

QCX
AVRO
CF105
MISC-
20

prologue

Tom Dugelby

Productions

106.2

FILE IN VAULT

CF-105 Engineering

Chronology.

Sections ^{ANALYZED} 4-15

UNCLASSIFIED

4. SCHEDULE

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
Jan./50	First Flight of CP-100 Mk. 1.	Prologue Tom Dugelby Productions
July/50	First Flight of 2nd CP-100 Mk. 1.	
Sept./50	Outbreak of Korean war.	
Feb./51	C103 Detail design commenced.	
Mar./51	C103 Wind Tunnel testing commenced.	ANALYZED
June/51	C103 Jig and Tool manufacture commenced.	
Oct./51	1st C100 delivered to RCAF. (Mk. 2).	
Dec./51	C103 Project cancelled. Performance and delivery incompatible with threat.	
Oct./52	1st Flight T.I. C100 Mk. 4.	
Dec./52	Estimated completion date of the first prototype C104 is January 1956.	Engines for C104 Dec. 1/52.
Feb./53	RCAF and Avro decide to proceed with C100 Mk. 6.	
June/53	Estimated 1st flight of C104 2nd prototype,	P/C-105/2
Aug./57.		June 2/52

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<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
July/53	RCAP decide to abandon Mk. 6. Performance and delivery incompatible with threat.	C105 Costs file: Letter ITS July 22/53
Aug./53	The date of commencement of detailed work on C105 project to spec. AIR-7-3 Iss. 1 was Sept. 1/53 with an objective for first prototype flight 34 months from this date (i.e. July/56).	C105 Meetings file - RNL memo Aug. 24/53
Sept./53	Release of C105 preliminary project schemes to drawing office commenced.	Sept. 1/53.
Oct./53	1st Flight production C100 Mk. 4.	
Apr./54	Estimated date of first flight of prototype is now Sept./56. (In Dec./52 it was estimated Jan./56)	Minutes of Meeting with RCAP Apr.13/54.
May/54	Estimated date of first flight of prototype is now Feb./57 (in April/54 it was Sept./56).	Analysis C105 Progress - June 20/55.
June/54	C105 engineering commenced planned overtime at the rate of 1½ hours per day.	Directive to commence June 12/54.
July/54	Avro decision (subject to DDP approval) that sub-contract order be given for 8 sets of wings.	Eng. Prog. Rept. June/55, July 19/54.
July/54	Introduction of glass cloth lofting into D.O. Expected to reduce parts change risk to minimum and facilitate rapid production.	

<u>DATE</u>	<u>DETAILED</u>	<u>REFERENCES</u>
Sept./54	Tool design meeting with representatives from sub-contractors. H.R. Smith outlines Avro plan for C105 tool contracting and the "Rules".	C105 Meeting File: Meeting Minutes Sept. 10/55.
Nov./54	Estimated date of first flight of prototype is /57. (In May/54 it was Feb./57).	
Feb./55	RCAN would like the integrated electronics system installed in all delivered airplanes. They insist upon the installation in the 14th and subsequent airplanes and hope for its inclusion in the 12th and 13th airplanes.	DDM Feb. 1/55.
Apr./55	<p>C105 program re-scheduled Apr. 15/55 retarding 1st flight 6 months to bring airframe into phase with engines and integrated electronic system.</p> <p>Schemes A & B considered. Scheme B adopted as follows:</p> <ul style="list-style-type: none">(a) Complete schedule has gone back 6 months for first prototype flight in(b) Engines are available for all aircraft well before scheduled flight date.(c) 150% spares are available for first two prototypes.(d) Only 4 prototype J.75's are required. These engines are twice as expensive as pro-duction.	C105 Program file, Schedule for Schemes A & B.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
	(e) Only 12 of first 15 aircraft are powered by J.75. Numbers 6,7 and 15 are powered by P.S.13	
	(f) Aircraft numbers 4 and 5 can be flown to Hughes instead of being shipped.	
	(g) P.S. 13 engines not required until Aug./57, even on 4 months lead time, instead of May/57 with only 1 month lead time for Scheme A.	
	(h) Hughes electronic system is not required in production quantities until Nov./58 on 5 months lead time, instead of July/58 on 5 months lead time.	
	(i) The I.E.S. is fitted to the 20th aircraft instead of 24th.	
	(j) Delivery to squadrons is Oct./59 instead of May/59 for Scheme A.	
	(k) Fully operative Jan./60 (See JCF C105 Programs Apr. 18/55.)	
Apr./55	Estimated date of first flight of prototype is now, May/57 (in April/54 it was Sept./56).	
Apr./55	Avro philosophy behind adoption of scaled-down Cook-Craigie plan outlined.	JCF note in 'C105 Programs' - Apr.18/55.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Apr./55	J.75 will be installed in 12 of first 14 C105 aircraft. 2 will incorporate P.S. 13 engines. (4th and 7th, RNL to JCF, Apr. 20/55.) Approval given to order 33 x J.75 engines.	Co-ord. Comm. 18th Meeting Agenda - Apr. 20/55.
Apr./55	Review of situation on integrated electronics system not favourable based on present USAF reluctance to permit RCAF via DDP to place letter of intent with MAC. At least six months slippage forecast.	Armament file, RNL memo, Apr.22/55, also Mar. 29/55.
Apr./55	DDP inform Avro 19 x J.75 will be ordered to be delivered between Dec./56 and Sept./57 to cover first 5 aircraft. A further 12 x J.75 will be ordered in May/55 to cover Scheme 'B' engine requirements to Jan./58. These 31 engines will come from P & W preproduction run.	Power Plant file, G. Hake memo, Apr. 22/55.
July/55	C105 Engineering planned overtime reduced by $\frac{1}{2}$ hour to 1 hour per day July 11/55.	
July/55	Avro outline economies to reduce C105 costs.	C105 Program file, July 22/55.
Aug./55	Aerodynamics department, I.P.O. and Structural Test restored to Normal Working Hours, i.e. 8:30 am to 4:45 pm.	Aug. 22/55.

5. DESIGN CHANGES & PROGRAM PHILIPPODY

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
July/53	2 crew proposal due to uncertainties in development of fire control system suitable for single crew operation.	
Dec./53	Manufacturing Div. state advantages of manufacturing C105 aircraft on a production basis - including prototypes and development aircraft.	H.R. Smith memo to JCF Dec. 8/53.
Feb./54	Agreed Company policy for manufacturing to produce all C105 aircraft including prototypes - for prototypes envisaged as first batch.	ITS memo to JCF and HRS - Feb. 1/54.
Mar./54	Avro internal policy to proceed with P.S.13/Gyron studies.	DDM Mar. 23/54.
Apr./54	Manufacturing Policy and Procedure laid down for C105 aircraft, based on initial batch of four prototypes - effectively manufacturing program is U.S. Cook-Craigie Production Plan with reduced build-up.	HRS Memo Apr. 5/54.
May/54	Prototype to be designed for J.67 only. Need not accommodate P.S. 13.	DDM May 11/54.
May/54	RCAF wish maximum range built into aircraft.	DDM May 12/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
May/54	4th Dev. Co-Ord. Comm. decides:- As a general policy for the Company, the object should be to keep the weight down if at all possible. If some of the specification requirements appeared to be out of line with this policy the Company are to raise the points at the Co-ord. Comm. meetings for review.	Meeting Minutes May 12/54.
May/54	Avro ask AF to consider the requirement for Flight refuelling.	Meetings with PCAF Dev. & Co-ord. Comm. May 12/54.
May/54	Following visits to Convair on F-102 and completion of Project 2 and 3 studies by Design Research Group, C105 status completely examined during May 3-8/54 internal meetings. Single engine Project 2 and 3 studies shown to be optimistic with conclusion that twin engine configuration is optimum for equipment and armament required.	(10) C105 Meetings file JCF memo Apr. 26/54. (11) Projects 2 & 3 Studies, DRG. (111) C105/F102 comparison by DRG, July/54. (1v) C104/2 & F102 Comparison by AeroD. Apr.16/53.
May/54	Design development and initial wind tunnel tests at Cornell have resulted in certain changes to the C105 wind. t/c now 3.5% at root and 3.8% at tip from 3% throughout, fin t/c now 3.5% root and	SK 7-0100-0001 May 31/54.

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3.8% tip from 3% throughout. Wing has stabilized in the high position at 1225 sq.ft. and 50 ft. span. Fin area to 138 sq.ft. from 125.6 sq.ft. 2 crew, 2 x J.67 engines plus A/B, side intakes with ramp and boundary layer bleed. Armament is now 8 Falcon missiles Model E or 3 Sparrow II from 6 missiles plus 50 x 2" FFAR rockets. Proposed fire control MG3/E9 initially with MX 1179 retrofit. No longer an avionics crate and electronic gear serviced through hatches. Engines withdrawn from rear. Long range belly tank now fitted (500 Imp. Gal.). In all other respects it satisfies the requirements of AIR-7-4. Gross design weight now lb.

May/54

Directive issued by Chief Engineer setting forth design responsibilities, method of issuing information, prototype and test specimen manufacturing arrangements, flight testing responsibilities, etc.

Avro Internal Memo
May 31/54.

June/54

- 6th Dev. Co-ord. Comm. Meeting decides:
- (a) Avro to continue with the V type windscreen for the prototype C105 aircraft.
 - (b) Avro to continue investigations on other configurations to provide background in case the V type is unacceptable.
 - (c) ARK-6 radio compass to be engineered as a permanent installation with suppressed antenna.

Meeting Minutes
June 14/55.

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	(d) Avro to investigate and report on the problem of installing both the ARA 25 and ARD 10 homers.	
	(e) There is no requirement for chaff dispensers in the C105.	
	(f) The 1 minute scramble time requirement to govern and not the 10 second start.	
Aug./54	Investigations proceeding with enlarged nose to accommodate larger radar scanner.	
Sept./54	Sir Roy Dobson expresses opinion that 'by 1959 every high altitude interceptor fighter would be fitted with a rocket as well as the ordinary gas turbine motor.'	Power Plant file: R.H. Dobson letter, Sept. 17/54.
	Avro studies showed rocket motor entirely unsuitable for long range version.	(no reference)
Sept./54	Cook-Craigie Policy reflected in estimate given to RCAF and DDP, per AD 15 and 16.	
Oct./54	11th Dev. and Co-ord. Comm. decides: (a) AFHQ to advise the Company of the use of the UHF homer as a final approach aid. (b) Avro to be responsible for the special equipment to be used with the aircraft subject to the conditions detailed in AIR-7-4. (c) Optimum aircraft performance to be given top priority over other aspects.	Meeting Minutes Oct. 29/54.

<u>DATE</u>	<u>DETAIL</u>	<u>REFERENCE</u>
Nov./54	Re-assessment of C105 wing leading edge. A 5% deep leading edge notch 6 inches wide should be made at the mid-wing position. The outboard wing leading edge should be increased by 10% of the present local chord. Re-distribution of wing skin thickness is required to increase stiffness.	DDM Nov. 9/54.
Nov./54	Design status at this time. Fin area up to 158.75 sq.ft. from 138 sq.ft., fin t/c 4% throughout from 3.5% root and 3.8% tip. Wing incorporating 5% notch, 6 inches wide and outboard 10% leading edge extension. 8 Falcon missiles now GAR-1A from Model E. Gross design weight now 1b.	Ref. dng. 7-0100-6 Nov. 25/54.
Dec./54	Decided 300 milliseconds maximum time armament bay doors should remain open.	DDM Dec. 12/54.
Feb./55	It is planned to install P & W J.75 in place of J.67 on first and subsequent airplanes. Earlier availability than other engines. It is believed Granda P.S. 13 will eventually be installed in the 14th and subsequent A/C. Design work on J.57 will be discontinued.	DDM Feb. 1/55.
Mar./55	Following discussion with USAF the J.57 and J.67 ruled out as powerplants for C105. J.75 will be used as interim powerplant.	Dev. Co-ord. Comm. 17th Meeting Agenda Mar. 2/55.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Mar./55	Impending changes to C105 configuration presented in considerable detail: (a) Change from J.75 P-5 to either A.S. 13 or B-20 or 21 variants of J.75 tentatively scheduled for 16th aircraft onward. (b) Changes to fuselage to optimum configuration based on Area Rule which reduced supersonic wave drag from present 0.012 to 0.008. Both changes necessitate considerable re-design which is outlined in referenced memo.	C105 Des. & Dev. file RNL memo - Mar. 7/55.
Apr./55	Avro philosophy behind adoption of scaled-down Cook-Craigie plan outlined.	JCF note in 'C105 Programs' - Apr. 18/55
Apr./55	18th Dev. and Co-ord. Comm. Meeting decides: (a) Avro to proceed in accordance with their interim electronics system proposal pending receipt of the Hughes IEC proposal. (b) Avro accept the MIL-S-5700 series as the structural criteria for the design of the C105. (c) The requirement for the installation of Doppler in the C105 still stands. (d) Requirement for radar homing stands.	Meeting Minutes Apr. 20/55.

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- (e) Two point pressure refuelling to be installed in lieu of single point refuelling with an estimated saving in weight of 50 lb. plus saving in mission fuel.
- (f) Gravity refuelling provisions to be deleted, with an estimated saving in weight of 12½ lb. plus saving in mission fuel.

May/55

Avro request authority to proceed with metal mock-up. DDP file, J.A.

Morley letter,
ref. SO.4877/1358
- May 5/55.

May/55

C105 19th Development co-ord. com.

Notes on 19th

- (a) Hydraulic System generally satisfactory.
- (b) Fuel system requires in particular check on aircraft lateral stability with feed failure from wing tanks. (Subsequently found satisfactory.)

Meeting C105 Dev.
Co-ord. Comm.
- May 18/55.

- (c) Avro urge AF acceptance of MIL-5-700 landing weight definition in lieu of AIR-7-4.
- (d) Stressing criteria for crew seats to AP 970, IAM and MIL-S-5100. All other crash stressing cases to MIL-S-5100.

DND file, letter
RRL to W/c Brough
- Feb. 17/55.

- (e) Avro confirm C105 meets 1 minute scramble time from readiness hangar at 2500 ft. altitude on 100°F summer day.

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- (f) Avro confirm line equipment will be designed to worst ambient conditions, sea level to 5,000 ft.
- (g) Discuss installation of VHF in place of UHF. Avro seek early decision meanwhile working on UHF.
- (h) Financial authority granted RCAF purchase of 21 Falcon (GAR-1A) missiles for early test program. 1st in Sept./55, 10 by Dec. 31/55, 21 by June/56. One inert, remainder with motors, but no guidance.
- (i) CARM will proceed with arrangements for Inyokern sled trials.
- (j) Avro making provision for missile jettison.
- (k) RCAF require both sides of windshield cleared of rain, ice, etc. Wholly, or in part if this is impossible.
- (l) MAE arranging to check C105/J.75 and P.S.13 performance estimates.
- (m) Avro processing an application for a C100 loan for strain gauge instrumentation development.
- (n) An increase of 10 seconds per engine in starting time between standard sea level conditions and the worst case was accepted for scrambling from maintenance line equipment.

June/55

Effect of installing J.75 instead of J.67.

6. PERFORMANCE & STABILITY

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Nov./53	<p>NAE issue report LP-87 "Assessment of the Performance Characteristics of the proposed Avro C105/1200 all-weather Supersonic Fighter Aircraft."</p> <p>Study of Avro brochure P/C-105/1 May 1953.</p> <p>(a) Considerable differences between NAE and Avro drag estimate.</p> <p>(b) Aircraft fails to meet RCAF combat performance based on NAE drag.</p> <p>(c) Aircraft fails to meet RCAF minimum combat radius. Found to be only 142 n.mi. with 12,400 lb. fuel, RB-106 and NAE drag.</p>	<p>NAE Lab. Report</p> <p>LP-87 - Nov.25/53.</p>
Apr./54	<p>Design temperature limits proposed as 20 mins. @ 250°F at 1 hour intervals for 1000 cycles.</p> <p>Maximum limit 10 mins. at 380°F.</p>	DDM Apr. 2/54.
May/54	RCAF wish maximum range built into aircraft.	DDM May 12/54.
May/54	Avro ask AF to consider the requirement for flight refuelling.	<p>Meetings with RCAF</p> <p>Dev. & Co-ord. Comm.</p> <p>May 12/54.</p>
June/54	Avro receive RAAF "Operational Requirement for Fighter Aircraft". DEG carry out CF-105 performance comparison based on this OR.	June/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
July/54	Avro, following recent criticism of drag estimates, reviews C105 drag and compares FAE, MAE, Avro Manchester, Avro Canada figures reduced to same configuration. Reasonable agreement subsonic. MAE estimate subsonic drag (1.4 M.N.) 42% higher than Avro Canada and Avro Manchester 103% higher. Avro Canada does not believe 'Area Rule' will materially contribute to reduced drag on the C105.	Aero.D. Report 'Notes on Profile Drag of C105' July/54.
Aug./54	C105 presentation to USAF in Baltimore: Avro receive MIL-C-5011A 'Standard Aircraft Characteristics and Performance' DRGA carry out CF-105 performance study based on this Spec. Extract received of preliminary USAF 'Design Specification for Long Range Interceptor'. DRG evaluate CF-105 against this Spec., May 19/54.	
Aug./54	Design diving speed is affirmed by J.A. Chamberlin as 2.12 which corresponds to 248°F on an NACA Standard Day. This figure is basis of calculations.	DDM Aug. 18/54.
Aug./54	Decided to open all armament bay doors during missile extension, regardless of number of missiles to be released, in order to localize adverse pressure.	DDM Aug. 23/54.
Sept./54	AF concerned with Avro reticence to investigate 'Area Rule' thoroughly.	DND file: G/C Footitt letter Sept. 3/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Sept./54	Fin area increased 15% from 138 sq.ft. to 158.75 sq.ft. New larger diameter nose to accommodate increased antenna (38" dia.) size has considerably reduced directional stability with 138 sq.ft. fin.	DDM Sept. 20/54 10th Co-ord. Comm. Sept./54.
Sept./54	PCAF request (instruct!) Avro to 'carry out a proper and immediate investigation in the application of the Area Rule to the C105'.	DND file: letter W/C Brough to JCF ref. S1038-105-TSDs Sept. 21/54. Affirm Avro letter ref. 5653/20/J Sept. 25/54.
Oct./54	AF allocate aircraft 18107 on indefinite loan for C105 flying control system evaluation.	DND file. AF letter ref. S1038-105 TSDs/ Avro(ACE) Oct.20/54.
Nov./54	Re-assessment of C105 wing leading edge. A 5% deep leading edge notch 6 inches wide should be made at the mid-wing position. The outboard wing leading edge should be increased by 10% of the present local chord. Re-distribution of wing skin thickness is required to increase stiffness.	DDM Nov. 9/54.
Nov./54	PCAF/DRB/RAE/NACA meet at Langley Laboratories to discuss C105 design problems. Avro estimate of supersonic drag considered highly optimistic (i.e. likely to be 50% higher). Negative camber is	NACA file. Joint PCAF/DRB/RAE report. Nov. 19/54.

DATEDETAILSREFERENCES

suggested unusual. NACA prefer positive camber in order to reduce drag due to lift. C105 fineness ratio considered low (i.e. 9 to 11 preferable to 7 realized). Electronic stability control not favourable received. NACA suggest elevons more suitable than elevator/aileron to reduce trim drag and increase reversal speed. Suggest meeting with Avro (arranged, see Dec. 9-10/54 and Dec. 20-21/54.)

Dec./54	Avro/RCAF/NACA meet at Moffett Field, Cal. (Ames) Dec. 9-10/54 to discuss C105 design problems. Supersonic drag criticised by NACA who think $C_{D0} = 0.025 - 0.030$. Avro estimate 0.016. NACA suggest $C_{D0} = 0.02$ is optimum for airplane class.	NACA file - visit report by RCAF, Dec./55 Also J.A. Chamberlin report Dec./55.
Dec./54	Preliminary 'Area Rule' study of drag coefficient indicates that: (a) Bluntness of exterior shape of intake duct lip could be reduced. (b) Dorsal fin aft of canopy to exhaust port for air conditioning system should be dished about $4\frac{1}{2}$ inches. (c) Lower fuselage surface between stations 215 and 368 should be dished about 2 inches.	DDM Dec. 14/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Dec./54	Definitely decided to change fuselage lines for 'Area Rule' benefits (as indicated above). The design speed of the airplane will be lowered to	DDM Dec. 17/54.
Dec./54	Fuselage weight reduction due to 'Area Rule' plus 400 lb. fuel (revised J.67 estimate) 1953 lb.	Report 'Design Changes for Weight Reduction' - Dec.22/54
Dec./54	Avro/RCAF/NACA meetings held in Washington Dec.20-21/54 to discuss C105 design problems. NACA generally in agreement with Avro design philosophy though there was some disagreement with respect to drag. NACA regarded 'Area Rule' as useful and suggested its application to the C105 might reduce the supersonic drag to the present Avro figure (0.0184). NACA figure without 'Area Rule' based on proprietary information was C_{D_0} between 0.025 and 0.030. NACA claim 0.020 represents - very good design.	(1) NACA file, Meeting summary from NACA Dec. 22/54, also (ii) Rept. by JAC . Meetings file, JCF memo Dec.22/54
Jan/55	Noted that stability marginal at speeds above 250 kts. EAS with landing gear down.	DDM Jan. 4/55.
Jan./55	Report 7-0400-05 Weight Summary and C.G. Position Issue 10 forwarded for AFHQ (and subsequent issues at monthly intervals).	

<u>DATE</u>	<u>DETAILED</u>	<u>REFERENCES</u>
Feb./55	Forwarded for AFM brochures on:- C105 Dive Brake Performance, C105 - A Note on Stability, Preliminary Wind Tunnel Tests on the Effect of Icing.	Aero memo 8205/15A/3 Feb. 2/55.
Feb./55	'Area Rule' study completed necessitating design changes to fuselage to reduce supersonic wave drag. (a) Thinner intake lips. (b) Contoured aft fuselage. (c) Fairing aft of tail pipes.	Area Rule Progress Report - Feb./55.
Mar./55	Impending changes to C105 configuration presented in considerable detail: Changes to fuselage to optimum configuration based on Area Rule which reduced supersonic wave drag from present 0.012 to 0.008. Both changes necessitate considerable re-design which is outlined in referenced memo.	C105 Des. & Dev. file RNL memo - Mar. 7/55.
Apr./55	C105 runway strength requirements.	DND file, Apr. 15/55.
Apr./55	Planned that C105 will not operate from aerodromes above 2,500 ft. Possible emergency at 3,500 ft. and ground handling equipment required for starting at 3,500 ft.	

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
May/55	RAC arranging to check C105/J.75 and P.S. 13 performance estimates. (19th Dev. Co-ord. Comm. Meeting, May 18/55)	DDO file, letter RNL to W/C Prough - Feb. 17/55.
June/55	Modifications to wing leading edge as outlined below improve: (a) Buffet - primarily droop. (b) Drag - subsonic - primarily droop. (c) Longitudinal stability - primarily notch and L.E. extension. (d) Directional stability - primarily droop.	C105 Des. & Dev. file JAC memo ref.2237/31/5 June 2/55.
June/55	Wind tunnel tests originally showed unacceptable buffet at values of α above 6° . Recent tests (May/55) with modified configuration have increased the critical value of α to an acceptable figure. The necessary changes are:- (a) The wing leading edge inboard of the main gear is drooped nose down. (b) The notch just forward of the main gear is reduced from 8% to 5%. (c) The wing leading edge outboard of the main gear has an increased chord and is also drooped down.	C100 Des. & Dev. file RNL letter June 3/55.

7. AERODYNAMIC TESTING

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
Mar./53	Avro request use of CARDS facilities for aerodynamic Testing. (Considered premature by AF since no specification issued for C105; letter in Armament file, Mar. 25/53.)	Armament file, JCF letter, ref. 3171/03/J Mar. 5/53.
July/53	Preliminary outline of proposal to fire rocket-propelled models of the C105 in co-operation with CARDS.	Armament file, JAC letter ref. 5646/03/J
Sep./54	10th Dev. and Co-ord. Comm. decides: Avro to proceed with wind tunnel tests with the object of obtaining data on stability characteristics of C105 when ice build up configurations are simulated on the wings.	Meeting Minutes Sept. 22/54.
Oct./54	NACA offer Avro use of 10 ft. supersonic wind tunnel for testing engine air intake model. Available about Oct./55 at \$3000/hour.	DDM Oct. 8/54.
Nov./54	Arrangement has been made with Gas Turbine Div. to test 1/6 scale model of engine air intake using Oranda engine.	DDM Nov. 16/54.
Nov./54	RAF tests indicate that wing de-icing is not req'd.	DDM Nov. 23/54.
Dec./54	Oranda/Avro meeting to discuss scale model intake duct tests and nacelle configuration for P.S. 13.	Minutes of Oranda Meeting - June 25/55.

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Mar./55 AFIR/Avro visit NACA Lewis Labs, Cleveland, to discuss and arrange supersonic wind tunnel tests of intakes and ducts.

8. ARMAMENT AND ELECTRONICS

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
July/53	2 crew proposal due to uncertainties in development of fire control system suitable for single crew operation.	P/C105/4 July 13/53.
July/53	Avro meeting with RCAF. Agree company proceed with 2 crew airplane with E9 electronic fire control system capable of being retrofitted with MX 1179 and changed to a single crew version.	Minutes of Meetings with RCAF - JCF July 24/53 also Costs file, letter FTS July 22/53.
Nov./53	Note of Falcon kill probability. Micro-wave salvo achieves 90% probability under most circumstances.	Armament file: JAC memo ref. 8006/03/J - Nov. 23/53.
Mar./54	Missile launching not provided for in hydraulic system though power available, if necessary. Feed into main power control hydraulic system with reduced response during missile firing.	C105 Meetings file JCF memo - Mar. 4/54.
May/54	Statement on armament requirements by RCAF primary armament in order of priority (1) Red Dean (2) Sparrow II (3) Falcon (details of numbers in reference). The missiles were selected in order of overall kill probability but availability was converse, No. 3 and No. 2 in 1956, and No. 1 in 1957.	Meetings with RCAF Dev. & Co-ord. Comm. May 12/54.

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Secondary armament now to be AA rockets with high performance guns with, if possible, Red Dean. Fire control was undefined but the AF were presently interested. in 42" dia. radar antenna instead of 28" dia. antenna proposed.

May/54 At meetings in Ottawa with RCAF on May 26 and 27/54 BDM May 28/54.
the armament and fire control were discussed.
Two alternative primary armaments were tentatively specified

- (1) Eight Falcon missiles, either micro-wave or I.R.
- (2) Three Sparrow II micro-wave or Sparrow II I.R. missiles.

Dept. of National
Defence letter
- A/V/M Plant
- July 6/54.

Engineering for both schemes to progress in parallel. Agreed to delete from AIR-7-4, requirements for two large missiles, T-171 guns and a visual sight.

Hughes fire control system similar to HG3/E9 type shall be used. Larger antenna than 28" dia. presently proposed will be required to improve acquisition range.

May/54 Investigation of 32" dia. radar antenna. Found to be unsuitable within present space provision and investigation proceeding with 30" dia. antenna. BDM May 31/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE/ISS</u>
June/54	Avro issue 'Proposed E9/MG3 type fire control system configuration for CF-105 (Falcon missile version).	Armament file, rept. C105-R-0001 - June 15/54.
July/54	Confirmatory letter from A/V/M Plant following armament and fire control meetings May 26-27/54. Avro authorized to make engineering study of problems of fitting Sparrow and Falcon to C105. Authorization to proceed with interim fire control system (MG3/E9) with MX 1179 retrofit. Every effort to be made to increase radar acquisition from 25 miles 80% of the time.	DND letter A/V/M Plant - July 6/54.
July/54	Design in progress of new nose to accommodate 30 inch dia. antenna.	DD: July 12/54.
July/54	The C105 armament bay will be designed to accommodate quickly interchangeable crates containing either three Sparrow II or 8 Falcon QAR-1A or IR equivalent.	Armament file: I.R. Craig memo ref. 3818/03/J July 25/54.
July/54	Proposal for 'Armament Firing Sequencing' issued.	Armament file: JAC memo - 3987'03/J - July 23/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
Aug./54	Decided to open all armament bay doors during missile extension, regardless of number of missiles to be released, in order to localize adverse pressure.	DDM Aug. 23/54.
Aug./54	Investigation proceeding with enlarged nose to accommodate larger radar scanner.	
Sept./54	Avro decision to proceed with Sparrow engineering and mock-up installation.	DDM Sept. 1/54.
Sept./54	Hughes estimate that MX 1179 delayed 2 yrs. Scheduled to fly in prototype form in the prototype P-102 in 1957. Production MX 1179 systems in 1958. Hughes intends to develop a 40" dia. antenna for use with MX 1179. This is the main delay in system. Hughes proposed radar fire control (MG3/E9) for the early C105's will accommodate only the GAR 1 Falcon missile and will utilize a 23 1/2" dia. antenna.	DDM Sept. 14/54.
Sept /54	Draft of Proposal for the installation of 8 Falcon missiles in the C105.	Armament file Sept. 15/54.
Sept./54	Unlikely radar equipment suitable for operation above 50,000 ft. Similarly RCAF supplied equipment unlikely to perform satisfactorily above 50,000 ft.	DDM Sept. 27/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Oct./54	Avro submit armament proposal in reply to letter from A/V/H Plant, July 6/54, authorizing engineering study of installation for 8 Falcon missiles or 3 Sparrow II missiles. Covering letter (JCF) notes restrictions due to structural weakness with side load of GAR-1B Falcon. This missile is compatible with MG3/E9 fire control system. Notes also C105 nose redesigned to accommodate 38" dia. antenna. Ultimately Hughes may propose 40" dia. antenna, with MX 1179 system, however presently 23½" is required for MG3/E9 system. (AF comments ref. 111)	(1) Letter JCF to W/C Brough Oct. 20/54. (ii) Armament Brochure for Falcon/Sparrow Installations. (iii) G/C Hale letter S1038 CF-105-1B3 TD 3014 - Jan. 2/55
Oct./54	AF ask for study with 4 Sparrow II missiles carried externally under the wings. Assumed max. allowable missile temp. 130°F.	DND file, AF letter ref. S1038 CF-105-1B3 (DAME) Oct. 29/54.
Nov./54	Information requested on performance penalty involved in external underwing installations of Sparrow II. (Taken to AFHQ by G.R. Oscar, Nov. 12/54) (Ref. Avro 6623/03/J, Nov. 30/54.)	S1038-105-7 TSDs/Avro (Arntz) Nov. 4/54.
Nov./54	Hughes present integrated fire control system proposals at AFHQ (with Avro representation).	Nov. 4 & 5/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Nov./54	Avro discuss fire control system and arrangement with RCAF on Nov. 4 and 5/54. Up to this point A/V/M Plant's letter dated July 6/64 prevailed.	(i) letter from RNL to W/C Brough ref. 6117/03/J.
	Specified fire control system was MG3/E9. Study installation of both Falcon GAR-1A and Sparrow II. Resulting from Nov. 4 and 5/54 meeting Avro understand A/V/M Plant's modified as follows (confirm ii).	(ii) Letter from DND ref.S1038 CF-105-183 TD 316B, Nov. 26/54.
	(1) Proceed with installation in Hughes brochure No. 0525 (MX 1179) instead of MG3/E9 system.	(iii) RCAF letter of confirmation, ref.S1038-105-10
	(2) Proceed with installation of Falcon and Sparrow on equal priority.	TSDs/Avro - Nov. 19/54.
	(3) Flight Control System, forming part of the integrated fire control system, but <u>excluding</u> damping functions, is agreed between Avro and RCAF to be a Hughes responsibility, in line with Hughes proposal. Avro propose placing contract with HAC for design study of system.	
Nov./54	It is intended that MX 1179 system shall fit in the same space at MG3/E9.	DDM Nov. 12/54.
Nov./54	RCAF have settled on MX 1179 system (modified). Certain long range intercepto characteristics will be introduced into this system. It is understood that MX 1179 will be available as soon as MG3 with installation data ready in summer 1955. Anticipated	DDM Nov. 12/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
	that Hughes will be given the autopilot contract with either Hughes or Minneapolis supplying the damping system.	
Nov./54	RCAF accept in principal Falcon and Sparrow installations submitted Oct. 20/54. Deletion of I.F. Falcon under consideration. There is a requirement for missile jettisoning.	DDM Nov. 16/54 also Armament file, I.R. Craig memo ref. 6272/03/J - Nov.16/54.
Nov./54	Avro issue 'Preliminary requirements for C105 Automatic Flight Control System.'	Armament file, G.R. Oscar letter Nov. 24/54.
Nov./54	Avro require CF-100 Mk. 4 with operating yaw damper system by Jan. 28/55 for trial installation of Falcon missile and equipment with air launching later.	Armament file, R.Adey memo ref. 6451/03/J Nov. 24/54.
Nov./54	Avro/RCAF Armament sub-committee meeting. Falcon and Sparrow missiles and installation reviewed. CArm CF-105 study of optimum aircraft-weapon-fire control system in progress. Preparation time for Falcon is 15 seconds, then lowered and fired in 0.5 seconds. Missile jettisoning is requirement for C105. Avro do not plan to design for this (ref. 2). (Later agree to include missile jettisoning.)	(1) Armament sub-committee meeting minutes (3rd meeting Nov.29/54) (2) DDM Dec. 28/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
Nov./54	AF comment on Armament - 4 allied systems. Avro to proceed with Falcon and Sparrow installations on equal priority. AF accept HAC fire control brochure No. 0525 in principle but with many modifications.	DND file. A/C Easton letter Nov. 26/54.
Dec./54	Arrangements for direct Avro-Douglas/Hughes-Douglas communication on Sparrow II. Avro to request Hughes to obtain USAF permission to work directly with Douglas (other action being taken RCAF - USN). (Hughes advised accordingly: ref. 6781/03/J, Dec.8/54) and 6928/03/J, Dec.15/54)	S1038-105-7-6 TSDs/ Avro (ArmtE) Dec.2/54
Dec./54	RCAF advise requirement for optical gunsight in prototype deleted AIR-7-4 Iss. 2. Emergency sighting device might be necessary with ECM and was responsibility of whoever developed weapons system.	RCAF letter ref. S1038-105-7 (ArmtE) Dec. 8/54.
Dec./54	Decided only 6, not 8, Falcon missiles will be installed.	DDM Dec. 10/54.
Dec./54	Decided to revert to 8 Falcon missiles (4 I.R. plus 4 micro-wave) Sparrow missiles may increase from 3 to 4.	DDM Dec. 14/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Dec./54	Decided 300 milliseconds maximum time armament bay doors should remain open.	DDM Dec. 14/54.
Dec./54	Provision for 8 missile attack will not be made. Provision for 4 I.R. missiles will be made only in one row.	RCAF letter ref. S1038-105(ACE-1) Dec. 15/54. DDM Dec. 17/54.
Dec /54	Avro comments on Hughes proposal for I.E.S. dated Dec. 23/54.	Armament file Jan./54.
Dec./54	Avro seek RCAF approval of 'Interim Electronic Equipment Installation' necessary for first 5 pre-production aircraft before complete MX 1179 equipment is available. This will enable preliminary flight test work to go ahead.	Letter from I.M.Liss to W/C Brough. (1) ref.8105/03A/J Dec. 30/54. (2) ref. Avro Report C105/R/0005, Dec. 22/54.
Jan./55	Requirement is for installation of 3 Sparrows only. Will provide for 4 only if necessary.	DDM Jan. 4/55.
Jan./55	Hughes proposal Dec. 23/54 for IES, including flight testing and the assurance of a satisfactory system for the RCAF costs \$15,322,279 covering a period through Dec./58.	Armament file, G.R. Oscar letter ref. 8237/03A/J, Jan. 6/55.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Jan./55	<p>Armament meeting with RCAF, conclusions:</p> <ul style="list-style-type: none"> (a) Probability of C105 making 2 passes very slight. (b) Probability of kill for Sparrow likely to be higher than for Falcon. 'Look angle' still to be investigated. (c) Probability of kill for proposed 3 Sparrow and 6 Falcon missiles not satisfactory. (d) DOR require provision for 8 I.R. or Micro-wave missiles capable of firing in one pass. (e) RCAF feel aircraft weight reductions at expense of operational versatility. (f) RCAF agree to obtain Falcon for test purposes and endeavour to obtain the use of C100 aircraft. 	DDM Jan. 14/55.
Jan/55	<p>RCAF/Avro armament systems sub-committee meeting. Memorandum from DOP, ref. 1038 CF-105-180(DOR) Dec. 15/54 was tabled by RCAF giving armament details.</p> <ul style="list-style-type: none"> (a) No requirement exists for firing 2 I.R. Falcons from rear row and 2 radar Falcons from front row simultaneously. (b) A requirement exists for C105 to be capable of carrying: <ul style="list-style-type: none"> (1) a load consisting of 8 I.R. Falcons, or (2) a load consisting of 8 radar Falcons, 	<p>Minutes 4th Meeting, C105 Armament Systems Sub-Comm. Jan.28/55.</p>

DATEDETAILSREFERENCES

or (3) a load consisting of 4 I.P. plus 4 radar Falcons.

(4) the C105 must be capable of releasing all eight Falcon missiles on one pass.

Provision must be made to jettison all missiles.

Suggested that CARM does not agree with philosophy of separate damping system. Should be included in integrated system.

Jan./55	Philosophy on Avro/Hughes dealings on MX 1179 Fire Control System. Form of development contract. What Avro expects of HAC with respect to: (a) Integrated Electronics System. (b) Falcon missile installation. (c) Sparrow missile installation. (d) Damping System.	Armament file, G.R. Oscar letter Jan. 29/55, also RNL letter Jan. 26/55
Jan./55	Armament group issue 'Proposal for Internal Installation of 4 Sparrow II Missiles.'	9 Armament Group Brochure - Feb./55.
Feb./55	RCAF would like the integrated electronics system installed in all delivered airplanes. They insist upon the installation in the 14th and subsequent airplanes and hope for its inclusion in the 12th and 13th airplanes.	DDM Feb. 1/55

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Feb./55	RCAP specification for electronic system calls for addition of equipment above the anticipated. Particularly alternating current power supply after both alternators have ceased functioning.	DND Feb. 1/55.
Feb./55	Avro make proposal to work direct with Douglas on Sparrow and modify MG-2 system. Complication between Hughes and Douglas would then be avoided.	DND file, letter PTS to A/V/M Plant, Feb. 7/55.
Feb./55	Proposal for internal installation of 4 Sparrow II missiles in C105 submitted to RCAP.	Submitted to AF Feb./55.
Feb./55	Draft Spec. AIR-7-5 for development of integrated electronic system brought for Avro consideration prior to discussions with USAF and Hughes.	
Mar./55	RCAP seeks confirmation on electronic equipment environment.	RCAP letter ref. S1038-105-18 (ACE-2)
Mar./55	RCAP inform Avro, Spec. AIR-7-5 (basis of integrated electronic and control systems) is issued. Extensive discussion between RCAP and Hughes pertaining to RCAP Spec. and MX 1179 system.	Int. Elec. & Con. System Meeting Mins. Mar. 31/55.
Apr./55	Spec. AIR-7-5 Iss. 1 for Integrated Elec. System signed Apr. 7/55.	DND file, letter AF to Avro - May 16/55.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
Apr./55	C105 Program re-scheduled Apr. 15/55 retarding 1st flight 6 months to bring airframe into phase with engines and integrated electronic system. Schemes A & B considered. Scheme B adopted as follows: (See Schedules Apr./55 for details)	C105 Program file, Schedule for Schemes A & B.
Apr./55	18th Dev. and Co-ord. Com. Meeting decides: Avro to proceed in accordance with their interim electronics system proposal pending receipt of the Hughes IEC proposal.	Meeting Minutes Apr. 20/55.
Apr./55	RCAF reply to letter from R.N. Lindley to W/C Brough Nov. 9/54, ref. 6117/03/J seeking confirmation certain armament/fire control points. RCAF do not agree MH and HAC asked to tender for damping system, Hughes only.	RCAF letter ref. S1038-105-7(ACE) Apr. 21/55.
Apr./55	Review of situation on integrated electronics system not favourable based on present USAF reluctance to permit RCAF via DDP to place letter of intent with HAC. At least six months slippage forecast.	Armament file, RNL memo, Apr. 22, 1955, also Mar. 29.
May/55	RCAF comments on missile installation issued by Avro - Feb./55. Agreed development of described installation as rapidly as quality of engineering data permits.	RCAF letters S1038CF-105-183 TD5119 (Carm) May 5/55 and S1038-105-7-6 (ArmIE) May 12/55

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
May/55	ANM authorized Avro design and develop (previously investigate) C105 missile installations for both Falcon and Sparrow II. (a) 8 Falcon GAR-1A missiles or equivalent I.R. missiles. (b) at least 3 Sparrow II missiles suitably modified for supersonic launch and operation at 60,000 ft. or equivalent I.R. missiles.	PCAF letter ref S1038-105-9 (Arate) May 14/55.
May/55	A/W/H Plant confirms second source C105 damping system is advisable and recommends Minneapolis-Honeywell.	PCAF letter ref. S1038 CF-105-180(AHTS) May 2/55.
May/55	AF outline CF-105 Armament installation test program incl. Tunnel tests, C100 trial installation and tests, rocket sled tests.	Armament file, ref. S1038 CF-105-183 TD582 (Carm) - May10, 1955.
May/55	C105 19th Dev. Co-ord. Comm. decides: (a) Financial authority granted PCAF purchase of 21 Falcon (GAR-1A) missiles for early test program. 1st in Sept. 1/55, 10 by Dec. 31/55, 21 by June/56. One inert, remainder with motors, but no guidance. (b) Avro making provision for missile jettison.	Notes on 19th Meeting C105 Dev. Co-ord.Comm. May 18/55. DND file, letter G.R. Oscar, June 20/55

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
May/55	AMHQ C105 Armament Development Program forwarded: relevant activities at Avro to be conducted accordingly. (Details Falcon and Sparrow mock-up and tests requirements and schedule.)	OC/TOPS C105ECF-105K-7 (AMHQ) - May 19/55.
June/55	'The effect of RCAF policies and indecisions on the design of a fire control and electronics system installation in the C105'.	Armament file - June 13/55.
	<p>Jan. - May/54 - two man E9/MG3 pending AF decision.</p> <p>May 27/54 - AF decision E9/MG3, two man.</p> <p>July/54 - HAC suggest auxiliary missile units to be out of armament bay.</p> <p>Sept./54 - Rumours that AF may install MX 1179. AF requirement for larger radar antenna.</p> <p>Nov./54 - AF decide to install MX 1179. Replanning equipment layout, installation design and cable runs commenced.</p> <p>Nov./54 to Present - No agreement AF/HAC on integrated system. Data scant and unconfirmed.</p> <p>May/55 - AF require AN/ARN-21 equipment readily accessible. Re-hash electronics bay layout.</p> <p>May/55 - AF notify two more boxes for AN/APX-25. Electronics bay re-design necessary.</p>	
June/55	Details of finalized Sparrow configuration and armament proposal evaluation.	DND file, G.R. Oscar letter ref. 2518/03/J June 15/55.
June/55	20th Dev. Co-ord. Comm. decides: A requirement exists to fully retract the missiles after independent loading without necessitating engine starting.	Meeting Minutes - June 22/55.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
June/55	Avro receive note from RCAP outlining procedure for armament installation modifications in absence of rigid specification. All mods. to be approved by RCAP.	RCAP letter ref. E1038-105-7(ARmte) June 29/55.
July/55	21st Dev. and Co-ord. Comm. Decides: It is noted that the sub-comm. recommendation that some method of de-energizing the missile launch hydraulic accumulator has been withdrawn on the basis that a manual stop valve to be incorporated in the hydraulic circuit.	Meeting Minutes July 30/55.
July/55	'Programming' development to continue for Falcon. Clutch/variable orifice scheme to be developed for Sparrow.	OC/TSDs S1038-105-7-6 (ARmte) - July 22/55.
Aug./55	Auxiliary air driven alternator may be used in Sparrow package during initial development. Power must be supplied from main aircraft system when installation finally approved.	OC/TSDs S1038-105-7-6 (ARmte) - Aug. 19/55.
Aug./55	Security delays progress of C105 Sparrow installation. No channel for information interchange between Avro/Douglas and Hughes/Douglas or vice versa.	DND file, RML letter ref. 3708/03/J - Aug. 29/55.

Aug./55 Delays on Hughes MX 1179 system and damping system Arrangement file - 144L
becoming critical. USAF restricting Hughes work memo - Aug. 29/55.
on any but AF projects. C105 will certainly be
restricted, if damping system unavailable on time.
Consideration again given to providing preliminary
fire control system i.e. F9/MK-3.

9. ARMAMENT & ELECTRONICS TESTING

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Sept./54	Proposal issued for C105 Falcon armament installation test program.	Armament file, L.R. Craig memo ref. 4 20/03/J Sept. 23/54.
Feb./55	RCAF express interest in missile installation development using supersonic track sled at Inyokern or Edwards AFB. Ask Avro to prepare detailed program.	RCAF letter ref. S1038-105-7 (ArmtE) Feb. 9/55.
Apr./55	Avro request to RCAF for C100 aircraft on loan for missile development not approved.	RCAF letter ref. S1038-105(ACE)-Apr.13
May/55	RCAF agree to loan C100 Mk. 4 (Orenda 9) including autopilot for an indefinite period for C105 development of missile installations.	RCAF letter ref. S1038CE-105-7(ArmtE) May 19/55.
May/55	C105 19th Dev. Co-ord. Comm. decides: CARM will proceed with arrangements for Inyokern sled trials.	Notes on 19th Meeting C105 Dev. Co-ord. Comm May 18/55.
June/55	Preliminary note on rocket sled testing of Falcon and Sparrow at Inyokern.	DND file, G.R. Oscar letter ref.2580/03/J June 17/55.

10. ENGINES

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Dec./52	<p>Critical review of engine situation for C104.</p> <p>The basic requirement is for an engine giving at least 21,000 lb. with afterburner at sea level. Even then the 'g' performance will not be entirely satisfactory. The most suitable engines are as follows:</p> <ul style="list-style-type: none"> (a) Bristol Olympus OL-3 (b) Wright J.67 (c) Rolls Royce R.A. 17 (d) Pratt & Whitney J.57.75 <p>Concluded that the Olympus 3 is the most suitable engine with respect to thrust, timing and availability.</p>	<p>Engines for C104</p> <p>Dec. 1/52.</p>
Jan.-Mar, 1953.	C104/2 - Development of Project. Introduction of Wright J.67 engine.	SK 20669 - Mar.23/53.
Aug./53	RE.106 selected for installation in C105. C105 design in progress on 1225 sq.ft. version. 2 crew.	SK 20785 - Aug.29/53
Sept./53	Orenda Engine meeting to discuss P.S.13 installation in C105.	Minutes of Orenda Meeting June 24/53 ⁵ .
Jan./54	Orenda draft P.S.13 preliminary model spec. issued.	Minutes of Orenda Meeting June 25/55

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
Mar./54	U.R. engine situation reviewed by G. Hake & RCAF.	
Mar./54	Oronda/Avro meeting to discuss P.S.13 intake and final nozzle.	Minutes of Oronda Meeting - June 25/55.
Mar./54	About this time RCAF studied all prospective engines for C105 and concluded RR RA.19R most suitable for prototypes with RB 106 for production version. RCAF omitted P.S.13 in study.	Power Plant file RCAF - AMTS/DDA Report Approx. Mar/54.
Mar./54	2nd Dev. & Co-ord. Comm. decides: (a) The design of the C105 should continue to be based on the RB.106 - J.67 class of engine keeping in mind that the P.S.13 may come along. (b) The higher mass flow J.57 may power the prototype aircraft and perhaps some production aircraft. (c) Data on the higher mass flow J.57 engine to be sent to Avro.	Meeting Minutes Mar. 10/54.
Mar./54	Avro internal policy to proceed with P.S.13/Oxyron studies.	DDM Mar. 23/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Mar./54	<p>Two review engine situations -</p> <p>(a) RB 106 - not ready for prototype.</p> <p>(b) B.O.L.4 - Bristol do not promise full after-burning.</p> <p>(c) J.67 - should be ready for prototype and production versions.</p> <p>(d) P.S.13 - good on paper - could not be ready before 4th aircraft.</p> <p>(e) Gyron - too big, duct/nozzle problems, subsonic performance only, without after-burner.</p> <p>(f) J.57 - suitable for prototype - performance well below spec. with J.57, however, conversion to RB 106 not too difficult if increased, revised, mass flows of J.57 are achieved.</p>	<p>Power Plant file</p> <p>JCFletter, Mar.17/54.</p>
Mar./54	<p>RB 106 weights increasing (1600 lb. - 2 engines).</p> <p>C105 gross design weight now up to 56,000 lb.</p>	DDM Mar. 29/54.
May/54	<p>Engine intake throat area fixed at 5.3 sq.ft. for J.67 engine.</p>	DDM May 11/54.
May/54	<p>Prototype to be designed for J.67 only. Need not accommodate P.S.13.</p>	DDM May 11/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
May/54	4th Dev. Co-ord. Comm. decides: From an inspection of the J.67 engine installation drawings the scheme was satisfactory.	Meeting Minutes May 12/54.
Apr/54	A/C F.R. Banks suggests RB 106 will not be ready in time for C105. Advises Olympus or Gyron as best substitutes. Bristol not prepared to provide full re-heat, therefore, Gyron remains. Mass flow similar to P.S. 13 and conversion to production P.S. 13 versions of C105 should consequently be simplified.	Power Plant file V. Cronstedt letter Apr. 7/54.
Apr/54	Engines for prototype will be Wright J.67 due to earlier development than other engines and under pressure for F-102. Available May/55. Gyron mass flow requires major duct re-design, no afterburner. J.75 is heavy (6100 lb.) and has fixed nozzle. Not ready in time for C105. A re-evaluation of C105 with J.67 engines was asked for by CAS before engine orders placed. Required Mar./56.	Minutes of Meeting with RCAF - Apr.13/54
Apr/54	J.67 engines will not be ordered for prototype aircraft until after further meeting with RCAF on May 10. Metal mock-up ordered immediately.	C105 meetings file JCF note - Apr.15/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
Apr./54	Avro write specification for Wright J.67-W1 engine mock-up.	Power Plant file Apr./54.
May/54	Stated by J.C. Floyd: Orenda product would receive serious consideration if requirement met.	Meeting with RCAF File Note May 10/54.
May/54	Avro outline engine requirements to Wright Aeronautical. 1 engine for rig test by Sept./55 2 further engines for prototype installation by Apr./56 for flight date July/56. Acceptable Wright. Further J.67 data on engine mock-up, specification, fuel system starting, engine mounting, etc.	Power Plant file Meeting Minutes with WAD May 15-19/54.
May/54	A/V/M Smith confirms RCAF prepared to order 6 J.67 engines.	Power Plant file F.T. Smye memo May 17/54.
May/54	AF advise Avro approval DDP to order prototype C105, J.67 engine.	DND file: AF letter ref. S1038-105-TSDs May 31/54.
July/54	Avro concerned that P.S.13 reheat less than J.67 and therefore not likely to provide sufficient reheat boost. Due to tight C105 schedule Orenda not certain P.S.13 can be brought into line in time, but will try.	Power Plant file: Avro/Orenda Meeting Minutes - July 27/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Oct./54	P & W J.57 running with low A/B thrust. Quality prototypes available 1957.	DDM Oct. 4/54.
Oct./54	Gyron and J.75 installation study reveals that fuselage would need 4 to 6 inches more depth and increased length over A/B with Gyron ground angle reduced to 13 degrees.	DDM Oct. 7/54.
Oct./54	Wright J.67 achieved 19,500 lb. with restricted final nozzle.	DDM Oct. 13/54.
Oct./54	Oranda advise 1st P.S.13 scheduled for delivery Jan./57. Hope for installation in 4th CF-105 development aircraft. Production engines for May/58.	
Oct./54	C105 Engine situation critically reviewed with RCAF. Avro requires 21 J.67 engines by end of 1956, 39 by end 1957. <u>USAF indicated J.67 not available to Canada before Jan./58.</u> <u>Alternative engine proposals for Gyron, J.75, J.57, BO 16 and P.S.13.</u> Summarized in reference. Meeting agreed to design for J.67, using the J.57 for early experimental airplanes if necessary and ultimately use the P.S.13.	'Meetings with RCAF' Minutes of meeting Oct. 18/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
	Small number of J.67 engines might be available for prototype aircraft which, it was agreed, should be ordered now also investigate the value of preliminary aircraft evaluation if fitted with J.57 engines as an interim measure.	
Oct./54	Decided to install P & W J.57 in first 8 aircraft with speed (thrust) limitation. Install Wright J.67 as soon as available.	DDM Oct. 22/54.
Nov./54	A note on engine situation suggests that J.75 more reliable than J.67. Afterburner on J.75 has two positions and has run successfully at design thrust (1700K ⁰). J.57 afterburner has run for 33 minutes.	DDM Nov. 9/54.
Dec./54	Reported that Wright J.67 has achieved 21,500 lb. thrust for short duration. Specific consumption high.	DDM Dec. 10/54.
Dec./54	Orenda/Avro meeting to discuss scale model intake duct tests and nacelle configuration for P.S.13.	Minutes of Orenda Meeting - June 25/55.
Jan./55	Decided to adopt J.75 engine for early proto- types due to delays with J.67.	C105 Engr. Progress Report Jan. - Feb. ³ /55

DATE

DETAILS

REFERENCES

Feb./55

It is planned to install P & W J.75 in place of J.67 on first and subsequent airplanes. Earlier availability than other engines. It is believed Orinda P.S. 13 will eventually be installed in the 14th and subsequent aircraft. Design work on J.57 will be discontinued.

WW Feb. 1/55

Feb./55

J.75 engine dry weight is 6,100 lb.
P.S.13 engine dry weight approx. 4,500 lb.

DDM Feb. 4/55.

PowerPlant file,

Oct. 29/54.

Feb./55

P & W report 5 J.75's built to date. They have grossed 700 hours running time including 70 hours in altitude chamber when 70,000 ft. simulated altitude achieved. Four separate 50 hour tests at 23,500 lb. thrust. Engine bare weight 6,100 lb. First flight in F-45 scheduled for March/55. Supersonic flight will be in F-105. Reported also: engine build program, mock-up availability, performance data, fuel inlet temp., stressing data.

Power Plant file,

S. Whitely memo

Feb. 7/55.

Feb./55

Avro asked to confirm that the C105 development program now approved for \$19,750,400 includes development costs associated with armament, ground handling and readiness equipment. Avro indicate J.75 data sufficiently complete to commence design development.

C105 Steering Comm.

14th Meeting Mins.

Feb. 9/55.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Mar./55	Following discussion with USAF the J.57 and J.67 ruled out as powerplants for C105. J.75 will be used as interim powerplant.	Dev. Co-ord. Com. 17th Meeting Agenda Mar. 2/55.
Mar./55	Impending changes to C105 configuration presented in considerable detail: Change from J.75 P-5 to either P.S.13 or B-20 or 21 variants of J.75 tentatively scheduled for 16th aircraft onward.	C105 Des. & Dev. file BNL memo - Mar. 7/55.
Apr./55	C105 program re-scheduled Apr. 15/55 retarding 1st flight 6 months to bring airframe into phase with engines and integrated electronic system. Schemes A & B considered. Scheme B adopted as follows: (See Schedules, Apr./55 for details).	C105 Program file, Schedule for Schemes A & B.
Apr./55	General review of J.75 and P.S. 13 status with respect to C105 design and development.	Letter from RNL to JCF, Apr. 20/55.
Apr./55	DDP advise that J.75 will only be ordered to back 5 development C105s. This is 19 engines. DDP will not implement RCAF contract demand for 39 engines as previously agreed. Decision based on assumed 6th and 7th with P.S. 13 and general P.S. 13 schedule which puts P.S. 13 in line for earlier installation than previously anticipated.	Power Plant file, J.A. Morley memo, Apr. 19/55.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Apr./55	J.75 will be installed in 12 of first 14 C105 aircraft. 2 will incorporate P.S.13 engines. (6th and 7th, RNL to JOP, Apr. 20/55.) Approval given to order 33 J.75 engines.	Co-ord. Comm. 18th Meeting Agenda Apr. 20/55.
Apr./55	DDP inform Avro 19 J.75 will be ordered to be delivered between Dec./56 and Sept./57 to cover first 5 aircraft. A further 12 J.75s will be ordered in May/55 to cover Scheme 'B' engine requirements to Jan./58. These 31 engines will come from P & W preproduction run.	Power Plant file, G. Hake memo, Apr.22/55
June/55	Effect of installing J.75 in lieu of J.67 engines reviewed with breakdown of all design changes.	Power Plant file, RNL memo June 15/55.
July/55	Avro/Orenda meeting to discuss installation of P.S. 13 in C105 aircraft.	Avro/Orenda liaison file, Minutes July 22, 1955.

11. STRUCTURES

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
Aug./53	J.A. Chamberlin quells internal criticism of basic wing structure. Agreed that layout of wing structure was basically right, that no advantage gained by changing over U/C attachment position or retracting space, or by reverting to low wing to ease U/C elastic problems.	C105 Meetings file G. Lake memo, Aug. 31/53.
Feb./54	Commencement of minor structural and functional testing, e.g. wear check on piano hinge, honeycomb panel tests, bearing selection tests.	
Apr./54	Design temperature limits proposed as 20 mins. @ 250°F at 1 hour intervals for 1000 cycles. Maximum limit 10 minutes at 380°F.	DDM Apr. 8/54.
Sept./54	Decided to increase fin t/c to 4% throughout from 3.5% root and 3.8% tip. Due to structural and aeroelastic problems in the 15% larger fin area.	DDM Sept. 30/54.
Nov./54	RCAF confirm Avro proposal to base stress analysis on 'limit load configuration' acceptable to AFHQ.	DND RCAF letter Nov. 18/54.
Nov./54	PCAF towing requirement for C105 received.	RCAF letter ref. S1038-105-9 TSDs/Avro Nov. 22/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Nov./54	Drop tank designed for 4 rad./sec. roll rate.	DDM Nov. 30/54.
Dec./54	The inboard wing skins will be reduced in thickness. Structure weight-saving 1650 lb. plus mission fuel saving of 500-600 lb.	<p>RCAP letter ref. S1038-105(ACE-1) Dec. 15/54. DDM Dec. 17/54.</p>
Jan./55	RCAP decide that C105 will be designed in accordance with AND 1048 rather than E075-40-10. (Nuts and bolts - Avro already doing this)	<p>RCAP letter ref. 1038-105(ACE-1) Jan. 13/55.</p>
Jan./55	15th Dev. and Co-ord. Comm. meeting decides: Avro to use magnesium skins in the fuselage of the C105.	<p>Meeting Minutes Jan. 19/55.</p>
Jan./55	Stress anticipate increasing airplane weight will require load factor reduction from 7.33 to 6.9. This not acceptable and hoped that slight structural modifications will be made to maintain the factor at 7.33.	DDM Jan. 21/55.
Jan./55	Recommended seat load factors received through RCAP from IAN.	<p>RCAP letter ref. S1038-105-14(ACE) Jan. 25/55.</p>
Jan./55	Avro receive recommended IAN seat load factors.	<p>DND file, RCAP letter Jan. 27/55.</p>

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Feb./55	Avro recommend FCOM adoption of the MIL-S-5701 landing weight definition in lieu of that in AIR-7-4. This would enable a structural weight saving of approx. 100 lb.	Avro 9142/11 J Feb. 17/55.
Mar./55	17th Dev. and Co-ord. Comm. decides: Nosewheel gear to be designed to withstand a towing load of 10,000 lbs. straight ahead and 6,000 lbs. at a 45 degree angle to the side.	Meeting Minutes Mar. 2/55. OC/TSDs S1038-105-11(ACE-1) Aug. 22/55.
Mar./55	Suggested magnesium skins may be suitable for C105 since criteria for wing design is likely to be stiffness.	Dev. Co-ord. Comm. 17th Meeting Agenda Mar. 2/55.
Apr./55	18th Dev. and Co-ord. Comm. decides: Avro accept the MIL-S-5700 series as the structural criteria for the design of the C105.	Meeting Minutes Apr. 20/55.
May/55	C105 19th Dev. Co-ord. Comm. Decides: (a) Avro urge AF acceptance of MIL-S-700 landing weight definition in lieu of AIR-7-4. (b) Stressing criteria for new seats to AP 970, IAM and MIL-S-5100. All other crash stressing cases to MIL-S-5100.	Notes on 19th Meeting C105 Dev. Co-ord. Comm. May 18/55. DND file, letter RNL to W/C Brough - Feb. 17/55.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
June/55	RCMF tentatively agree to use of MIL-S-5700 definition of landing weight. With P. 13 as basis for weight definition new landing weight is 45,000 lb. (previously 47,000 lb.) RCMF do not agree to reduction in brake capacity and weight requirement for brake design remains at 47,000 lb.	CI05 Des. & Dev. file RNL memo ref.2238/11/J June 2/55.

12. STRUCTURAL & FUNCTIONAL TESTING

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Feb./54	Commencement of minor structural and functional testing, e.g. wear check on piano hinge, honeycomb panel tests, bearing selection tests.	
June/54	Avro requested to report on case for conducting structural tests at plant rather than NAF, (forwarded July 27/54: suggesting fatigue testing at NAF).	OC/TSDs S1038-105-TSU June 9/54.
May/55	19th Dev. and Co-ord. Comm. decides: Avro processing an application for a C100 loan for strain-gauge instrumentation development.	Notes on 19th Meeting C105 Dev. Co-ord. Comm. - May 18/55.

13. MISCELLANEOUS EQUIPMENT & SERVICES

GENERAL

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
May/54	Equipment to be designed for operation at all altitudes up to 60,000 ft.	DDM May 28/54.
July./54	8th Dev. and Co-ord. Comm. meeting decides: (a) No airframe (i.e. wing and fin) de-icing to be installed in the C105. (b) Avro to continue investigation into the problem of de-icing on a design study basis in case it should be decided at a later date that airframe de-icing should be required.	Meeting Minutes July 21/54.
Sept./54	10th Dev. and Co-ord. Comm. decides: Avro to locate vital components, as much as possible, in spots where their vulnerability is relatively low.	Meeting Minutes Sept. 22/54.
Oct./54	11th Dev. and Co-ord. Comm. decides: Avro to be responsible for the special equipment to be used with the aircraft subject to the conditions detailed in AIN-7-4.	Meeting Minutes Oct. 29/54.
Nov./54	PCAF are in favour of Maxaret anti-skid units for C105.	DDM Nov. 16/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Nov./54	Equipment service life in most cases based on equivalent MIL specifications.	DDM Nov. 19/54.
Nov./54	RCAF towing requirement for C105 received.	RCAF letter ref. S1038-105-9 TSDs/Avro Nov. 22/54.
Nov./54	NAE tests indicate that wing de-icing is not req'd.	DDM Nov. 23/54.
Dec./54	RCAF wish confirmation only Phillips headscrews will be used on C105 (confirmed Jan. 6/55 DND file).	RCAF letter ref. S1038-105(ACE-1) Dec. 15/54.
Dec./54	Proposed equipment list first forwarded (Iss. 5) to AFHQ and DDP with cautionary letter and marked 'Preliminary - Not for Official Use'. (OC/TSDs request Nov. 19/54 and 11th Co-ord. Comm. Oct. 29/54.)	Avro 6942/14/J Dec. 15/54, (and at approx. monthly intervals thereafter)
Dec./54	RCAF ask for Avro compliance with ABC Air Standardization Agreements 17/1 to 17/12 inclusive.	RCAF letter ref. 1038-105(ACE) Dec. 21/54
Jan./55	In general minimum equipment life to be designed for 500 hours.	DDM Jan. 21/55.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Mar./55	15th Dev. and Steering Comm. discusses flight simulator required before C105 first flight. Agree Avro only firm to do the job. Avro requested to show cost of similar design and development in proposal for training aids.	
Mar./55	C105 runway strength requirements based on USAF Tech. Mem. WCLS-53-13 'Ground Flotation Requirements'.	RCAF Letter ref. S1038-105(ACE) Mar. 15/55.
Mar./55	DOR has ruled that only ground support equipment as required, to enable C105 to fly (not intercept missions) must be air transportable. This would be an advantage (but not a requirement) for all ground support equipment. Air transportable equipment should be accommodated by C119 type aircraft.	Dev.-Co-ord. Comm. 17th Meeting Agenda Mar. 2/55.
Mar./55	RCAF seeks confirmation on electronic equipment environment.	RCAF letter ref. S1038-105-18(ACE-2).
Apr./55	Spec. Inst. 92-1, Iss. 1 for development of automatic flight control system signed Apr. 6/55.	DND file, letter AF to Avro - May 16/55.
Apr./55	RCAF/Avro discuss interchangeability.	Interchangeability Meeting, Apr. 26/55.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
May/55	<p>C105 19th Dev. Co-ord. Comm.:</p> <p>Avro confirm line equipment will be designed to worst ambient conditions, sea level to 5,000 ft.</p>	<p>Notes on 19th Meeting C105 Dev. Co-ord. Comm. May 18/55.</p>
June/55	<p>20th Dev. and Co-ord. Comm. decides:</p> <p>(a) All panels and doors that may have to be removed for DI inspection to be secured with latches or quick release fasteners.</p> <p>(b) If the circuit breakers are to be used as switches they are to be of the push-pull or toggle type preferably the latter.</p>	<p>Meeting Minutes June 22/55.</p>
July/55	<p>21st Dev. and Co-ord. Comm. decides:</p> <p>From a maintenance point of view Camlock fasteners to Spec. NAS 547 to be acceptable to NCAAF. Company to continue their investigation with respect to adequate strength of this type of fastener.</p>	<p>Meeting Minutes July 20/55.</p>
July/55	<p>No present requirement for any ground handling or servicing equipment to be stowed aboard the aircraft.</p>	<p>OC/TSDs S1038-10-11 (ACE-1) July 26/55.</p>

13.1 RADIO

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Jan./54	Avro proposed face-down mounting of AFM6 accepted.	CC/TSDs S1038-105-18 (ACE-2) Jan. 26/54.
Apr./54	Avro report 'Radar Temperature Control' forwarded for AFHQ use in setting up GFAB qualification test program, (with supplementary information May 5/54).	Avro 2250/020/J Apr. 27/54.
June/54	6th Dev. and Co-ord. Comm. Meeting decides: (a) AFM-6 radio compass to be engineered as a permanent installation with suppressed antenna. (b) Avro to investigate and report on the problem of installing both the AFA 25 and ARD 10 homers. (c) There is no requirement for chaff dispensers in the C105.	Meeting Minutes June 14/54.
Oct./54	11th Dev. and Co-ord. Comm. decides: AFHQ to advise the Company of the use of the UHF homer as a final approach aid.	Meeting Minutes Oct. 29/54.
Nov./54	Operational requirement now exists for the AFA 25 to be used as a landing aid in addition to ECM application to C105.	RCAF letter ref. S1038-105-18 TSDs/Avro Nov. 26/54.
Jan./55	15th Dev. and Co-ord. Comm. Meeting decides: That Avro are to proceed as outlined in their proposal for interim radio and navigation equipment, pending completion of DATel review.	Meeting Minutes Jan. 19/55.

DATE

DETAILS

REFERENCES

Apr./55

18th Dev. and Co-ord. Comm. Meeting decides:

- (a) The requirement for the installation of Doppler in the C105 still stands.
- (b) Requirement for radar homing stands.

Meeting Minutes

Apr. 20/55.

May/55

C105 19th Dev. and Co-ord. Comm.:

Discuss installation of VHF in place of UHF.
Avro seek early decision meanwhile working on UHF.

Notes on 19th Meeting

C105 Dev. & Co-ord.

Comm. - May 18/55.

June/55

20th Dev. and Co-ord. Comm. decides:

- (a) VHF equipment is not required in C105 A/C.
- (b) All aircraft delivered to the RCAF, not having an integrated electronic system, to be equipped with the R Theta, and the R. Thetas be provided for the first 15 A/C to be installed as necessary.

Meeting Minutes

- June 22/55.

13.2 HYDRAULIC SYSTEM

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
Mar. '54	Certain decisions on C105 components. Control actuated by 4000 lb./sq.in. hydraulic system from 4 pumps, two per engine. Additional pump for services (i.e. undercarriage, dive brakes, etc.). Missile launching not provided for in hydraulic system though power available, if necessary. Feed into main power control hydraulic system with reduced response during missile firing.	C105 Meetings file JCE memo - Mar. 4/54.
Nov./54	Agreed hydraulic actuators and servos in automatic control system developed separately under separate study contract from Avro.	PCAF letter of confirmation, ref. S1038-105-10 TSDS/Avro - Nov. 19/54.
Feb./55	Flying Controls Hydraulic System Brochure H-1 and drawings submitted.	Avro 9247/07/J Feb. 23/55.
Mar./55	Brochure H-2 'Utility Hydraulic System' and schematic drawings forwarded for AFHQ.	Avro 9692/09/J Mar. 18/55.
May/55	AFHQ/Avro meeting held to discuss Flying Control Hydraulic System proposal.	May 4-5/55.
May/55	AFHQ conference on Hydraulic System held on May 4.	S1038 CF105-180 (AMTS/DAEng).

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
May/55	C105 19th Development and Co-ord. Comm. decides: Hydraulic System generally satisfactory.	Notes on 19th Meeting C105 Dev. Co-ord. Comm. - May 18/55.
July/55	21st Dev. and Co-ord. Comm. decides: (a) The hydraulic system is satisfactory at present. (b) If it is discovered in flight testing the air- craft that failure of one pump does make a sig- nificant difference to the operation of the aircraft, a suitable warning system will have to be installed.	Meeting Minutes July 20/55.

13.3 COCKPIT

DATE

DETAILS

REFERENCES

Apr./54	Decision to use Martin-Baker light weight seat.	DDM Apr. 30/54.
June/54	6th Dev. and Co-ord. Comm. Meeting decides: (a) Avro to continue with the V-type windscreen for the prototype C105 aircraft. (b) Avro to continue investigations on other configurations to provide background in case the V-type is unacceptable.	Meeting Minutes June 14/54.
Aug./54	Avro receive details of ejection seat - composite disconnect.	DND file: AF letter ref. S1038-105-TSDs Aug. 24/54.
Nov./54	RCAF tentative requirement received for quick disconnect of aircrew services upon seat ejection.	RCAF letter ref. S1038 CF-105-8-4 TSDs/ Avro - Nov. 22/54.
Dec./54	13th Dev. and Co-ord. Comm. decides: Avro to provide cockpit air temperature regulation.	Meeting Minutes Dec. 1/54.
Dec./54	C105 instrument marking requirements detailed by RCAF.	RCAF letter ref. S1038-105-4 TSDs/Avro Dec. 1/54.
Dec./54	RCAF confirm ejection seat disconnects are to be mounted on the right hand side of seats.	RCAF letter ref. S1038 CF-105-16 ACA Dec. 9/54.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Dec./54	RCAF confirm maintenance of a lower cabin pressure differential during combat flight (specified UCAF 80-1) not required in C105.	RCAF letter ref. C1038-105-8-3(ACE) Dec. 28/54.
Dec./54	RCAF confirm Avro emergency controls colour scheme.	RCAF letter ref. C1038-105-4(ACE) Dec. 28/54.
Jan./55	15th Dev. and Co-ord. Comm. decides: (a) At this time, it did not appear necessary to carry out a full scale flight test development program using a C100 with a C105 windscreen. (b) Avro's proposal to clear one side of the 'V' windscreen was acceptable but it was desirable to clear both sides if possible.	Meeting Minutes Jan. 19/55.
Feb./55	RCAF require navigator's window to be lower and larger.	DDM Feb. 4/55.
Mar./55	17th Dev. and Co-ord. Comm. decides: (a) Cockpit fire extinguisher requirement cancelled. (b) Avro to provide a centrally located master warning light on the pilot's instrument panel, and to assess the reliability of this warning system. (c) Replaceable oxygen bottles to be located in a readily accessible spot to allow quick substitution.	Meeting Minutes Mar. 2/55. OC/TSDs C1038-105-11(ACE-1) Aug. 22/55.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Apr./55	RCAF criticize C105 canopy release following cockpit mock-up inspection. Jamming of locking bar and reliability of gas cartridge for canopy unlocking are suspect.	RCAF letter ref. S1038-105-16(ACE)
May/55	Details of canopy release system provided (at AFHQ request).	Avro 1/85/08/J May 5/55.
May/55	19th Dev. and Co-ord. Comm. decides: RCAF require both sides of windshield cleared of rain, ice, etc. Wholly, or in part if this is impossible.	Notes on 19th Meeting C105 Dev. Co-ord. Comm. - May 15/55.
June/55	20th Dev. and Co-ord. Comm. decides: Avro to proceed with the design of the J4 compass installation.	Meeting Minutes - June 22/55.
July/55	21st Dev. and Co-ord. Comm. decides: A 12" square window to be installed in the rear cockpit as soon as possible but by at least the 14th C105 aircraft.	Meeting Minutes - July 20/55.
July/55	B2-A stick grip to be used pending approval and availability of B9. (Ref. Avro enquiry May 2/55).	OC/TSDs S1038-105-10-1 (ACE-1) - July 26/55.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
Aug./55	Company's proposed Master Warning Light/Indicator system agreed in principle.	OC/TSDs S1038-105-4 (ACE-1) Aug. 23/55.
Aug./55	Avro proposal for engine controls stressing accepted. (Limit torque at each lever 750 lb. ins.) (Ref. Avro 6301/04/J, Nov. 17/54.)	OC/TSDs S1038-105-15 (ACE-1) Aug. 23/55.
Aug./55	EOP to be submitted to introduce larger navigator's window in production, effective not later than 16th aircraft.	OC/TSDs S22-1-7(b) (ACE-1) Aug. 23/55.
Aug./55	Reasons given against re-opening of the question of alternatives to the V-type windscreen. (Ref. OC/TSDs Aug. 23/55.)	Avro 3769/08/J Aug. 31/55.

13.4 ELECTRICAL SYSTEM

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
July/54	Proposals for simplification of electrical and electronic wiring and accessories forwarded for AFHQ and AMC consideration. These cover: (1) Simplified wiring identification. (2) Use of taper pins in lieu of soldered joints and eyelet terminals. (Not pursued - iii) (3) Adoption of taper pins terminal blocks. (4) 'O' Ring bulkhead sealing. (5) Simplified cable clipping.	(i) Avro 377702F/J July 13/54. (ii) Avro notes on MEETING with RCAF - Aug. 17/54 (iii) Avro internal memo 5020/02E/J Sept. 28/54.
Feb./55	Preliminary report on electrical power supply arrangements forwarded for AFHQ. These cover latest known requirements, including integrated electronic system. We intend to proceed accordingly.	Avro 8884/02E/J Feb. 7/55.
Apr./55	Exterior lights to conform to OR/4-5 requirements. No requirement for identification lights.	OC/TSDs S1038-105-5 (ACE) Apr. 22/55.

13.5 FUEL SYSTEM

DATE

DETAILS

REFERENCE

July/54 Long range (500 Imp. Gal.) drop tank must be included. DDM July 6/54.

July/54 8th Dev. and Co-ord. Comm meeting decides: Meeting Minutes
The engine emergency fuel system to be retained July 21/54.
with a temporary cockpit control panel.

Oct./54 Descriptive notes and drawings covering fuel Avro 5335/05/J
system forwarded for AFHQ. Oct. 8/54.

Oct./54 ANDCM-80 required refuelling aircraft less 10% DDM Oct. 12-13/54.
in 3 mins. Present scheme passing 535 gals./min. is
inadequate, requires 4.6 mins. Deviation may be
sought.

Jan./55 Supplementary fuel system drawings forwarded for Avro 8617/05/J
AFHQ. Jan. 24/55.

Jan./55 AFHQ meeting to discuss fuel system proposals
held on Jan. 27/55.

Feb./55 RCAF require: DDM Feb. 4/55.
(a) Installation of primary and secondary master
warning light system to indicate emergency.
(b) Separate fuel contents indication for each
tank to show no flow for fuel no air valve
failure.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
Apr./55	18th Dev. and Co-ord. Comm. Meeting decides: (a) Two point pressure refuelling to be installed in lieu of single point refuelling with an estimated saving in weight of 50 lb. plus saving in mission fuel. (b) Gravity refuelling provisions to be deleted, with an estimated saving in weight of 12½ lb. plus saving in mission fuel.	Meeting Minutes Apr. 20/55.
May/55	AFHQ/Avro meeting held to discuss fuel system proposal.	May 4 and 5/55.
May/55	19th Dev. and Co-ord. Comm. decides: Fuel system requires in particular check on aircraft lateral stability with feed failure from wing tanks. (Subsequently found satisfactory.)	Notes on 19th Meeting C105 Dev. co-ord. comm. May 18/55.
AUG./55	Gravity refuelling provisions not required.	OC/TSDs S1038-105-8-1 (ACE-1) Aug. 23/55.

13.6 OXYGEN SYSTEM

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
Sept./54	PCAF meeting held at IAM covering all aspects of oxygen system.	AFHQ S1038CF-105-180 Sect. 23/54.
Apr./55	Oxygen flow indicator not a requirement.	OC/TSDs S1038-CF-105- -8-4-(ACE)-Apr.25/55.
May/55	AFHQ ruling requested on necessity for oxygen quantity and pressure gauges for deerver.	Avro 1/27/02A/J May 3/55.

13.7 DAMPING SYSTEM

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
Nov./54	Outline reasons why Avro considers HAC should do the damping system.	Damping System File Approx. Nov./54.
Nov./54	Damping system is agreed to be subject to separate contractual action. Avro have prepared specification for submittal to Minneapolis-Honeywell and HAC with requests for: (a) assurance companies are prepared to tender. (b) tentative cost figures.	PCAF letter ref. S1038-105-10 TSDs/Avro Nov. 19/54.
Nov./54	Minneapolis-Honeywell has indicated that they will supply damper system without a contract for auto-pilot.	DDM Nov. 16/54.
Jan./55	What Avro expects of HAC with respect to damping system.	Armament file - GRO letter Jan.29/55, also RNL letter Jan.26/55.
Feb./55	Reliability of damping system should be considerably higher than other electronic equipment and on a par with engine reliability, because (a) In certain circumstances C105 unsafe without damper. (b) Considerable opposition to (a) above in RCAF. Concern expressed with primary system tied to digital computer with predicted failure of the order of 2 hours.	Damping System file, RNL memo, Feb. 9/55.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
Apr. '55	RCAP do not agree. HH and HAC asked to tender for damping system, Hughes only.	RCAP letter ref. C1025-105-7(ACB) Apr. 21/55.
May/55	Program schedule for damping system outlined (Technical requirement revised July 26/55). Flight Test hardware required Jan. 1/57 1st set, Mar. 1/57 2nd set.	Damping System file, Reqs. C105 Damping System - May 16/55.
July/55	Hughes have run out of money for C105 damping system. Will continue work on reduced scale with delivery postponed one day per day of delay in receiving contractual coverage after July 1/55. Hughes estimate \$120,000 required to complete work.	Damping system file, JAC memo - July 28/55
July/55	Avro write requirements for C105 damping system. Approved by Hughes and RCAP.	Damping System file July 26/55.
Aug./55	Damping System Requirements (Iss. 3, July 26/55) forwarded for incorporation by DIE Eng in Spec. IHST 92-4.	Aug. 16/55. Aug. 30/55.
Aug./55	Delays on Hughes MX 1179 system and damping system becoming critical. USAF restricting Hughes work on any but AF projects. C105 will certainly be restricted, if damping system unavailable on time. Consideration again given to providing preliminary fire control system i.e. B9/MC-3.	Arrangement file - REL memo - Aug. 29/55.

13.8 AIR CONDITIONING SYSTEM

DATE

DESCRIPTION

REF. NUMBER

Jan./55

15th Dev. and co-ord. comm. decides:

Meeting Minutes

(a) A freezable boiler to be made an integral part of the proposed air conditioning system.

Jan. 19/55.

(b) A pilot operated temperature regulator in addition to the automatic temperature control features of the Avro proposal to be added to the system.

(c) The Avro proposed Simple Evaporative Air Conditioning System is approved in principle.

Aug./55

ECAP agree revision of cabin pressure scheduling. (Max. pressure differential 4.5 psi reached at 60,000 ft. approx. instead of 24,000 ft.) Spec. AIR-7-4 will be amended.

OC/TSDs S1038-105(ACE-1) Aug. 23/55.

Aug./55

Permission given to use different sized connections for low pressure/low temperature air conditioning and high pressure/high temperature electronics and starting ground air supply lines.

OC/TSDs S1038-105-11 (ACE-1) Aug. 22/55.

14. FLIGHT TESTING

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
July/54	Outline of aircraft allocation and test program for: (a) Fire Control System - 2 aircraft. (b) Flight control system - 2 aircraft. (c) Telecom. and Nav. Aids - 2 aircraft. (d) Weapon Development - 4 aircraft.	Arrangement file, G.R. Oscar letter Ref. 4117/03/J July 29/54.
Sept./54	10th Dev. and Co-ord. Comm decides: RCAF to allocate 18107 to Avro on indefinite loan for flight test purposes.	Meeting Minutes Sept. 22/54.
Oct./54	AF allocate aircraft 18107 on indefinite loan for C105 flying control system evaluation.	DND file. AF letter ref. S1038-105 TSDs/ Avro (ACE) Oct. 29/54.
Dec./54	RCAF tentative estimate of pre-production C105 aircraft for evaluation. Total number represents 29 aircraft, of which 11 would be required by Avro and 18 by RCAF. Preliminary details of 8 phase programme for these aircraft.	Note in DND file: Data by phone from G/C Footitt - Dec. 7/54
Mar./55	Proposed programme covering utilization of J57 engines, forwarded for AFHQ.	Avro 8501/22/J Jan. 19/55.

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCE</u>
Jan./55	PCAS Draft Report DA ng-33 Aircraft Evaluation and Test Program' setting forth proposed general procedure, including allocation of test aircraft, forwarded for Avro comment. (Avro indicated provisional agreement).	CC/TDR C1038CH-15 (ACE-1) Jan. 24/55.
Apr./55	C105 program re-scheduled Apr. 15/55 retarding 1st flight 6 months to bring airframe into phase with engines and integrated electronic system. Schemes A & B considered. Scheme B adopted as follows: (See Schedule Apr./55 for details).	C105 Program file, Schedule for Schemes A & B.
May/55	Avro require loan of additional C100 airplane for C105 instrumentation development.	C105 Des. & Dev. file JCF memo May 18/55.
June/55	20th Dev. and Co-ord. Comm. decides: (a) Extension of one runway at Malton to 10,000 ft. is necessary for the first flight of the C105 and will endeavour to keep up-to-date on progress of discussions between DOT and DND. (b) There is a technical requirement for a C100 aircraft to be allocated to Avro for telecommunication equipment testing.	Meeting Minutes - June 22/55.

15. READINESS & STANDBY

<u>DATE</u>	<u>DETAILS</u>	<u>REFERENCES</u>
June/54	6th Dev. Co-ord. Comm. decides: The 1 minute scramble time requirement to govern and not the 10 second start.	Meeting Minutes June 14/54.
Nov./54	ECAP Advise requirement for turn around time is same as USAF, i.e. 4 aircraft in 15 mins. AIR-7-4 requires one aircraft turn around in 5 mins.	DDM Nov. 5/54.
Dec./54	ECAP confirm certain aspects of 'Standby Readiness and Maintenance'.	ECAP letter ref. S1038-105 (ACE) Dec. 9/54.
Jan./55	15th Dev. and Co-ord. Comm. decides: (a) The use of four automatic disconnect couplings of the same type and to US standards was acceptable. (b) The deviation to AIR-7-4 to allow the couplings for engine starting to be located at the engines and not adjacent to the air conditioning couplings was acceptable.	Meeting Minutes Jan. 19/55.
Apr./55	Planned that C105 will not operate from aerodromes above 2,500 ft. Possible emergency at 3,500 ft. and ground handling equipment req'd. for starting at 3,500 ft.	Co-ord. Comm. 18th Meeting Agenda Apr. 20/55.

DATE

DETAILS

REFERENCES

May/55

19th Dev. Co-ord. Comm. decision:

Notes on 19th Meeting

- (a) Avro confirm C105 needs 1 minute scramble time from readiness hangar at 2500 ft. altitude on 100°F summer day.

C105 Dev. Co-ord. Com.
May 18/55.

- (b) An increase of 10 seconds per engine in starting time between standard sea level conditions and the worst case was accepted for scrambling from maintenance line equipment.

CF-105 STRUCTURAL PLASTIC AND ANTENNA RESEARCH

STRUCTURAL PLASTIC MODEL

<u>Model Scale and Type</u>	<u>Date of Completion of Model</u>	<u>Purpose of Test</u>
1/5 3% Fin with Portion of Wing	Sept. 15/54	Checking Deflections and Stress in Comparison with the Results obtained by Stress Analysis.
1/5.25 Front Portion of Fuselage with Air Ducts and Fuel Tanks	Feb. 1/55	Checking Deflections and Stress for Applied Unit Load Cases.
1/5.25 Segment of Front Fuselage Structure	Apr. 7/55	Checking the Effect of Stiffness of Ducts on Deflection of Front Fuselage.
1/5.25 Centre Wing Portion with Fin, Front and Rear Fuselage Structure	June 15/55	Checking Deflections and Stress Due to Loads applied to the F
1/5.25 Complete Structural Model of Aircraft	Aug. 21/55	Checking Deflections and Stress Due to Different Loading Cases. This test will serve also as a static test of the full scale aircraft.

Note: All the above models were designed and manufactured by Avro.

ANTENNA RESEARCH MODEL

1/48 Complete Model Sheet Metal	Jan./55	Free Flight Model Antenna Research.
Modified 1/48 Model	June/55	Low Frequency Radio Compass Research
1/18 Complete Model Cast Aluminum	Apr./55	UHF and L-Band Antenna Research
1/8 Complete Model Sheet Copper	July/54	Exp. UHF and L-Band Antenna Research
Full Scale Belly Mock-up - 2 Models	Oct./55	UHF and L-Band Antenna Research
Full Scale Fin Mock-up	June/55	Fin Cap Antenna and X-Band Antenna Research

Note: All the above antenna models were designed and manufactured by Sinclair Laboratories

TABLE 1

NA RESEARCH MODEL PROGRAMS

MODEL PROGRAM

<u>Purpose of Test</u>	<u>Test Facility</u>	<u>Estimated Test Date</u>	<u>Remarks</u>
Deflections and Stresses on with the Results Stress Analysis.	Avro	Jan./55	Completed.
Deflections and Stresses Unit Load Cases.	Avro	Apr./55	Completed.
Effect of Stiffness Deflection of Front	Avro	Apr./55	Completed Aug./55.
Deflections and Stresses applied to the Fin.	Avro	June/Sept./55	Suspended until Costs and Program reviewed.
Deflections and Stresses Unit Loading Cases. This serve also as a study for test of the full size	Avro	Oct./Dec./55	

ARCH MODELS

Model Antenna	Sinclair Radio Lab.	Jan./55	Complete.
Radio Compass	Sinclair Radio Lab.	June/55	Complete, Sept./55.
Antenna	Sinclair Radio Lab.	Apr./55	Complete, Aug./55.
1-Band Antenna	Sinclair Radio Lab.	Aug./54	Complete, July/55.
Antenna	Sinclair Radio Lab.	Oct./55	Extensive test period.
Antenna and X-Band Arch	Sinclair Radio Lab.	June/55	Complete, Sept./55.

Sinclair Laboratories Ltd.

CF-105 WIND TUNNEL PROGRAM

<u>Model Scale and Type</u>	<u>Model Designed & Manufactured by</u>	<u>Completion Date of Model</u>	<u>Purpose of Test</u>	<u>Test Facility</u>	
3/100 Complete Model Sting Mounted	Cornell, Buffalo	Sept./53 Complete	Subsonic and Transonic 3 Axis Stability & Control	Cornell 3' x 4' Transonic 10' x 12' Subsonic	St St St St
4/100 Complete Model Sting Mounted	Cornell, Buffalo	Mar./55 Complete	Transonic Armament Tests Falcon & Sparrow Missile Long. & Dir. Stab. & Control	Cornell 3' x 4' Transonic	St St St St St
1/10 Reflection Plane Wing	NAE, Ottawa	Jan/55	Subsonic, Preliminary Study of Icing Condi- tions on Long. & Lat. Control	NAE, Ottawa 10' x 5.7' Low Speed	Co
1/8 Reflection Plane Wing	Avro	Mar/55 Complete	Subsonic, More Advanced Study of Icing Condi- tions with Notch & L.E. Extension Included.	NAE, Ottawa. 10' x 5.7' Low Speed.	Co
7/100 Complete Model	Avro & NAE	Apr/55 Initial Completion	Subsonic, Canopy & Missiles Jettison, Ground Effects.	NAE, Ottawa 10' x 5.7' Low Speed	Ma
1/50 Complete Model Sting Mounted	Avro	Apr/55 Complete	Supersonic, Lateral & Direc. Stability & Control.	NAE, Ottawa 14" x 30" Supersonic	Ju

D TUNNEL PROGRAM

TABLE 2

<u>Test</u>	<u>Test Facility</u>	<u>Test Date</u>	<u>Remarks</u>
Transonic 2 Control	Cornell 3' x 4' Transonic 10' x 12' Subsonic	Stage 1 Complete Sep/53 Stage 2 Complete Apr/54 Stage 3 Complete Jun/54 Stage 4 Complete Jul/54 Stage 5 Complete Oct/54	Long. Stab., with & without Camber, t/c 3%, M = 0.5 - 1.23 Long. Stab., Lat. Stab. & Control, Camber, t/c 3%, M = 0.5 - 1.23. Long. Stab. Check, Direc. Stab. & Control, New Nose, New Canopy, M = 0.5 - 1.23. Notch Invest., Complete Test with Optimum Notch, Low Speed, High Angle of Attack, M = 0.5. Notch Invest. at all Speeds, Long. & Direc. Stab., High R.N. New Nose, L.E. Extension & Notch, M = 0.5 - 1.23
Missile Tests	Cornell 3' x 4' Transonic	Stage 1 Complete Mar/55 Stage 2 Complete Mar/55 Stage 3 Complete Mar/55 Stage 4 Complete Apr/55 Stage 5 Complete May/55 Stage 6 Complete May/55 Stage 7 Complete May/55	Long. & Direc. Stab. Comparison 0.03 & 0.04 Scale Models. M = 0.5 - 1.23 Transonic Force Tests on Missiles, Armament Bay Pressures, Bay Door Hinge Moments. M = 0.9 - 1.2. Transonic Tests for Miss. Effect on Aircraft. M = 0.95 - 1.2. Transonic Force Tests on Missile for Trajectory Analysis. M = 0.95 - 1.2. Long. Stab. Investigate L.E. Droop. M = 0.5 - 1.2. Complete Long. & Direct. Stab. & Control Tests with Optimum Droop. M = 0.5 - 1.2. Investigation at High R.N. & High Angle of Attack. M = 0.5.
Primary Indi- Lat.	NAE, Ottawa 10' x 5.7' Low Speed	Complete Jan./55	This test was an extension to NAE icing research program. Model was approximate only.
Advanced Indi- L.E.	NAE, Ottawa. 10' x 5.7' Low Speed.	Complete Mar/55.	
	NAE, Ottawa 10' x 5.7' Low Speed	May/55	One run completed at high incidence at end May. Further testing sched- uled for June-July/55, but suspended due to model re-work for notch, L.E. ext., droop. Est. ready Nov./55.
1 &	NAE, Ottawa 16" x 30" Supersonic	July/55	Balance not ready. Start test approx. Mid-July/55. M = 1.23, 1.36, 1.56, 1.8 & 2.0. Model returned to Avro for re-work for notch, L.E. droop, ext. Est. ready Nov./55.

CF-105 WIND TUNNEL PROGRAM

<u>Model Scale and Type</u>	<u>Model Designed & Manufactured By</u>	<u>Completion Date of Model</u>	<u>Purpose of Test</u>	<u>Test Facility</u>	<u>Test Date</u>
1/40 Fuselage Intake	Avro	Apr./55 Complete	Supersonic, Study of Air-flow through the Intakes.	NAE, Ottawa 10" x 10" Supersonic	Mid-June/55
1/50 Reflection Plane	NAE, Ottawa	Sept./55	Supersonic, Long. Stab. & Control. Lat. Control.	NAE, Ottawa 14" x 30" Supersonic	Oct./55
1/24 Complete Model	NAE, Ottawa	June/55	Subsonic, Spin Characteristics and Recovery.	NAE, Ottawa Spinning Tunnel	Not finalized
1/6 Fuselage Intake	Avro	Oct./55. Delivered to Cleveland by Oct. 1/55.	Supersonic, Study of Air-flow through Intakes.	MACA, Cleveland 8' x 6' Supersonic Lewis Lab.	Nov./55
3/100 Complete Model	Cornell, Buffalo.	Oct./55	Supersonic, Directional Stab. at High Angles of Attack.	Bedford, England 3' x 3' Supersonic.	Not finalized
1/50 Canopy Model with Dorsal and Nose Fuselage.	Avro	May/54	High Subsonic Rake Survey of Canopy and Dorsal.	NAE, Ottawa 10" x 10" Supersonic.	Complete, June/54.

CF-105 WATER TUNNEL PROGRAM

3/100 Canopy Model with Dorsal and Nose Fuselage.	Avro	May/54	Water Tunnel Test with Visual Flow Check on Canopy/Dorsal Combination.	NAE, Ottawa. Water Tunnel 9.84" x 13.11"	Complete, May/54
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NOTE: The programmes and costs for the outstanding wind tunnel tests to be carried out by NAE on the 7/100, 1/30, 1/50 and 1/24 scale models are under review.

TUNNEL PROGRAM

TABLE 2(cont'd.)

<u>Test Facility</u>	<u>Test Date</u>	<u>Remarks</u>
NAE, Ottawa 10" x 10" Supersonic	Mid-June/55	M = 1.4, 1.8 & 2.0. Commenced Mid-June/55 Preliminary tests complete. Further testing continues.
NAE, Ottawa 14" x 30" Supersonic	Oct./55	Test date not finalized, but probably Oct./55. M = 1.23, 1.36, 1.56, 1.8 & 2.0.
NAE, Ottawa Spinning Tunnel	Not finalized.	Model Design Complete.
MACA, Cleveland 8' x 6' Supersonic Lewis Lab.	Nov./55	Model Instrumented by Lewis Lab. during Oct./55. Model Design complete July 15/55.
Bedford, England 3' x 3' Supersonic.	Not finalized.	Use of Bedford facility improbable due to scheduled capacity. Langley 4 ft. supersonic and 4 ft. Unitary Plan supersonic investigated. Both heavily booked. Space may be arranged in Unitary Plan tunnel. Required, 3 speeds between M = 1.4 & 2.0.
NAE, Ottawa 10" x 10" Supersonic.	Complete, June/54.	Rake surveys with original canopy and canopy modified in water tunnel. M = 0.71 and 0.83.

TUNNEL PROGRAM

NAE, Ottawa. Water Tunnel 9.84" x 13.11"	Complete, May/54	Test to determine whether loss of fin effectiveness might be caused by flow breakaway around the canopy. Canopy modified for optimum flow.
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tunnel tests to be carried out
els are under review.

CF-105 FREE FLIGHT MODEL PROGRAM

<u>Model Scale and Type</u>	<u>Completion Date of Model</u>	<u>Purpose of Test</u>	<u>Test Facility</u>	<u>Estimate</u>
1/8 2 Crude Models	Dec./54	Check Firing Technique, Telemetering and Tracking.	CARDE Range, Picton, Ont.	D
1/8 1 Crude Model	Apr./55	Check Functioning of Yaw Impulse and $\alpha - \beta$ Vanes.	CARDE Range, Picton, Ont.	M
1/8 1 Drag Model, Straight L.E. plus Notch.	Apr./55	Telemetry System Check and Preliminary Drag Check incl. Flow through Air Intakes and Ducts.	CARDE Range, Picton, Ont.	M
1/8 1 Crude Model	Apr./55	Re-check Functioning of Yaw Impulse and $\alpha - \beta$ Vanes.	CARDE Range, Picton, Ont.	Ju
1/8 2 Drag Models, Ext. L.E., Notch and Droop (1 to include Area Rule Mods.)	June & July, 1955	Check Drag with two dif- ferent air intakes and ducts.	CARDE Range, Picton, Ont.	1st - Aug 2nd - Sep
1/8 2 Yaw Stability Models, Ext. L.E., Notch and Droop. Area Rule Mods.	Sept./55	Check Directional Stability.	CARDE Range, Picton, Ont.	Oc
1/8 2 Models with Movable Elevators. Ext. L.E., Notch, Droop and Area Rule Mods.	Oct./55	Check Longitudinal Stability.	CARDE Range, Picton, Ont.	Dec
1/8 1 Spare Model plus Five Boosters.		The program for spares will be decided after firing the above models.		

TABLE 3

MODEL PROGRAM

<u>Test Facility</u>	<u>Estimated Test Date</u>	<u>Remarks</u>
CARDE Range, Picton, Ont.	Dec./54	Complete Dec. 15/54.
CARDE Range, Picton, Ont.	May/55	Complete May 1/55.
CARDE Range, Picton, Ont.	May/55	Complete May 1/55.
CARDE Range, Picton, Ont.	June/55	Complete June 15/55.
CARDE Range, Picton, Ont.	1st - Aug. 26/55 2nd - Sept. 30/55	Doppler Tracking delayed until Oct./55, (possibly use kine- theodolite). Stop work issued July/55 pending investigation of costs. FFM now under review to determine which tests are absolutely essential with present budget limitation. Sept. 16/55 Program for these models is now re-established.
CARDE Range, Picton, Ont.	Oct. 31/55	
CARDE Range, Picton, Ont.	Dec. 15/55	

SUPERSONIC CD_{MIN} @ 1.5 MACH NUMBER

0.026

0.024

0.022

0.020

0.018

0.016

0.014

0.012

0.01

D F A J A D D F A J A O D F A J A O D F A

1952

1953

1954

C104/1-617

C104/2-1189

C105/1200
REF: P/C105/1

C105/1200
REF: NAE LR87

C105/1225
REF: C105 BROCHURE
JULY 1954

C105/1225
MOD. FOR
AREA RULE

C105/1225
USED FOR
PERF. EST.

C105/1225
EST. BY AREA
RULE

NACA
OPTIMUM
FOR C105

C105/1225
NAE QUOTE
TO NACA

NACA
FORECAST
C_D 0.025-
0.030

AT 1.4 MACH NUMBER
ADJUSTED FOR CONFIG.
C_D MIN
NAE 0.0150
RAE 0.0158
NAE 0.0148
M. MAN. 0.0237
REF: P/C105/13

APPENDIX 1

1.4 MACH NUMBER
STUDIED FOR CONFIG.

WRO 0:0150
RAG 0:0158
NAG 0:0148
MAN 0:0287
EF: P/C105/13

NACA
FORECAST
CF 0:015-
0:030

FIGURE COMPROMISED
FROM NACA MEETINGS,
AREA RULE, WIND
TUNNEL AND ONE DRAG
ROCKET MODEL

C105/1225
EST. BY AREA
RULE

CF-105 MINIMUM DRAG COEFFICIENT
SUPERSONIC

DOES NOT INCLUDE SPILLAGE DRAG

NACA
OPTIMUM
FOR C105

C105/1225
USED FOR
PERF. EST.

C105/1225
NATO QUOTE
TO NACA

- 3% THICKNESS CHORD
- 3 1/2% THICKNESS CHORD
- 3 1/2% t/c, AREA RULE
- 3 1/2% t/c, AR, LE DROOP & EXTENSION & NOTCH

C105/1225
MOD. FOR
AREA RULE

C105/1225
USED FOR
PERF. EST.

C105/1225
USED FOR
PERF. EST.

COMMON BOUNDARY FOR PERFORMANCE
ESTIMATES.

C105/1225
13 BROCHURE
Y 1954

J A O D F A J A O D F A J A O D

1954

1955

1956

SEPTEMBER 12 / 55

CF-105

SUBSONIC MINIMUM DRAG COEFFICIENT C_{DMIN}

0.015

0.010

0.005

0.005

0.005

0.005

C104/1-617

C104/2-1189

C105/1200
REF: NAE LR 87

ADJUSTED FOR CONFIG
 C_{DMIN} ANR 0.0087
 RAE 0.0084
 NAE 0.0081
 AN-MAN 0.0084
 REF: P/C105/13

C105/1225
 REF: CDS BROCHURE
 JULY 1954

C105/1225
 NACA (LANGLEY)
 FORECAST

C105/1225
 USED FOR
 PIET EST
 (NACA BUREAU
 MAY BE 1955)
 WASHINGTON

D F A T A O D E A T A O D F A T A O D F A

1952

1953

1954

19

CF-105 MINIMUM DRAG COEFFICIENT SUBSONIC

- 3% THICKNESS CHORD
- 3 1/2% THICKNESS CHORD
- 3 1/2% W/C, A/R, LE DROOP, EXTENSION & NOSE

----- C_{DMIN} BOUNDARY FOR PERFORMANCE ESTIMATES

TRUSTED FOR CONFIG
ANR 0-0087
RAE 0-0084
NAE 0-0091
AN-MAN 0-0084
REF: P/C105/13

C105/125
NACA (LANGLEY)
FORECAST

BASED ON NACA
TANKS WIND TUNNEL
FOUR DRAG ROCKET
MODEL. INCLUDE AREA
RULE THICK LE DROOP
NOSE EXTENSION

C105/1225
F: CDS BROCHURE
JULY 1954

C105/1225
USED FOR
PERT. EST.
(DATA SUBJECT
MAY BE 1955)
WASHINGTON

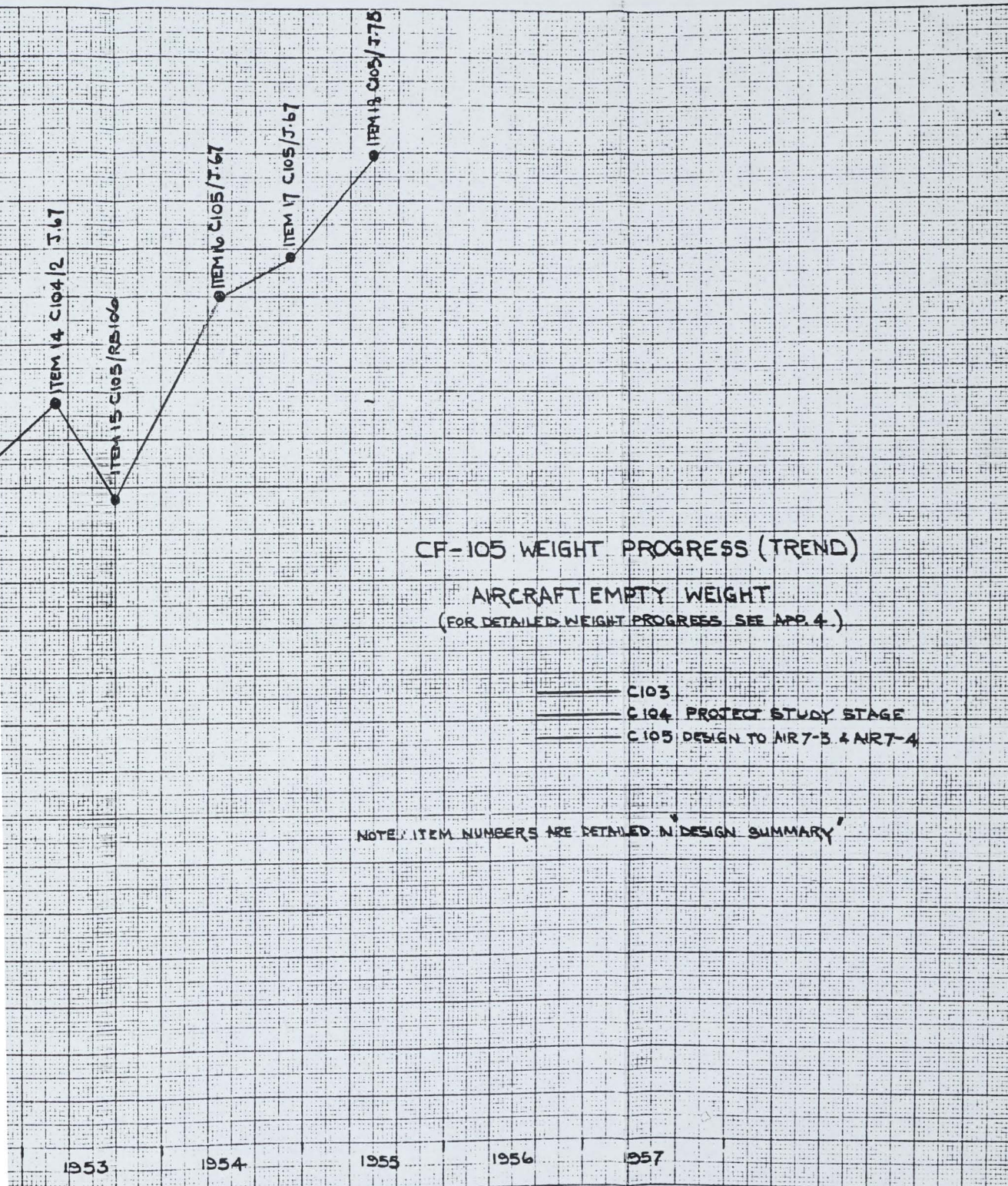
C105/1253
USED FOR
PERT. EST.

J A O D F A J A O D F A J A O D F

54

1955

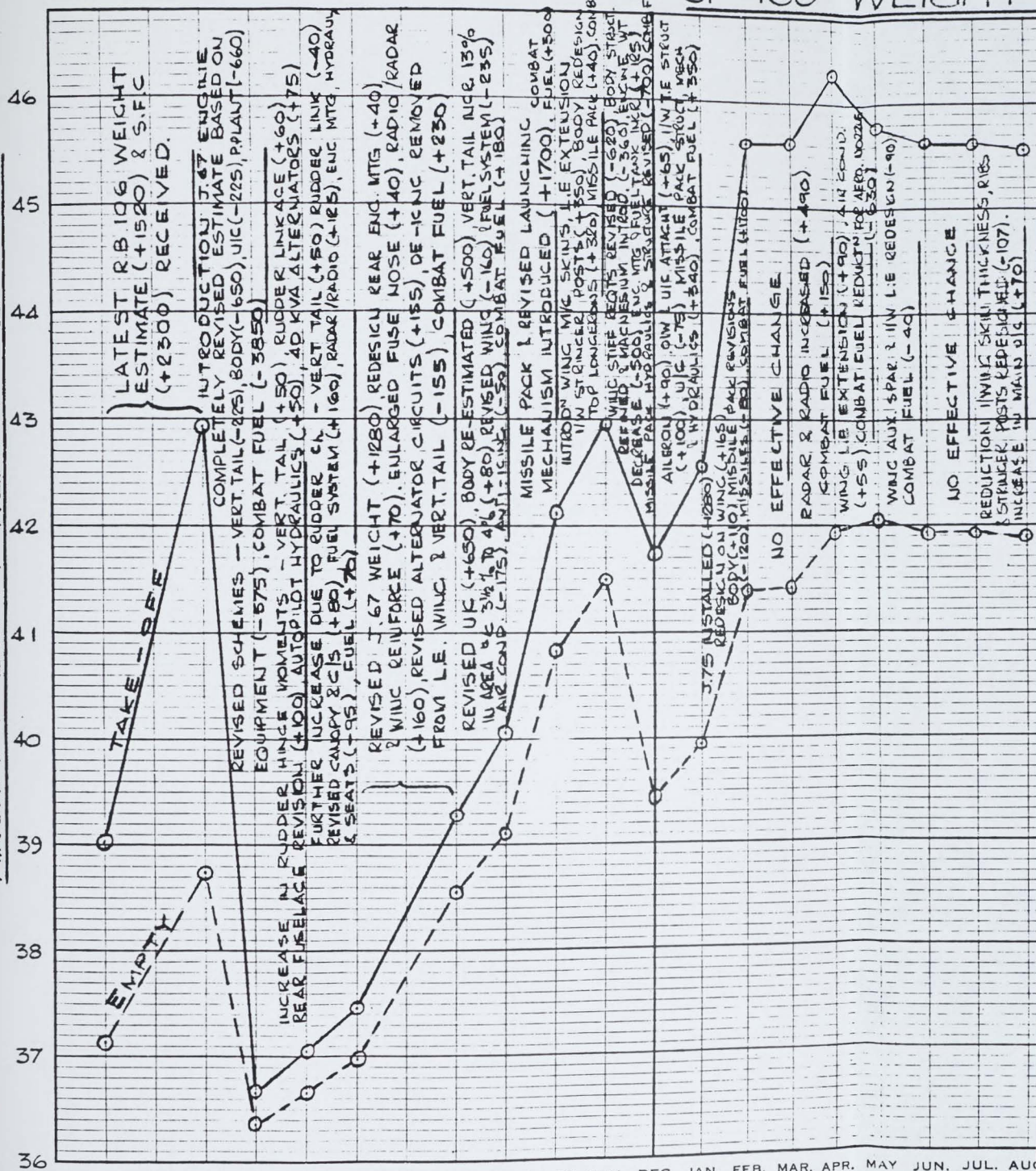
1956



SEPTEMBER 12/55



AIRCRAFT EMPTY WEIGHT - LB X 1000



CF-105 WEIGHT

DEC. JAN. FEB. MAR. APR. MAY JUN. JUL. AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY JUN. JUL. AUG.

1954

1955

-105 WEIGHT RECORD

