

QCX
Avro
CF105

R7-0400-34
Iss-27

FILE IN VAULT

Arrow 2
Prod. A/C

Report: 7-0400-34
Issue : 27

WEIGHT & C.G. SUMMARY

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1 Jan/59



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DATE
JAN 07 1993

Report no.: QCX - AVRO - CF105 - R-7-0400-34-Ess.27

has been ☐ downgraded to : _____

☒ de-classified

by (Name): Michel W. Drapeau

(Dept.): A/DND Coordinator, Access to Information

Date: Dec. 7, 1992

R. Auger
Signature

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AVRO AIRCRAFT LIMITED
INTER-DEPARTMENTAL MEMORANDUM

Ref: 9266/11/J
Date: 1 January, 1959
To: See Distribution
From: E.F. Burnett - Weight Supervisor
Subject: Arrow 2 Production A/C Weight & C.G. Summary Report: 7-0400-34 Issue 27

Attached is a copy of Weight and C.G. Summary Report: 7-0400-34 Issue 27, dated January 1st, 1958, for your retention.

This report is revised monthly and is issued complete on the 1st of each month.


E.F. Burnett

ag

cc: Messrs. J.C. Floyd D. Wade C. Marshall
 R.N. Lindley D. Scard W. Potocki
 R. Marshall F. Brame A. Crust
 C.V. Lindow W. Czerwinski (6 copies R.C.A.F.)
 F.P. Mitchell J. Lucas D. Inglis
 T. Higgins S. Kwiatkowski D. Moore
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 B.C. Alford T. Roberts D. Danby

Classification cancelled / changed to: UNCLASSIFIED

By authority of: DRDA 7/DAREP 5-3/DAS Eng 6-4-5

Date: 5 Nov 1992

Signature: B. Aubrey

Unit / Rank / Appointment: DSIS 3, Secretary CRAD HQ DRP

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C O N F I D E N T I A L

Aircraft: Arrow 2
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I N D E X

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<u>Sheet</u>	<u>Content</u>
1-1 to 1-4	Introductory notes and explanation of Weight changes.
2-1 to 2-2	Weight & C.G. Summary
3	Horizontal C.G. plot showing the fixed points on flight envelope. The possible variations of C.G. with fuel used has been omitted until such time as fully approved fuel sequencing is established.
4-1 to 4-15	I.B.M. Detail sheet of Weight and C.G.'s.

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Introduction and Weight Changes

The following is a weight and C.G. summary of the Arrow 2 Production Aircraft, based on the latest weight estimates available.

All weight and C.G. changes are relative to issue 26 of this report of December 1st, 1958.

Early Arrow 2 Aircraft will not be as this summary designates but will be Flight Test Vehicles with Instrumentation. Reference should be made to the following reports:-

A/C 25206 Weight Report - 7-0400-82 Issue 5
A/C 25207 Weight Report - 7-0400-85 Issue 3

General:

- a) Orenda P,S. 13 Engines comprise the Power Plant, weight 4835 lb each excluding Nose Bullet, Inlet Frame and Avro installed accessories.
- b) A package containing one GENIE missile (828 lb), four FALCON missiles (148.1 lb) each, a fixed fuel tank 154 gals) and a removable fuel tank 174 gals) forms the current armament pack. Capability exists for the fitment of a second GENIE missile in lieu of the removable fuel tank.
- c) The Hughes MA 1 Electronic System is installed with an estimated weight of the system comprising both removable and fixed equipment of 2648 lb.

In addition to the above, the Minneapolis-Honeywell MH 64 Damping System is installed.

- d) Where actual weights of Arrow 1 parts that apply to Arrow 2 Aircraft have been obtained, these weights have been recorded in the Arrow 2 records a considerable number of Arrow 2 components and parts have been weighed.

On I.B.M. sheets in the report, immediately preceeding the item title will be found a number varying from 0 to 100. This is the percentage actual weight recorded in the relevant item.

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<u>1. Structure</u>		<u>Weight lb</u>
a) <u>Wings</u>	No weight change.	
b) <u>Fin & Rudder</u>	No weight change.	
c) <u>Fuselage Fwd. Sta. 255 ins</u>		
	Navigators Canopy Assign X74-158 addition of window blinds	+ 8.35
	Cockpit Formers re-estimated	+ 0.04
	Air Intakes re-estimated	- 0.90
	<u>Front Fuselage Increase</u>	<u>+ 7.49</u>
d) <u>Centre Fuselage Sta 255 - 485 ins</u>	No weight change	
e) <u>Duct Bay Sta. 485 - 591.65</u>		
	Skins Duct Bay. Shroud beam now part of Duct Bay was previously included with Engine Shroud	+ 1.39
	<u>Total Duct Bay Increase</u>	<u>+ 1.39</u>
f) <u>Engine Bay Sta. 591 - 742.5 ins</u>		
	Engine Shroud - shroud beam deleted now in Duct Bay - incorporated of minor changes	+ 0.26
	Engine Access Doors - re-estimated	+ 0.03
	Heavy Formers - increase in "V" struts	+ 0.26
	<u>Total Engine Bay Increase</u>	<u>+ 0.55</u>
g) <u>Rear Fuselage Sta. 742.5 - aft</u>		
	Remov. Engine Doors - actual weights obtained	+ 2.47
	<u>Total Rear Fuselage Increase</u>	<u>+ 2.47</u>
h) <u>Fuselage Joints</u>	No weight changes.	
		+ 11.90
	<u>Total Structural Increase</u>	<u>+ 11.90</u>
<u>2. Landing Gear</u>		
	Nose U/C Door - re-estimated	+ 0.05
	Main U/C Doors & Fairings Assign X74-4297 - Locking of Pivot Door incorporated	+ 5.21
	<u>Total Landing Gear Increase</u>	<u>+ 5.26</u>
3. <u>Power Plant & Service</u>	No weight change.	
4. <u>Flying Controls</u>	No weight change.	

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5. Equipment Fixed & Removable

Weight lb

Damping System - addition of Command Signal Converter (X74.117)	+ 10.00
Electrical System - re-estimated	- 3.01
Brake Parachute - actual weight of Arrow 1 chute obtained	+ 3.70
Air Conditioning	+ 56.07
Weighed weight in excess of heat exchanger spec. weight.	+ 15.86
Increase due to act. weight of shut off valves	+ 0.50
Weighed weight in excess of weight allowance for flexible metal joints (C.S-J-106,7,8,9,10)	+ 27.88
Increase due to under estimate of ducts	+ 3.59
Increase due to Assign. X74.4070 (cockpit & Radar Temp Control)	+ 8.99
Increase due to Misc. changes	+ 1.85
Deletion of Oil Heat exchanger replaced by duct	- 8.04
Deletion of Nitrogen line to IR seeker	- 2.34
Deletion of Air Conditioning in Fin	- 12.22
Additional installations for Hughes MA 1 Electronics System	+ 20.00
Radio and Radar Removable. This has been re-estimated and is based on Hughes Report X470000-100 issue C for Electronic System for Arrow 1A/C 25202 plus the following functions.	+ 211.70
a) ARN 6 Compass	
b) J4 Compass	
c) Air to Air I.F.F.	
d) ALC10 Interphone	
e) Additional AFCS components	
f) Inverter for missile firing	
g) Cockpit Presentation - two instruments replacing Artificial Horizon and R.M.I.	
This results in a system total comprising equipment and Hughes supplied racks of 2068.7 lb.	
Radio & Radar Fixed Re-estimate of cabling	+ 30.00
Armament Pack Structure addition of pressurized bulkhead	+ 9.50
Armament Pack Mechanisms - evaluation of Bohanan ejector rack	+ 15.00
Armament Pack Hydraulics - initial schematic estimated	+ 40.61
Armament Pack Fuel System - initial schematic estimated	- 5.67
Removable Tank Genie Bay - Fuel system added	+ 5.67

Total Equipment Increase

+ 373.57

6. Trapped Fuel

No weight change.

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7. Useful Load

Weight lb

Missiles - latest estimates incorporated + 84.40
Genie now 828 lb was 812 lb + 16.00 lb
(4 off) Falcon GAR3A now 148.1 lb ea was 131.0 lb ea.
+ 68.40 lb

Total Useful Load Increase + 84.40

Maximum Internal Fuel

- a) Tanks 1-8 2491 gal @ 7.8 lb/gal - 19433.00 lb is unchanged
b) Armament Pack 154 gal @ 7.8 lb/gal - 1201.20 ϕ
c) Armament Pack Remov. Tank 174 gal @ 7.8 lb/gal - 1358.00 lb is unchanged.

ϕ The capacity of the Armament Pack integral tank has been reduced by 26 gal.
(199.68 lb) to provide space for hydraulic valves and fuel disconnects mounted
in the Pack.

Summary

Weight Change - Aircraft Basic Weight

Structure	+ 11.90
Landing Gear	+ 5.26
Equipment	+ <u>373.57</u>
<u>Total</u>	+ <u>390.73</u>

Useful Load Increase + 84.40

Weight Change - Operational Weight Empty

Issue 26

46,061.21

Issue 27

46,536.34

+ 475.13 lb

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Weight & C.G. Summary

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Description	Weight lb	H. Arm ins	V. Arm ins
Structure	19,460.95	566.31	137.16
Wings	10,050.85	642.93	142.17
Fin & Rudder	1,030.94	754.65	208.99
Fuselage Fwd Sta. 255 ins	2,673.08	182.48	128.43
Sta. 255 - 485 ins	1,734.42	374.84	129.81
Sta. 485 - 591.65 ins	1,172.08	538.75	105.54
Sta. 591.65 - 742.5 ins	1,597.61	659.08	111.66
Sta. 742.5 ins. aft.	1,158.79	809.83	129.05
"Marry-Up"	43.18	467.77	109.69
Landing Gear - Retracted	2,703.24	489.49	135.07
Main Landing Gear	2,048.67	538.68	141.00
Main Gear Doors & Fairings	293.19	539.39	138.30
Nose Landing Gear	333.81	170.80	99.70
Nose Gear Door & Fairing	27.57	162.25	88.68
Power Plant & Services	11,450.87	675.26	121.79
Engines Bare PS 13	9,670.00	693.16	121.25
Engine Accessories (Inlet Frame etc)	388.00	620.58	120.47
Engine Controls	32.32	279.90	117.49
Gear Boxes & Drives on Fuselage	291.87	608.57	103.28
Gear Boxes & Starters on Engine	146.45	601.97	113.57
Fire Extinguisher System	73.58	686.35	131.21
Engine Mountings	75.39	671.91	141.52
Fuel System	773.26	529.49	135.09
Flying Controls Group	1,959.46	655.69	138.11
Mechanical Flying Controls	958.44	677.70	147.62
Hydraulic Flying Controls	1,001.02	634.62	129.01
Equipment Fixed and Removable	8,512.23	331.82	113.61
Instruments	34.61	167.52	138.92
Probe	14.86	-34.07	108.00
Cockpit Pressure Sealing	5.00	186.00	130.00
Cabin Consoles	17.68	175.29	124.49
Oxygen System	21.16	259.40	156.88
Ejector Seats	342.94	204.50	134.11
Cockpit Equipment	6.00	187.50	145.00
Air Conditioning System	943.04	344.82	135.23
Cockpit Insulation	14.31	187.48	132.00
Hydraulics Utilities System	650.75	498.84	117.86
Mech. Door Stops Main U/C Doors	3.02	516.00	120.00
Anti Skid Controls System	37.68	479.24	113.38
Drag Chute	96.26	786.06	143.24
Electrical System	1,225.59	427.45	112.54
Low Pressure Pneumatics	50.08	394.66	126.02
Surface Finish	100.00	572.83	140.20
Intake De-icing Boots	88.00	195.82	118.00
Canopy Actuation	63.52	209.61	154.34
Radar Door Actuation	10.00	268.00	95.00
Radio & Radar Removable	2,068.70	178.45	104.58
Radio & Radar Fixed	579.09	254.00	122.48
MH 64 Damping System	196.42	466.19	134.46

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Description	Weight lb	H. Arm ins	V. Arm ins	M.A.C. %
Armament Pack Structure	760.25	389.33	98.73	
Armament Pack Hydraulics	220.61	418.34	100.32	
Armament Pack Mechanisms	605.00	379.92	94.33	
Armament Pack Air Conditioning	5.21	305.50	102.50	
Armament Pack Pneumatics	24.45	286.92	103.50	
Armament Pack Electrics	108.00	367.00	101.00	
Armament Pack Fuel System	14.33	467.00	90.00	
Removable Tank for Genie Bay	205.67	367.96	99.72	
Trapped Fuel	213.80	548.26	141.79	
U/C Up		548.65	128.60	
Aircraft Basic Weight	44,300.55			
U/C Down		550.98	124.75	
Useful Load (less usable fuel)	2,235.79	357.23	109.29	
Crew	390.00	194.00	136.50	
Engine Fire Ext. Fluid	25.00	730.00	129.00	
Oil	162.00	638.31	110.89	
Oxygen Charge	13.39	259.69	159.91	
Water for Air Conditioning	225.00	267.91	131.56	
Missiles	1,420.40	378.49	97.29	
U/C Up		539.45	127.67	28.58
Operational Weight Empty	46,536.34			
U/C Down		541.67	124.01	29.19
Half Max. Int. Fuel	10,996.10	-	-	-
Combat Weight ($\frac{1}{2}$ Max. Int. Fuel)	57,532.44	-	-	-
Max. Int. Fuel	21,992.20	525.32	138.67	
a) Tanks 1-8: 2491 gal @ 7.8 lb/gal	19,433.00	541.85	144.16	
b) Arm. Pack 154 gal @ 7.8 lb/gal	1,201.20	446.00	97.00	
c) Arm. Pack Remova. Tank (174 gal @ 7.8 lb/gal)	1,358.00	359.00	97.00	
U/C Up		534.92	131.20	27.33
Gross Weight (Max. Int. Fuel)	68,528.54			
U/C Down		536.42	128.71	27.74
Max. Ext. Fuel (500 gal @ 7.8 lb/gal + drop tank)	4,242.36	520.32	60.79	
U/C Up		534.07	127.10	27.10
Max. Gross Weight (Int. + Ext. Fuel)	72,770.90			
U/C Down		535.48	124.75	27.48

N.B. 1. Aircraft Datum = 120 ins. above an arbitrarily chosen ground line.

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**WEIGHT AND C. OF G BY FUNCTIONAL
COMPONENT**

PROJECT Arrow 2 Prod. A/C

DESCRIPTION	REFERENCE NO.	COMP. NO.	WEIGHT	H.
TOTAL WING GROUP 2 PROD	1000000			
OUTER WING	1010000			
100 OUTER WING SKINS	1010001	64	9291070	
100 POSTS AND INTERCOSTALS	1010002	64	243673	
100 OUTER WING SPARS	1010003	64	3925870	
100 OUTER WING RIBS	1010004	64	1345669	
18 AILERON CONTROL BOX	1010006	64	3792077	
100 RIB 12	1010007	64	762664	
100 O W AILERON JACK FITTING	1010009	64	104672	
AILERON JOINTS AND FAIRING	1010010		329378	
			197945	
100 AILERON	1020000	74	3360079	
			33600	
20 ELEVATOR	1030000	82	4463875	
20 ELEVATOR MARRY UP	1030001		159773	
			46235	
INNER WING	1040000			
81 MAIN U C STRUCTURE	1040001	62	3321757	
95 INNER WING SPARS	1040002	62	4191757	
61 I W STRUCTURE F S TO M S	1040007	62	10853949	
17 I W STRUCTURE M S TO R S	1040008	62	1500160	
30 CENTRE TRAILING EDGE	1040009	62	3189872	
40 ELEVATOR CONTROL BOX I W	1040010	62	4339872	
25 TRANSP JOINT MARRY UP	1040011		706563	
61 CENTRE LINE JOINTS	1040012	62	5828166	
91 INNER WING SKINS	1040013	62	2804862	
63 STRUT PICK UP FITTINGS	1040014	62	1231661	
62 RIBS 1 TO 9	1040016	62	4851661	
DORSAL FAIRING I *	1040017	62	11348	
100 RIB 10	1040018	62	1070663	
49 FUSELAGE HINGE JOINT I *	1040019	62	1262861	
25 TRANSP JOINT	1040020	62	1294263	
49 FUSELAGE HINGE JOINT	1040021		393553	
DORSAL FAIRING C A	1040023		591356	
SHUT OFF VALVE OPERAT MECH	1040024	62	51354	
62 LEADING EDGE I W	1040025	62	2148946	
			696435	
LEADING EDGE O W	1050000	65	3087063	
			30870	

WEIGHT AND C. OF G BY FUNCTIONAL COMPONENT

PROJECT_____

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WEIGHT AND C. OF G BY FUNCTIONAL COMPONENT

PROJECT _____

	DESCRIPTION	REFERENCE NO.	COMP. NO.	WEIGHT	H.
	SKIN D B	30400001	56	636653	
5	FORMERS D B	30400002	56	73355	
	TOP LONGERONS	30400003	56	4985	
	MTG BRKTS SIDE PANEL	30400004	56	19051	
	LOWER LONGERONS	30400005	56	1030152	
72	MAIN FRAME STA 538 77	30400006	56	598053	
	ACCESS PANELS	30400007	56	387452	
	LOWER PANEL ASSY	30400008	56	21754	
	DROP TANK MTG STRUCTURE	30400009	56	84158	
20	LOWER SIDE PANELS FWD	30400010	56	1075650	
	LOWER CENTRE PANEL FWD	30400011	56	279151	
16	LOWER CENTRE PANEL AFT	30400012	56	699056	
	LOWER CENTRE PANEL AFT	30400013	56	260956	
60	FLOATING DUCT	30400014	56	4562755	
	HEAT EXCHANGER MTG	30400015	56	70557	
				105080	
	ENGINE BAY	30500000			
100	TOP LONGERONS	30500001	58	67466	
84	BOTTOM LONGERONS	30500002	58	846465	
	ENGINE ACCESS DOORS	30500003	58	1349463	
	ENGINE TUNNEL	30500004	58	6313565	
71	ENG RAILS ATTACH TO FORM	30500005	58	290668	
	PANELS AT ENG ACCESS DOORS	30500006	58	1127264	
	BOTTOM CTR PANEL FWD	30500007	58	472761	
	BOTTOM CTR PANEL CENTRE	30500008	58	416867	
	BOTTOM CTR PANEL AFT	30500009	58	771972	
5	SIDE PANEL FWD	30500010	58	859761	
5	SIDE PANEL CENTRE	30500011	58	748167	
32	SIDE PANEL AFT	30500012	58	746372	
41	HEAVY FORMERS	30500013	58	1966166	
				159761	
	REAR FUSELAGE	30600000			
	OUTER SKINS FIXED	30600001	59	565877	
	FORMERS FIXED R F	30600002	59	1050977	
	LONGERONS FIXED R F	30600003	59	251977	
	TUNNEL FIXED R F	30600004	59	1099477	
85	ENGINE ACCESS DOORS R F	30600005	59	927077	
29	FAIRING UNDER RUDDER FIXED	30600006	59	290178	
	REMOVABLE TAILCONES	30600007	59	6309382	
	CENTRE STRUC AND STING REM	30600008	59	1093583	
				115879	
96	DIVE BRAKES	30700001	72	1170650	
96	DIVE BRAKES C A	30700002		42248	
				12128	

WEIGHT AND C. OF G BY FUNCTIONAL COMPONENTS

PROJECT_____

[illegible]

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WEIGHT AND C. OF G BY FUNCTIONAL COMPONENT

PROJECT _____

DESCRIPTION				REFERENCE NO.	COMP. NO.	WEIGHT	H.
BRAKE PARACHUTE				70800000			
83	BRAKE	PARACHUTE	F F	70800001	52	47915	
83	BRAKE	PARACHUTE	R F	70800005	59	90188	
83	BRAKE	PARACHUTE	I W	70800006	62	12961	
						9626	
ELECTRICAL SYSTEM				70900000			
	ELECTRICAL	WIRING	R N	70900001	51	1299	
	ELECTRICAL	WIRING	F F	70900002	52	296619	
	ELECTRICAL	WIRING	C F	70900003	54	235439	
	ELECTRICAL	WIRING	A I	70900004	55	127421	
	ELECTRICAL	WIRING	D B	70900005	56	901552	
	ELECTRICAL	WIRING	E B	70900006	58	6459	
	ELECTRICAL	WIRING	I W	70900008	62	923653	
	ELECTRICAL	WIRING	FIN	70900009	83	35279	
	ELECTRICAL	WIRING	NUC	70900010	91	33018	
	ELECTRICAL	WIRING	ENG	70900011		200260	
	ELECTRICAL	WIRING	C A	70900012		1374633	
	ELECTRICS	F F		70900013	52	1642915	
	ELECTRICS	C F		70900014	54	863645	
	ELECTRICS	E H		70900015	58	111761	
	ELECTRICS	ENG		70900016		1755458	
	ELECTRICS	C A		70900017		80261	
	ELECTRICS	FIN		70900018	83	4489	
	ELECTRICS	I W		70900019	62	227562	
	ELECTRICS	CAW		70900020		12067	
	ELECTRICS	MUC		70900021	92	7451	
	ELECTRICS	A I		70900022	55	490622	
	ELECTRICS	D B		70900023	56	2546851	
	ELECTRICS	R F		70900024	59	17680	
	WINDSCREEN	DEMISTING		70900025	52	349019	
						122559	
L P PNEUMATICS				71000000			
	L P PNEUMATICS	F F		71000001	52	199319	
	L P PNEUMATICS	C F		71000002	54	79632	
	L P PNEUMATICS	FIN		71000005	83	41474	
	L P PNEUMATICS	R N		71000006	51	1997	
	L P PNEUMATICS	ENG		71000008		140363	
	L P PNEUMATICS	I W		71000009	62	20352	
						5008	
INTAKE DE ICING				71200000	55	880019	
						8800	
RADIO AND RADAR FIXED				71400000			

WEIGHT AND C. OF G BY FUNCTIONAL COMPONENT

PROJECT_____

DESCRIPTION	REFERENCE NO.	COMP. NO.	WEIGHT
RADIO AND RADAR FIXED R N	7140000151		500
RADIO AND RADAR FIXED F F	7140000252		215011
RADIO AND RADAR FIXED C F	7140000354		84002
RADIO AND RADAR FIXED FIN	7140000583		32007
RADIO AND RADAR FIXED C A	71400006		225002
RADIO AND RADAR FIXED I W	7140000762		18085
			57909
60 CANOPY ACTUATION	7160000052		63522
			6352
CABIN CONSOLES	7170000052		17681
			1768
RADAR DOOR ACTUATION	7180000054		10002
			1000
SURFACE FINISH R N	7190000151		246
SURFACE FINISH F F	7190000252		3631
SURFACE FINISH CANOPY	7190000353		642
SURFACE FINISH C F	7190000454		9283
SURFACE FINISH INTAKES	7190000555		4082
SURFACE FINISH D B	7190000656		3495
SURFACE FINISH E B	7190000758		4436
SURFACE FINISH R F	7190000859		4027
SURFACE FINISH I W	7190000962		31516
SURFACE FINISH O W	7190001064		10677
SURFACE FINISH O W L EDGE	7190001165		3196
SURFACE FINISH DIVE BRAKES	7190001272		285
SURFACE FINISH AILERON	7190001374		3537
SURFACE FINISH ELEVATOR	7190001482		5667
SURFACE FINISH FIN	7190001583		6397
SURFACE FINISH RUDDER	7190001684		2028
SURFACE FINISH ARM PACK	7190001794		4723
			10000

WEIGHT AND C. OF G BY FUNCTIONAL COMPO

PROJECT_____

[illegible]

RIGHT AND C. OF G BY

FUNCTIONAL GROUP COMPONENT

REPORT NO.

SHEET

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