN AVIATION, INC. [redacted]	PAGE NO 38 OF 51
CHECKED BY: T M E		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
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
	[redacted]				

PREPARED BY: J W C	NORTH AMERICAN AVIATION, INC.	PAGE NO. 39 OF 51
CHECKED BY: W H L	[redacted]	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
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

[redacted]

PREPARED BY: J W C	NORTH AMERICAN AVIATION, INC.	PAGE NO. 40 OF 51
CHECKED BY: W H L	[redacted]	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
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				
AN/ART-27 Crash Locator Beacon	69				
Automatic Flight and Stability Control	290				
Auto Navigator	495				
Standby Platform	40				
Controls and Displays	20				
Shelves and Supports	80				
Reconnaissance Provisions	250				
		The average arms for the Electronics Group have been assumed for the total installation.			
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					
Pressurizing and Cooling System	(2880)	1190	(3427200)	220	(633600)
Heat Exchangers	250				
Helium System	850				
Scoops & Ducts	1450				
Controls	80				
Sealing & Test Provisions	250				

PREPARED BY: J W C	NORTH AMERICAN AVIATION, INC.	PAGE NO. 41 OF 51
CHECKED BY: W H L	[redacted]	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
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. = $\frac{1572.89}{1335.81}$ - 834.19 = 55.3% M.A.C.

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

[redacted]

PREPARED BY: D D M	NORTH AMERICAN AVIATION, INC.	PAGE NO. 42 OF 51
CHECKED BY: T M E	[redacted]	REPORT NO. NA-56-450
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)		(197965)
Structure	660	473	312180	175	115500
Cameras and Stab. Mounts	700	487	340900	220	154000
System Controls	348	418	145464	215	74820
Wire and Prov.	215	450	96750	215	46225
Shelves and Supports	35	450	15750	212	7420
Trapped Fuel 320 Gallons	187	1321	247087	167	31229
Trapped Oil 8 Gallons	60	1990	119400	214	12840
Total - Non-Expendable Items	2475		1351181		500894
Expendable Items					
Fuel (101330 Gallons)	(59278)		(7[illegible])		(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, 21800 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		8123284[illegible]		12969983
TOTAL - USEFUL LOAD	63958		8258402[illegible]		13470877

[redacted]

PREPARED BY: T A M	NORTH AMERICAN AVIATION, INC. [redacted]	PAGE NO. 43 OF 51
CHECKED BY: J H W		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

[redacted]

UNCLASSIFIED

PREPARED BY: J W C	NORTH AMERICAN AVIATION, INC.	PAGE NO. 44 OF 51
CHECKED BY: W H L	[redacted]	REPORT NO. NA-56-450
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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PREPARED BY: J W C	NORTH AMERICAN AVIATION, INC.	PAGE NO. 45 OF 51
CHECKED BY: W H L	ALTERNATE I-A	REPORT NO. NA-56-450
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		+ 983603
TAKE-OFF GROSS WEIGHT - RADAR MAPPING MISSION - COHERENT DOPPLER RADAR - GEAR UP	206794	1481.81	306429313	188.70	39081648
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					

PREPARED BY: J W C	NORTH AMERICAN AVIATION, INC.	PAGE NO. 46 OF 51
CHECKED BY: W H L	[redacted]-1	REPORT NO. NA-56-450
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		38152170
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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PREPARED BY: J W C	NORTH AMERICAN AVIATION, INC.	PAGE NO. 47 OF 51
CHECKED BY: W H L	[redacted] ALTERNATE I-C	REPORT NO. NA-56-450
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. [redacted]	PAGE NO. 48 OF 51
CHECKED BY: W H L	ALTERNATE I-D	REPORT NO. NA-56-450
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. = $\frac{1486.34}{1335.81} - 834.19$ = 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. = $\frac{1481.97}{1335.81} - 834.19$ = 48.5% MAC					
VERTICAL C.G. = 200.0 - 188.8 = 11.2 inches below FRL					

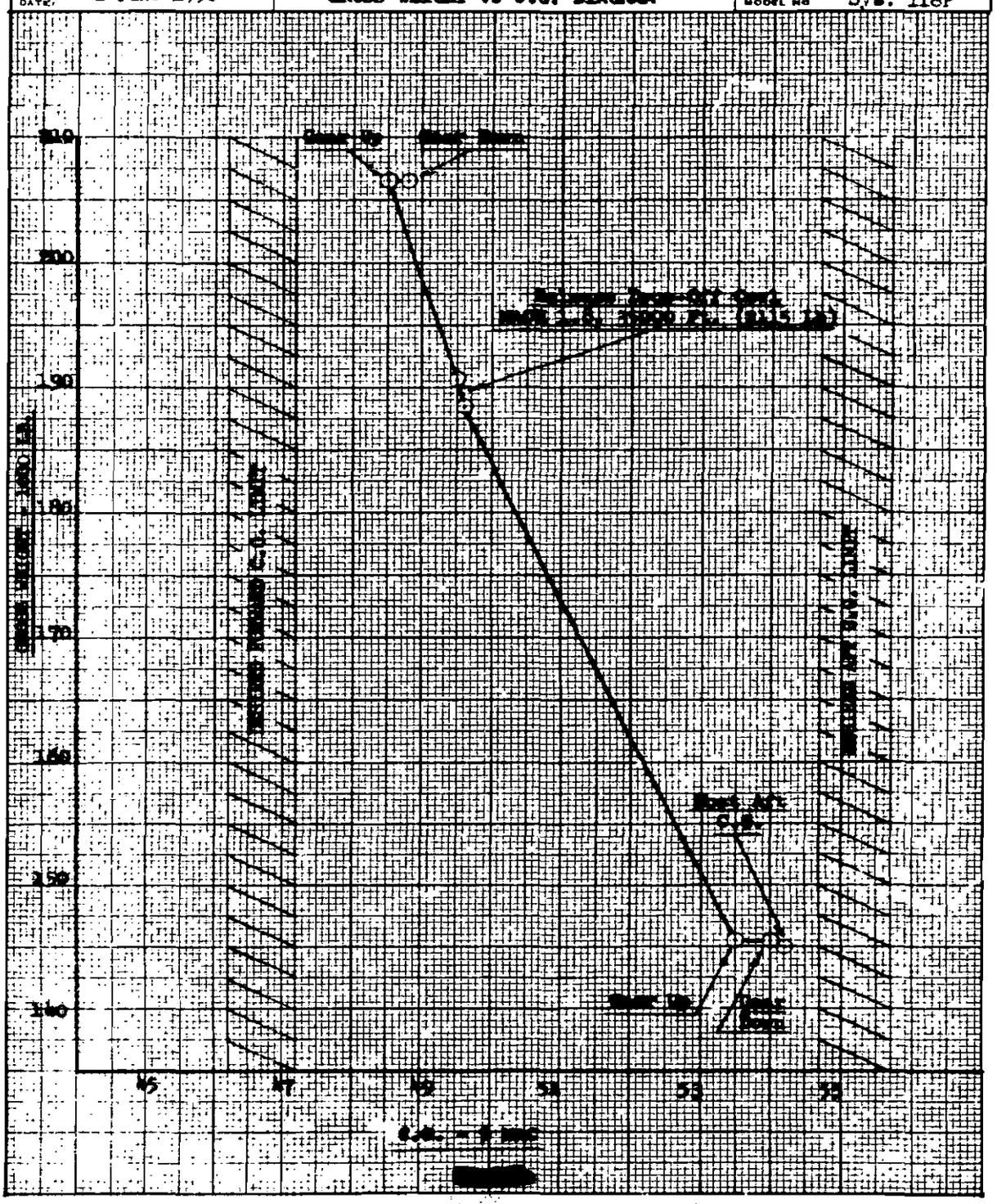
[redacted]

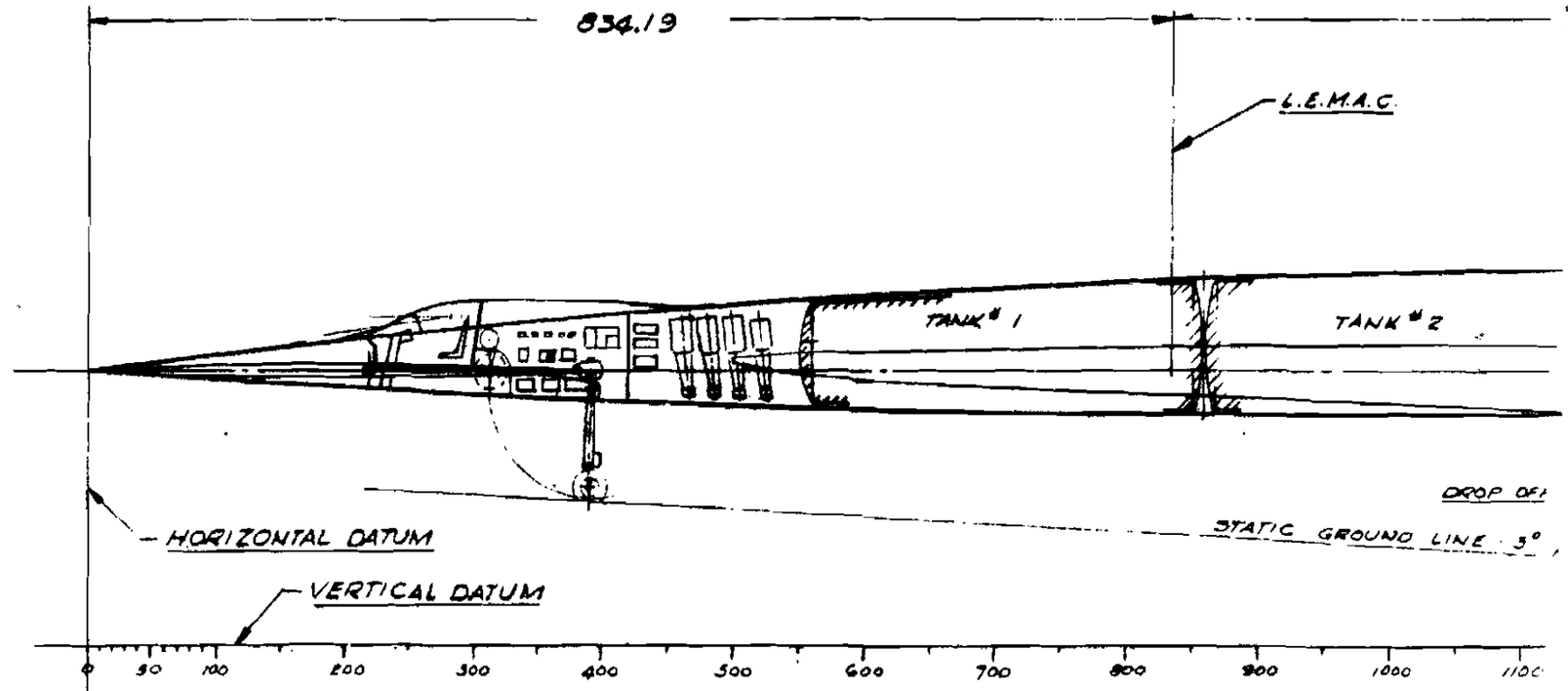
PREPARED BY: J W C	NORTH AMERICAN AVIATION, INC. [redacted]	PAGE NO. 49 OF 51
CHECKED BY: W H L		REPORT NO. NA-56-450
DATE: 1 June 1956	EXTREME C.G. CONDITIONS	MODEL NO. Sys. 118P

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 / 1335.61 - 834.19 = 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		3804864O
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 / 1335.81 - 834.19 = 54.2% MAC					
VERTICAL C.G. = 200.0 - 173.0 = 27.0 inches below FRL					

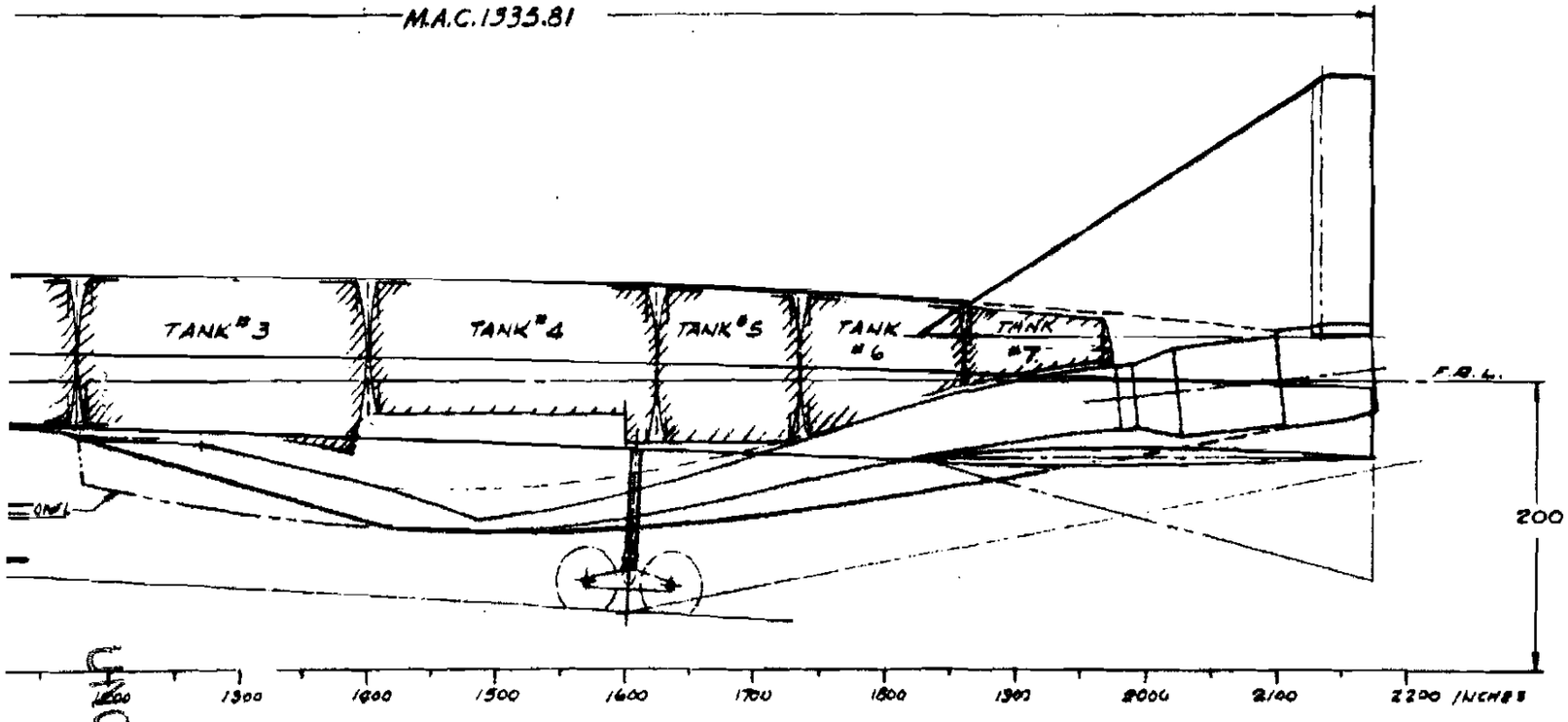
FORM ED-147

PREPARED BY J W C	NORTH AMERICAN AVIATION, INC.	PAGE NO 50 OF 51
CHECKED BY W H L	[redacted]	REPORT NO NA-56-450
DATE: 1 June 1956	GROSS WEIGHT vs C.G. DIAGRAM	MODEL NO Sys. 116P





1



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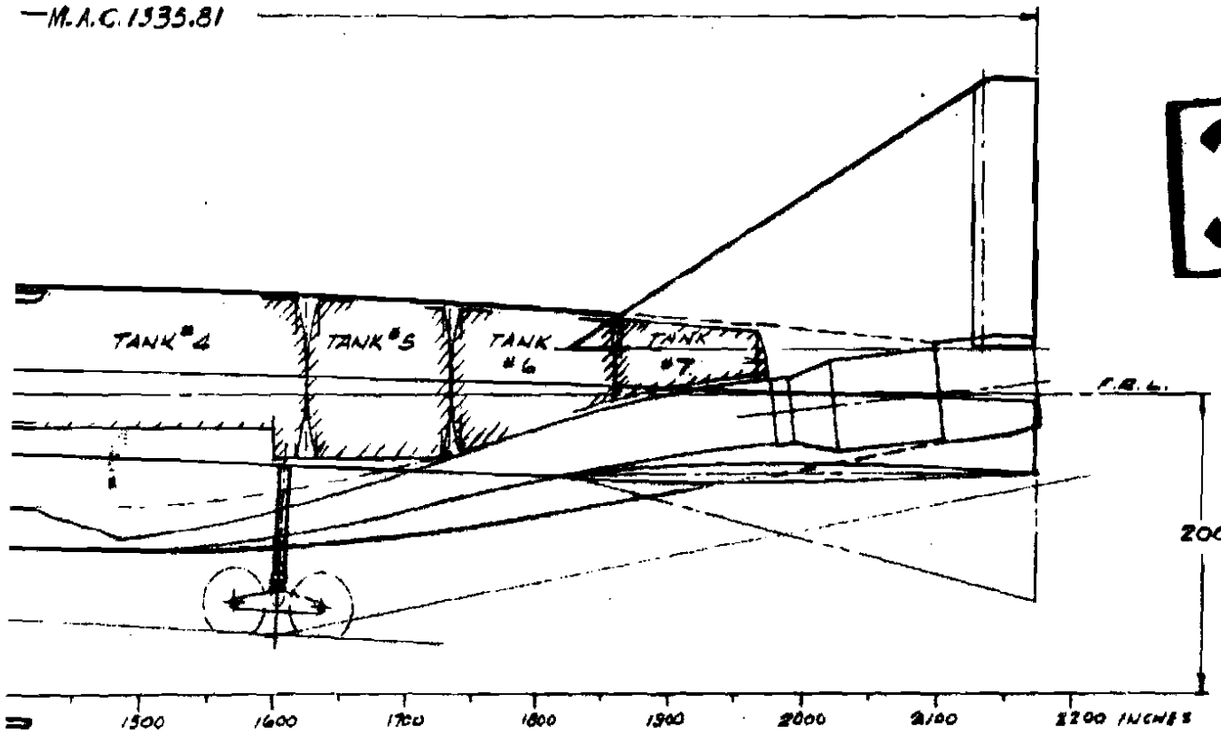
DLE	NORTH AMERICAN AVIATION, INC.	SHEET NO. 51 OF 51
JNK	INTERNATIONAL AIRPORT LOS ANGELES 45, CALIFORNIA	DRAWING NO. NA 48F-1670
DATE February 1956	AIRPLANE DIAGRAM	MODEL NO. Spec. 118P
		SCALE 1" = 60"

3



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

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NORTH AMERICAN AVIATION, INC.
INTERNATIONAL AIRPORT
LOS ANGELES 45, CALIFORNIA

REPORT NA-56-450

APPENDIX I

SUPPORTING DATA

RECONNAISSANCE

WEAPONS SYSTEM 110P

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.

[redacted]

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.

$$W_w = \delta_w \left\{ 41.5 C G^{1/4} S^{3/4} + \left[\frac{A^{3/2} S^{1/2} N J}{10 K_f t \cos^2 \Lambda (1 - .25 \sin \Lambda)} \right] \times \left[G - \frac{(\Omega + \omega)(1 + \lambda) \mathfrak{F} J''}{(\mathfrak{F} + \lambda) J} \right] \right\} q_w$$

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.

$$= .036 - .0327\, e^{-.00247\sqrt{GN}}$$

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.

$$K = .92 - \frac{AR^{1/2}(1+\lambda)}{S^{1/2}t(1+\lambda\sigma)}\left(.0338 + .000004P^{3/4}\right)$$

t = The Root Airfoil Thickness Ratio in the Streamline.

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

$$= \frac{AR^{3/2}(1+\lambda)NJ'}{22.08S^{1/2}tT\cos\Lambda}\left[G - \frac{(\Omega+\omega)(1+\lambda)\gamma J''}{(\gamma+\lambda)J'}\right]$$

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

T = Structural Chord Factor.

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

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

γ = The rate of taper of the wing.

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

[redacted]

Ω = The deadweight of the wing structure.

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

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

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

$$= \frac{P}{.500+(1.85\times10^{-6})P}$$

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

τ = 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 [redacted]	4	- .005	

Table 1 Continued Next Page

TABLE 1 (CONT'D)

	See Part I 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'' = .4910

f = 20830 pounds per square inch.

J = .48938

γ = 3.0

ρ_M = 1.0393

T = 1963.5

PART III. HORIZONTAL TAIL WEIGHT.

1. Horizontal Tail Weight Equation.

$$W_H = \delta_H \left[41.5\, C\, n_L^{1/4} S^{3/4} + \frac{AR^{3/2} S^{1/2} n_L J}{8.00 K f t \cos^2 \Lambda (1 - .25 \sin \Lambda)} \right] \rho_M$$

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

$$= .035 - .0327\, e^{-.0025 f n_L}$$

* n_L = 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.

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

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.

[redacted]

$$K = .92 - \frac{AR^{1/2}(1+\lambda)}{5^{1/2} t (1+\lambda\sigma)} (.0333 + .000004 P^{3/4})$$

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

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

$$= \frac{AR^{3/2}(1+\lambda)\pi J'}{17.66 \, 5^{1/2} t \tau \cos\Lambda}$$

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

τ = 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 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)

$$= \frac{P}{.500 + (1.85 \times 10^{-5}) P}$$

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

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_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

	See Part I Paragraph		
Basic			1.100
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.

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

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

$$= .035 - .0327\, e^{-.00890 \sqrt{n_L}}$$

* n_L = Limit critical Vertical Tail Load in pounds.

S = Vertical Tail Area in square feet.

R = 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

$= \frac{t_t}{t_r}$ = 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.

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

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

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

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

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

τ = Structural Chord Factor. [redacted]

$$T = \frac{\text{Cos}\,\Lambda}{1-.2r\,\text{Sin}\,\Lambda\,\text{Cos}\,\Lambda\,[\,1+1.2r\,\text{Sin}\,\Lambda\,\text{Cos}\,\Lambda\,]}$$

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

	See Part X Paragraph		
Basic			1.000
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

T_L = 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

T = 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.

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

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.

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

* The Mean Diameter is defined as:

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

The Width and the Depth occur at the same section.

[redacted]

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

	See Part I Paragraph		
Basic			1.000
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.

$$W_g = \left[\delta_g \varphi_g + \nu\right]\left[.14 e^{.07\mu/\mu} \Gamma^{7/8}\right] \varphi_g$$

2. Definitions of Symbols.

W_g = Landing Gear Group Weight in pounds.

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

$$\nu = \frac{135599}{(T-1900)^{.1304}}$$

= .15 for any aircraft other than those falling into the category 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.

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

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_q = .960

ν = .150

μ = 12.5 feet.

Γ = 160227 pounds.

τ = 1963.5

q_q = .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.

[redacted]

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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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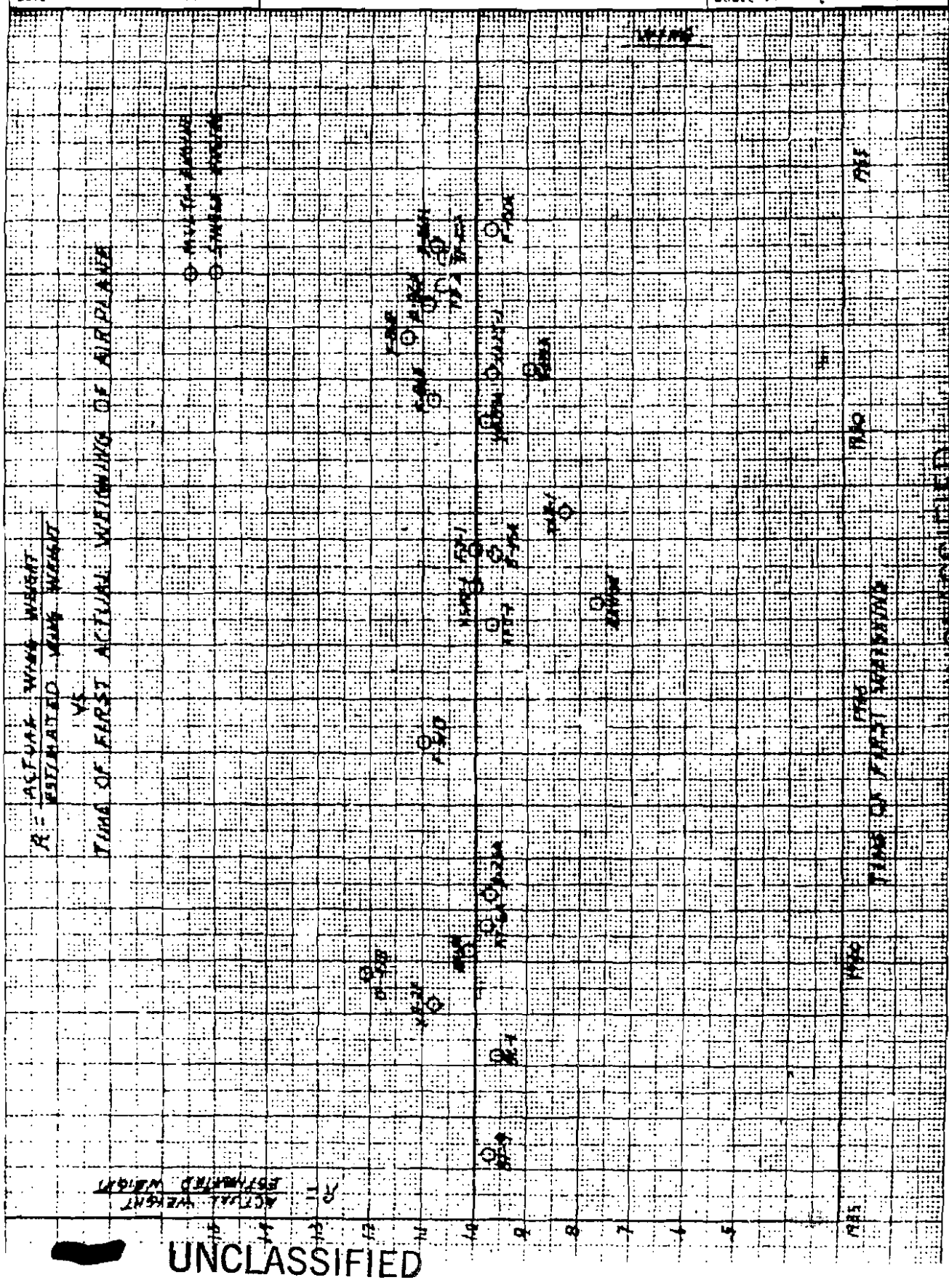
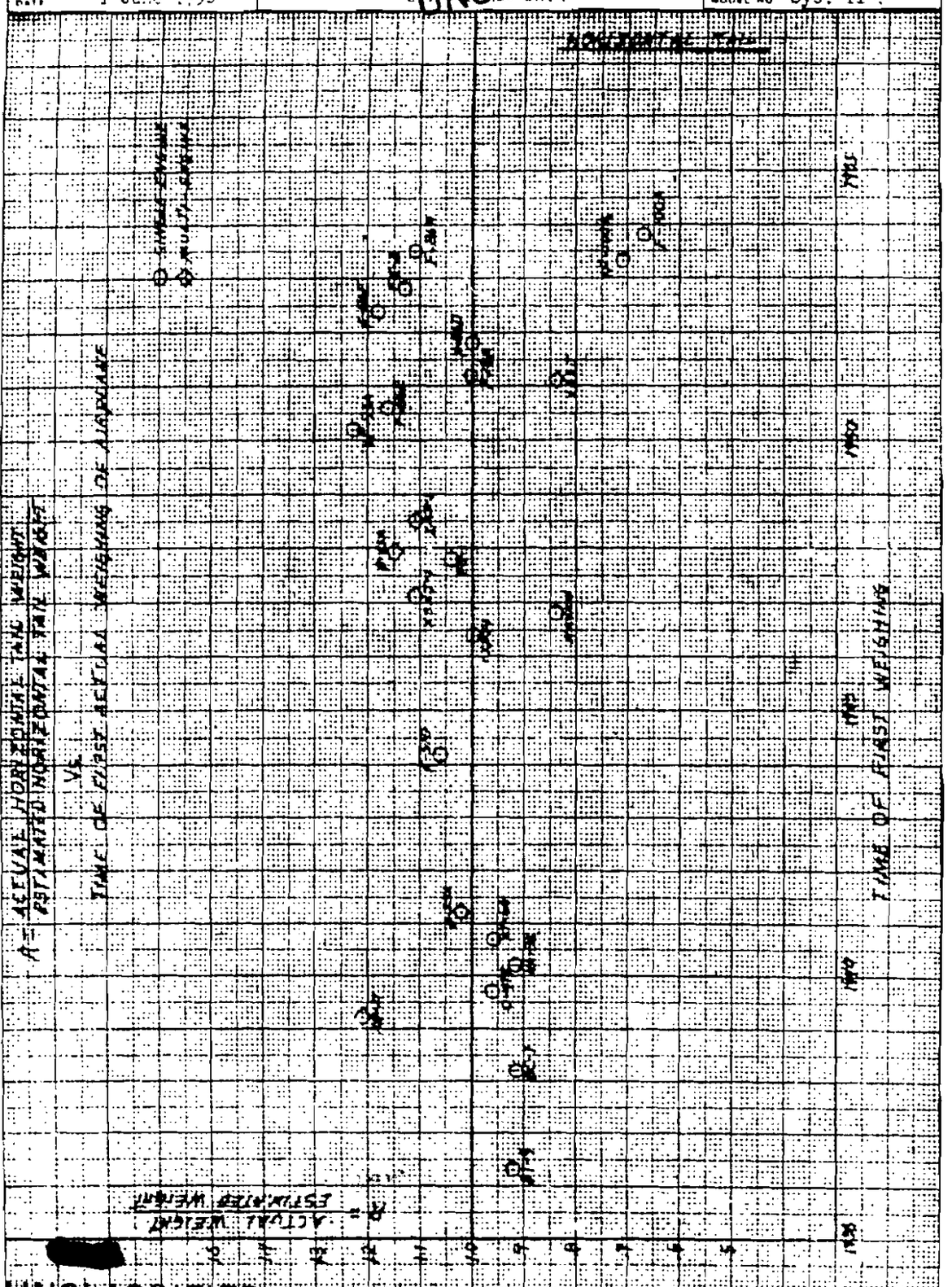
FORM 60-148

APPENDIX I

PREPARED BY: [redacted] A V	NORTH AMERICAN AVIATION, INC.	PAGE NO 24 OF 47
CHECKED BY: S S P	UNCLASSIFIED	REPORT NO NA-58-450
DATE: 1 June 1956	SUPERSONIC MISSILE	MODEL NO Sys. 112P

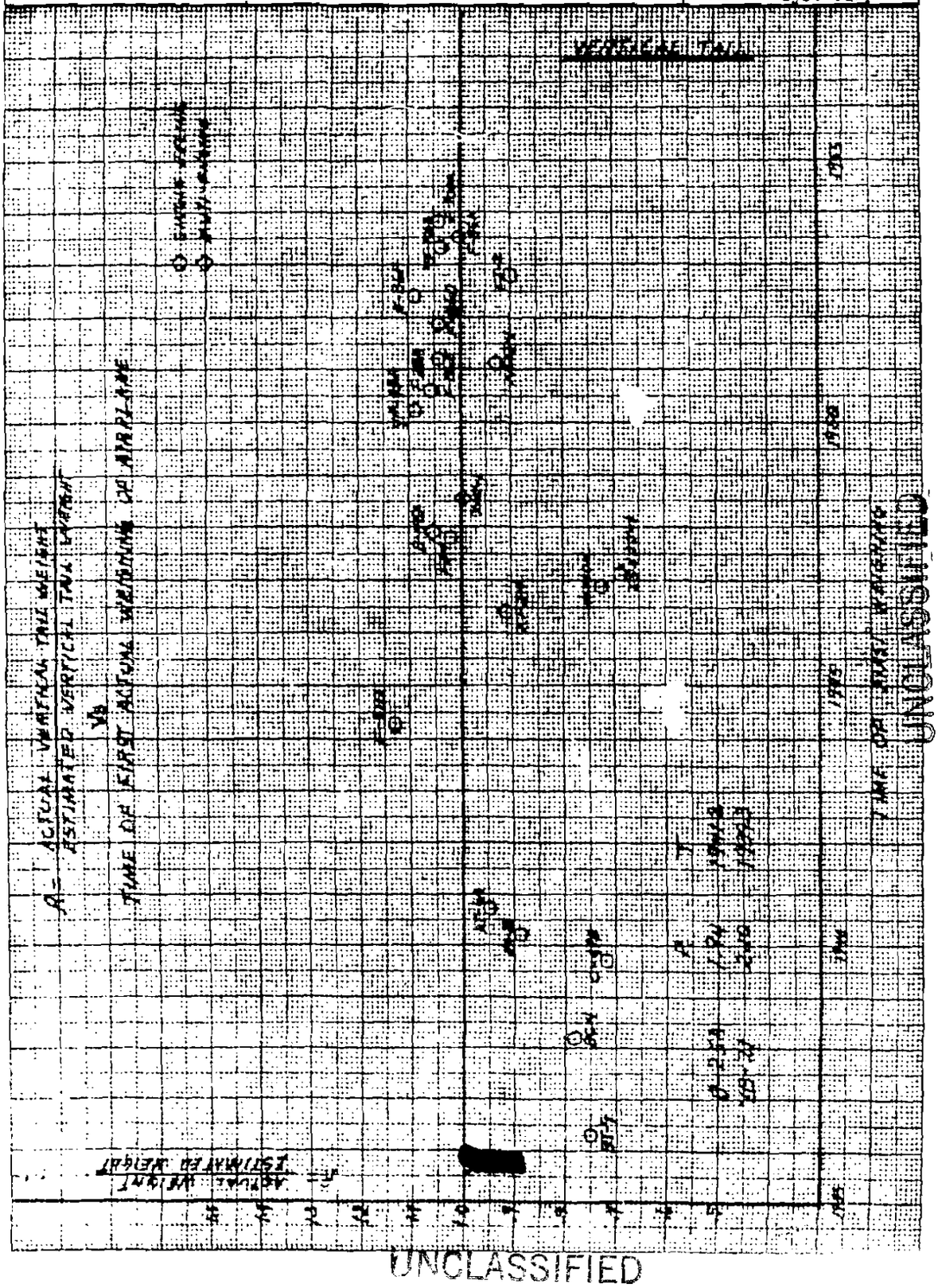


PREPARED BY W A N	NORTH AMERICAN AVIATION, INC.	PAGE NO 25 OF 47
CHECKED BY S S B	[redacted]	REPORT NO NA-56-[illegible]
DATE 1 June 1956	SUBJECT [illegible]	MODEL NO Sys. 118P



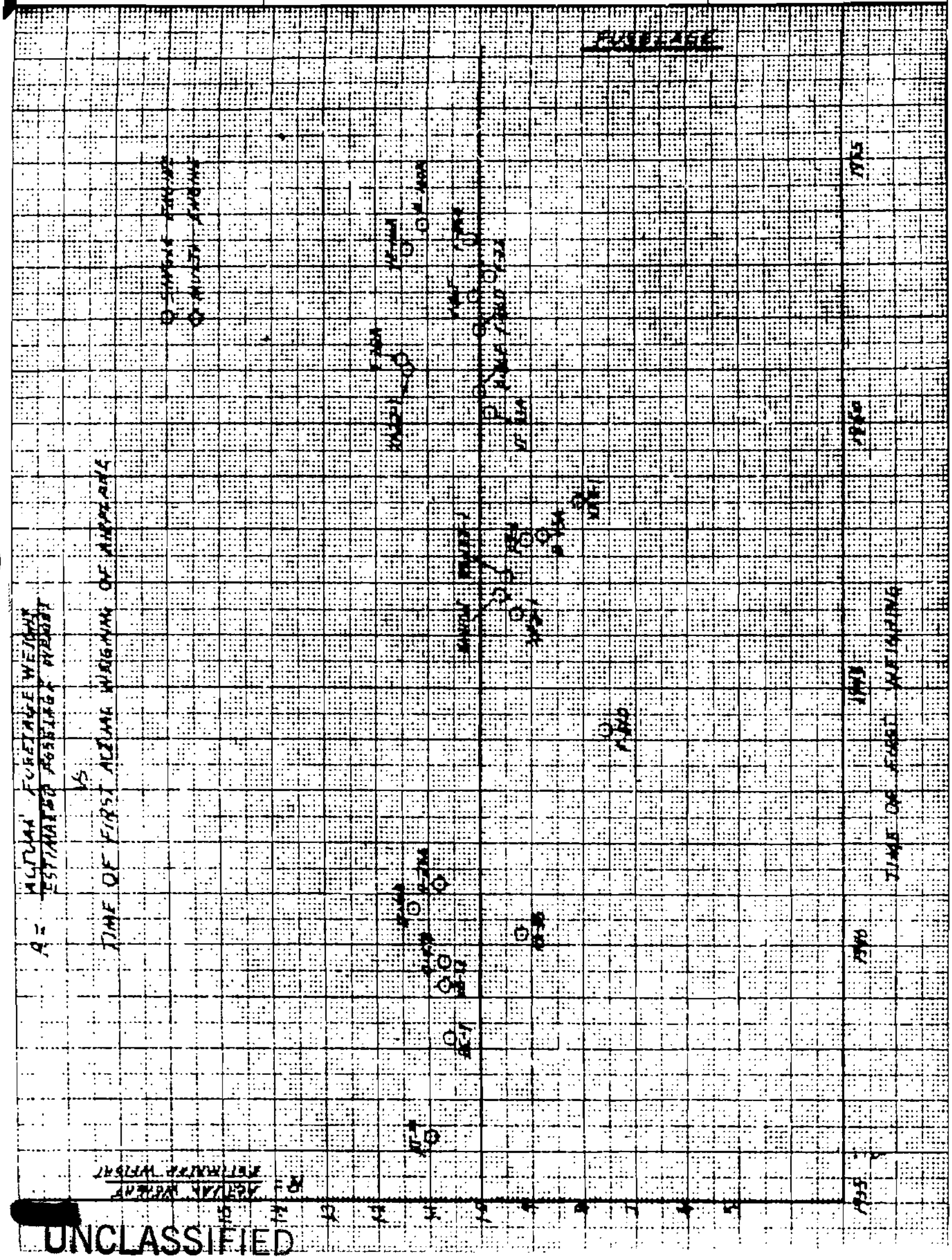
FORM ED-148

PREPARED BY: W A P	NORTH AMERICAN AVIATION, INC.	PAGE NO 26 OF 47
CHECKED BY: S S P	[redacted]	REPORT NO NA-56-44
DATE: 1 June 1956	SUPPORTING DATA	MODEL NO Sys. 118P



FORM SD-149

PREPARED BY V A K	NORTH AMERICAN AVIATION, INC.	PAGE NO 27 OF 47
CHECKED BY S S B	UNCLASSIF[redacted]	REPORT NO NA-56-450
DATE 1 June 1956	SUPPORTING DATA	MODEL NO Sys. 118P



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PREPARED BY: V A M	NORTH AMERICAN AVIATION, INC.	PAGE NO 28 OF 47
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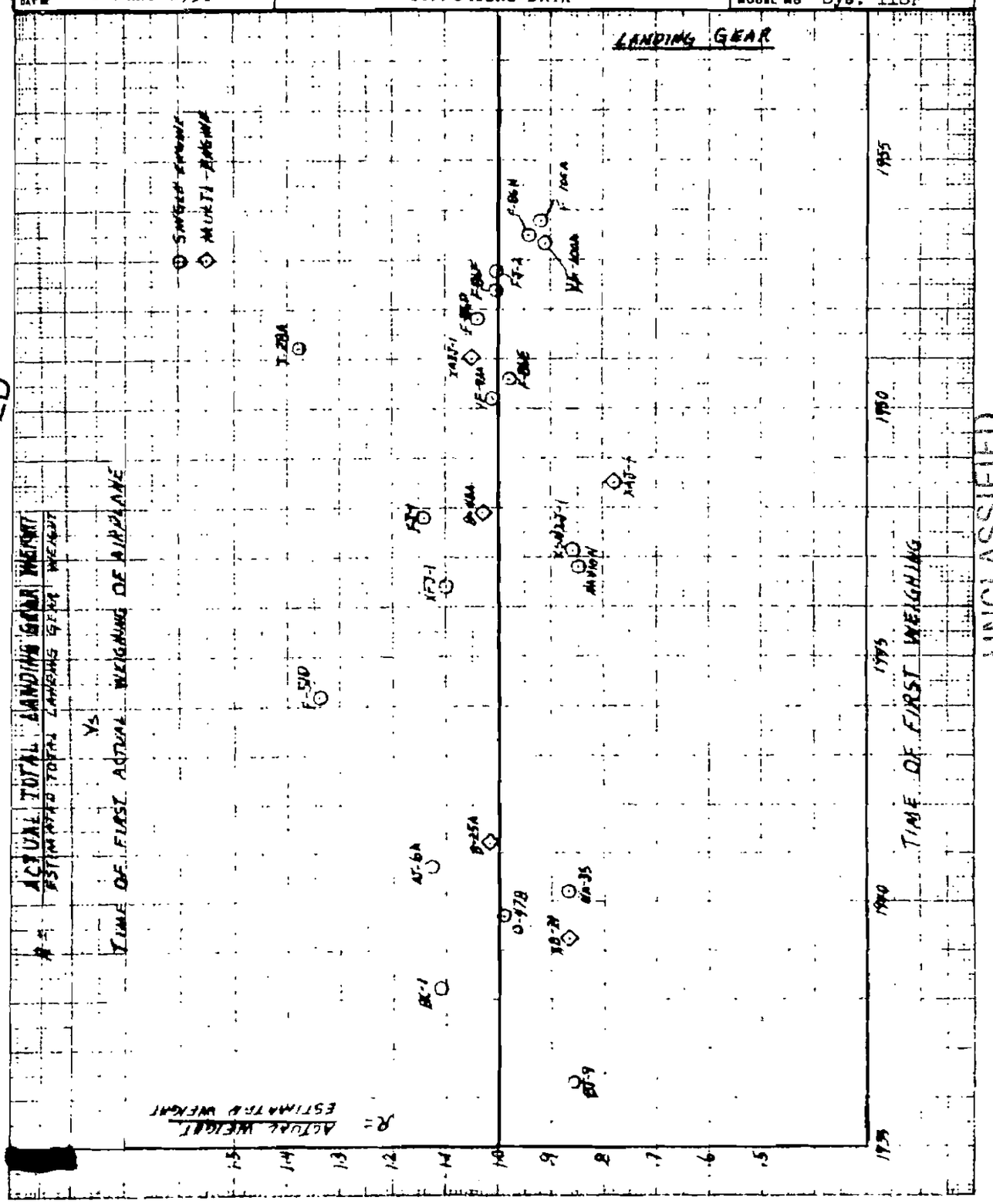
DATE 1 June 1956	SUPPORTING DATA	MODEL NO Sys. 118P



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PREPARED BY W A M	NORTH AMERICAN AVIATION, INC.	PAGE NO 29 OF 47
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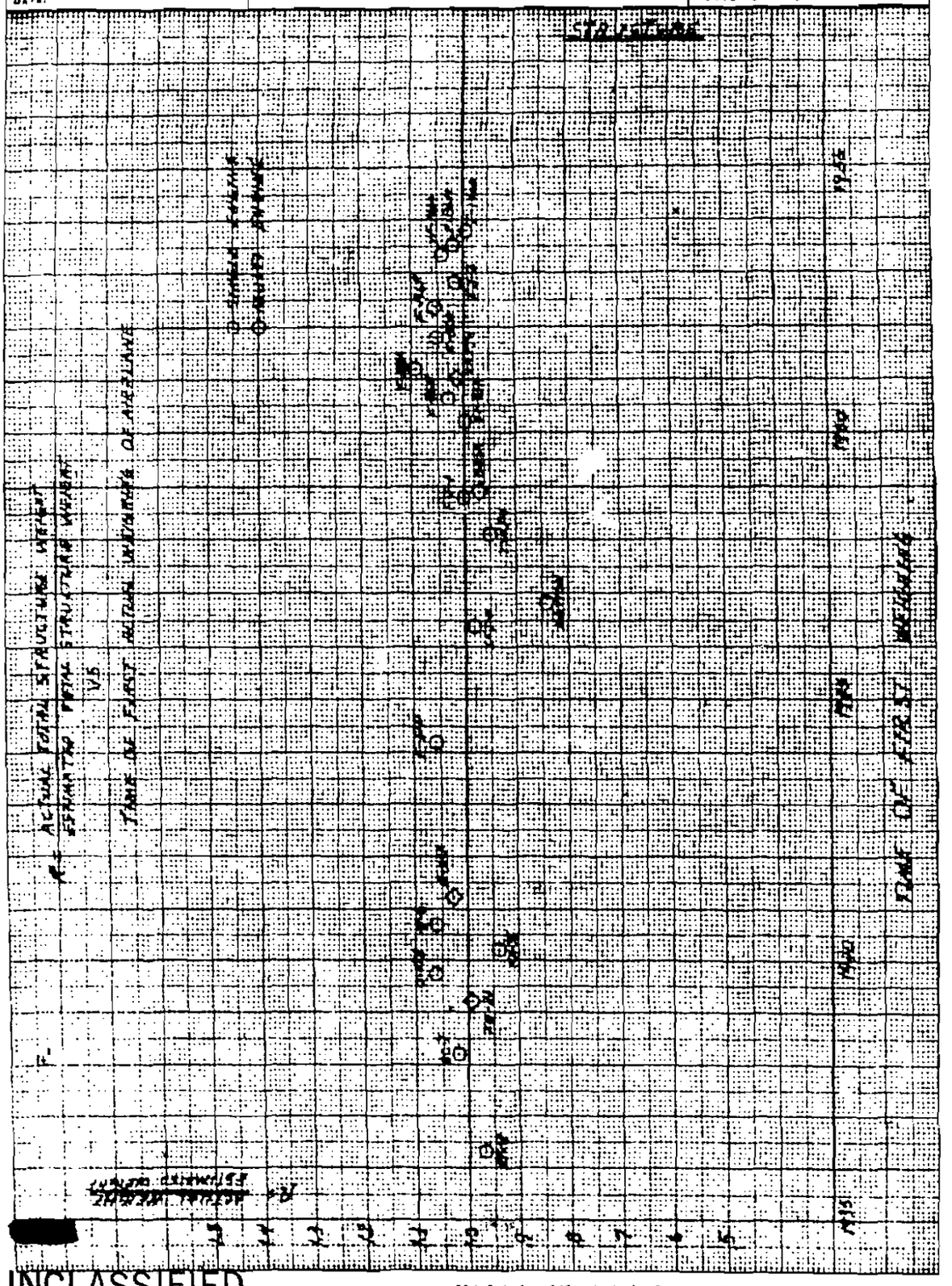
DATE 1 June 1956	SUPPORTING DATA	MODEL NO Sys. 118P



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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 $C_N \times 10^{-6}$

(b) Γ vs AR

(c) T vs Λ

(d) f vs P

(e) J vs λ

(f) J' vs λ

(g) J'' vs λ

(h) J''' vs λ

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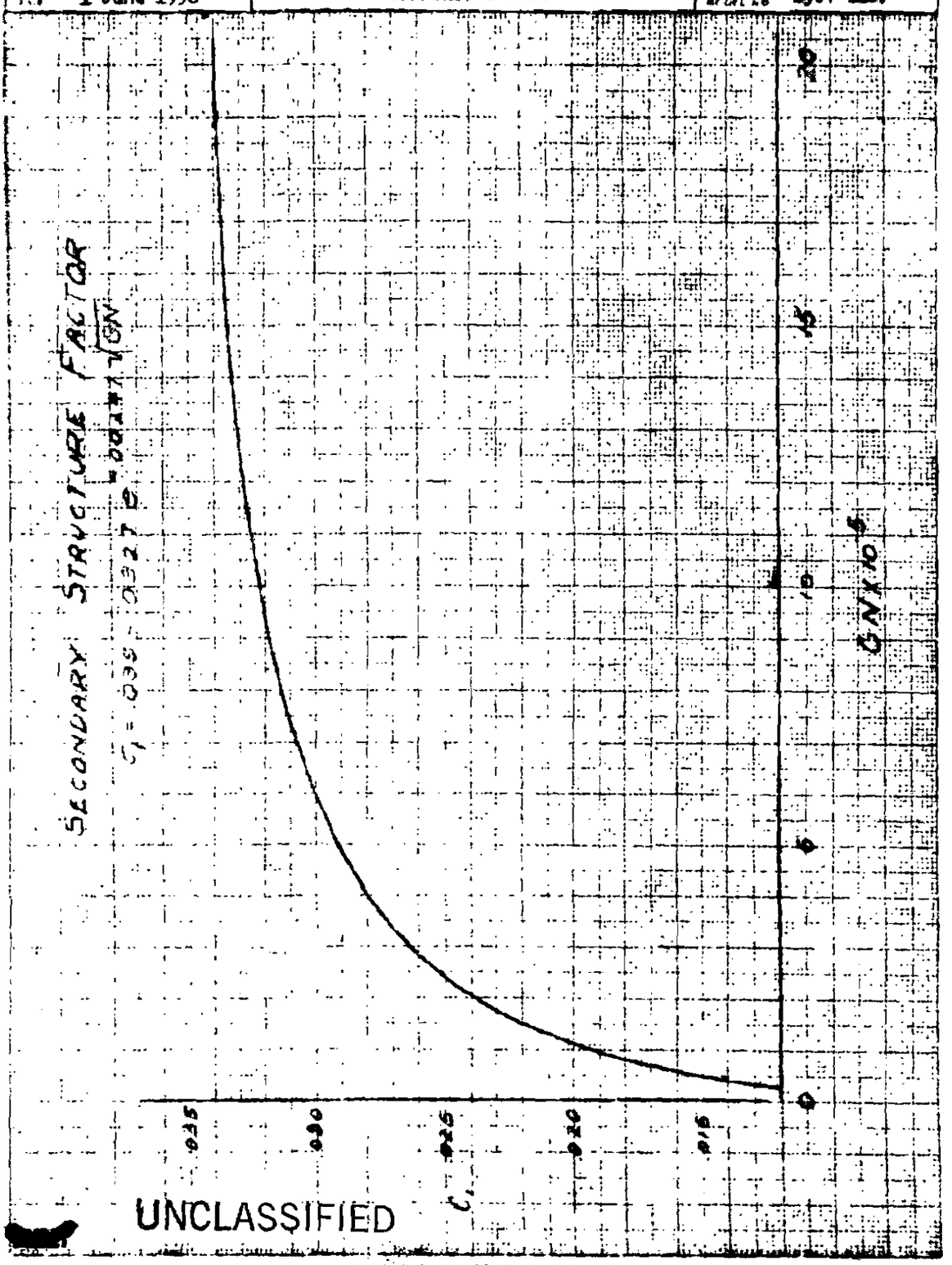

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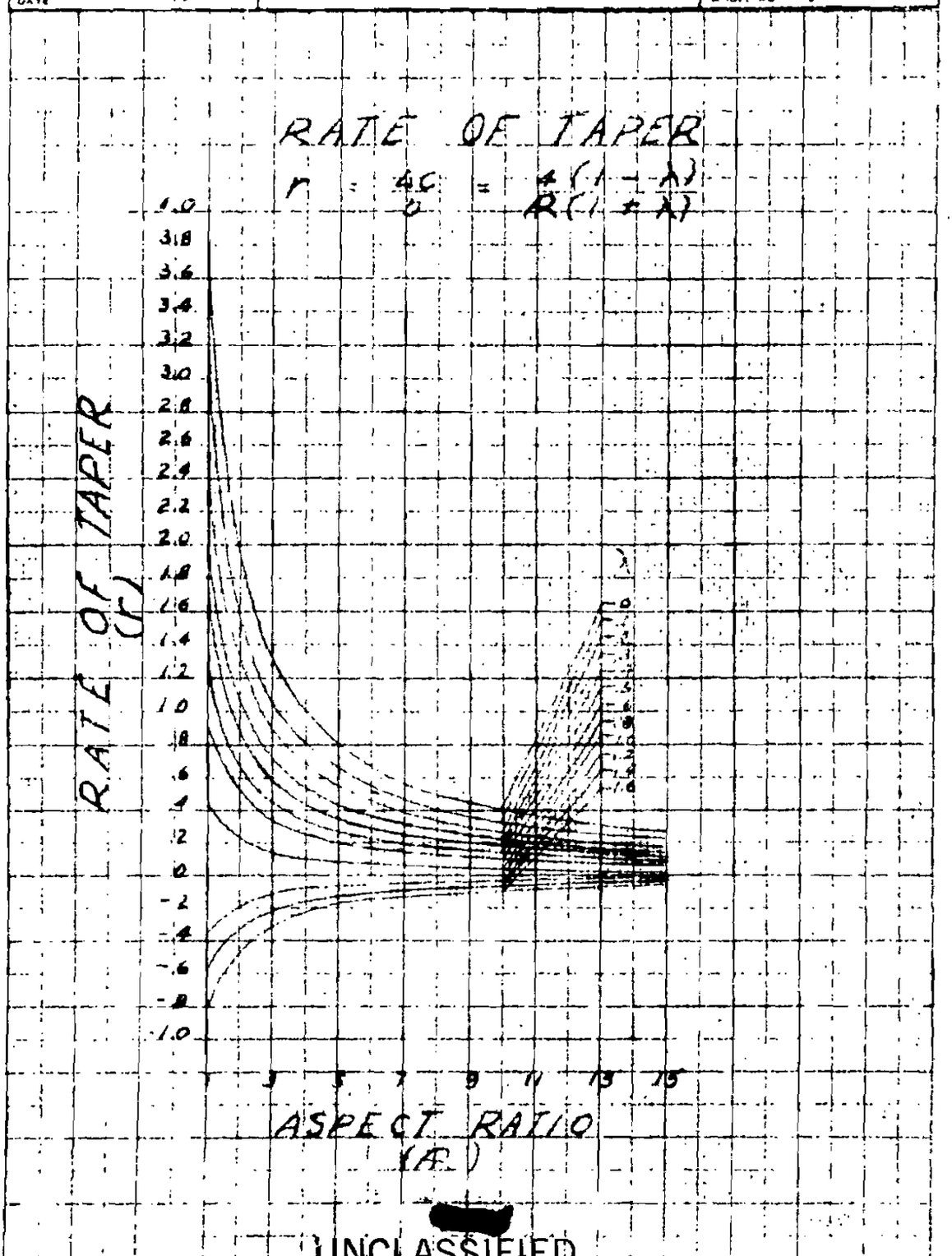
APPENDIX I

PREPARED BY W A M	NORTH AMERICAN AVIATION, INC.	PAGE NO 38 OF 47
CHECKED BY S S B	[redacted]	REPORT NO NA-56-450
DATE 1 June 1956	SUPPORTING DATA	MODEL NO Sys. 118P



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APPENDIX I

PREPARED BY W A M	NORTH AMERICAN AVIATION, INC.	PAGE NO. 33 OF 47
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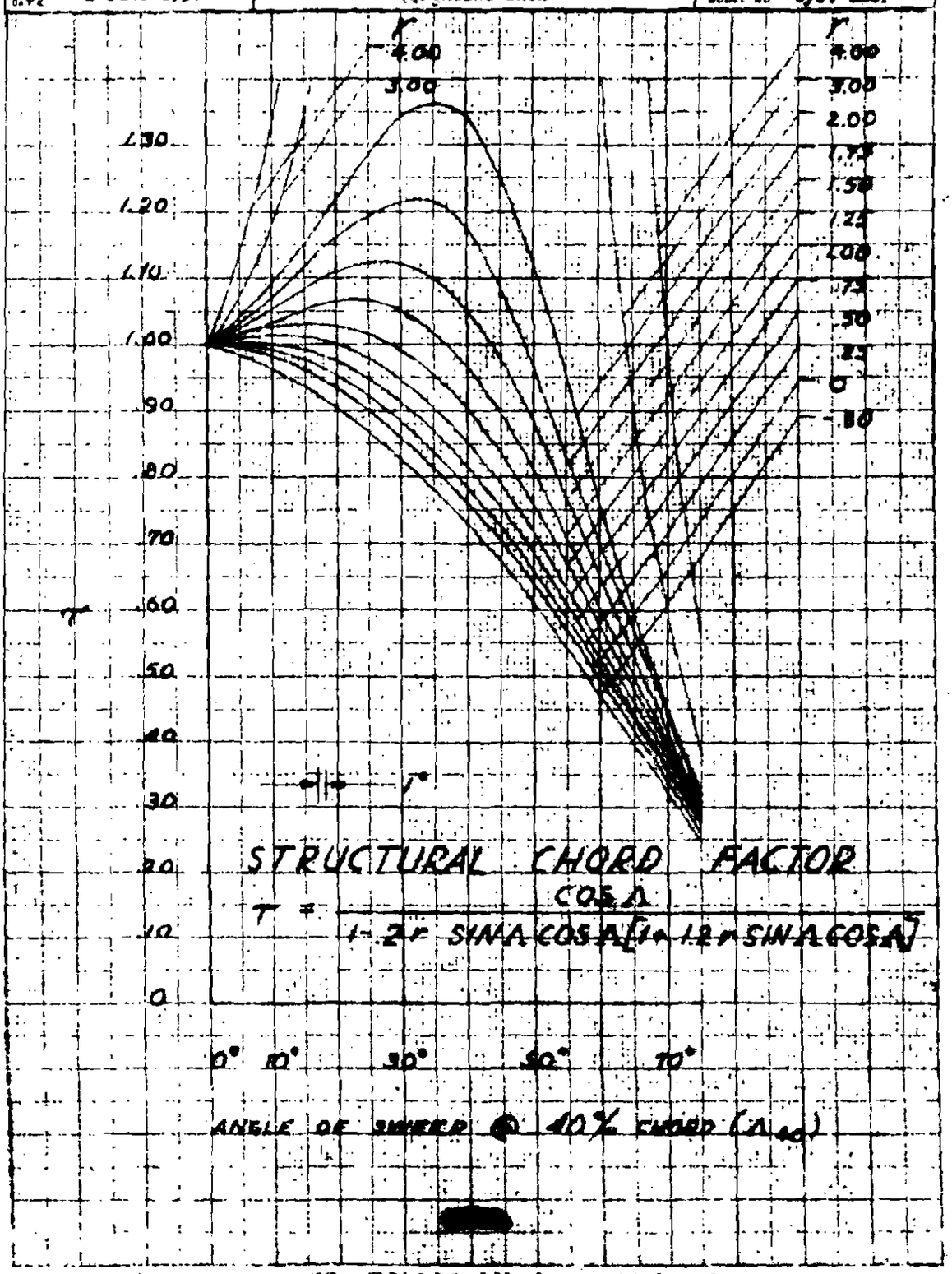
DATE 1 June 1956	SUPPORTING DATA	MODEL NO. Sys. 116P



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PREPARED BY W A M

CHECKED BY S S B

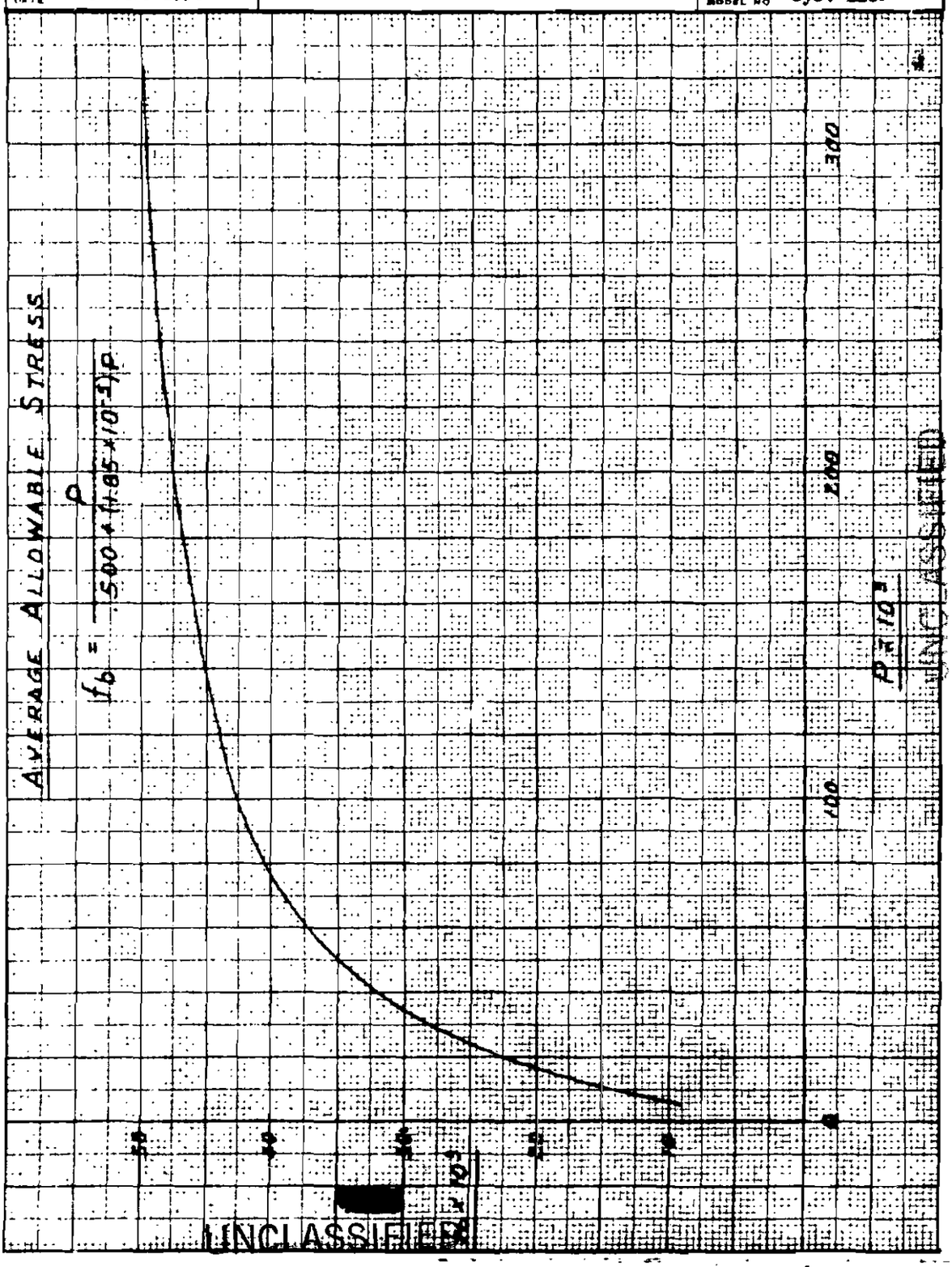
DATE 1 June 1956

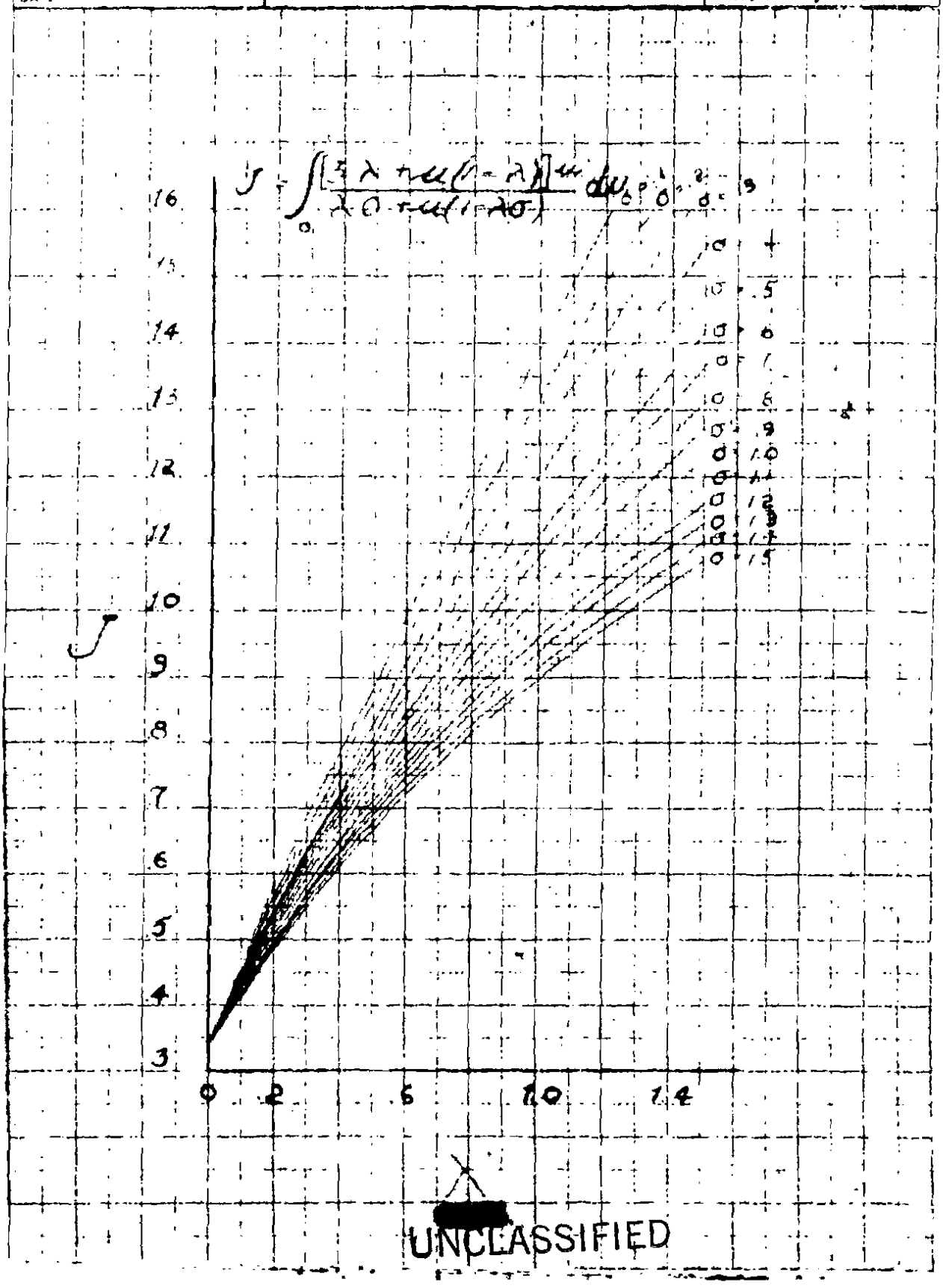
NORTH AMERICAN AVIATION, INC.

SUPPORTING DATA

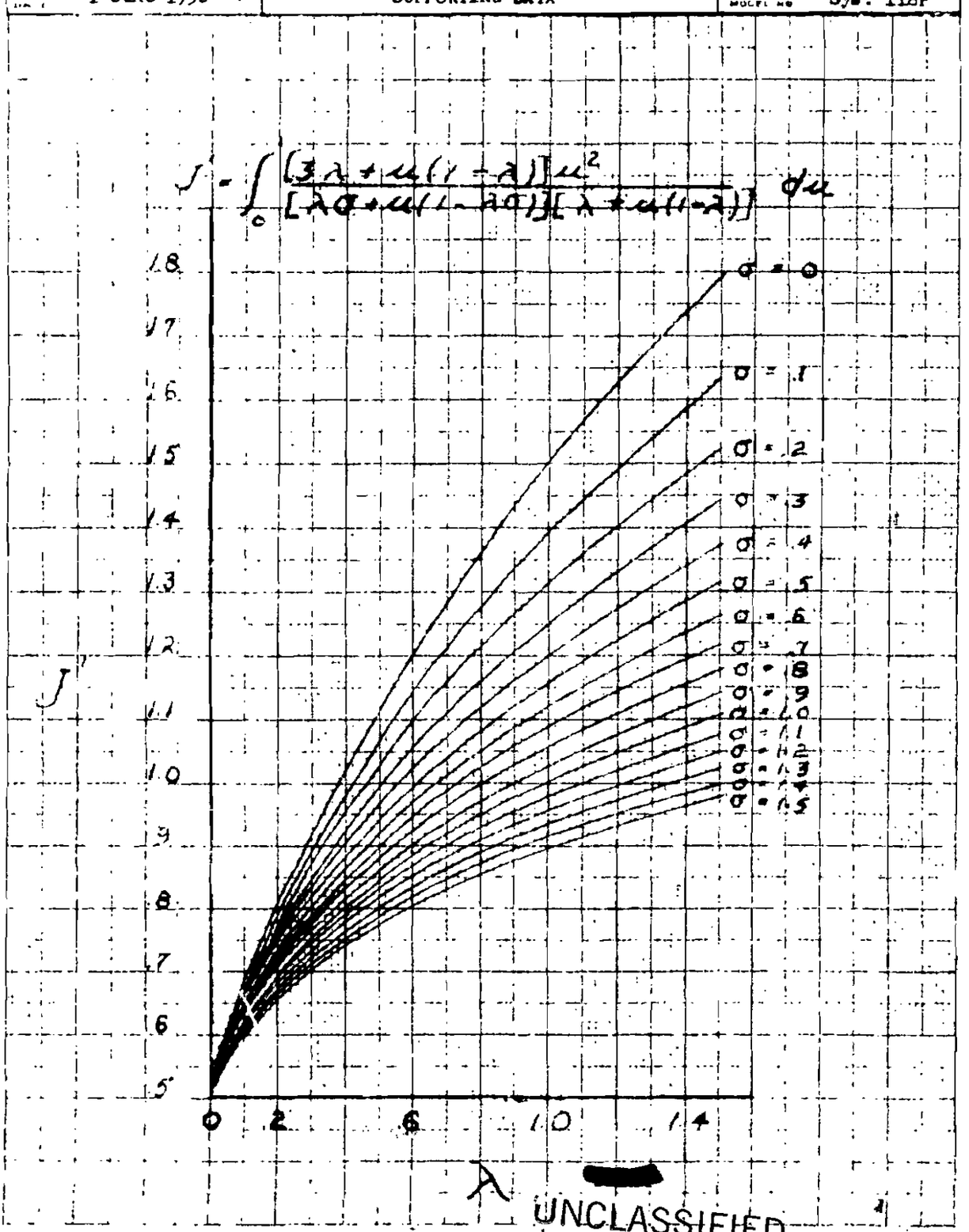
REPORT NO NA-56-450

MODEL NO Sys. 118P

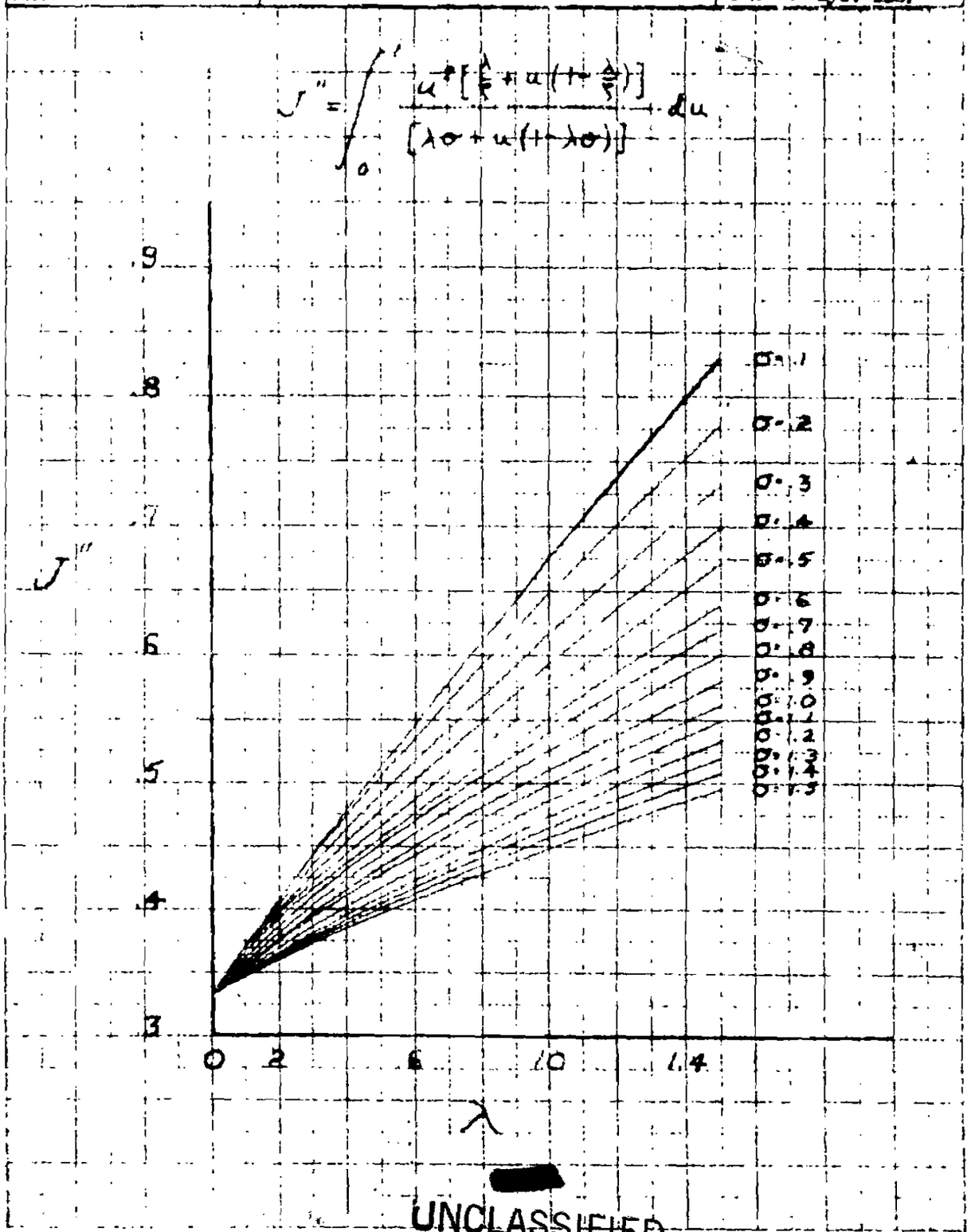


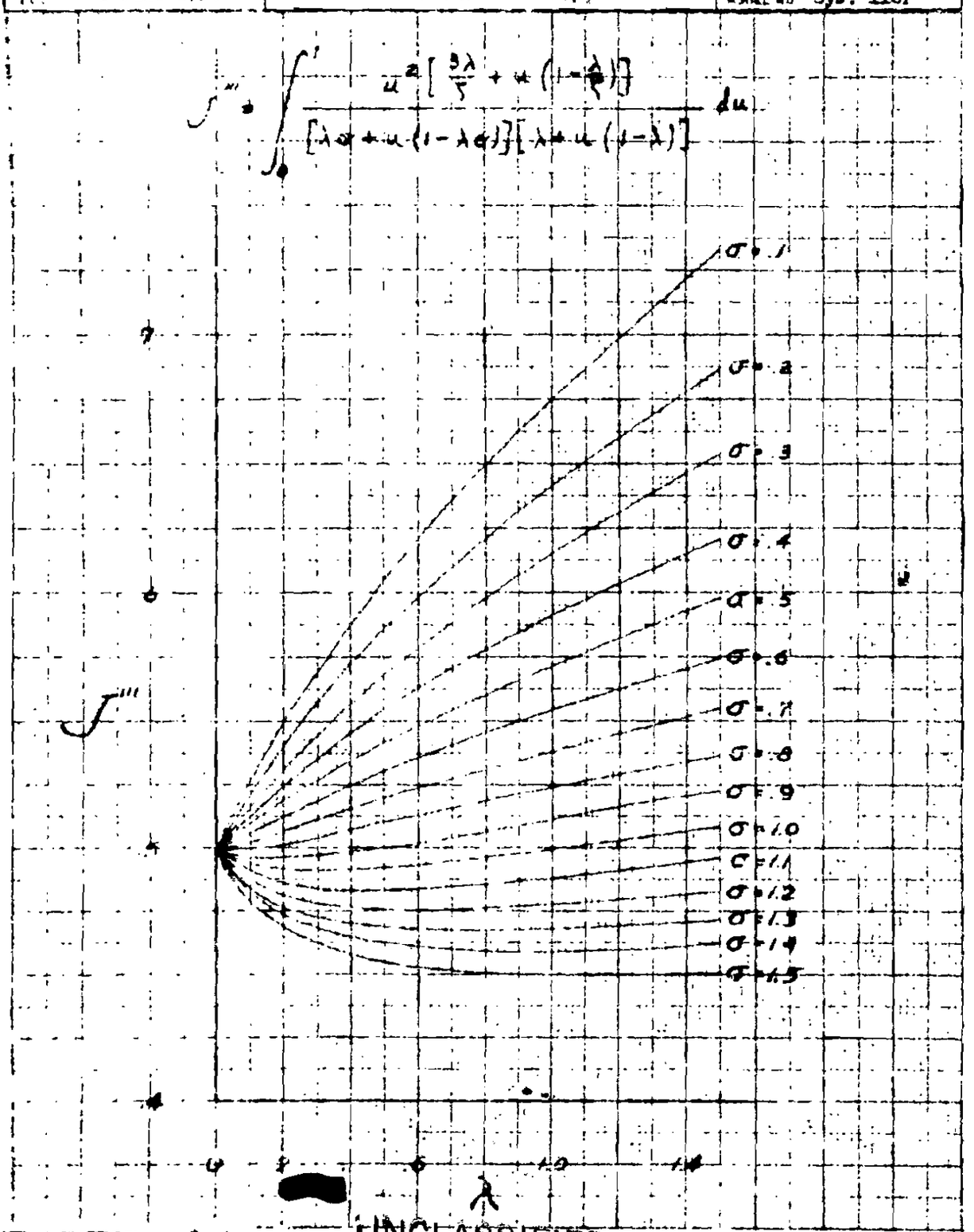

16
15
14
13
12
11
10
9
8
7
6
5
4
3
0
2
6
10
14

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



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





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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.

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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.

[redacted]

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

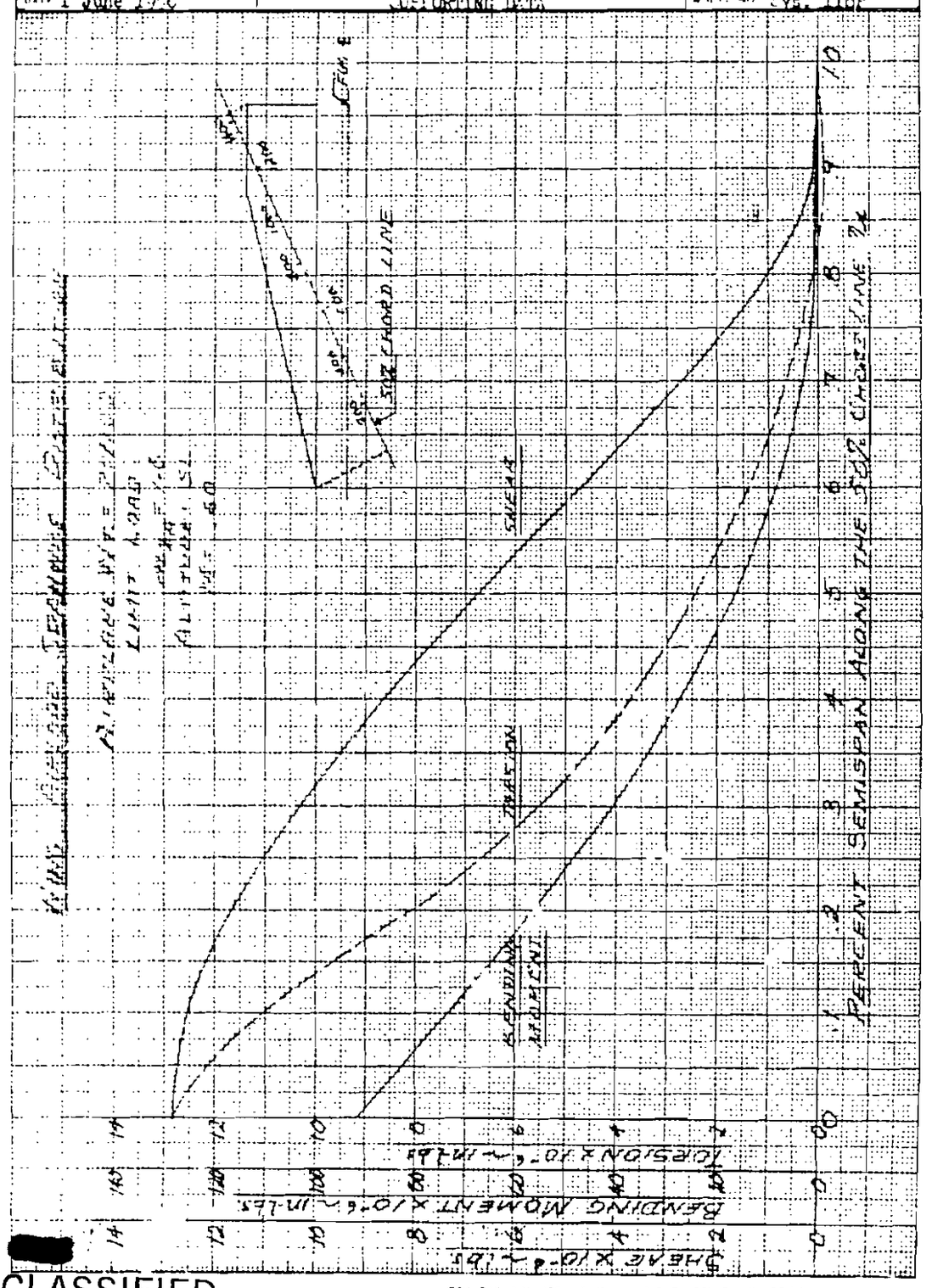
NORTH AMERICAN AVIATION, INC.

[redacted]

1 June 19[illegible]

REPORTING DATA

NA-56-450



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APPENDIX I

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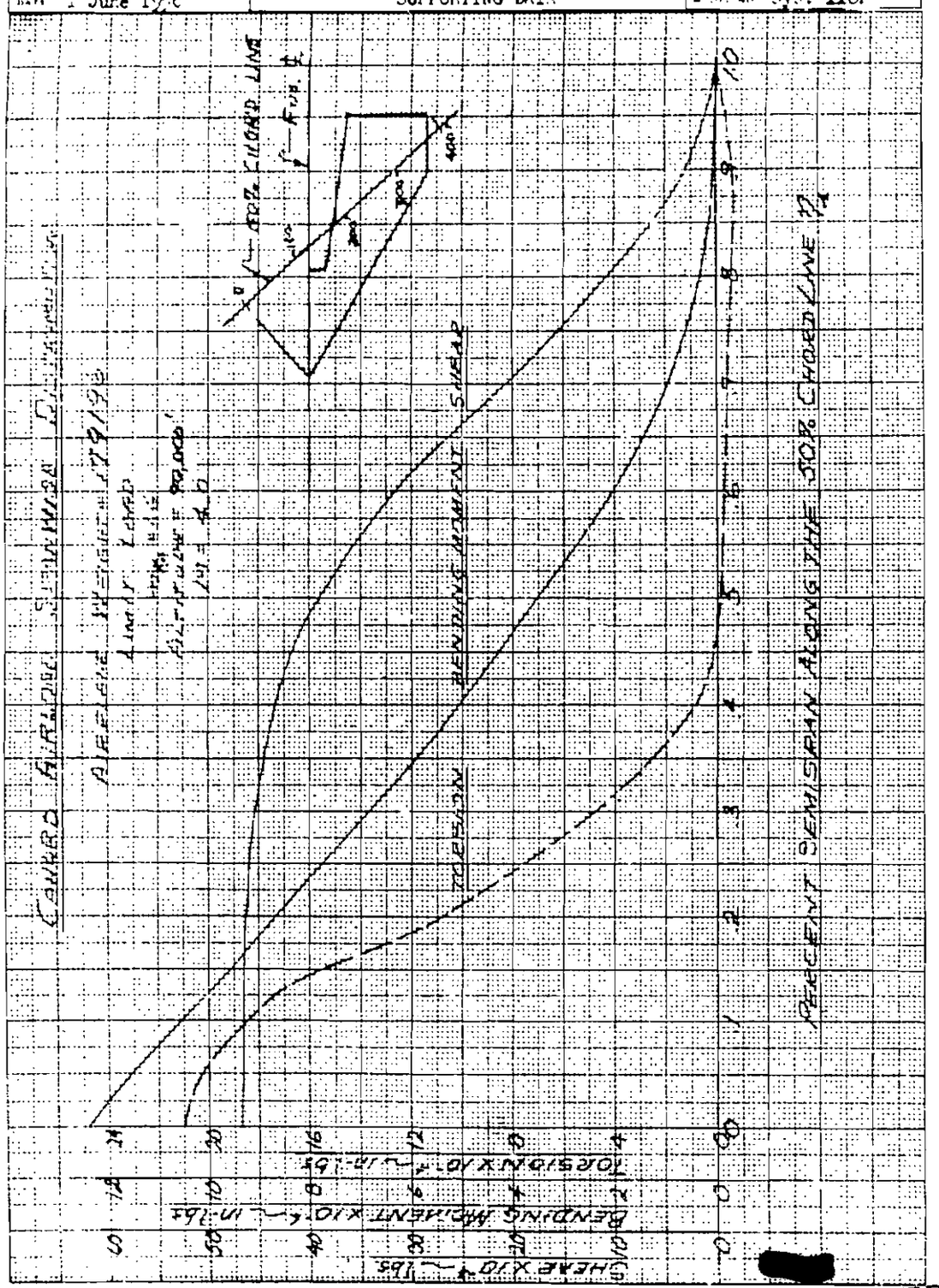
1 June 1946	SUPPORTING DATA	Sys. 118P



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NORTH AMERICAN AVIATION, INC.

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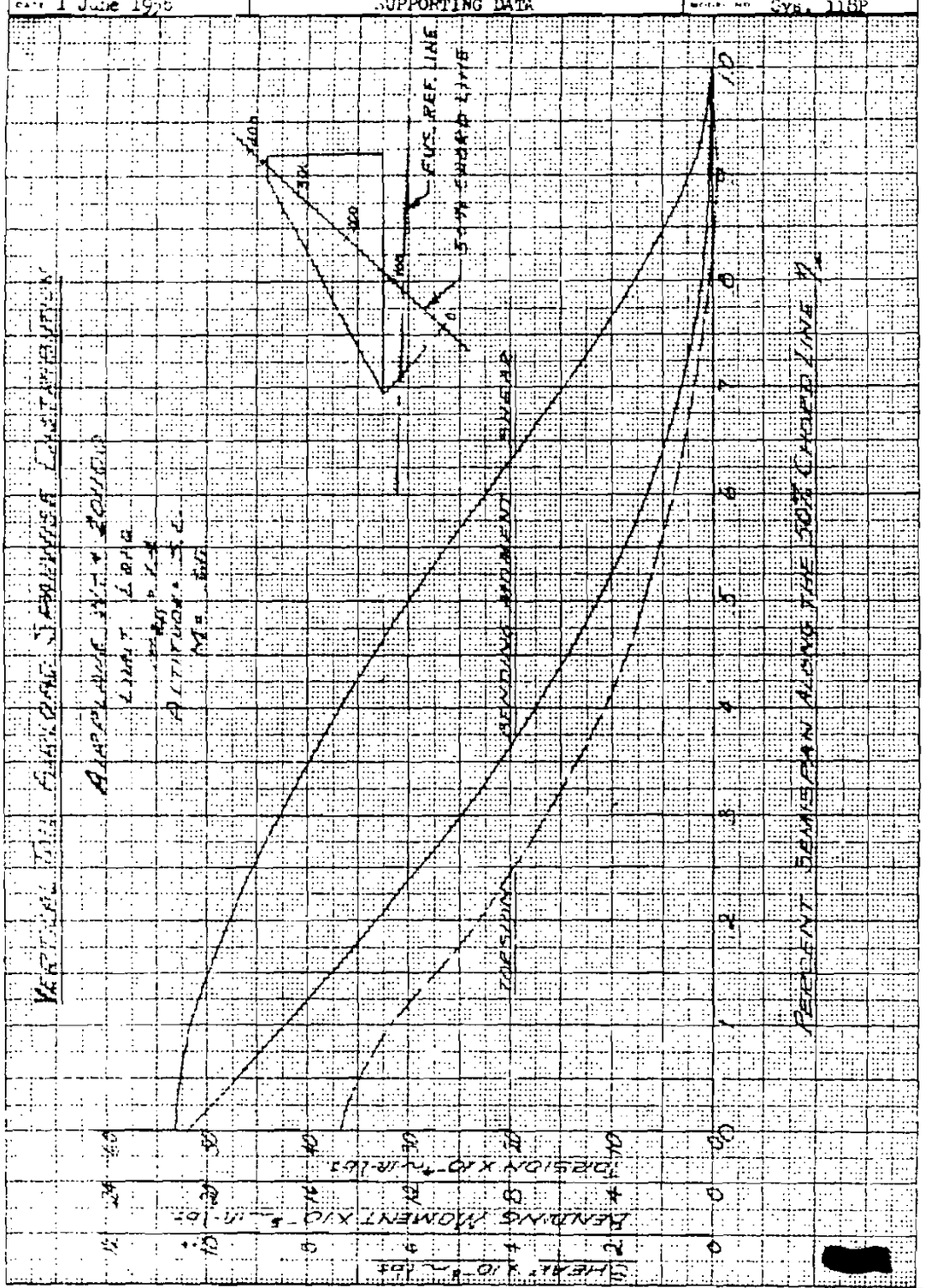
1 June 1956

SUPPORTING DATA

NA-56-450



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NOTE: A SINGLE BAREA DISTRIBUTION FOR THE "1-G" CONDITION IS SHOWN

WING DEAD WEIGHT DISTRIBUTION
TIP DOWN CONDITION

WEIGHT PER INCH - LB

0 4 8 12 16 20 24 28

50% CHORD LINE

SCALE: 1" = 200"

FUS. ℄

MAIN LANDING GEAR

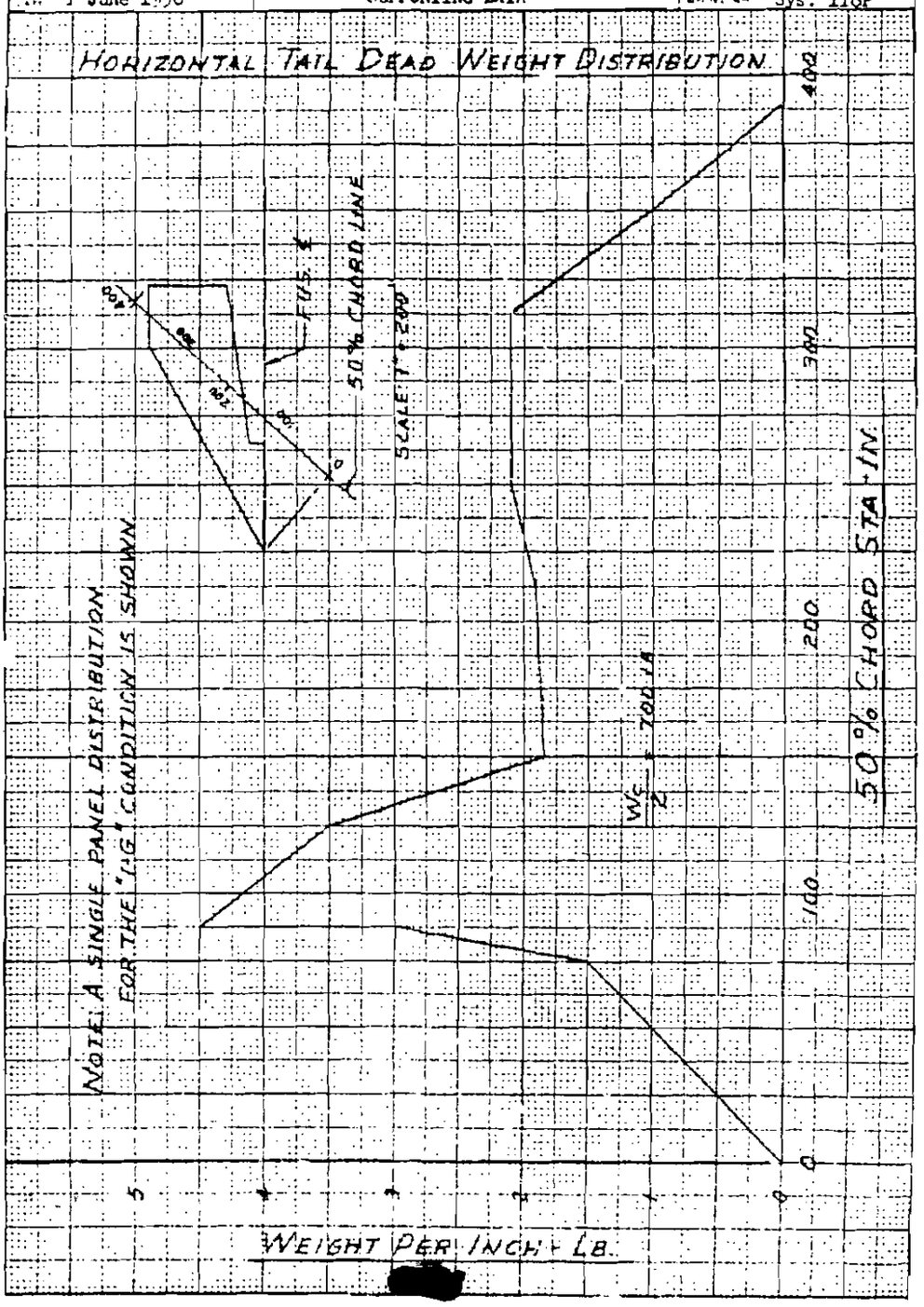
ROLLING TIP DOWN

DISTRIBUTED WEIGHT PER PANEL = 13895 LB

0 200 400 600 800 1000 1200 1400

50% CHORD STA. - IN.

[redacted]



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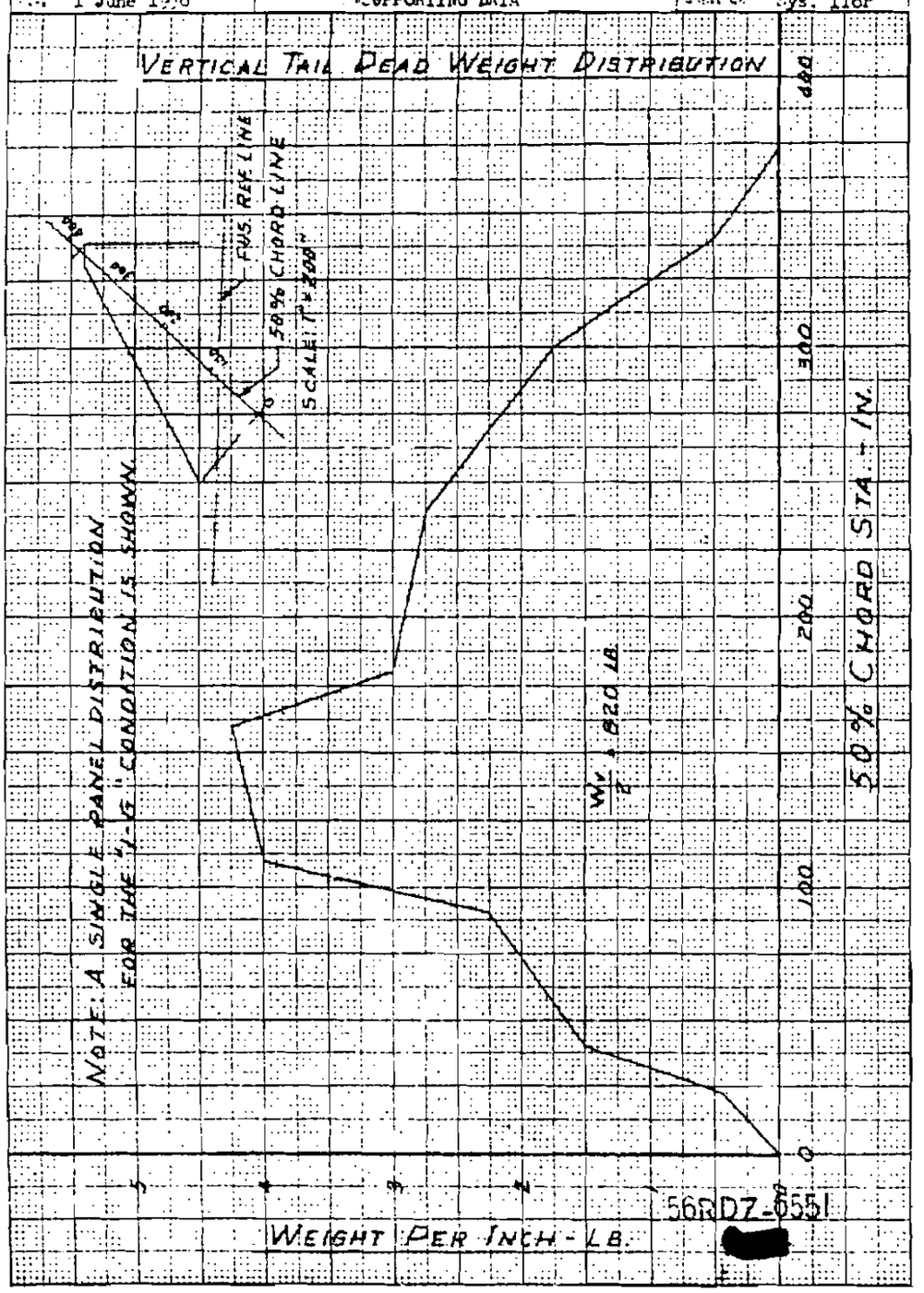
[redacted] B	[redacted]	[redacted] NA-56-450
[redacted] 1 June 1956	[redacted] SUPPORTING DATA	[redacted] Sys. 118P



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