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ARROW WEAPON SYSTEM  
CO-ORDINATING CONTRACTOR

REPORT NO. 11

DECEMBER 1958

TRAINING REQUIREMENTS  
AVRO AND ORENDA PERSONNEL

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### SUMMARY

Avro requirements for training on the electronic, missile and damper systems, and Avro and Orenda requirements for cross-training, as defined herein, have been reviewed by the AWSC 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 the length of courses have been detailed.

The proposed contractual arrangements for effecting the program are included.

This report supersedes AWSCC 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.



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### 1.3 Cont'd

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".

### 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 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 65 different training courses would be required, extending from the present time to December 1960.

### 2.2 Program Planning

To reduce this impracticable requirement to a manageable program, three arbitrary levels of training were selected as described below, and each of the 65 requested courses was assigned to one of these levels. The requirements, exactly as received, and the levels established for each, are detailed in paragraphs 4.1 and 4.2.

#### 2.2.1 Familiarization (Level 1)

Short briefings 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 (Level 2)

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.





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### 2.2.3 Complete Course (Level 3)

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

In paragraphs 4.3 and 4.4, the requirements are re-grouped into these three general classifications, and the duration and proposed completion dates of courses are shown.

In cases where the number of trainees required on a sub-system at a particular time does not warrant conducting a special course, one of the following will be arranged during detail planning:

- (a) The trainees will be included in an earlier course.
- (b) The trainees will be included in a course being given primarily for RCAF personnel.
- (c) The early portion of basic and complete courses may be planned to serve as a familiarization course, and thus absorb some people allocated to Level 1 training.

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 test programs or squadron service, is shown in Appendix 1. 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. Commencing September 1959, electronic system courses will be given at Avro with the assistance of HAC instructors. 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.



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3.1 Cont'd

(b) Labour 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.

4. TRAINING PROGRAM

4.1 Training Requirements on Electronic, Missile and Damper Systems as Stated by Avro

Dates given below are as requested for completion of training. Training levels are defined in paragraph 2.2.

	NO. OF AVRO PERSONNEL TRAINING LEVEL			DATE
	1	2	3	
(a) <u>MA-1C Electronic System</u>				
Briefing	12			Mar. 59
Cockpit controls etc. (aircrew)	2			Mar. 59
Field service representatives	3			Dec. 58
	1			Oct. 60
Field engineer representatives	3			Mar. 60
	3			Oct. 60
Service engineer	2			July 60
Service data engineer	1			Dec. 58
	1			Mar. 60
Sub-total	28			





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4.1 Cont'd

	NO. OF AVRO PERSONNEL TRAINING LEVEL			DATE
	1	2	3	
(a) <u>Cont'd</u>				
Brought forward	28			
Service analyst	3			Dec. 58
	3			Mar. 60
	1			Oct. 60
Technical writer	1			Mar. 59
Engineers			5	Apr. 59
			3	Sept 59
Supervision, Radar (complete course)			3	Apr. 59
			4	Sept 59
			2	Feb. 60
			1	Aug. 60
Radar mechanics			4	Apr. 59
			11	Sept 59
			19	Feb. 60
			16	Aug. 60
Supervision, Communication and Navigation (C & N)			1	Sept 59
			1	Feb. 60
Radio mechanics			6	Sept 59
			6	Feb. 60
			6	Aug. 60
Inspectors			1	Apr. 59
			6	Sept 59
			4	Feb. 60
			3	Aug. 60
	36		102	



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4.1 Cont'd

	NO. OF AVRO PERSONNEL TRAINING LEVEL			DATE
	1	2	3	
(b) <u>Falcon Missile</u>				
Briefing	8			Mar. 59
Field service representatives	3			Dec. 58
	1			Oct. 60
Field engineer representatives	3			Mar. 60
	3			Oct. 60
Service engineer	2			July 60
Service data engineer	1			Dec. 58
	1			Mar. 60
Service analyst	3			Dec. 58
	3			Mar. 60
	1			Oct. 60
Technical writer	1			Mar. 59
Engineers			2	Nov. 59
Technicians			4	Nov. 59
Supervision			1	Nov. 59
Electronic technician			3	Nov. 59
Electrical technician			3	Nov. 59
Inspectors			2	Nov. 59
	30		15	



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4.1 Cont'd

	NO. OF AVRO PERSONNEL TRAINING LEVEL			DATE
	1	2	3	
(c) <u>YG-339B Damper</u>				
Briefing	12			Mar. 59
Field service representatives	3			Dec. 58
	1			Oct. 60
Field engineer representatives	3			Mar. 60
	3			Oct. 60
Service engineer	2			July 60
Service data engineer	1			Dec. 58
	1			Mar. 60
Service analyst	3			Dec. 58
	3			Mar. 60
	1			Oct. 60
Technical writer	1			Mar. 59
Engineers			11	Nov. 58
Supervision			2	Mar. 59
			1	Sept 59
			1	Feb. 60
Technicians			6	Mar. 59
			6	Apr. 59
			7	Sept 59
			7	Feb. 60
			6	Aug. 60
Inspectors			2	Mar. 59
			2	Sept 59
			3	Feb. 60
			2	Aug. 60
	34		56	





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4.2 Personnel Cross-Training Requirements  
as stated by Avro and Orenda

Dates given are as requested for completion of training.

	NO. OF AVRO PERSONNEL TRAINING LEVEL			DATE
	1	2	3	
(a) <u>Iroquois</u>				
Briefing	9			Dec. 58
Field service representatives	3			Dec. 58
	1			Oct. 60
Field engineer representatives	3			Mar. 60
	3			Oct. 60
Service engineer	2			July 60
Service data engineer	1			Dec. 58
	1			Mar. 60
Service analyst	3			Dec. 58
	3			Mar. 60
	1			Oct. 60
Technical writer	1			Mar. 59
General foreman			1	Mar. 59
Flight service, general			2	Mar. 59
Sub-foreman			6	Mar. 59
Engine mechanics			2	Dec. 58
			10	Mar. 59
Engineers, Technical Design			1	Dec. 58
Engineers, Equipment Design			2	Dec. 58
Engineers, Flight Test			1	Dec. 58
Engine running, installation, etc.			4	Dec. 58
			13	June 59
Pilot			1	Dec. 58
	31		43	



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4.2 Cont'd

	NO. OF ORENDA PERSONNEL TRAINING LEVEL			DATE
	1	2	3	
(b) <u>Arrow Airframe</u>				
Supervisors, Service Department and Flight Test	6	1		Dec. 58 Mar. 59
Pilots		2		Dec. 58
Foreman, airframe		1		Dec. 58
Sub-foreman, airframe		2		Dec. 58
Flight mechanic		4		Dec. 58
Electrician		2		Dec. 58
Inspector		2		Dec. 58
Engineer-inspector		1		Mar. 59
Operations engineer		1		Dec. 58
Field representatives		3		Dec. 58
		2		June 59
		2		Dec. 59
		2		June 60
		2		Dec. 60
Engineers		2		Mar. 59
	6	29		



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4.3 Avro Training Summary

(a) Familiarization briefings - Level 1

Length of each briefing - 1 week

SUBJECT	PROPOSED COMPLETION DATE	NUMBER OF PERSONNEL	
MA-1C Electronic System	Dec. 58	7	36
	Mar. 59	15	
	Mar. 60	7	
	July 60	2	
	Oct. 60	5	
Falcon Missile	Dec. 58	7	30
	Mar. 59	13	
	Mar. 60	3	
	July 60	2	
	Oct. 60	5	
YG-339B Damper	Dec. 58	7	34
	Mar. 59	13	
	Mar. 60	7	
	July 60	2	
	Oct. 60	5	
			100





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4.3 Cont'd

(b) Complete courses - Level 3

	PROPOSED COMPLETION DATE	LENGTH OF COURSE (weeks)	TRAINING MAN-WEEKS		NUMBER OF TRAINEES	
MA-1C Electronic System	Apr. 59 *	20	260		13	
	Sept 59 *	20	620		31	
	Feb. 60	20	640		32	
	Aug. 60	20	520		26	
				2040		102
Falcon Missile	Nov. 59 *	11	165		15	
				165		15
YG-339B Damper	Nov. 58	8	88		11	
	Mar. 59	8	80		10	
	Apr. 59	8	48		6	
	Sept 59	8	80		10	
	Feb. 60	8	88		11	
	Aug, 60	8	64		8	
				448		56
				2653		273

\* These courses will be given at Hughes Aircraft  
Company, Culver City, California.



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#### 4.4 Avro and Orenda Cross-Training Summary

(a) Familiarization briefing - Level 1

Length of each briefing - 1 week

SUBJECT	PROPOSED COMPLETION DATE	NO. OF PERSONNEL	
		AVRO	ORENDA
Iroquois	Dec. 58	16	
	Mar. 59	1	
	Mar. 60	7	
	July 60	2	
	Oct. 60	5	
Arrow airframe	Mar. 59		6
		31	6

(b) Basic and Complete courses - Levels 2 and 3

SUBJECT	PROPOSED COMPLETION DATE	TRAINING LEVEL	LENGTH OF COURSE (weeks)	TRAINING MAN-WEEKS		NUMBER OF TRAINEES	
				AVRO	ORENDA	AVRO	ORENDA
Iroquois	Dec. 58	3	2	22		11	
	Mar. 59	3	2	38		19	
	June 59	3	2	26		13	
Airframe	Dec. 58	2	2		36		18
	Mar. 59	2	2		6		3
	June 59	2	2		4		2
	Dec. 59	2	2		4		2
	June 60	2	2		4		2
	Dec. 60	2	2		4		2
				86	58	43	29



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#### 4.5 Training Man-weeks Summary

SUBJECT	AVRO				ORENDA			
	LEVEL			TOTAL	LEVEL			TOTAL
	1	2	3		1	2	3	
	man-wks	man-wks	man-wks	man-weeks	man-wks	man-wks	man-wks	man-weeks
MA-1C Electronic System	36		2040	2076				
Falcon Missile	30		165	195				
YG-339B Damper	34		448	482				
Iroquois	31		86	117				
Arrow Airframe					6	58		64
				2870				64





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APPENDIX 1

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

Hangar 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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Hangar Floor:

Supervision	1
Mechanics	8
	<hr/>
	53

Second Shift

Same as first shift

53
<hr/>
106
<hr/>



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## APPENDIX 2

### COMMENTS: DRAFT - AWSCC REPORT NO. 11

A draft of this report was discussed at a meeting of AAWS, 1202 TSD and Avro representatives held at Avro on November 20th and 21st, 1958. The draft was also included in the Information Supplement to Statement of Work Brochure AD-53 Issue 2. Since that time a few minor changes have been made. In particular, one Division of Avro decided that the program would be better served by giving briefings rather than complete courses to its personnel, but providing these briefings to a larger number of people. This has the apparent effect of inflating the number of trainees, especially as some people will be required to attend more than one course. In fact, the number of training man-weeks has been slightly reduced from the figures of the draft report. A breakdown of the draft by man-weeks follows for comparison with the revised summary in paragraph 4.5.

### Training Man-weeks Summary from Draft, November 1958

#### For Reference Only

SUBJECT	AVRO				ORENDA			
	LEVEL			TOTAL	LEVEL			TOTAL
	1	2	3		1	2	3	
	man-wks	man-wks	man-wks	man-weeks	man-wks	man-wks	man-wks	man-weeks
MA-1C Electronic System	14	40	2240	2294				
Falcon Missile	8	20	187	215				
YG-339B Damper	12	12	400	424				
Iroquois	9	104		113				
Arrow Airframe						30		30
				3046				30

