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UNCLASSIFIED

ROYAL CANADIAN AIR FORCE

DIVISION OF

AIR MEMBER FOR TECHNICAL SERVICES

DEVELOPMENT STUDY

IROQUOIS SECOND PRELIMINARY MOCK-UP INSPECTION

MOCK-UP BOARD REPORT

REPORT DAEng-52

CONFIDENTIAL

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MOCK-UP BOARD REPORT

REPORT DAEng-52

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Secretary
Mock-Up Board

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Mock-Up Board

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AMTS/CAE

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Preface

1 The Mock-Up Board Report is issued on the authority of the Chief of Aeronautical Engineering. Details are given of the RCAF assessment of the second preliminary mock-up of the Iroquois engine (fitted with the Lucas hydromechanical fuel control system) being developed and produced for the RCAF by Orenda Engines Limited.

2 The contents of this Report are not to be disclosed to anyone outside the RCAF without the prior approval of the Chief of Aeronautical Engineering.

SUMMARY

1 A Royal Canadian Air Force Mock-Up Board Inspection convened at Orenda Engines Limited on 6 Dec 56 to assess the second preliminary mock-up of the Iroquois engine fitted with the Lucas hydromechanical fuel control system. The inspection team submitted 8 change requests and the Company subsequently submitted a list of items which were either not included or will be changed on the Lucas Mock-Up as inspected at the second mock-up inspection.

2 The engine design changes and investigations being undertaken by the Company are to be reported to the Orenda Development Co-ordinating Committee. The Mock-up is to be available for inspection periodically by the RCAF prior to the CF105-Iroquois Installation Mock-Up.

3 The Mock-Up Board's findings were approved by the Chief of Aeronautical Engineering as categorized in Appendix "A".

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IROQUOIS MOCK-UP BOARD

INTRODUCTION

1 The Iroquois two-spool turbojet engine is being developed and produced by Orenda Engines Limited in accordance with the requirements of Specification MIL-E-5007A and the Preliminary Model Specification EMS-8. The Iroquois is scheduled to be fitted in the sixth CF105 aircraft and to power production CF105 Service aircraft.

2 The Second Preliminary Mock-Up Board Inspection was called in accordance with the requirements of DAEng Report Number 46. The purpose of this mock-up inspection was to evaluate the Iroquois engine fitted with the Lucas hydromechanical fuel control system and to:

(a) Provide early direction to the Company concerning RCAF requirements and enable changes to be incorporated prior to the installation mock-up inspection.

(b) Provide an initial comparison of the Lucas system with that of the Bendix fuel control.

3 The CF105-Iroquois Installation Mock-Up should be held by Jul 57 or as soon as possible this year. By this date, altitude performance data from the NACA tunnel and B47 flight tests should enable the selection of the fuel control system to be made.

4 The second preliminary mock-up was fitted with after-burner unit but the nozzle area control unit was not shown. Several mock-up components are undergoing design change or further investigation and the Company submitted a list of these items (Appendix "B") to the RCAF on 10 January, 1957. The RCAF change requests (E1 to E7) submitted at the first preliminary mock-up inspection on 11 Jun 56 were actioned as detailed in the Iroquois Monthly Progress Report for October 1956. A complete review of all Iroquois change requests submitted by the RCAF and Orenda Engines Limited will be required in the Semi-Annual Technical Report for June 1957. In the interim period the mock-up will be available for periodic inspection by the RCAF Maintenance Appraisal Team and action of change requests will be reported to the Iroquois Development Co-ordinating Committee.

5 The Mock-Up Board was convened in Plant 1 of Orenda Engines Limited, Malton, at 1100 hours, 6 December 1956. The Mock-Up was assessed in accordance with the requirements of Specification MIL-E-5007A and DAEng Report Number 46.

II COMPOSITION OF MOCK-UP BOARD

6 Board Members

W/C	E.P.	Bridgland	(Acting Chairman)	OC TSDs AVRoe
S/L	P de L	Markham		AFHQ/DMEng
S/L	J.E.	Neelin		AMCHQ/ACT
S/L	L.J.	Sullivan	(Acting Secretary)	OC TSDs AVRoe

7 RCAF Technical Advisors

F/L	R.A.	Doiron	AMCHQ/ACT
F/O	J.H.	MacDonald	1205 TSD
WO1	E.H.	Rossell	1202 TSD
WO2	W.G.	Wentworth	1202 TSD
Sgt	P.A.	Bell	1202 TSD

8 Other Representatives

Mr	H.K.	Wallington	DDP Malton
Mr	B.A.	Avery	Orenda Engines Ltd
Mr	R.G.	Dennys	Orenda Engines Ltd
Mr	W.E.	Rowan	Orenda Engines Ltd
Mr	D.H.	Parker	Orenda Engines Ltd

III DEFINITION OF CATEGORIES

9 Cat 1 - Does not apply in this case in view of definition given in DAEng Report Number 47.

Cat 2 - To be incorporated in the Installation Mock-up on the CF105 aircraft. Some items may not require evaluation on the engine mock-up but are to be incorporated on production engines.

Cat 3 - Changes of a nature requiring further study by the Company or the RCAF.

IV CONCLUSIONS AND RECOMMENDATIONS

10 The inspection team submitted 8 Change Requests for categorization by the Mock-up Board. These changes were supplemented by a list of items, submitted by the Company, which were not included in the Mock-up or will be changed at a later date.

11 The Change Requests as submitted and categorized by the Mock-Up Board are approved by the Chief of Aeronautical Engineering.

It is recommended that:

(a) The Change Requests, as categorized, be implemented.

(b) The mock-up be available for periodic inspection by the RCAF Maintenance Appraisal Team.

(c) Action on all engine design changes be reported to the Iroquois Development Co-ordinating Committee.

(d) A complete review of RCAF and Company design Change Requests be included in the Semi-Annual Technical Report for June 1957.

MOCK-UP COMPONENTS UNDERGOING DESIGN CHANGE

SUBMITTED BY RCAF

E32 - Fill Connections

Submitted by:	1202 TSD
Change Desired:	Have fill connections at side of aircraft approximately 5.5 feet above the ground.
Reason:	Considerable time is absorbed in panel removal when working in limited space (4 feet clearance) under the aircraft.
Effect on Aircraft:	Aircraft modifications will be required. The size and location of the access panels may be prohibitive.
Action:	The engine company is to study the accessibility of fill connections. The RCAF will review the requirement and discuss with the aircraft company.
	Cat. 3

E-33 - Fuel Filtration

Submitted by:	1202 TSD
Change Desired:	Provide a 200 mesh (74 micron) filter of angle capacity upstream of the fuel pump inlet.
Reason:	Integral tank sealant and residual swarf may enter engine fuel system. A filter of adequate size cannot be engine fitted because of envelope limitations.
Action:	RCAF to refer to AVRoe requesting that a 200 mesh strainer be placed in the aircraft fuel system.
	Cat. 3

E-34 - Position of Oxygen Bottle

Submitted by: OC TSDs

Change Desired: Re-positioning of oxygen bottle

Reason: The present position appears to interfere with run of engine-aircraft fuel connection.

Action: Orenda to re-position oxygen bottle

Cat. 2

E-35 - Engine Oxygen System

Submitted by: AFHQ

Change Desired: Single source of oxygen for both engines is recommended and this should be airframe mounted.

Reason: A single charging point would facilitate turn-around and enable all oxygen to be used on either engine if required.

Action: The RCAF will consider the efficacy of a single source and the feasibility of airframe mounting.

Cat. 3

E-36 - Oxygen System

Submitted by: AFHQ

Change Desired: Oxygen and oil replenishment must not be carried out through the same access panel.

Reason: Safety design requirements.

Action: Cat. 2

E-37 - Fuel System

Submitted by: 1202 TSD

Change Desired: Mount the low pressure warning switch (engine inlet) on the engine.

Reason: This should give a more accurate indication of fuel pressure at inlet and enable access to the undercarriage selector valve.

Action: RCAF will discuss this with the aircraft company.

Cat. 3

E-38 - Electrical Disconnect

Submitted by: 1202 TSD, MAT

Change Desired: That the connector mating lever be locked in place by some means other than locking wire.

Reason: This is a left-handed operation and is also time-consuming on engine removal.

Action: The company will attempt to delete the lock-wire feature.

Cat. 3

E-39 - Oil Drain Point

Submitted by: 1202 TSD MAT

Change Desired: An oil drain incorporating a magnetic plug should be installed at lowest point on engine gearbox.

Reason: To provide complete oil drainage and provide indication of malfunction in gears and drives.

Action: Orenda will comply

Cat. 2

ITEMS SUBJECT TO CHANGE AND INVESTIGATION

SUBMITTED BY ORENDA

The following items were either not included or will be changed on the Lucas engine mock-up:

1 The mock-up did not include the shroud although this was partially shown at the previous mock-up board on the Bendix system.

2 Thermocouples were not included in this mock-up.

3 Afterburner The spray bar system will not be used and therefore the spray bar bosses will be deleted and replaced by the main fuel inlet. The "splitter valve" shown will be replaced by a solenoid valve for afterburner fuel shut-off.

The hot streak valve for afterburner ignition was not shown.

4 Nozzle area control unit was not shown.

5 The fuel starting pump shown was a "lash up" version. The final version will be smaller and more compact.

6 The re-oiling connections shown were representative but not finalized.

7 The oxygen system shown was a mock-up of the present development system. The mounting arrangement of the final system will be altered somewhat, the servicing point is still to be finalized.

8 Restrictors will be mounted at the aft face of the air to air cooler compatible with the aircraft nacelle to give the required pressure drop across the cooler.

9 The fire detection and extinguishing system inside the shroud was not shown.

10 The power take-off was not the version which will be supplied with C105 engines.

11 The fuel inlet bosses on the mid frame were not to the latest configuration.

12 The front frame handling bosses under the main trunnions were not to the latest configuration.