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RD.86. A.

GROUND TEST DEPARTMENT. SUMMARY OF MINIMUM PRE-FLIGHT TEST. HEQUIREMENTS FOR FIRST FLIGHT ONLY.

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ANNEXE J. H. PARKIN CNRC-ICIST



AVRO AIRCRAFT LIMITED

RESEARCH & DEVELOPMENT (AIRFRAME)

ARROW 1 FIRST AIRCRAFT PROJECT

REPORT No. RD.86.A

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GROUND TEST DEPARTMENT

SUMMARY OF MINIMUM PRE-FLIGHT TEST

REQUIREMENTS FOR FIRST FLIGHT ONLY

CHECKED:

APPROVED:

DATE:

PREPARED By E.J. Lynch & R. Kendall

Ground Test Dept.

DATE September 27th, 1957

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PROJECT

ARROW 1 FIRST AIRCRAFT

REPORT NO. RD. 86A

SHEET NO. 2 of 11

DATE September 27th,1957

PREPARED E.J. Lynch

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TITLE

Summary of Minimum Pre-Flight Test Requirements for First Flight only of First Arrow 1 Aircraft.

INTRODUCTION

Report RD.86, previously issued at July 18th, 1957, listed what were then considered to be the pre-flight test requirements for the first flight of the first aircraft. In view of the shortened available time before the scheduled flight date, this report presents a considerably reduced program, regarded by all Engineering Division parties concerned as representing the minimum testing needed to ensure a safe and successful first flight. Much more engineering testing will be necessary later, and a further report will be issued in due course.

A time schedule is included at the end of this report, and it is to be recognised that this is based upon anticipation of no serious deviations of the aircraft systems from the acceptable criteria. The possibility of delay to the flight date in the event of serious performance deficiences cannot be excluded.

The descriptive data herein is intended as a summary only, for administrative information. Completely detailed procedures have been, or are being, produced by the Ground Test and Flight Test Department, who are responsible for the performance of the tests.

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DATE September 27th.1957

PREPARED E.J. Lynch

SUMMARY OF PRE-FLIGHT TEST REQUIREMENTS

Operations are numbered to correspond to Ground Test Department Pre-Flight Test Programme.

(1) FLIGHT TEST INSTRUMENTATION INSTALLATION

To be co-ordinated with other work on the aircraft. No special time allowance.

(2) ELECTRICAL FUNCTIONING TESTS -- R.T. 08-604

Check to Report No. P/Systems/34 "Production and Pre-Flight Testing of Electrical Systems* Issue 2, in conjunction with Inspection Deptartment.

No additional engineering tests required.

(3) OXYGEN SYSTEM -- R.T. 08-643

With converter removed, pressurize system (300 p.s.i.), check for leaks.

Disconnect Pilot's emergency oxygen bottle; blank off outlets to mask and pressure suit on Pilot's composite

Disconnect normal oxygen supply line from dual check valve.

Pressurize emergency system to 1,800 p.s.i. Repeat on Navigator's system.

Check operation of composite leads disconnect and emergency trip valves on pilots and navigators seats by pulling them slowly up ramps.

Check converter loss over 24 hours at 70°F (Off A/C).

Check capacity gauge against weighed weight of oxygen on installation of converter into aircraft.

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(4) LOW PRESSURE PNEUMATICS (PITOT-STATIC SYSTEMS) -- R.T. 08-645

Static Lines --- disconnect static lines from all units supplied by both nose boom static sources. Apply air pressure (2 to 5 p.s.i.) to water trap drain plug in primary static system. Check air flow out of lines. Repeat with air supply to secondary lines.

Seal off static holes in nose boom with red tape. Attach vacuum source to water trap drain plug in primary system. Check pressure drop with front cockpit altimeter.

Repeat on secondary system.

A similar check is made on the Pitot lines, checking on the front cockpit ASI.

Similar checks are made on the Upper Fin Probe pitot systems.

(5) ESCAPE SYSTEM - CANOPY ACTUATION -- R.T. 08-805

Using air pressure to operate the emergency canopy jacks, demonstrate that canopy emergency mechanism functions correctly.

(6) ESCAPE SYSTEM - SEAT CLEARANCE -- R.T. 08-805

Check bail-out warning system operation.

Check escape system controls functioning.

Withdraw seats, check for adequate clearance.

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(7) UTILITY HYDRAULICS -- R.T. 08-611

Fit pressure gauges (4) downstream of Brake Control valve in Brake lines. Attach thermocouples (3) to hydraulic pipes.

Check compensator level; slowly pressurize system; check warning light operation, cut out pressure, changes in compensator level and temperature and return system pressure. With external power off, operate wheel brakes; check emergency brake warning light operation.

Repeat Above Five Times

Shut off Ground Hydraulic rig Heat Exchanger. Raise pressure until A/C pressure regulator valve opens. Read temperatures at 1 minute intervals.

Connect Ground rig to Armament disconnect, raise pressure until relief valves are fully open. Check all visible lines for leakage. Operate emergency A/C alternator and check lines for leakage.

Landing Gear

Check rigging requirements. Operate landing gear 5 times.

Check for damage. Record cut-in and cut-out pressures.

Carry out Emergency lowering. Check for leaks and damage.

Bleed and prime system.

Speed Brakes

Operate Speed Brakes in stages, five times. Check rigging. Record operating times. Check for creep.

Operate Speed Brakes five times.

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Wheel Brakes -- Normal System

Check pressures operating brakes separately and together. Repeat each five times.

Emergency System -- Operate each side separately, then together. Repeat three times.

Check Parking brake.

Record number of brake operations available on emergency system. Repeat three times.

(8) PARACHUTE BRAKE -- R.T. 08-651

Static Function

Remove Parachute Compartment doors. Operate locking mechanism, checking latch and indicating light. Repeat 20 times.

Self Actuation

Deflect cable run until compartment doors open.

Effectiveness of Solenoid Latch

Load of 150 lb. at cockpit handle with solenoid latch artifically energised. Measure position of latch roller relative to forward edge of door before, during and after loading.

Static Load

Remove fuselage rear fairing and fit loading rig to stinger attachment points. Measure pilot's effort required to operate jettison mechanism with load of 10,000 lb. applied at parachute strap.

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(9) FLYING CONTROLS HYDRAULICS -- R.T. 08-613

Attach thermocouples (2) to system piping.

Pressurize system slowly, check changes in return pressure and fluid temperatures. Discharge. Repeat five times.

Check operation with Utility System unpressurized. Check operation of each system (A and B) separately, with other systems unpressurized. Check relief valves by overpressurizing to 4,800 p.s.i.

(10) AIR CONDITIONING -- R.T. 08-692

Check the delivery of air to each compartment and if necessary adjust by fitting restrictors at duct joints.

(11) FLIGHT TEST INSTRUMENTATION INSTALLATION

All instrumentation required for following stages (13), (15) and (16) must be installed during or before this opportunity.

(12) MOVE TO D.1 HANGER

Stages (13), (14), (15) and (16) must be conducted in D.1 hanger due to the fixed nature of equipments to be used.

(13) DAMPING SYSTEM -- R.T. 08-614 ADD. 9

Check out Damping System using Minneapolis-Honeywell Ground Test Equipment U.G.6004 A-1 and M.B.1 Pitot Static tester.

Check accelerometers by shaking aircraft.

Check gyros by rocking or rotating aircraft.

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(14) FLIGHT TEST INSTRUMENTATION CALIBRATION

All instrumentation required for stages (15) and (16) must be calibrated at this time.

(15) FLYING CONTROLS (FUNCTIONAL AND RESPONSE) R.T. 08-614

Measure break-out forces, for Control Column and Rudder Pedals. Check Control surface angles against Control Column angle.

Frequency Response

Manual oscillation of stick and rudder pedals with a Trace Recorder measuring parallel and differential servo ram positions. Check operating loads.

Measure stick forces with servo stationary and servo displacing at maximum rate with external signal supplied to parallel servo. For both Aileron and Elevator.

Measure Elevator, Aileron and Rudder Parallel Servo authority over range of movement at three positions.

Damper And Control System Hydraulics

Check the operation of the system hydraulics with step and triangular wave inputs to the differential and parallel servos, with varying hydraulic supply. Record signals and movements of all servos, control surface movements, actuator valves inlet pressures and movements.

(16) FLIGHT SIMULATION TEST -- R.T. 08-614 ADD. 11

The aircraft to be supplied with hydraulic and electrical power and to be electrically linked to the flight simulation computer. Recordings of all servo signals and positions, control column and rudder pedal positions, control surface positions, actuator valves inlet pressures and positions, throttle lever position, air brake angles are to be made and/or transmitted to the computer room. An instrument panel is to be provided in the pilot's cockpit to display Altitude, I.A.S., Mach. No., Roll, Pitch and Sideslip. The pilot will "fly" the aircraft under varying conditions and will perform manoeuvres at one or more of the flight conditions.

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Damper mode will be further checked by introducing step inputs in each axis from the Flight Test Panel.

(17) MOVE TO D.2 HANGAR AND WEIGH

The aircraft will be moved back to D.2 Hangar for greater production convenience and to make use of the recess available in the floor there for stage 18. Weighing is necessary for the proper interpretation of stage (18) test results.

(18) RESONANCE TEST -- R.T. 08-720

Connect hydraulic and electrical ground supply trailer. Connect electromagnetic vibrators. A/C supported on partly deflated tires. Determine natural frequencies and mode shapes of aircraft and control surface, with and without flying control systems operative. Also observe natural frequencies of F/C circuits, engine control circuits, nosewheel steering controls.

(19) MOVE OUTSIDE

The handling of fuel in open systems is not permitted inside hangars.

(20) FUEL TANKS PRESSURE -- R.T. 08-795

Pressurize fuel tanks as follows:

Nos. 1 and 2 -- 12 p.s.i.g. Nos. 3, 4, 6, 7, 8 -- 24 p.s.i.g. (approx. (Subject to acceptance of system relief valves) No. 5 - 24 p.s.i.g. (approx. (Subject to acceptance of system relief valves)

Measure deflections of structure with portable gauges, and check for leaks.

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(21) FUEL PRESSURIZATION SYSTEM TEST -- R.T. 08-608

Connect 25 p.s.i. gauges downstream of Absolute and Differential Pressure regulators. Connect Ground Electrical Supply. Apply 85 p.s.i.g. air pressure to inlet of Hop. line to system.

Check electrical actuation and override, pressure regulation, pressure build up rate, relief valve actuation, electrical overrides and pressure relief adequacy. Check Fuel System air leakage, A/C structure and external pipe leakage.

(22) FUEL SYSTEM OPERATIONAL TESTS -- R.T. 08-608

Check on Flow proportioners, Fuel Transfer Pumps, Refuelling equipment, full refuelling, defuelling, condensate drain valves, Fuel system leakage tests.

Transfer system functioning tests, flow rates, cross feed functioning, transfer pump by-pass, air admission valves, low level warning system. Check on Net and Gross capacity. Repeated flushing of entire system to remove any foreign matter remaining from manufacturing operations.

(23) FLIGHT TEST INSTRUMENTATION CALIBRATION

All instrumentation for use during ground engine running must be calibrated by or at this time.

(24) CROUND ENGINE RUNNING -- R.T. 08-742

Carried out in conjunction with Production and Flight Test Depts. Check engine installation and trim, and auxiliary equipment and systems as follow:

Nacelle cooling, afterburner functioning, Fuel System, F/C Hydraulics, Utility Hydraulics, Radio, Interphone, Intake Pressure, Air Conditioning Turbine R.P.M.

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(25) TAXI TESTS -- R.F.T. 07-5019

Check the ground handling characteristics of the aircraft including: Wheel Brake tests, Accelerate - Stops, Nose Wheel steering assessment, Parachute Brake, Air Brakes, Engine handling. Carried out by Flight Test Dept.

(26) INSTALLATION OF RAM AIR TURBINE

Delivery of the Ram Air Turbine from the manufacturer is not expected until approximately this date and it is hoped to fit it at this time.

(27) INSPECTION, WEIGHING, COMPASS SWINGING, TELEMETRY CHECKS, ETC.

These, and all other outstanding operations, are to be completed during this period.

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OFLT, TEST INSTRUMENTATION INSTALLATION		
@ELECTRICAL FUNCTIONING TESTS		
3 OXYGEN & P PNEUMATICS (PITOT-ST	ATIC SYSTEM)	
5 ESCAPE SYSTEM-CANOPY ACTUATION		
© ESCAPE SYSTEM - SEAT CLEARANCES		
@ UTILITY HYDRAULICS		
@ PARACHUTE BRAKE (MECHANISM & STATIC LO	OAD)	
FLYING CONTROLS HYDRAULICS		
@AIR CONDITIONING SYSTEM		
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@Move to DI HANGAR		
(3) DAMPING SYSTEM GO-NO GO		
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@FLIGHT SIMULATION		
MOVE TO DE HANGAR WEIGH.		
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