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AVRO ARROW PROGRESS REPORT

SS 117

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		Date																		

UNCLASSIFIED

UNCLASSIFIED

AVRO ARROW PROGRESS REPORT

MARCH 1958

AVRO AIRCRAFT LIMITED

MALTON - ONTARIO

CONTENTS

SECTION

INTRODUCTION

1 SUMMARY

Master Phasing Chart
Allocation of Aircraft - Program 5 (Amended)
Engineering
Tooling
Production



2 ENGINEERING - DESIGN AND TECHNICAL

Mockups and Specifications

Wind Tunnel and Free Flight Model Tests

Engineering Parts Release - ARROW 1 Aircraft No's 25201 to 25205

Engineering Parts Release Schedule ARROW 2

Engineering Mockups

Wind Tunnel and Free Flight Model Tests

Aircraft Design - Excluding Ground Support Equipment, Mockups,

Models and A.S. T.

Technical Departments

Minneapolis - Honeywell (MH-64) Damping System

Air Conditioning System

3 ENGINEERING - TEST PROGRAM

Flight Test Program ARROW 1

Flight Test Program ARROW 1

Flight Test Program ARROW 2

Major Tests of Structure and Systems - ARROW 1

Major Tests of Structure and Systems - ARROW 2

Engineering Flight Test

Structure and Systems Tests

Instrumentation Laboratory

4 ENGINEERING - GROUND SUPPORT EQUIPMENT AND

SYSTEMS TRAINERS

Engineering Ground Support Equipment and Systems

Trainers

Ground Support Equipment - Design and Development

Ground Support Equipment - Major Items

Airframe Systems Trainer Design Study

5 TOOLING AND MANUFACTURING

Total Tooling - Costs and Performance

Progress Chart - First Aircraft

Progress Chart - Second Aircraft

Progress Chart - Third Aircraft

Progress Chart - Fourth Aircraft

Progress Chart - Fifth Aircraft

Progress Chart - Sixth Aircraft

Progress Chart - Seventh Aircraft

Progress Chart - Eighth Aircraft

Total Production - Costs and Performance



INTRODUCTION

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This Progress Report has been prepared to indicate the current position of the ARROW Program at Avro Aircraft Limited and at the major sub-contractors associated with the Program.

Three elements of progress are reported as follows:

- (1) The physical progress in terms of percentage completed at the reporting date
- (2) Manhour expenditures
- (3) Dollar expenditures

The Master Phasing Chart represents the program being reported against. Where necessary for better definition, one bar on the Master Phasing Chart has been expanded into several bars in the Progress Reports.

Dollar expenditure charts show cumulative costs including labor, overhead, direct charges, material, administrative overhead, fees, and sales tax where applicable.

Engineering manhour expenditure charts show the direct cumulative manhours, including subcontract engineering personnel used directly by Avro in the basic program. However, Engineering hours expended by outside sources of sub-systems, such as R.C.A., Honeywell and Orenda Engines Limited, are not included. Progress charts for some of the related external programs are included. Future reports will contain data of this type as it becomes available for other external programs. Manufacturing manhour expenditure charts include equivalent manhours for sub-contract work.

Amendments to basic information, over the previous issue of the report, are indicated thus *.

This report is the last to be issued using the present format, since the expansion in scope of the ARROW program makes it necessary to extend the report coverage correspondingly.

It is proposed that future reporting action based upon the Program Planning Report called out as item 6.6 in the Statement of Work for the Avro ARROW Program (Brochure No. SS 118).

SECTION 1

UNCLASSIFIED



SUMMARY

The Summary section includes the Master Phasing Chart, Allocation of Aircraft, Manhour and Dollar Expenditure Charts for the Engineering, Tooling and Production programs.

ENGINEERING

At present a program is being negotiated to modify aircraft 25204 and 25205 into development vehicles for the ASTRA I electronic system. The first flight dates shown in this report for these two aircraft are based on the assumption that they are built to the standard ARROW 1 configuration, incorporating an interim electronic system and with structural modifications for the ASTRA I installation.

The Allocation of Aircraft chart has been

redrawn to show a more detailed presentation of the function of each test vehicle.

A nominal 5% fee has been included in the actual dollar expenditure figures from April 1st, 1957 to facilitate comparison, pending negotiation of fees subsequent to March 1957.

TOOLING

Dollar expenditures for the tooling program are substantially the same as our planned figure.

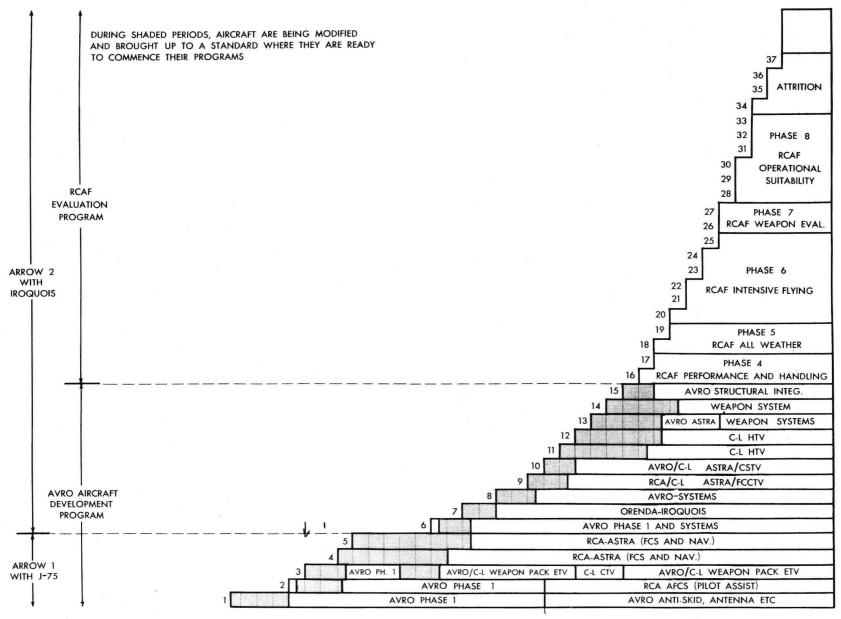
PRODUCTION

Expenditures on the program are proceeding within the planned program budget.



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ALLOCATION OF AIRCRAFT - PROGRAM 5 (AMENDED)

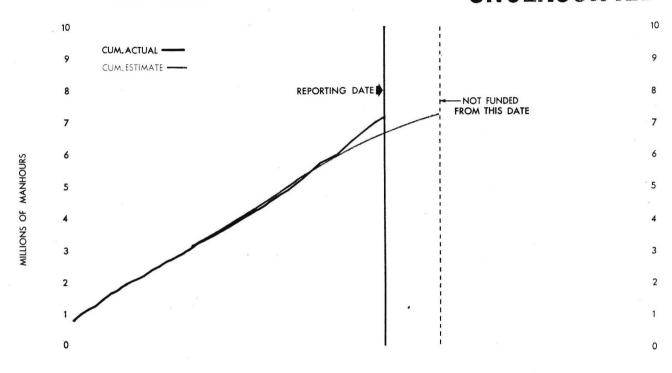


MILLIONS OF MANHOURS

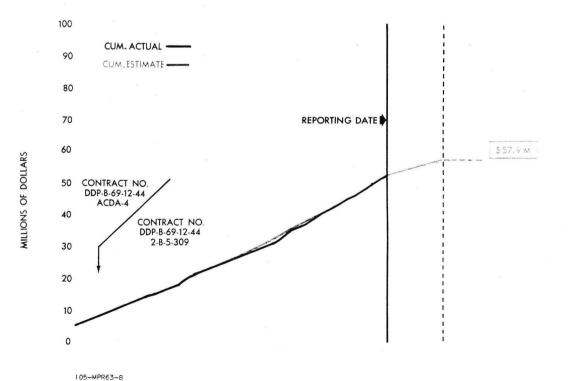


ENGINEERING

UNCLASSIFIED



MANHOUR EXPENDITURES



DOLLAR EXPENDITURES

MILLIONS OF DOLLARS

100

90

80

70

60

50

40

30

20

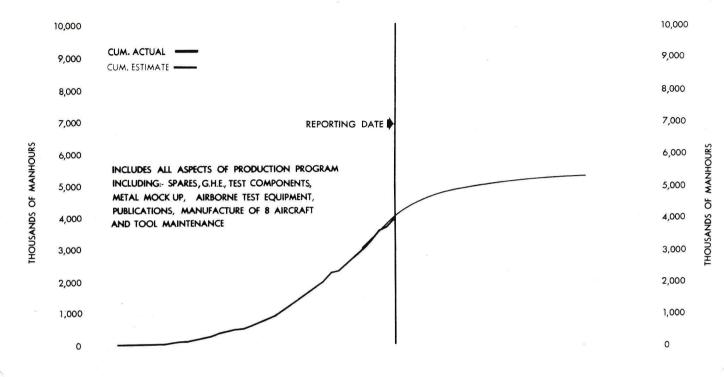
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0

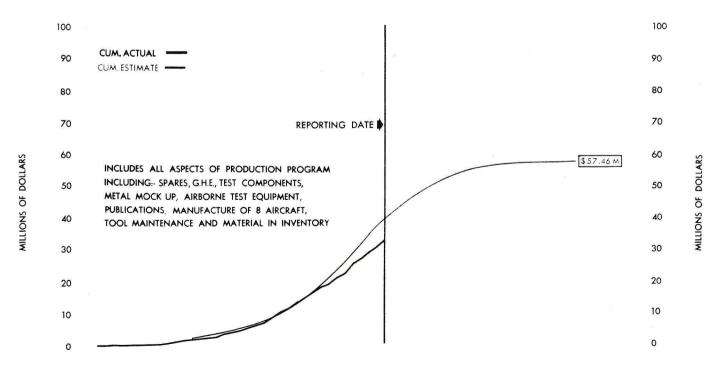




UNCLASSIFIED



MANHOUR EXPENDITURES



105-MPR65-8

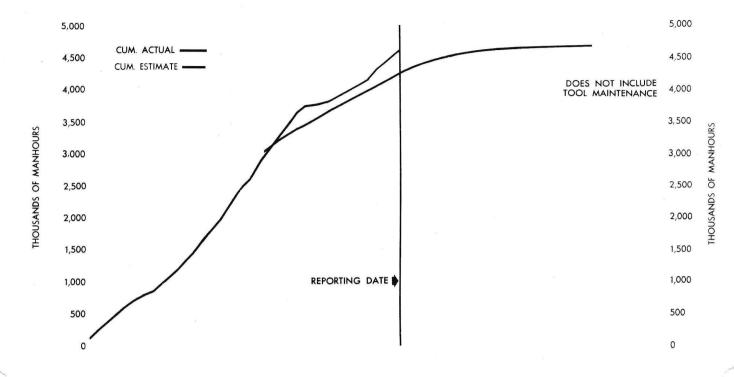
DOLLAR EXPENDITURES



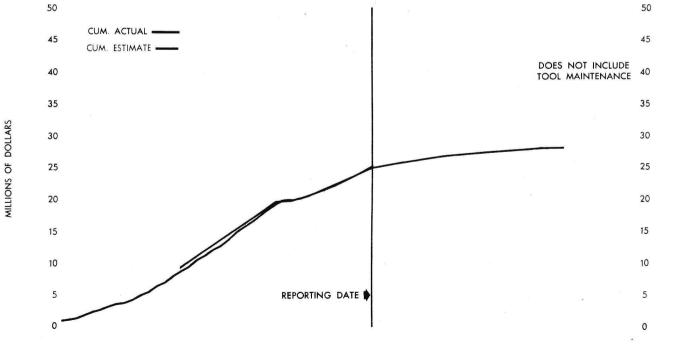


105-MPR64-8

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MANHOUR EXPENDITURES



DOLLAR EXPENDITURES

MILLIONS OF DOLLARS

UNCLASSIFIED SECTION 2

ENGINEERING - DESIGN AND TECHNICAL



ENGINEERING - DESIGN AND TECHNICAL

Changes to the engine installation and gearbox mockup were approved by the RCAF on February 17th, 1958.

It is intended that further wind tunnel tests will be carried out on the 1/24 spinning model, but at present no definite schedule is available for these tests

as they depend on the availability of the wind tunnel.

On the ARROW 2 Engineering Parts Release Schedule the Drop Tank estimate has been deleted, the estimates for 16 components have been amended, and a schedule has been added for the outer wing.





MOCKUPS AND SPECIFICATIONS

UNGLASSIFIED

R.C.A.F. MOCKUP EVALUATION DATE

REVISED TO SEPT. 18 1957

CUM. ACTUAL

CUM. ESTIMATE

ARROW 1 MOCKUP

COMPLETE

COMPLETE MOCKUP REWORK FOR ARROW 2

DESIGN

BUILD

MOCKUP CHANGES

ENGINE INSTALLATION & GEARBOXES

COCKPIT LIGHTING

NOT SCHEDULED

SPARROW 2D PACK

DESIGN

BUILD

RCAF MOCKUP EVALUATION OF THIS CHANGE

REPORTING DATE

MOCKUPS

ARROW 1 MODEL SPECIFICATION

COMPLETE

R.C.A.F. ACCEPTANCE

CUM. ACTUAL CUM. ESTIMATE

ARROW 2 MODEL SPECIFICATION MOCKUP CONFERENCE SYSTEMS BROCHURES (REFERENCE MATERIAL ONLY FOR ARROW 2 MODEL SPECIFICATION)

PREPARATION

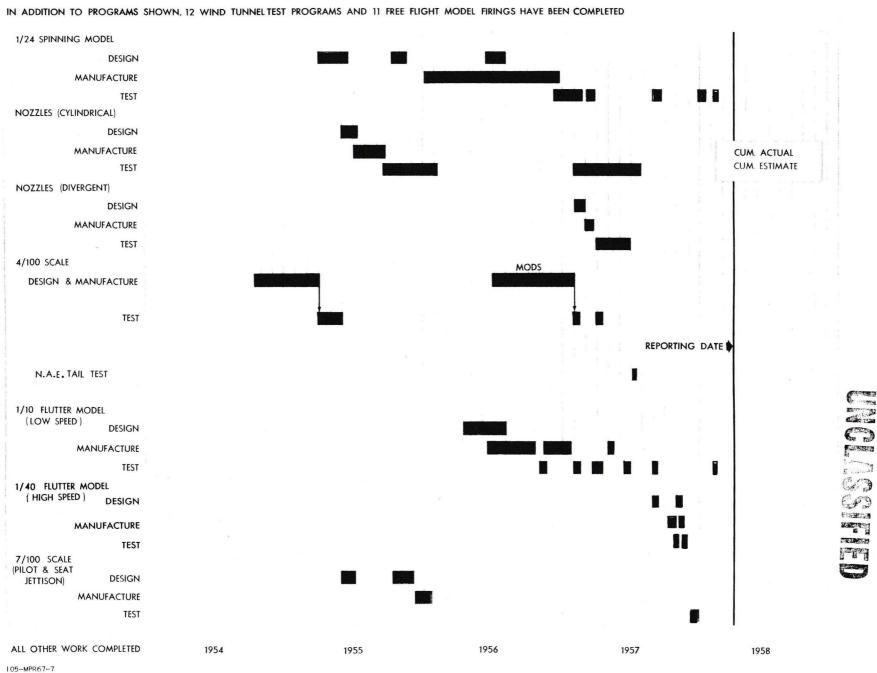
R.C.A.F.

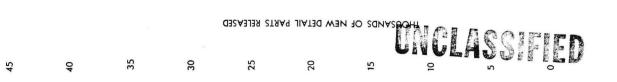
FINALIZATION

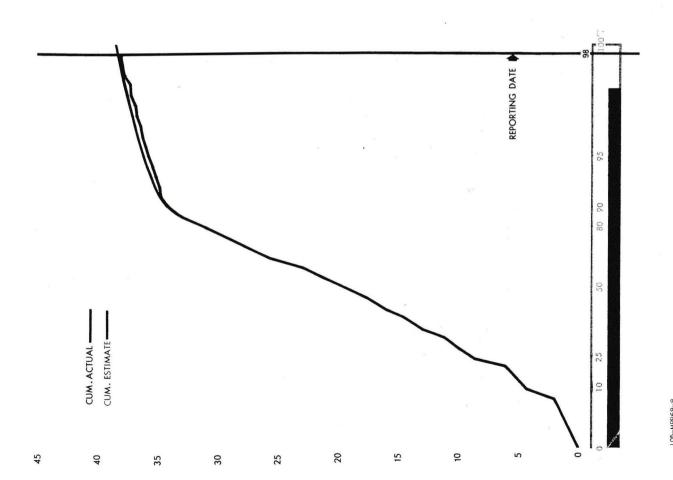
FOLLOW-UP TO R.C.A.F.

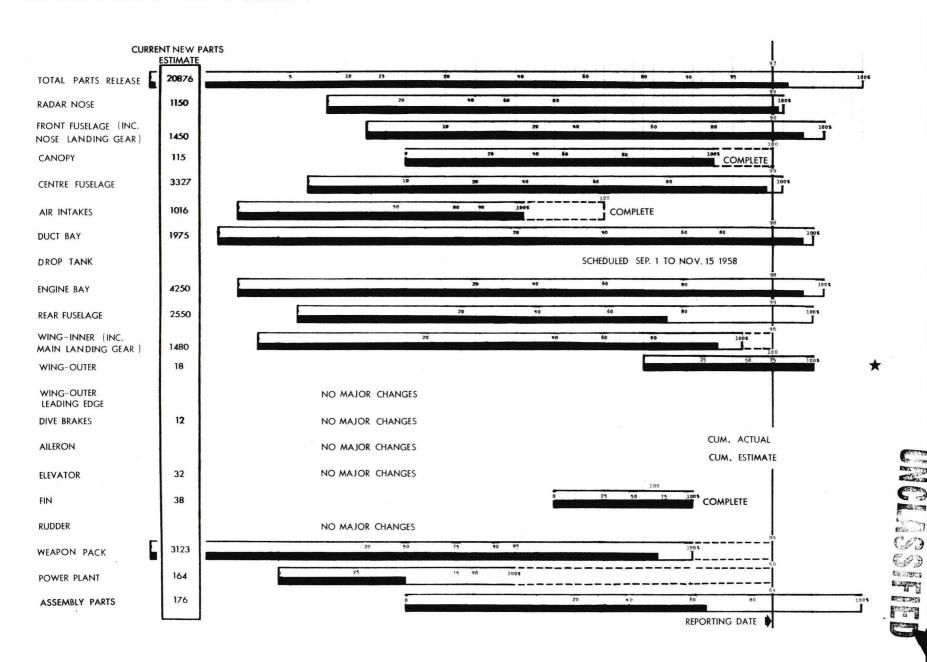
REPORTING DATE

WIND TUNNEL AND FREE FLIGHT MODEL TESTS





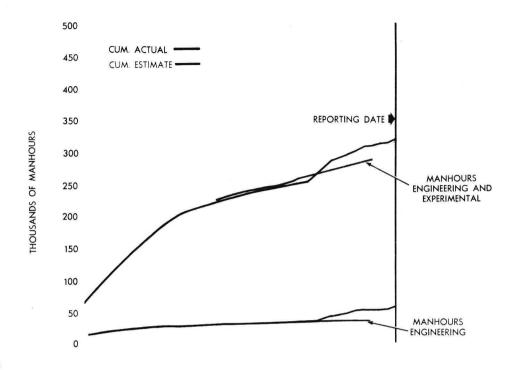






ENGINEERING MOCKUPS

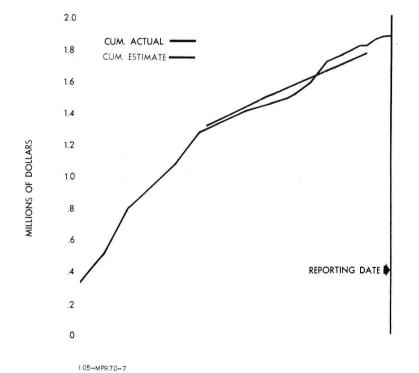
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450 400 350 300 250 200 150 100 50

500

MANHOUR EXPENDITURES



2.0

1.8

1.6

1.4

1.2

1.0

8

MITIONS OF DOULARS

.4

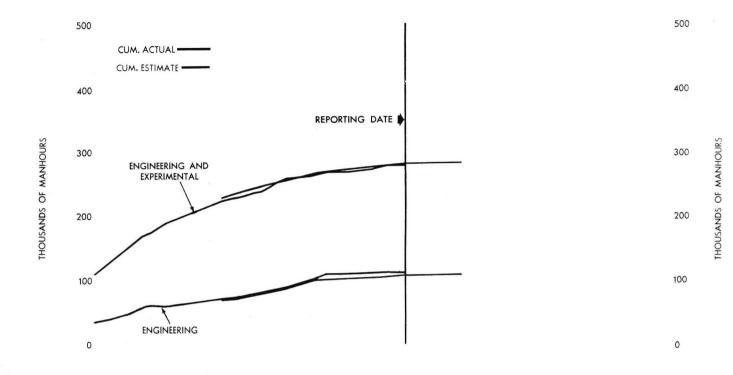
.2

0

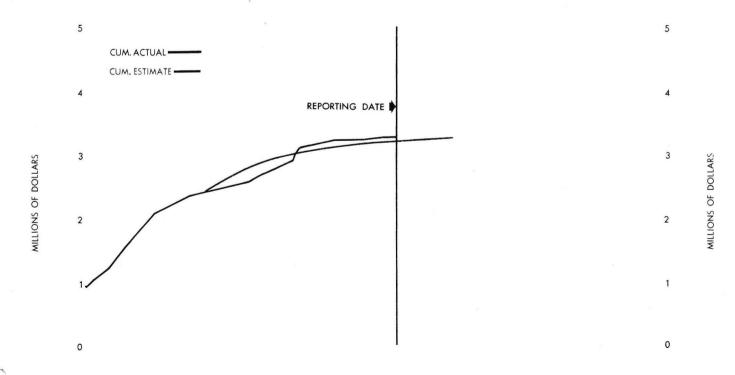
DOLLAR EXPENDITURES



WIND TUNNEL AND FREE FLIGHT MODEL TESTS



MANHOUR EXPENDITURES

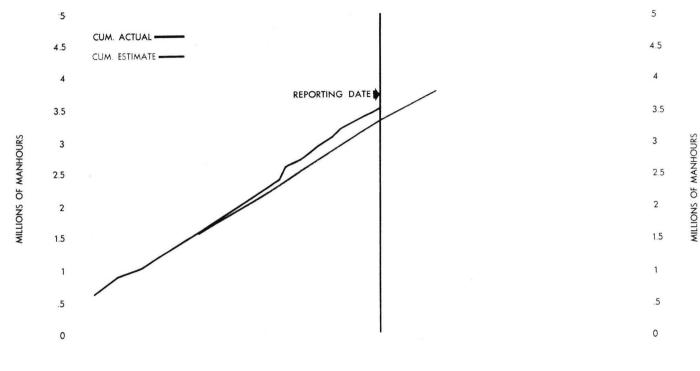


DOLLAR EXPENDITURES

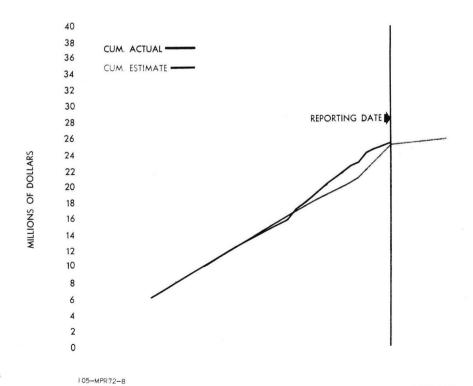
105-MPR71-7

-

AIRCRAFT DESIGN-EXCLUDING GROUND SUPPORT EQUIPMENT, MOCKUPS, MODELS AND A.S.T.



MANHOUR EXPENDITURES

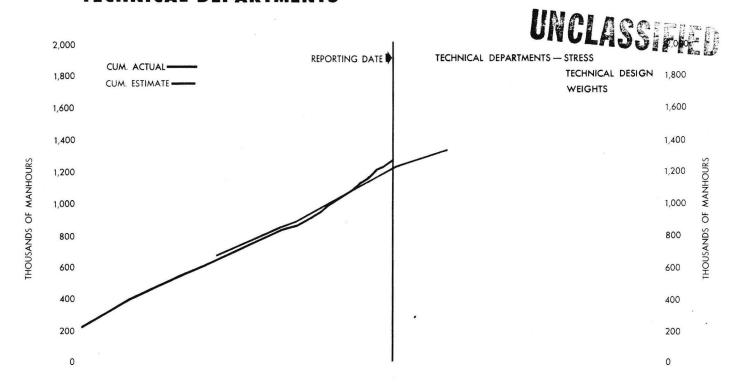


DOLLAR EXPENDITURES

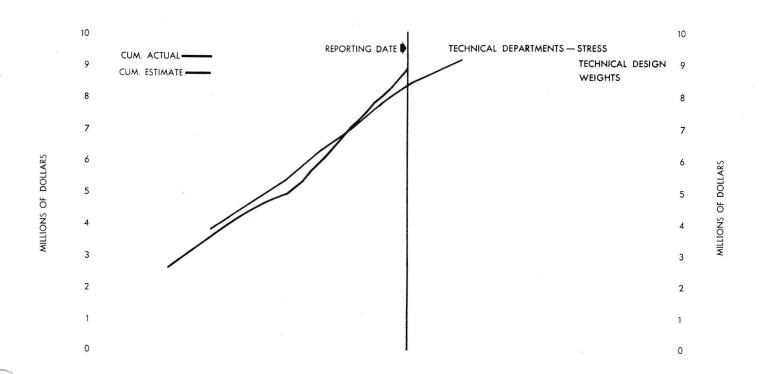
MILLIONS OF DOLLARS



TECHNICAL DEPARTMENTS



MANHOUR EXPENDITURES

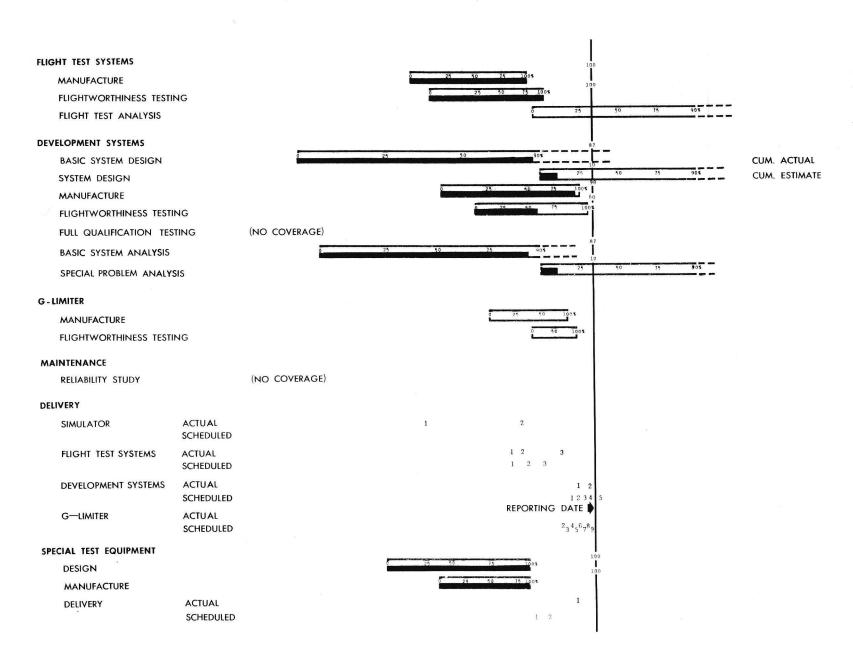


DOLLAR EXPENDITURES

105-MPR73-7

ECRE

MINNEAPOLIS-HONEYWELL (MH-64) DAMPING SYSTEM





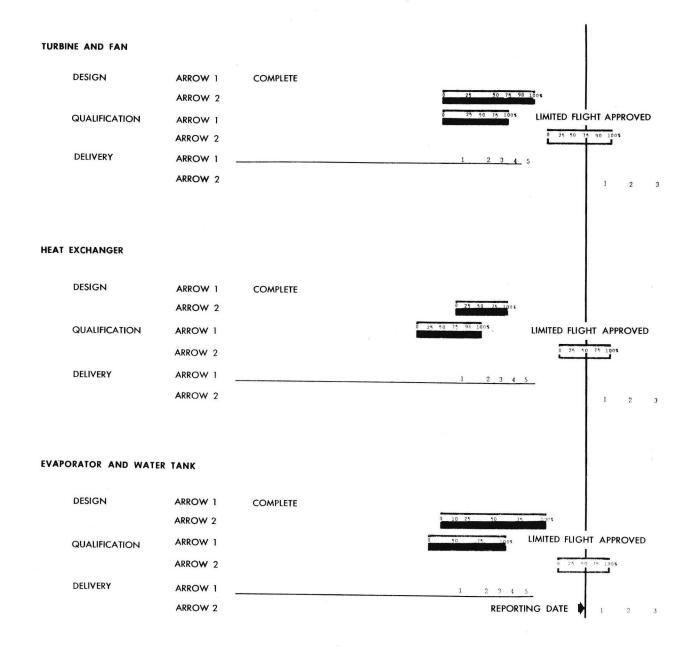
CUM. ACTUAL ___

CUM. ESTIMATE 1-2-

•

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AIR CONDITIONING SYSTEM



UNCLASSIFIED

SECTION 3 ENGINEERING - TEST PROGRAM

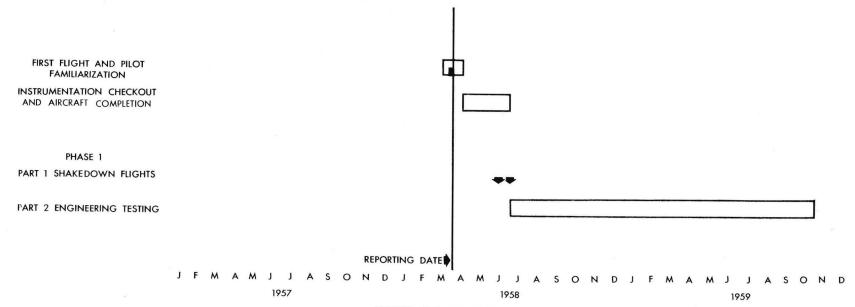


ENGINEERING - TEST PROGRAM

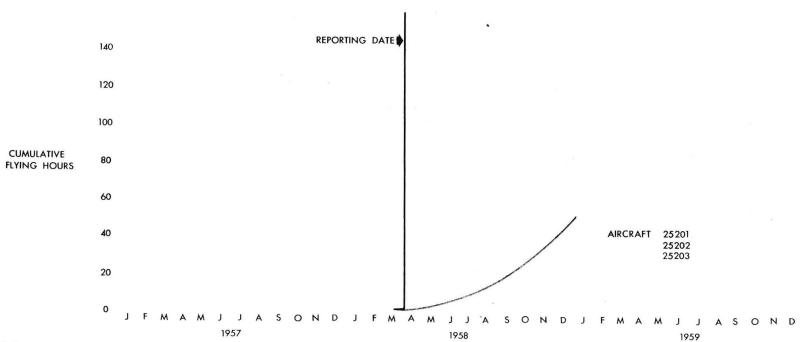
The note "Operation and maintenance of flight test vehicles not funded" has been deleted from the Flight Test Program bar charts for ARROW 1 and 2 and also from the manhour and dollar expenditure Flight Test charts. The start of Phase 1 testing on the ARROW 1 Flight Test bar chart is now scheduled for July 1st, 1958 in line with the Allocation of Aircraft chart in Section 1 and the note regarding the provision of time for AFCS development is deleted.

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FLIGHT TEST PROGRAM ARROW I

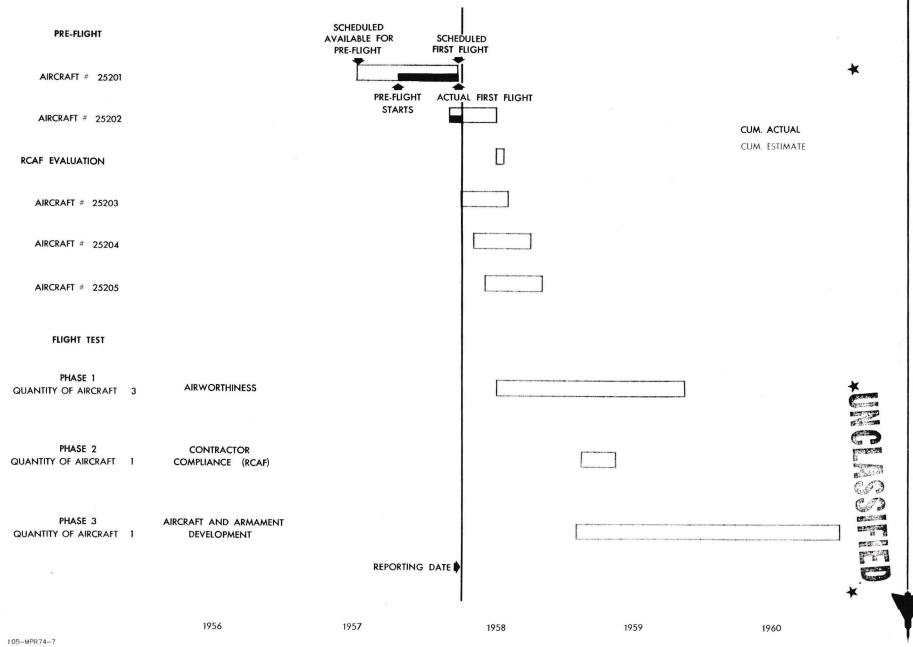


ARROW AIRCRAFT 25201



CRET

FLIGHT TEST PROGRAM ARROW I



FLIGHT TEST PROGRAM ARROW 2

PRE-FLIGHT

AIRCRAFT #25206

AIRCRAFT #25207

AIRCRAFT #25208

FLIGHT TEST

PHASE 1

AIRWORTHINESS

QUANTITY OF AIRCRAFT 1

PHASE 2

CONTRACTOR COMPLIANCE

QUANTITY OF AIRCRAFT 1

(R.C.A.F.)

PHASE 3 QUANTITY OF AIRCRAFT 2 AIRCRAFT AND ARMAMENT DEVELOPMENT

REPORTING DATE

SCHEDULED AVAILABLE FOR FIRST PRE-FLIGHT **FLIGHT**

ACTUAL

ESTIMATE

a contract 20/21/2

THIS CHART SHOWS PHASE 3 ARROW 2 DEVELOPMENT FLYING APPLICABLE ONLY TO AIRCRAFT ON PRESENT CONTRACT



SECRET

ECR

MAJOR TESTS OF STRUCTURE AND SYSTEMS - ARROW 1

STRUCTURAL TEST
COMPLETE AIRCRAFT

RIG DESIGN AND MANUFACTURE

TESTING

AIR CONDITIONING

RIG DESIGN AND MANUFACTURE

TESTING

FUEL SYSTEM

RIG DESIGN AND MANUFACTURE

TESTING

ELECTRICAL

LANDING GEAR

RIG DESIGN AND MANUFACTURE

TESTING

CANOPY AND ESCAPE MECHANISMS

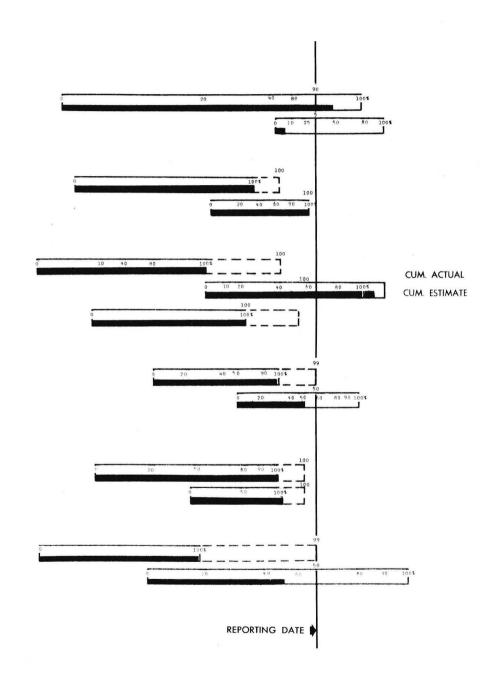
RIG DESIGN AND MANUFACTURE

TESTING

FLYING CONTROLS

RIG DESIGN AND MANUFACTURE

TESTING



MAJOR TESTS OF STRUCTURE AND SYSTEMS - ARROW 2

SPARROW 2D MISSILE PACK DEVELOPMENT

RIG DESIGN AND MANUFACTURE

TESTING

AIR CONDITIONING

RIG DESIGN AND MANUFACTURE

TESTING

ELECTRICAL

RIG DESIGN AND MANUFACTURE

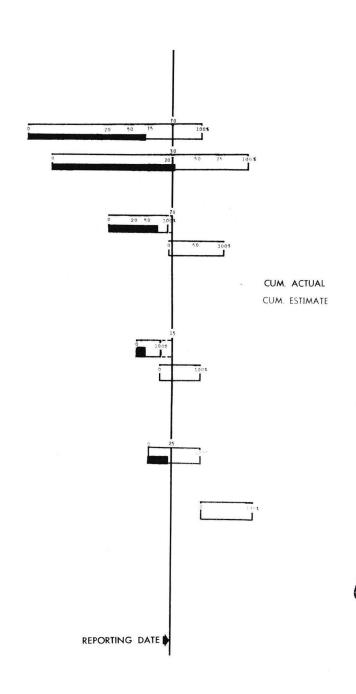
TESTING

FUEL SYSTEM

RIG DESIGN AND MANUFACTURE

TESTING

OTHER ARROW 2 TEST PROGRAMS WILL BE ADDED WHEN PLANNING IS SUFFICIENTLY ADVANCED

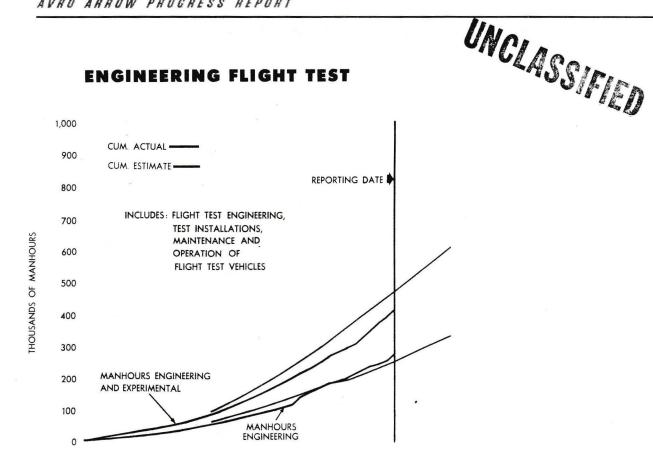




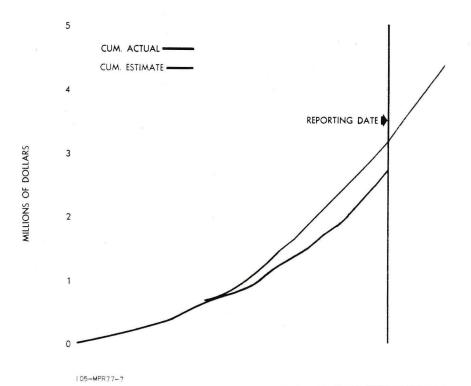
1,000

THOUSANDS OF MANHOURS

ENGINEERING FLIGHT TEST



MANHOUR EXPENDITURES



DOLLAR EXPENDITURES

MILLIONS OF DOLLARS

MILLIONS OF MANHOURS

0.3

0.2

0.1

0

2.0

1.9

1.8

1.7

1.6

1.5

1.4

1.3

1.2

1.1

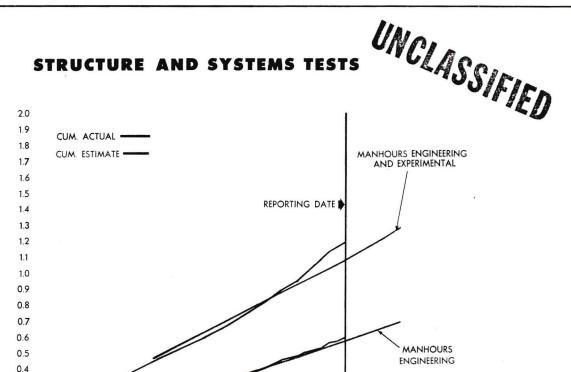
1.0

0.9 0.8

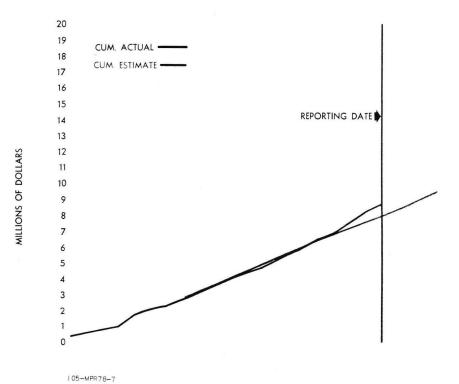
0.7

0.6

STRUCTURE AND SYSTEMS TESTS



MANHOUR EXPENDITURES



DOLLAR EXPENDITURES

0

MILLIONS OF DOLLARS

200

180

160

140

120

100

60

40

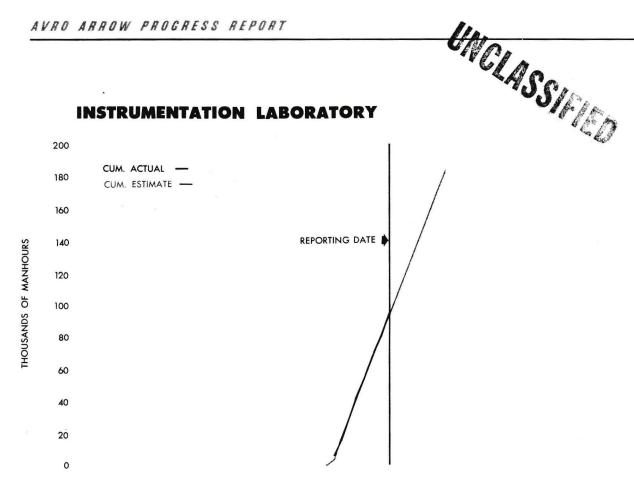
20

0

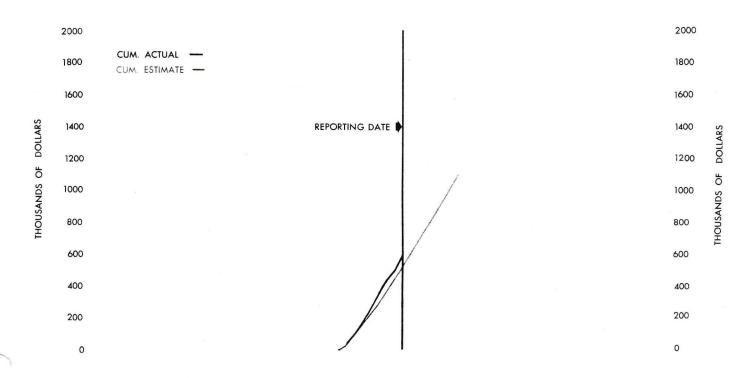
THOUSANDS OF MANHOURS

105-MPR2883-4

INSTRUMENTATION LABORATORY



MANHOUR EXPENDITURES



DOLLAR EXPENDITURES

UNCLASSIFIED

SECTION 4 ENGINEERING GROUND SUPPORT EQUIPMENT AND SYSTEMS TRAINERS



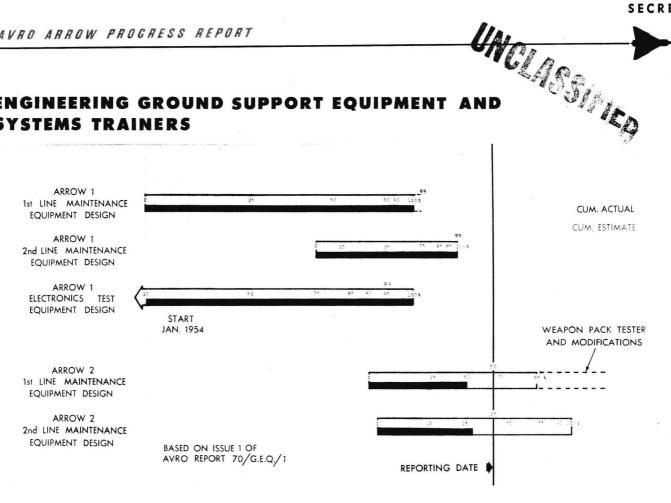
ENGINEERING - GROUND SUPPORT EQUIPMENT AND SYSTEMS TRAINERS

The Airframe Systems Trainer bar chart has been re-titled Systems Trainers, and schedules

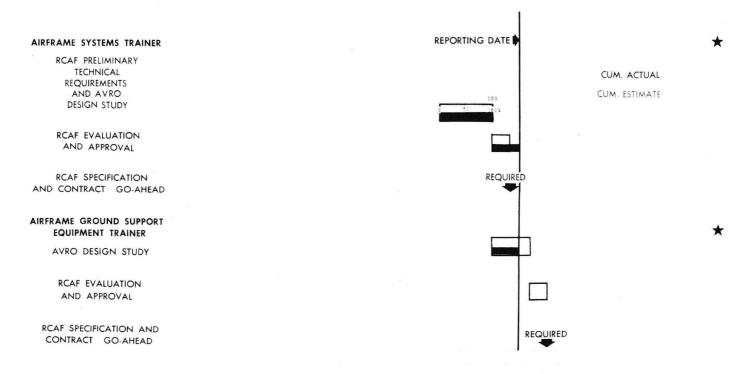
added for the various stages of the Airframe Ground Support Equipment Trainer.



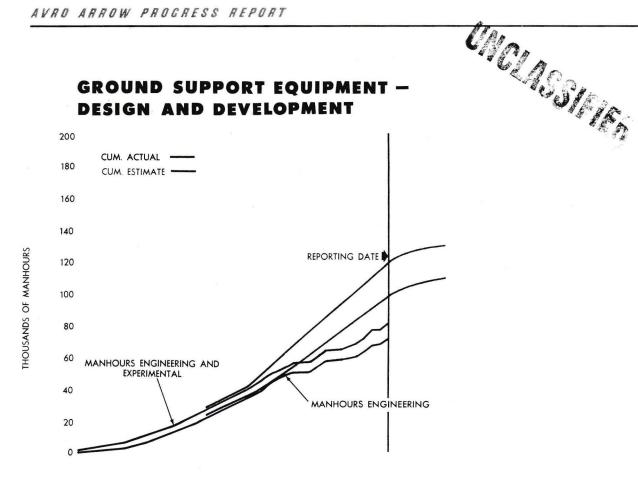
ENGINEERING GROUND SUPPORT EQUIPMENT AND SYSTEMS TRAINERS



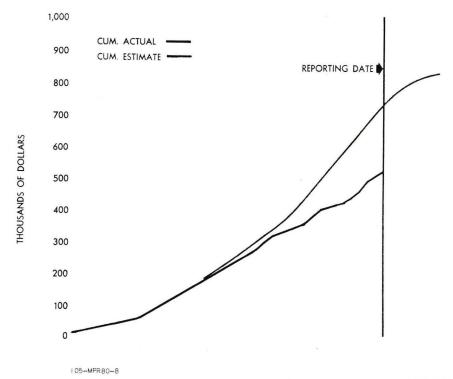
ENGINEERING GROUND SUPPORT EQUIPMENT



GROUND SUPPORT EQUIPMENT -DESIGN AND DEVELOPMENT



MANHOUR EXPENDITURES



DOLLAR EXPENDITURES

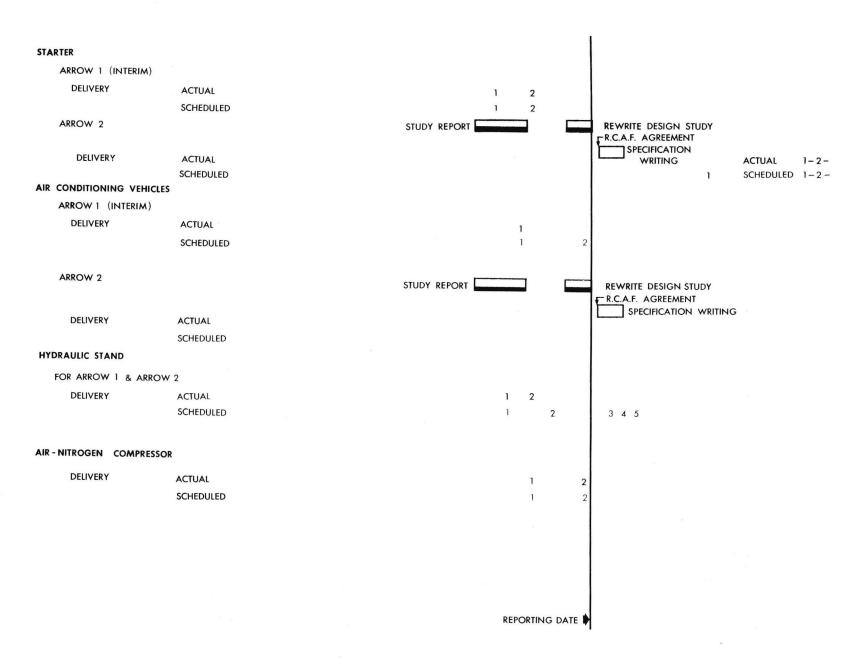


1,000

OF DOLLARS

THOUSANDS

GROUND SUPPORT EQUIPMENT - MAJOR ITEMS





20

18

16

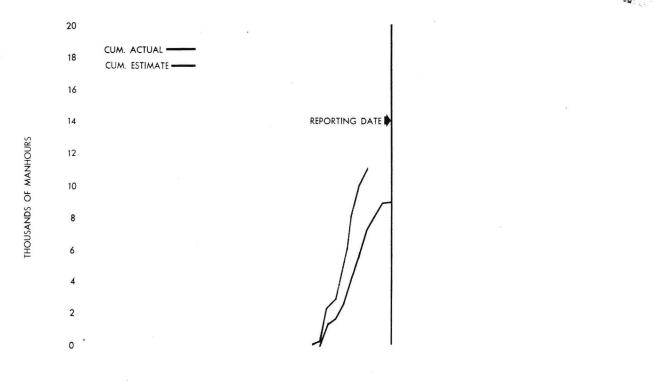
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2

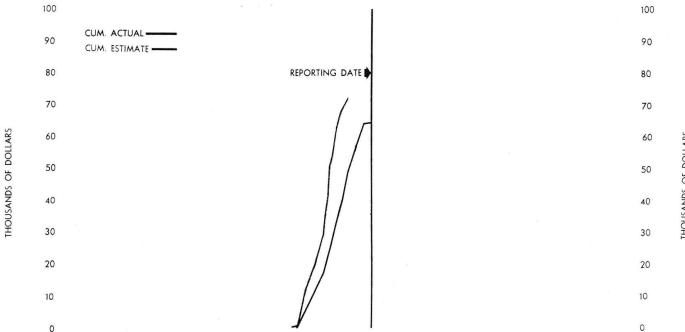
0

THOUSANDS OF MANHOURS

UNCLASSIFIED



MANHOUR EXPENDITURES



105-MPR81-7

DOLLAR EXPENDITURES

THOUSANDS OF DOLLARS



SECTION 5 TOOLING AND MANUFACTURING



TOOLING AND MANUFACTURING

This section deals with those phases of the program which relate to the Manufacturing Division. It affords a comparison of total Tooling and Production costs with performance in terms of percentage completed at the reporting date. More detailed breakdown of total production costs now available has resulted in amendment of total production expenditures.

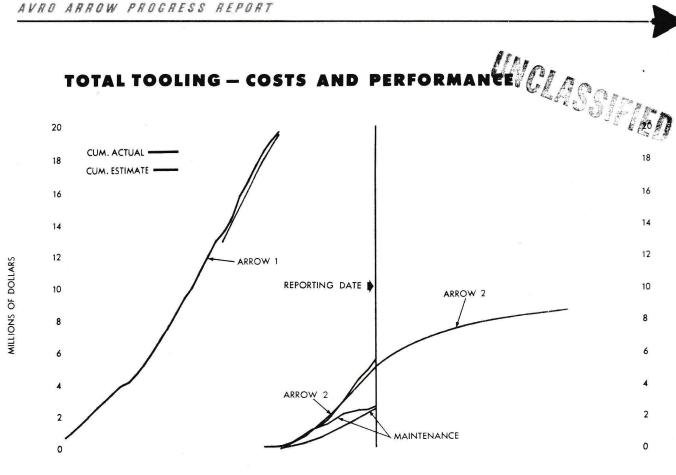
Bar charts showing the progress of the first eight aircraft and the static test aircraft are included. Manhour and dollar expenditures for the production of spares, ground support equipment, publications and the metal mockup are shown, as are costs for test components, airborne test equipment and production material. A more detailed breakdown of production material costs is now available and expenditures have been amended to include material in inventory for three aircraft.

The section also contains tables which reflect the supply position for pacing items of Avro furnished equipment and for Government Supplied Material.

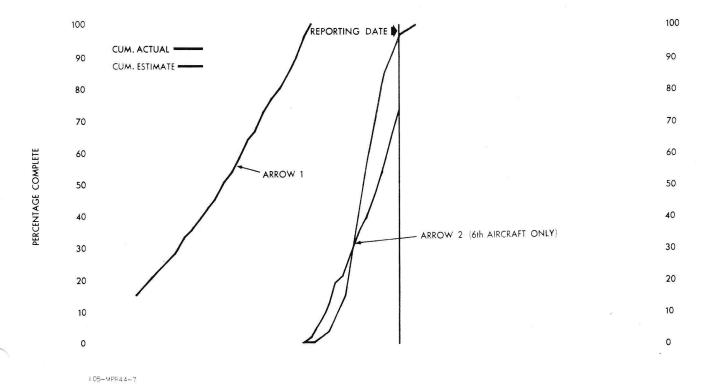


MILLIONS OF DOLLARS





DOLLAR EXPENDITURES

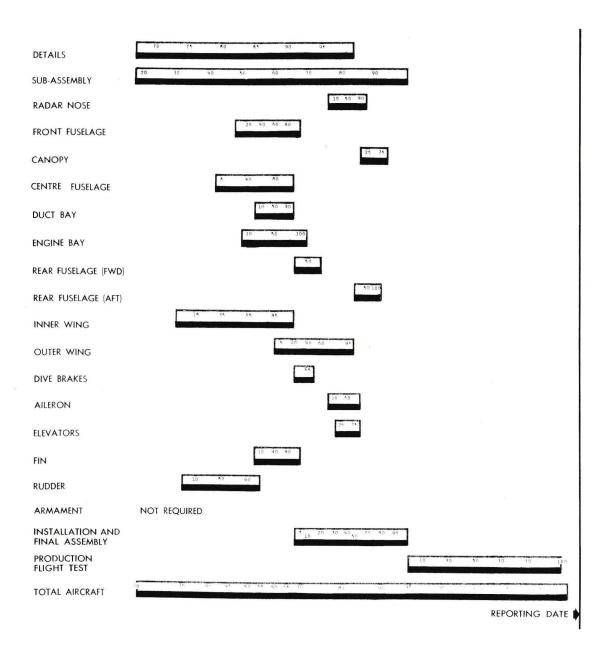


PHYSICAL PERFORMANCE

PERCENTAGE COMPLETE

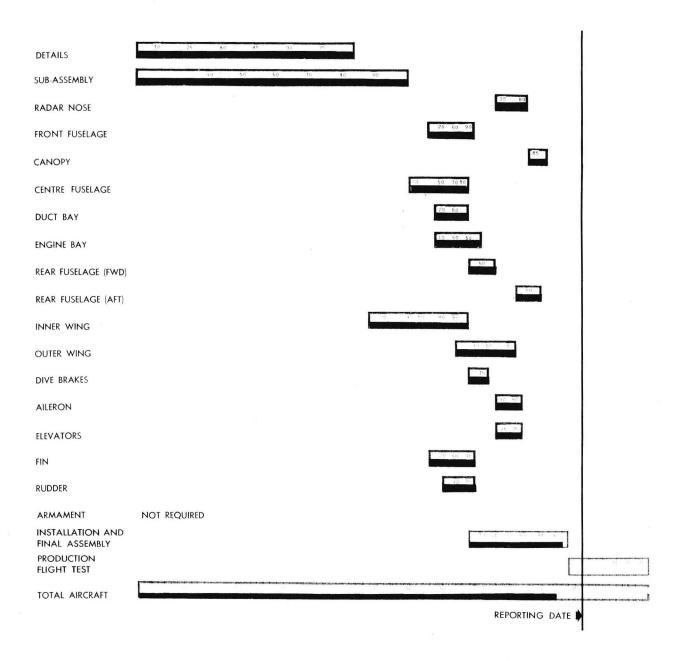
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PROGRESS CHART - FIRST AIRCRAFT

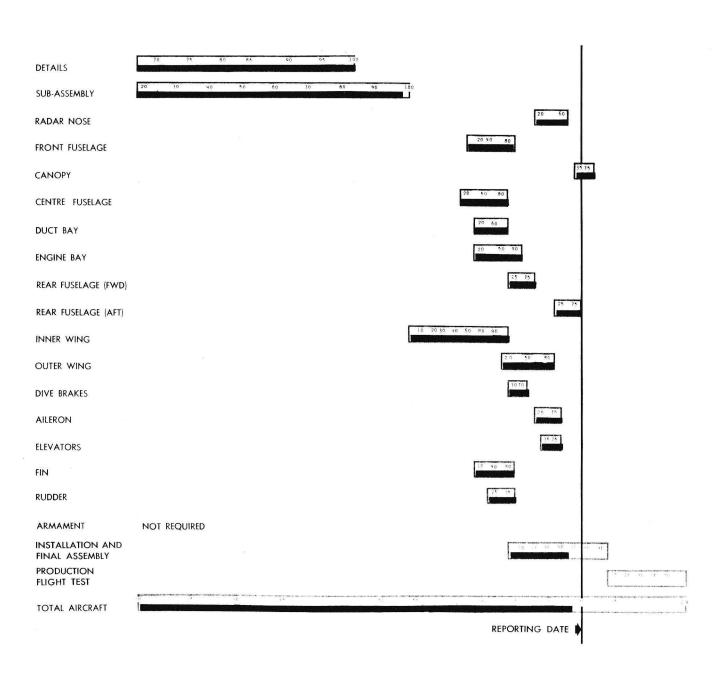


CUM. ACTUAL CUM ESTIMATE /O

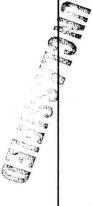
PROGRESS CHART - SECOND AIRCRAFT



CUM. ACTUAL Of CUM. ESTIMATE /C

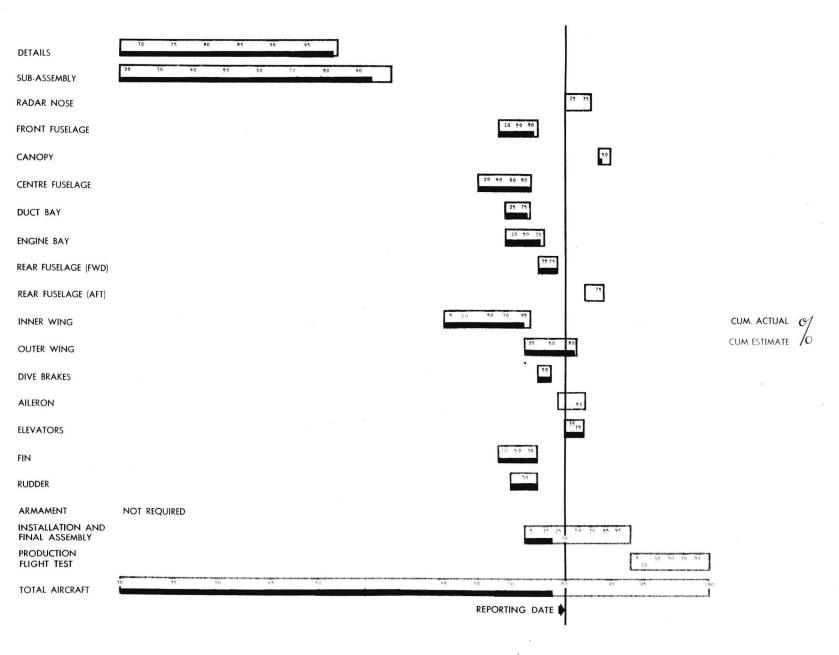


CUM ACTUAL CO

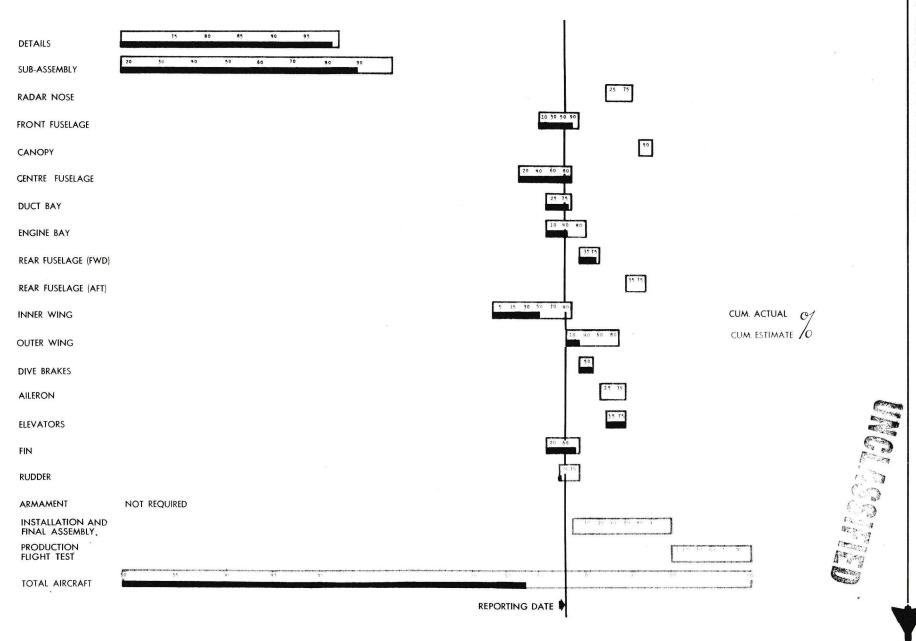


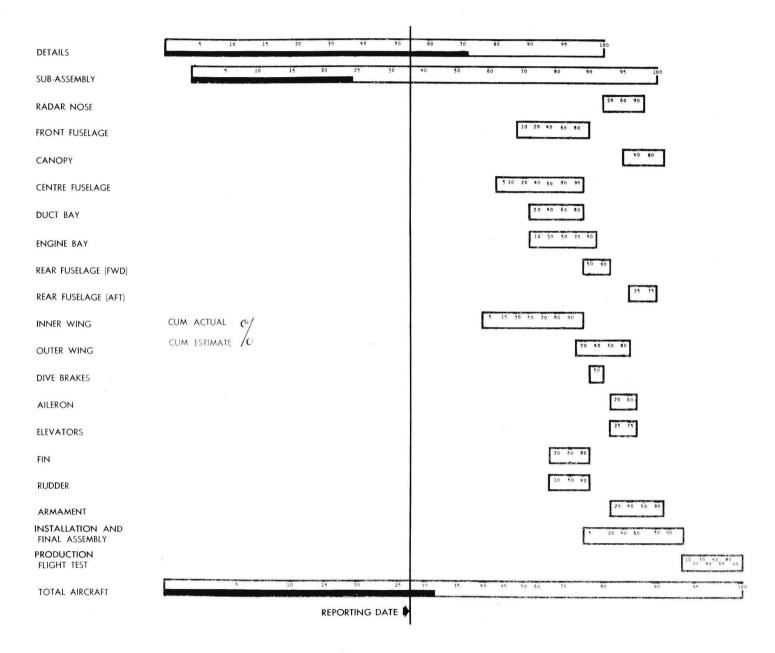
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PROGRESS CHART - FOURTH AIRCRAFT



PROGRESS CHART - FIFTH AIRCRAFT



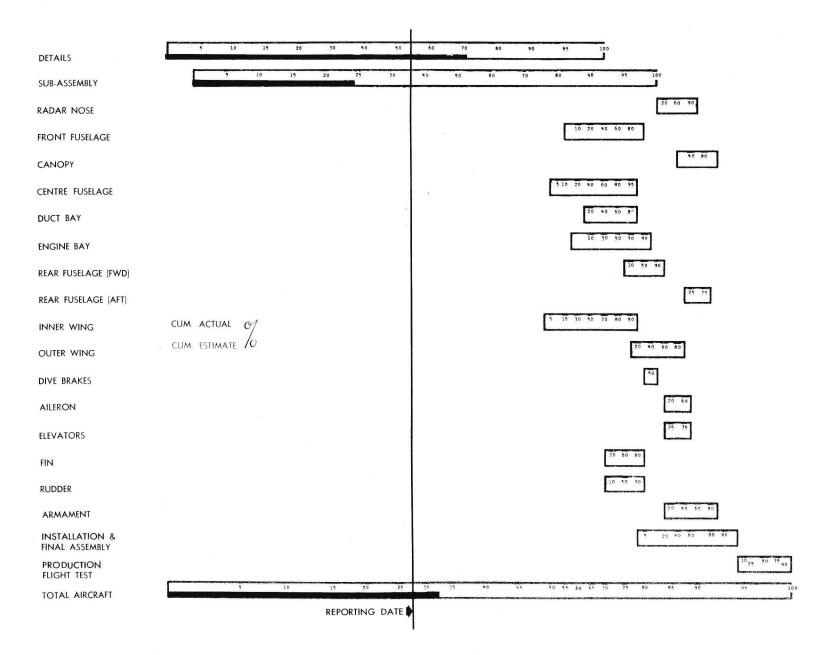




SECRE

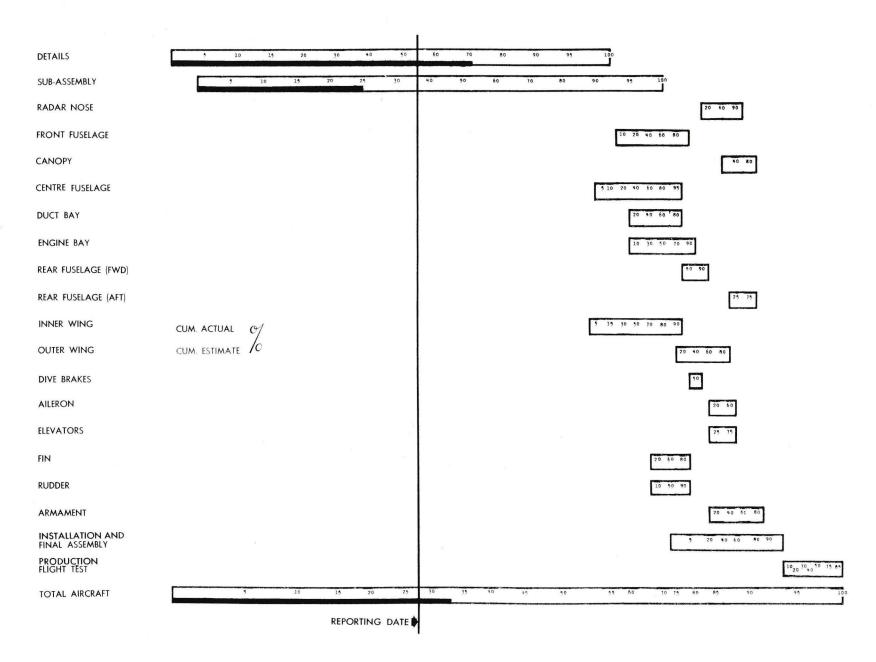
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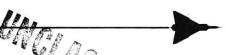
PROGRESS CHART - SEVENTH AIRCRAFT



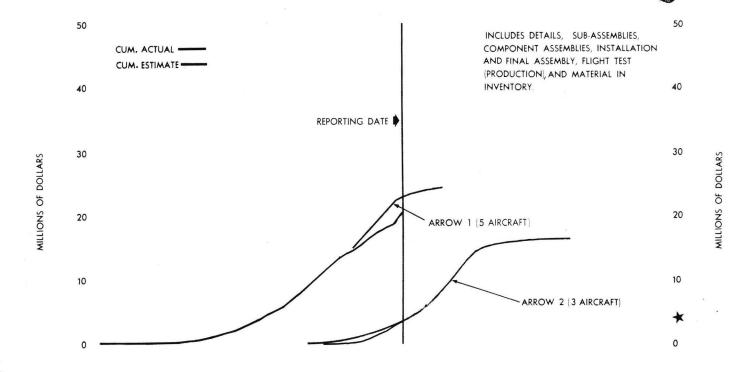
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PROGRESS CHART - EIGHTH AIRCRAFT

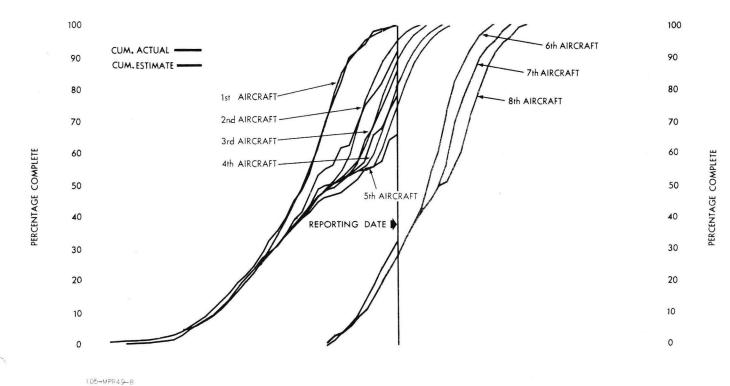




TOTAL PRODUCTION - COSTS AND PERFORMANCE



DOLLAR EXPENDITURES



PHYSICAL PERFORMANCE

PROGRESS CHART - STATIC TEST AIRCRAFT

DETAILS SUB-ASSEMBLY RADAR NOSE NOT REQUIRED FRONT FUSELAGE CANOPY CENTRE FUSELAGE **DUCT BAY** ENGINE BAY REAR FUSELAGE (FWD) REAR FUSELAGE (AFT) NOT REQUIRED INNER WING OUTER WING DIVE BRAKES NOT REQUIRED **AILERON ELEVATORS** FIN **RUDDER** ARMAMENT NOT REQUIRED INSTALLATION AND 60 80 95 FINAL ASSEMBLY PRODUCTION FLIGHT TEST NOT REQUIRED TOTAL AIRCRAFT

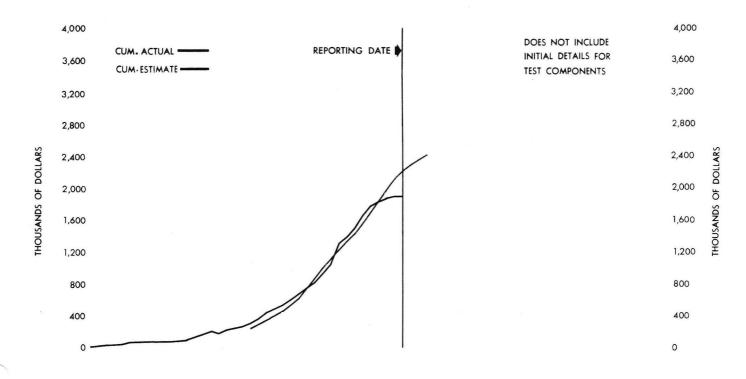
CUM. ACTUAL OF



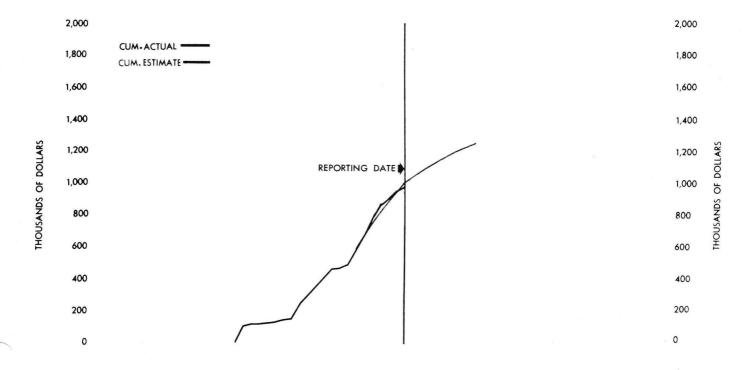
ECRE

105-MPR56-8

TEST COMPONENTS AND AIRBORNE TEST EQUIPMENT COSTS



TEST COMPONENT DOLLAR EXPENDITURES

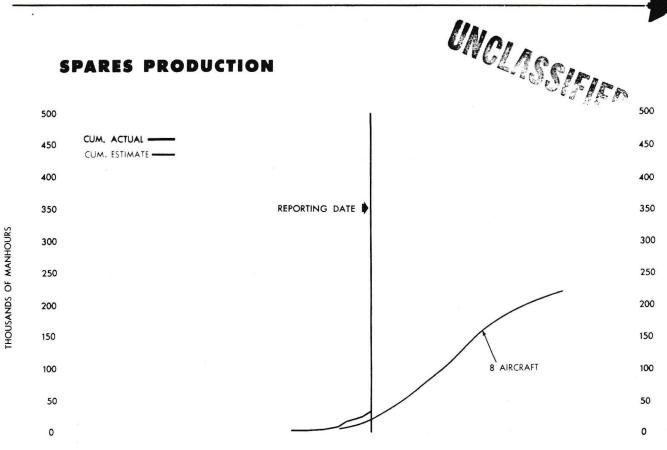


AIRBORNE TEST EQUIPMENT DOLLAR EXPENDITURES

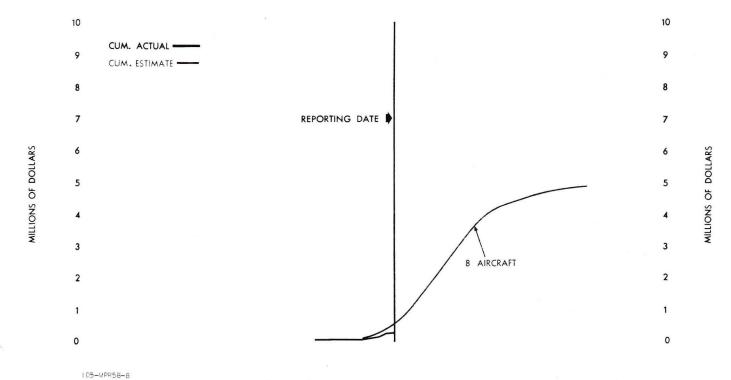


THOUSANDS OF MANHOURS



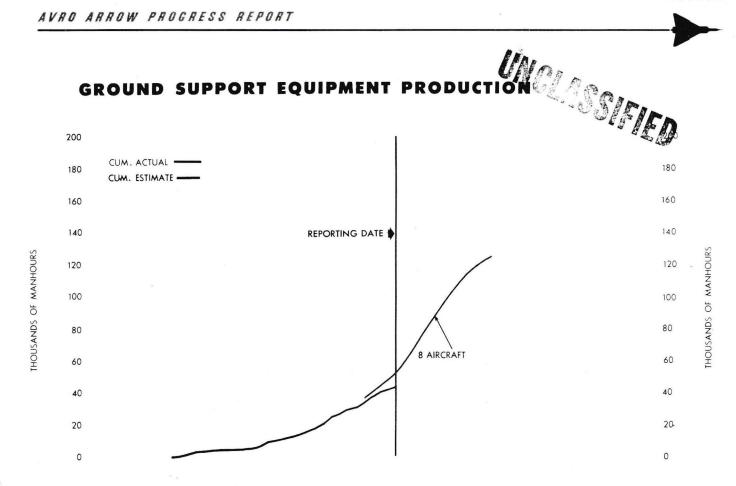


MANHOUR EXPENDITURES

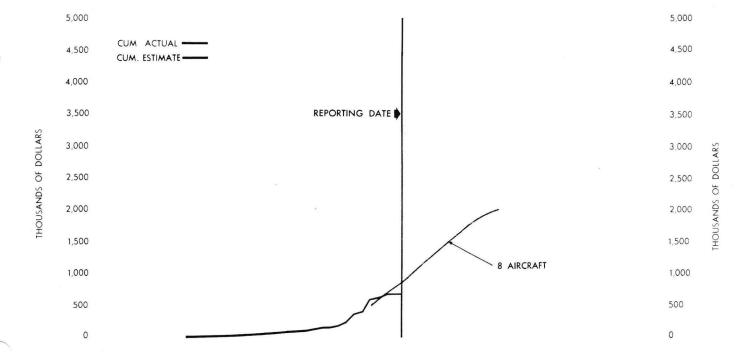


DOLLAR EXPENDITURES



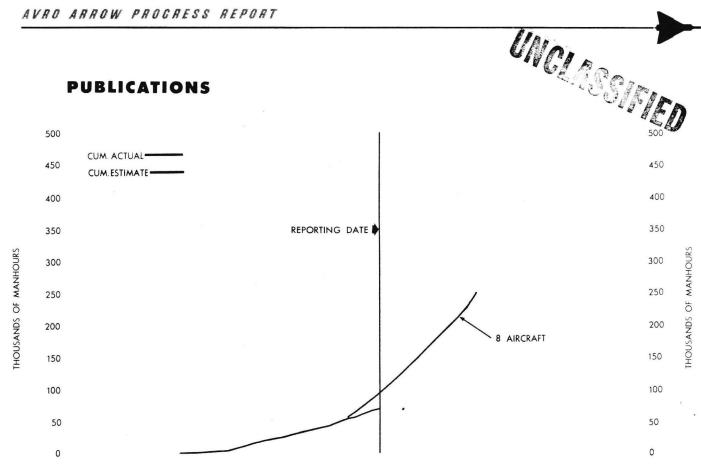


MANHOUR EXPENDITURES

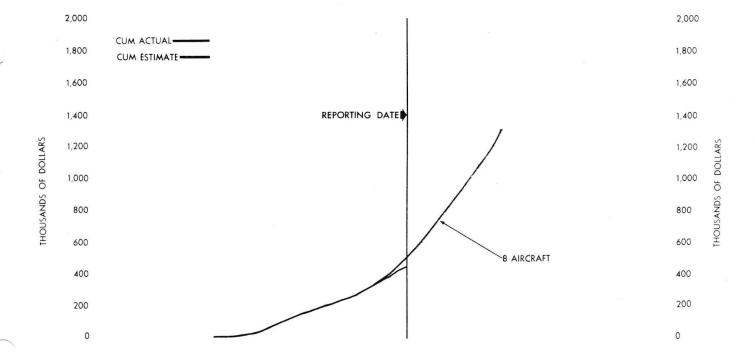


105-MPR59-8 **DOLLAR EXPENDITURES**

105-MPR60-8

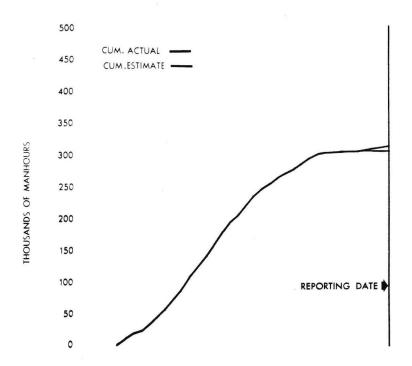


MANHOUR EXPENDITURES

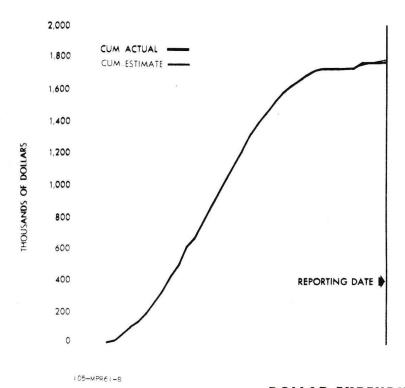


DOLLAR EXPENDITURES

METAL MOCK UP PRODUCTION



MANHOUR EXPENDITURES



DOLLAR EXPENDITURES

2,000

1,800

0

1,600 1,400

1,200

1,000 800

THOUSANDS OF DOLLARS

600

400

200

0



AVRO FURNISHED EQUIPMENT (PACING ITEMS) - PAGE

DESCRIPTION PER MONTH AIRCRAFT ACCEPTANCES CUMULATIVE TOTAL PER MONTH AIRCRAFT COMPLETIONS CUMULATIVE TOTAL APPROX. 113 ITEMS FUEL SYSTEM VALVE, FUEL NO AIR PUMP, FUEL BOOSTER FLOW PROPORTIONER CENTRE OF GRAVITY CONTROL APPROX, 15 ITEMS FLYING CONTROLS DAMPING SYSTEM DECELERATION PARACHUTE LOW PRESSURE PNEUMATICS APPROX. 17 ITEMS VALVE, CANOPY SEAL APPROX. 5 ITEMS OXYGEN CONVERTER, OXYGEN APPROX. 82 ITEMS HYDRAULIC UTILITIES COMPENSATOR PUMP, CONSTANT DELIVERY APPROX. HYDRAULIC FLYING CONTROLS 55 ITEMS POWER CONTROL, ELEVATOR POWER CONTROL, AILERON POWER CONTROL, RUDDER ARMAMENT HYDRAULICS APPROX. 24 ITEMS VALVE, MANIFOLD ASSY

ACTUAL IT	EMS RECEIVED
REQUIREME	NT SCHEDULE -1-2-
PROMISED	DATES FOR 1ST A/C
OLD 💠	REVISED -

REPORTING DATE

AVRO FURNISHED EQUIPMENT (PACING ITEMS) – PAGE 2

DESCRIPTION

FIRE PROTECTION APPROX. 1 ITEM						
SUPPLY UNIT FIRE EXTINGUISHER	1 2 3 4 5	6	7	8		
ELECTRICAL APPROX. 188 ITEMS ALTERNATORS AND TRANSFORMER RECTIFIER UNIT	1 23 45			6	7	8
STRUCTURE APPROX. 66 ITEMS	♦					
RADOME DE-ICING APPROX. 27 ITEMS	1 23 45			6	7	8
DE-ICER BOOTS ENGINE INSTALLATION APPROX. 51 ITEMS	1 23 45			6	7	8
GEAR BOXES AIR CONDITIONING APPROX. 91 ITEMS	1 23 4 5		(6	7 8	
TURBINE AND FAN WATER BOILER	1, 23 45		,		7 8	
HEAT EXCHANGER FURNISHINGS APPROX. 1 ITEM	1 23 45			6.	7	8
EJECTOR SEATS INSTRUMENTS APPROX. 19 ITEMS	1 2 3 4 5			6	7	8
GAUGE, FUEL QUANTITY ELECTRONICS	1 2 3 4 5	6	7	8		
SUSCEPTIFORMER MK 1 ONLY LANDING GEAR APPROX. 8 ITEMS	1 2 3 4 5					
MAIN GEAR NOSE GEAR	1 2 3 4 5				6	7
OXYGEN REGULATOR	2 3 4 5					

ACTUAL ITEMS RECEIVED ____ REQUIREMENT SCHEDULE -1-2-PROMISED DATES FOR 1ST A/C OLD 💠 REVISED -

REPORTING DATE



GOVERNMENT FURNISHED EQUIPMENT - PAGE 1

DESCRIPTION			
PER MONTH AIRCRAFT ACCEPTANCES CUMULATIVE TOTAL	1	1 1 1 1 1 3 5 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 6 7 8
PER MONTH AIRCRAFT COMPLETIONS CUMULATIVE TOTAL	1 1		1 1 7 8
J.4 COMPASS			
SERVO AMPLIFIER	1 2 3 4 5	6 7 8	
CONTROLLER	2 3 4 5	6 7 8	
COMPENSATOR	1♥ 2 3♥ 4 5	6 7 8	
COMPENSATOR TRANSMITTER REMOTE COMPASS	1 → 2 3 → 4 5	6 7 8	
A CONTRACTOR OF THE CONTRACTOR	_		
DIRECTIONAL GYRO	2 3 4 5	6 7 8	
INSTRUMENTS	_		
AIRSPEED INDICATOR	2 3 4 5	6 7 8	
ALTIMETER	1 2 3 4 5	6 7 8	
8 DAY CLOCK	2 3 4 5	6 7 8	
RATE OF CLIMB INDICATOR	1 2 3 4 5	6 7 8	
ARTIFICIAL HORIZON	1 23 45	6 7 8	
ACCELEROMETER	1 2 3 4 5	6 7 B	
CABIN PRESSURE INDICATOR	1 23 45	6 7 B	
TURN & BANK INDICATOR	1 23 45	€ 7 8	
ALL CUETIC COURSES	1 23 45	6 7 8	
MAGNETIC COMPASS POWER PLANT	1 2 3 4 3	, ,	
J75 PROTOTY PF ENGINES (2 SETS FOR IST A/C) J75 PRODUCTION ENGINES (2nd, 3rd, 4th & 5th A/C) IROQUOIS ENGINES (6th, 7th & 8th A/C)	23 4 5	6 7 8	
ELECTRONICS FOR MK 1 A/C			
TRANSPONDER A P X CONTROL RADAR A P X	1 2 3 4 5 1 2 3 4 5		
MOUNTING TRANSPONDER APX LOOP CABLE ARN-6	1 2 3 4 5 1 2 3 4 5		
RECEIVER ARN-6 MTG. RECEIVER ARN-6	1 2 3 4 5		
AMPLIFIER ARA-25 RELAY ARA-25	1 2 3 4 5 1 2 3 4 5	х.	
MOUNTING AMPLIFIER ARA-25 MOUNTING RELAY ARA-25	1 2 3 4 5 1 2 3 4 5		ACTUAL ITEMS RECEIVED -3-3-
ANTENNA ARA-25 TRANSMITTER RECEIVER ARC-34	1 2 3 4 5		PROMISED DATES FOR 1ST A/C OLD ♥ REVISED ♥
CONTROL ARC-34	1 2 3 4 5		

REPORTING DATE

105-MPR28-7



GOVERNMENT FURNISHED EQUIPMENT - PAGE 2

UNCLASSIFIED

DESCRIPTION

MOUNTING TRANSCEIVER A R C-34 CONTROL PANEL A I C-10			2 3 4	1 <u>5</u> 4 5	
RELAY ASSEMBLY AIC-10 DYNAMOTOR AIC-10	-	1	2 3	4 5	
MOUNTING DYNAMOTOR AIC-10 INDICATOR RADIO COURSE	2	10	2 3	4_5	
ELECTRONICS FOR MK2 A/C					
ASTRA					
R-THETA					
R. O. COMPUTER		1	2 3	4 5	
G.S.I. COMPUTER		1	2 3	4 5	
INTEGRATOR		1	2 3	4 5	
MOUNTING		1	2 3	4.5	

NO LONGER REQUIRED

ACTUAL ITEMS RECEIVED

REQUIREMENT SCHEDULE -1-2
PROMISED DATES FOR 1ST A/C

OLD ⇔ REVISED

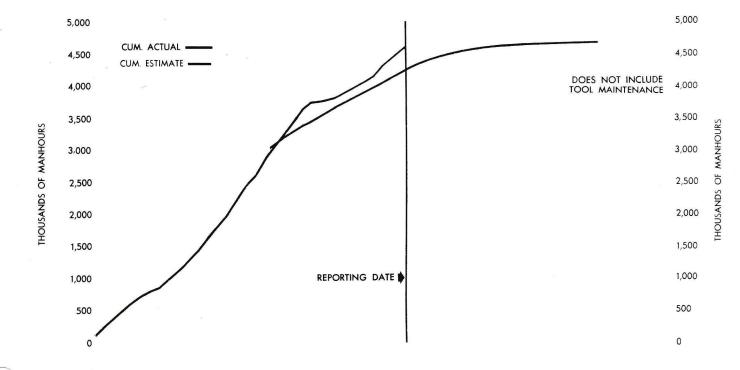
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REPORTING DATE

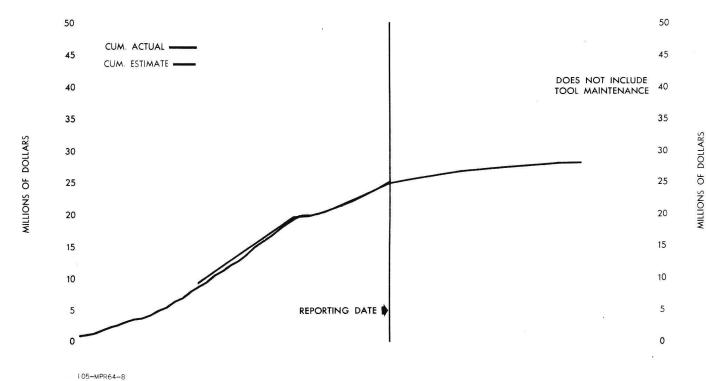




UNCLASSIFIED.



MANHOUR EXPENDITURES

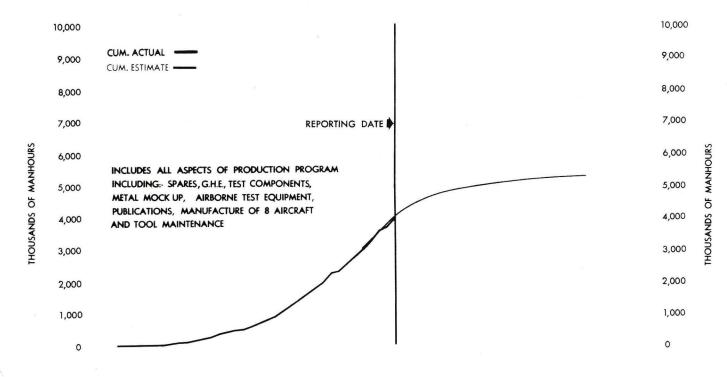


DOLLAR EXPENDITURES

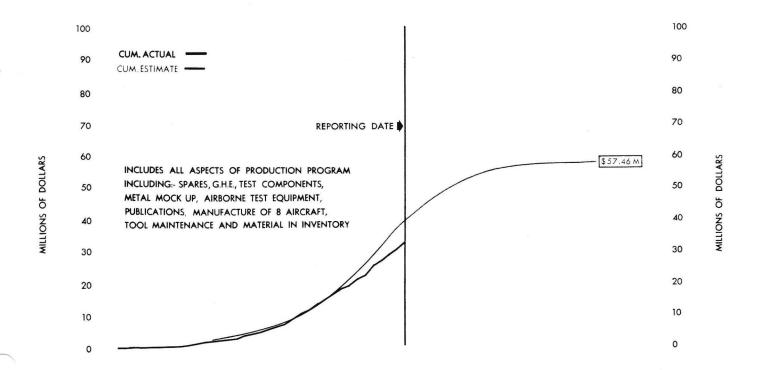




UNCLASSIFIED



MANHOUR EXPENDITURES



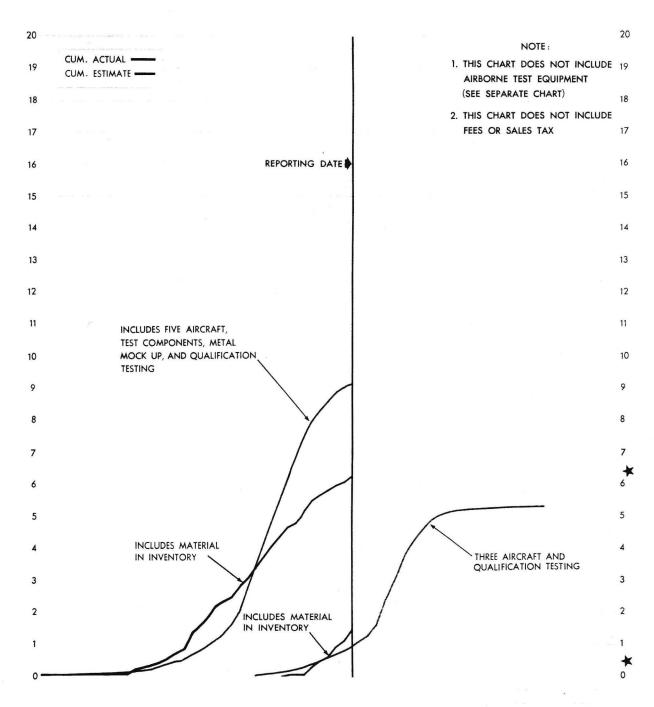
DOLLAR EXPENDITURES

105-MPR65-8



PRODUCTION MATERIAL DOLLARS





105-MPR62-9

MILLIONS OF DOLLARS

MILLIONS OF DOLLARS