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72/PERF/22 ADD.1

UNCLASSIFIED SECRET

FURTHER ARROW PERFORMANCE WITH  
P AND V JT4B-23 ENGINES  
- NEW MISSIONS

PERFORMANCE GROUP

SEPT.1958





AVRO AIRCRAFT LIMITED

MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

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AIRCRAFT: ARROW

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- NEW MISSIONS

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REPORT NO. 72/PERF/22 ADD.1

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FURTHER ARROW PERFORMANCE WITH P AND W JT4B-23 ENGINES

- NEW MISSIONS

SUMMARY

This Addendum gives the performance of the Arrow, when powered by the P and W JT4B-23 (P6) engines, for the six new missions quoted in Periodic Performance Report No.14.

The assumptions regarding engine data and weights are, to all practical purposes, as quoted in the parent report (72/PERF/22).

The distances achieved are summarised and compared with the Iroquois powered Arrow in the following table.

<u>MISSION</u>	<u>RADIUS OF ACTION N.M.</u>	
	<u>J75 (P6)</u>	<u>IROQUOIS</u>
1. Subsonic High Altitude Mission - Subsonic combat	403	442
2. Subsonic High Altitude Mission - Supersonic combat	304	347
3. Supersonic High Altitude Mission - Supersonic combat	165	238
4. Combat Air Patrol - Supersonic combat	412	467
5. Subsonic low level mission (10,000') - Subsonic combat	424	349
	<u>RANGE N.M.</u>	
6(a) Ferry Mission (no armament) ventral tank carried throughout	1203	1306
6(b) Ferry Mission (no armament) ventral tank jettisoned when empty	1313	1357



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SUMMARY (Cont'd)

Details of the individual missions are given in Tables 1-7.

The main reason for the JT4B-23 version having a better radius of action in the Subsonic low level mission is an apparent improvement in economy of this engine compared to the Iroquois at 10,000 ft.



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TABLE 1 ARROW 2 WITH J75-P6 ENGINES

SUBSONIC HIGH ALTITUDE MISSION - SUBSONIC COMBAT

CONDITION	DISTANCE N.M.	TIME MIN.	FUEL LB.	A/C WT. LB.
Start Weight	-	-	-	68672
Engine Start	-	.5	100	68572
Take-off to Unstick at S.L. Max Thrust A/B Unlit	-	.38	174	68398
Acc. to 527 kts. at S.L. Max Thrust A/B Unlit	6.2	1.04	520	67878
Climb at 527 kts. TAS to 28,000' (opt. Cruise Out Altitude) Max Thrust, A/B Unlit	32.5	3.76	1350	66528
Cruise Out at M = .90 at 28,000' A/B Unlit	326.5	36.50	4927	61601
Climb at M = .92 to 50,000' Max Thrust A/B Lit	37.70	4.32	2423	59178
Combat at M = .92 at 50,000' Max Thrust A/B Lit	-	5.0	2025	55425 *
Descend to 34,000' at Idle Thrust	-	3.2	240	55185
Cruise Back at M = .90 at Opt. Altitude (34,000')	402.9	46.60	5070	50115
Loiter Over Base at 34,000' at Max. Endurance Speed	-	15.0	1515	48600
Descend to S.L. at Idle Thrust	-	5.90	307	48293
Land with Reserves for 5 min. Loiter at S.L. at Max. Endurance Speed	-	5.0	782	47511
TOTAL	805.8	127.20	19433	

\*1728 lb. Missiles fired during combat  
Fuel density 7.8 lb/gallon.





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TABLE 2 ARROW 2

WITH J75-P6 ENGINES

SUBSONIC HIGH ALTITUDE MISSION - SUPERSONIC COMBAT

CONDITION	DISTANCE N.M.	TIME MIN.	FUEL LB.	A/C WT. LB.
Start Weight	-	-	-	68672
Engine Start	-	.50	100	68572
Take-off to Unstick at S.L. Max Thrust	-	.38	174	68398
A/B Unlit	-	.38	174	68398
Acc. to 527 kts. at S.L. Max Thrust	-	.38	174	68398
A/B Unlit	6.20	1.04	520	67878
Climb at 527 kts. TAS to 28,000' Max Thrust A/B Unlit (Opt. Cruise Out Altitude)	32.50	3.76	1350	66528
Cruise Out at M = .90 at Optimum	-	-	-	-
Cruise Altitude (28,000')	230.0	25.80	3580	62948
Acc. to M = 1.5 at 28,000' Max Thrust	-	-	-	-
A/B Lit	14.40	1.18	1774	61174
Climb at M = 1.5 to 50,000' Max Thrust	-	-	-	-
A/B Lit	20.40	1.48	1540	59634
Combat at M = 1.5 at 50,000' Max Thrust A/B Lit	-	5.00	3800	54106 *
Descend to 34,000' at Idle Thrust	-	3.2	240	53866
Cruise Back at M = .90 at Optimum	-	-	-	-
Cruise Altitude (34,000')	303.5	35.00	3751	50115
Loiter Over Base at 34,000' at Max	-	-	-	-
Endurance Speed	-	15.00	1515	48600
Descend to S.L. at Idle Thrust	-	5.90	307	48293
Land with Reserves for 5 min. Loiter at S.L. at Max. Endurance Speed	-	5.00	782	47511
TOTAL	607.0	103.24	19433	

\* 1728 lb. Missiles fired during combat  
Fuel density 7.8 lb/gallon.



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TABLE 3 ARROW 2

WITH J75-P6 ENGINES

SUPERSONIC HIGH ALTITUDE MISSION - SUPERSONIC COMBAT

CONDITION	DISTANCE N.M.	TIME MIN.	FUEL LB.	A/C WT. LB.
Start Weight	-	-	-	68672
Engine Start	-	.50	100	68572
Take-off to Unstick at S L. Max Thrust	-			
A/B Unlit	-	.38	174	68398
Acc. to M = .92 at S.L. Max Thrust				
A/B Unlit	9.25	1.36	712	67686
Climb at M = .92 to 30,000' Max Thrust				
A/B Lit (Opt. Acceleration Altitude)	9.2	1.12	1875	65811
Acc. to M = 1.5 at 30,000' Max Thrust				
A/B Lit	16.5	1.35	1880	63931
Climb at M = 1.5 to 50,000' Max				
Thrust A/B Lit (Opt. Cruise Out Alt.)	22.5	1.58	1650	62281
Cruise Out at M = 1.5 at 50,000'				
with Partial Afterburning	107.0	7.45	4420	57861
Combat at M = 1.5 at 50,000' Max				
Thrust A/B Lit	-	5.00	3800	52333 *
Descend to 34,000' at Idle Thrust	-	3.2	240	52093
Cruise Back at M = .90 at Optimum				
Cruise Altitude (34,000')	164.45	19.0	1978	50115
Loiter Over Base at 34,000' at Max				
Endurance Speed	-	15.00	1515	48600
Descend to S.L. at Idle Thrust	-	5.90	307	48293
Land with Fuel Reserves for 5 min.				
Loiter at S.L. at Max. Endurance Speed	-	5.00	782	47511
TOTAL	328.9	66.84	19433	

\* 1728 lb. Missiles fired during combat  
Fuel density 7.8 lb/gallon.



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TABLE 4 ARROW 2 WITH J75-P6 ENGINES

COMBAT AIR PATROL - SUPERSONIC COMBAT

WITH VENTRAL TANK - JETTISONED AT FUEL EXHAUSTION

CONDITION	DISTANCE N.M.	TIME MIN.	FUEL LB.	A/C WT. LB.
Start Weight	-	-	-	72914
Engine Start	-	.50	100	72814
Take-off to Unstick at S.L. Max Thrust A/B Unlit	-	.45	193	72624
Acc. to 527 kts at S.L. Max Thrust A/B Unlit	6.65	1.10	545	72076
Climb at 527 kts. TAS to 27,500 <sup>§</sup> Max Thrust A/B Unlit (Opt. Cruise Out. Altitude)	39.0	4.6	1600	70476
Cruise Out at M = .90 at 27,500 <sup>§</sup>	328.03	36.72	5400	64734
Acc. to M = 1.5 at 27,500 Max Thrust A/B Lit	15.2	1.26	1920	62814
Climb to 50,000 <sup>§</sup> at M = 1.5 Max Thrust A/B Lit	23.2	1.63	1740	61074
Combat at M = 1.5 at 50,000 Max Thrust A/B Lit	-	5.0	3800	55546 *
Descend to 34,000 <sup>§</sup> at Idle Thrust	-	3.2	240	55306
Cruise Back at M = .90 at Opt. Altitude (34,000)	412.08	46.92	5191	50115
Loiter Over Base at 34,000 <sup>§</sup> at Max. Endurance Speed	-	15.0	1515	48600
Descend to S.L. at Idle Thrust	-	5.90	307	48293
Land with Reserves for 5 min. Loiter at S.L. at Max. Endurance Speed	-	5.0	782	47511
TOTAL	824.2	127.28	23333	

\* 1728 lb. Missiles fired during combat  
Fuel density 7.8 lb/gallon.





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TABLE 5 ARROW 2 WITH J75-P6 ENGINES

SUBSONIC LOW LEVEL MISSION (10,000') -SUBSONIC COMBAT

CONDITION	DISTANCE N.M.	TIME MIN.	FUEL LB.	A/C WT LB.
Start Weight	-	-	-	68672
Engine Start	-	.50	100	68572
Take-off to Unstick at S.L. Max Thrust A/B Unlit	-	.38	174	68398
Acc. to 527 kts. at S.L. Max Thrust A/B Unlit	6.20	1.04	520	67878
Climb to 10,000' at 527 kts. TAS Max Thrust A/B Unlit	7.4	.86	440	67438
Cruise at M = .60 (Opt. Cruise Speed) at 10,000' A/B Unlit	404.0	63.3	7000	60438
Acc. to M = .92 at 10,000' Max Thrust A/B Unlit	6.4	.77	324	60114
Combat at M = .92 at 10,000' Max Thrust A/B Unlit	-	5.0	2340	56046 *
Climb to 34,000' at 527 kts. TAS Max Thrust A/B Unlit	34.0	3.90	1070	54976
Cruise Back at M = .90 at Opt. Alt. (34,000')	390.0	45.0	4861	50115
Loiter Over Base at 34,000' at Max. Endurance Speed	-	15.0	1515	48600
Descend to S.L. at Idle Thrust	-	5.9	307	48293
Land with Reserves for 5 min. Loiter at S.L. at Max. Endurance Speed	-	5.0	782	47511
TOTAL	848.0	146.65	19433	

\* 1728 lb. Missiles fired during combat  
Fuel density 7.8 lb/gallon.



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TABLE 6 ARROW 2 WITH J75-P6 ENGINES

FERRY MISSION (NO ARMAMENT)

VENTRAL TANK CARRIED THROUGHOUT

CONDITION	DISTANCE N.M.	TIME MIN.	FUEL LB.	A/C WT. LB.
Start Weight	-	-	-	71186
Engine Start	-	.50	100	71086
Take-off to Unstick Max Thrust	-			
A/B Unlit	-	.41	184	70902
Acc. to 527 kts. at S.L. Max Thrust				
A/B Unlit	6.45	1.08	535	70367
Climb at 527 kts. TAS to 30,000' Max				
Thrust A/B Unlit	45.2	5.2	1780	68587
Cruise Climb to 34,000' at M = .90	1151.2	127.61	18102	50485
Loiter Over Base at 34,000' at Max.				
Endurance Speed	-	15.0	1540	48945
Descend to S.L. at Idle Thrust	-	5.90	307	48638
Land with reserves for 5 min. Loiter				
at S.L. at Max. Endurance Speed	-	5.0	785	47853
TOTAL	1202.85	160.07	23333	

Fuel density 7.8 lb/gallon.



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TABLE 7 ARROW 2 WITH J75-P6 ENGINES

FERRY MISSION (NO ARMAMENT)

VENTRAL TANK JETTISONED WHEN EMPTY

CONDITION	DISTANCE N.M.	TIME MIN.	FUEL LB.	A/C WT. LB.
Start Weight	-	-	-	71186
Engine Start	-	.50	100	71086
Take-off to Unstick Max Thrust	-	.41	184	70902
A/B Unlit	-	.41	184	70902
Acc.to 527 kts. at S.L. Max Thrust	-	.41	184	70902
A/B Unlit	6.45	1.08	535	70367
Climb at 527 kts. TAS to 30,000' Max	-	-	-	-
Thrust A/B Unlit	45.2	5.2	1780	68587
Cruise Climb to 34,000' at M = .90	1261.3	143.6	18165	50080
Loiter Over Base at 34,000' at Max.	-	-	-	-
Endurance Speed	-	15.0	1515	48600
Descend to S.L. at Idle Thrust	-	5.90	307	48293
Land with Reserves for 5 min. Loiter	-	-	-	-
at S.L. at Max. Endurance Speed	-	5.0	782	47511
TOTAL	1312.95	176.89	23333	

Fuel density 7.8 lb/gallon.



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