

ARROW WEAPON SYSTEM
CO-ORDINATING CONTRACTOR

PRELIMINARY
REPORT NO. 11

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NOVEMBER 1953

INTERIM REPORT ON
TRAINING REQUIREMENTS
AVRO AND OHEDA PERSONNEL

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Issued: _____

Arrow Weapon System
Co-ordinator

Approved: _____

Vice-President
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SUMMARY

Avro requirements for training on the electronic and damper systems, and Avro and Orenda requirements for cross-training, as defined herein, have been reviewed by the ANSC Department.

The varying requirements have been reduced to a manageable program, by defining three levels of training: (a) familiarization (b) basic and (c) complete. The approximate dates for completion of training and, where possible, the length of courses have been detailed.

The proposed contractual arrangements for effecting the program are included.

This report supersedes ANSCC Report No. 5.

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1. INTRODUCTION

1.1 Requirement for Formal Training

In order to satisfactorily carry out the Arrow engineering, manufacture and test program defined by AD-53 Issue 2, Statement of Work, Revised Arrow Program, it is necessary that engineers and technicians employed by Avro Aircraft Limited be trained on the theory and operation of equipment manufactured by Associate Contractors and sub-contractors. Four of the sub-systems, the Iroquois engine, the MA-1C integrated electronic system, the Falcon missile, and the YG-339B damper system, are of sufficient complexity to make formal training courses mandatory.

1.2 Training on Electronic, Missile and Damper Systems

Avro is responsible (with technical assistance from Hughes Aircraft Company) for compatibility of airframe and electronics, and for pre-installation testing, installation, primary function, calibration, and repairs (to the first and second line maintenance level) of the MA-1C electronic system. Experience with the MG-2 system has shown that a formal training course including practical work, or a lecture course followed by on-the-job training, is essential to enable personnel to carry out their duties in an efficient manner. The number of people required is based on MG-2 experience with a factor to allow for the added complexity of the MA-1C system.

Similar requirements exist for training on the Falcon missile.

In the case of the damper system, Avro responsibilities are the same as in the MA-1C system, but the assistance provided by the sub-contractor will be on an as-required basis rather than full time.

1.3 Avro-Orenda Cross-Training

Avro is responsible for installation, run-up, and first line maintenance and removal of the Iroquois in the Arrow. Orenda is responsible for second and higher line maintenance of all Iroquois engines up to RCAF acceptance of the aircraft, including build-up of Orenda-supplied accessories and all adjustment and fault rectification requiring a check-out and run-up facility. In order to accomplish these tasks efficiently, and particularly to ensure that no unnecessary removals of engines take place, it is necessary that a limited number of both Avro and Orenda personnel receive training on the related systems of both the airframe and the engine.

In addition, Orenda aircrew must receive conversion training for the Arrow in order to carry out flight operations on aircraft allocated to Iroquois test programs. Training of Avro personnel on the engine, and Orenda personnel on the airframe, will be referred to hereafter as "contractor cross-training".

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1.4 Scope of this Report

This report deals with contractor cross-training and training of Avro personnel on the electronic, missile and damper systems, but excludes training of Avro and Orenda personnel on their own products.

2. REQUIREMENTS

2.1 Preliminary Estimate of Program

In order to form an estimate of the nature of the training required, and the number of people to be trained, Avro and Orenda were asked to submit requirements for training under the headings of type of training, required date of completion, and the number of people involved. Replies received indicated that 52 different training courses would be required, extending from the present time to December 1960. This is obviously impracticable, but the requirements, exactly as received, are summarized, for reference only, in Table 1.

2.2 Program Planning

To reduce the information contained in Table 1 to a manageable program, three arbitrary levels of training were selected as follows:

2.2.1 Familiarization

Short courses for those (usually senior personnel) who need to have an appreciation of the problems involved, but who will not be engaged at any time in actual operations.

2.2.2 Basic Course

More detailed than the familiarization courses, basic courses are directed at those who require a background in theory, operation and maintenance, but who will not be engaged directly in operation or testing. These courses, supplemented by manuals or EO's, should enable an experienced engineer or technician to supervise the handling of problems as they arise.

2.2.3 Complete Course

These courses are detailed and are designed to train engineers and technicians who are to be engaged in actual testing, calibration and trouble-shooting.

The information in Table 1 has been re-grouped into these three general classifications as shown in Table 2. Dates for conducting these courses are included, together with the length of course where this information is available.

The organization of trained personnel to support the electronics, missile, and damper systems in aircraft allocated to test programs at Avro, and aircraft being prepared for delivery to RCAF bases for

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test programs or squadron service, is shown in Table 3. The peak load is 13 aircraft; the organization shown is marginally adequate to handle this load.

2.3 Location of Schools

Avro and Orenda will conduct courses on the airframe and engine respectively at their Malton facilities. Initial training on the integrated electronic system and the Falcon missile will be given by Hughes Aircraft Company at Culver City, under sub-contract to Avro. Training on the YG-339B damper will be given by Honeywell Controls Limited at its Toronto facility, similarly under sub-contract.

During 1960, it may be possible to send a limited number of contractor personnel to the RCAF training school at Camp Borden.

3. CONTRACTUAL COVERAGE

- 3.1 The following items are covered by paragraph 12.4 of AD-53 Issue 2 Statement of Work, Revised Arrow Program:
 - (a) Procurement of training courses and instructors under sub-contract from Hughes Aircraft Company and Honeywell Controls Limited.
 - (b) Labor costs of Avro personnel attending courses on the engine, electronic, and damper systems.
- 3.2 The preparation and presentation of airframe courses for Orenda personnel are covered in paragraph 12.19(a) of AD-53 Issue 2.
- 3.3 The co-ordination of contractor cross-training is covered in paragraph 12.19(a) of AD-53 Issue 2.
- 3.4 The preparation and presentation of engine courses for Avro personnel is covered in Orenda Engines Limited Statement of Work.

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TABLE 1

(a) Training Requirements on Electronic, Missile, and Damper Systems as stated by Avro.

Dates given are for completion of training.

TYPE OF COURSE	NUMBER OF AVRO PERSONNEL				
	FLIGHT OP'NS.	MANUF'G	ENG.	SALES & SERVICE	QUALITY CONTROL
(i) <u>MA-1C Electronic System</u>					
Briefing		Mar. 59 12			
Cockpit controls, etc.	Mar. 59 2				
Service Representatives (Basic course)				(Dec 59 (1 (Dec 60 (2	
Service Analyst (Basic course)				Aug. 59 1	
Service Engineers (Detailed course)				Aug. 59 1	
Technical Writer (Detailed course)				Mar. 59 1	
Engineers			(Apr. 59 (3 (Sept 59 (3		
Technicians			Sept 59 12		
Supervision, Radar (Complete course)		(Apr. 59 (1 (Sept 59 (2 (Feb. 60 (2 (Aug. 60 (1			(Mar. 59 (1 (Sept 59 (1

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TABLE 1 (CONT'D)

(a) Cont'd

TYPE OF COURSE	NUMBER OF AVRO PERSONNEL				
	FLIGHT OP'NS.	MANUF'G	ENG.	SALES & SERVICE	QUALITY CONTROL
(i) <u>MA-1C Electronic System</u> (Cont'd)					
		(Apr. 59			
		(5			
		(Sept 59			
Radar Mechanics		(10			
		(Feb. 60			
		(19			
		(Aug. 60			
		16			
Supervision, C & N		(Sept 59			
		(1			
		(Feb. 60			
		(1			
		(Sept 59			
		(6			
Radio Mechanics		(Feb. 60			
		(6			
		(Aug. 60			
		(6			
					(Mar. 59
					(3
Inspectors					(Sept 59
					(4
					(Feb. 60
					(4
					(Aug. 60
					(3

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TABLE 1 (CONT'D)

(a) Cont'd

TYPE OF COURSE	NUMBER OF AVRO PERSONNEL				
	FLIGHT OP'NS.	MANUF'G	ENG.	SALES & SERVICE	QUALITY CONTROL
(ii) <u>Falcon Missile</u>					
Briefing		Sept 59 8			
Service Representatives (Basic course)				(Dec 59 1 (Dec 60 2	
Service Analyst (Basic course)				Aug. 59 1	
Service Engineers (Detailed course)				Aug. 59 1	
Technical Writer (Detailed course)				Mar. 59 1	
Engineers			Nov. 59 2		
Technicians			Nov. 59 4		
Supervision		Nov. 59 1			
Electronic technician		Nov. 59 3			
Electrical technician		Nov. 59 3			
Inspectors					Nov. 59 2

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TABLE 1 (CONT'D)

(a) Cont'd

TYPE OF COURSE	NUMBER OF AVRO PERSONNEL				
	FLIGHT OP'NS.	MANUF'G	ENG.	SALES & SERVICE	QUALITY CONTROL
(iii) <u>VG-332B Damper</u>					
Briefing		Mar 59 12			
Service Representatives (Basic course)				Dec. 59 1	
Service Analyst (Basic course)				Dec. 60 2	
Service Engineers (Detailed course)				Aug. 59 1	
Technical Writer (Detailed course)				Mar. 59 1	
Engineers			Nov. 58 11		
Supervision		(Sept 59 (1 (Feb 60 (1			
Technicians		(Sept 59 (7 (Feb 60 (7 (Aug 60 (6	Mar. 59 6		
Inspectors					(Mar. 59 (2 (Sept 59 (2 (Feb. 60 (3 (Aug. 60 (2

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TABLE 1 (CONT'D)

(b) Personnel Cross-Training Requirements as stated by Avro and Orenda.

Dates given are course completion dates.

TYPE OF COURSE	NUMBER OF AVRO PERSONNEL				
	FLIGHT OP'NS.	MANUF'G	ENG.	SALES & SERVICE	QUALITY CONTROL
1. General foreman			Mar. 59 1		
2. Flight service - General			Mar. 59 2		
3. Sub-foreman		Mar. 59 4	Mar. 59 2		
4. Engine mechanics		Mar. 59 8	Mar. 59 4		
5. Engineers - Technical Design			Mar. 59 1		
6. Engineers - Equipment Design			Mar. 59 2		
7. Engineers - Flight Test			Mar. 59 1		
8. Briefing		Dec. 58 9			
9. Engine running, installation, etc.		June 59 6			June 59 11
10. Engineers - Service				(Mar 59 (1 (Dec 60 (1	
11. Service representatives				(Mar 60 (3	
12. Service analysts				Mar. 60 4	
13. Pilot	Mar. 59 1				

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TABLE 1 (CONT'D)

(b) Cont'd

TYPE OF COURSE	NUMBER OF ORENDA PERSONNEL
ARROW AIRFRAME	
1. Pilot indoctrination and conversion flight training	April '59 2
2. Observer - flight engineer	April '59 2
3. Sub-foreman, airframe	April '59 1
4. Aircraft mechanic, airframe	April '59 4
5. Electricians	April '59 2
6. Inspectors	April '59 2
7. Service representatives	April '59 2

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TABLE 2

(a) Avro Training Requirements Summary

TYPE OF COURSE	LEVEL (see para 2.2)	DURATION (weeks) (approx.)	COMPLETION DATE	NUMBER OF TRAINEES
<u>NA-1C Integrated Electronic System</u>				
Briefing	1	1	Mar. 59	14
Basic course	2	10	Sept 59	2
	2	10	Aug. 60	2
Complete course	3	20	* Apr. 59	14
	3	20	Sept 59	40
	3	20	Feb. 60	32
	3	20	Aug. 60	26
				<u>130</u>
<u>Falcon Missile</u>				
Briefing	1	1	Sept 59	8
Basic course	2	Not known	Sept 59	2
			Aug. 60	2
Complete course	3	11	Mar. 59	1
			* Nov. 59	16
				<u>29</u>
<u>YG-339B Damper</u>				
Briefing	1	1	Mar. 59	12
Basic course	2	4	Dec. 59	1
	2	4	Dec. 60	2
Complete course	3	8	Nov. 58	11
	3	8	Mar. 59	9
	3	8	Sept 59	11
	3	8	Feb. 60	11
	3	8	Aug. 60	8
				<u>65</u>

* These courses given by HAC at Culver City; all other NA-1C and Falcon courses are expected to be given at Avro by HAC instructor.

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TABLE 2 (CONT'D)

(b) Avro and Orenda Cross-Training Requirements Summary

TYPE OF COURSE	LEVEL (see para 2.2)	DURATION (weeks) (approx.)	COMPLETION DATE	NUMBER OF TRAINEES	
				AVRO	ORENDA
<u>Airframe</u>					
Basic course	2	2	Dec. 58		15
<u>Iroquois</u>					
Briefing	1	1	Dec. 58	9	
Complete course	3	2	Dec. 58	13	
	3	2	Mar. 59	30	
	3	2	Mar. 60	8	
	3	2	Dec. 60	1	
				61	15

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TABLE 2 (CONT'D)

(c) Recapitulation

TYPE OF COURSE	NUMBER OF TRAINEES	
	AVRO	ORENDA
MA-1C integrated electronic system	130	
Falcon missile	29	
YG-339B damper	65	
Airframe		15
Iroquois engine	61	
	285	15

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TABLE 3

FULLY TRAINED PRODUCTION PERSONNEL REQUIRED TO
SUPPORT ELECTRONIC, MISSILE AND DAMPER SYSTEMS

The following is required to support a peak load of 13 aircraft. The actual distribution of people will change from day to day to suit requirements.

First Shift

MA-1C Electronic System:-

Bench Test Positions:

Supervision	1
Radar and computer mechanics	6
C & N mechanics	2

Hanger Floor:

Supervision	3
Radar and computer mechanics	19
C & N mechanics	7

Falcon Missile:-

Supervision	1
Electrical and electronic mechanics	3

Damper:-

Bench Test Positions:

Mechanics	2
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Hanger Floor:

Supervision	1
Mechanics	8
	53

Second Shift

Same as first shift

53

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