

*FR 8/31*

Mngr.....	Eng. Supt.....
Sec.....	A/F. Mngr.....
Asst. Sec.....	Ch. Eng. A/D.....
Ch. Acct.	Pers. Supt.....
11 DEC 1961	
.....	Supply Sales.....
Stores.....	
Ansd.....	Init.....

ACTION COPY SENT TO ENGINE SUPT

MISSION AUSTRALIENNE  
S.N.E.C.M.A.  
70, bld Kellermann

PARIS 13e  
France

COMMONWEALTH AIRCRAFT CORPORATION PTY.LTD.  
BOX 779 H P.O.  
Elizabeth Street

MELBOURNE  
Australia

CIRCULATION / COPIES <i>14/2167</i>	
E.F. MNGR ✓	FCT. ADM. SUPT.
DSGN. ENGR ✓	MC. SHOP. SUPT.
DEV. ENGR ✓	PRODUCN. SUPT.
SERV. ENGR	ASSM. Y. SUPT.
QUAL. ENGR	FOUNDRY. SUPT.
PROD. ENGR	METCAL. SUPT.
MATL. ENGR	PROCESS SUPT.
CH. TL. DSGR	TOOL. PROD. SUPT.
CH. INSP. E. F.	TOOL. ROOM. SUPT.
A/F MANAGER	SUPT. INSPECTION

Attention : the MANAGER

Subject : Test cell calibration and engine accessories.

Dear Sir,

Attached herewith is a copy of the minutes of a meeting held between Mr. MELBOURNE and members of the SNECMA Direction du Contrôle at Villaroché.

The following is the status of the principal points raised :

- (a) Test cell calibration. Further discussions will be necessary in Australia.
- (b) The spare accessories required have been communicated to the RAAF as per letter P 197 and the quantities are more generous than those proposed by SNECMA Contrôle. The SNECMA recommendation is based on idealistic conditions which are hardly likely to be achieved in the early stages of the project.
- (c) The recommended list of rigs for C.A.C. has already been forwarded under cover of letter P 214 and includes the rigs listed by SNECMA Contrôle.

Yours faithfully,

*G.H. Foster*

G.H. FOSTER

WJM/SG

*[Handwritten signature]*

Le 2 Décembre 1961

CD n° 52.565

RB/PP

-:-

CD to Australian Mission  
-----

PURPOSE : Questionnaire about :

- 1°/ Test cell calibration.-
  - 2°/ Engine accessories.-
- 

You will find hereunder with regard to our report CD n°52.535 the answers to the questionnaire on the above purpose which has been treated at the meeting held at VILLAROCHE on the 8th.11.1961.-

Were present : Mr MELBOURNE (C.A.C. Australia)  
Mr BONNEMAIRE (CW)  
Mr KOU (CWT)  
Mr BENNETT (CDR)

1.- Test cell calibration.-

1.1.- Question.- What kind of special features will be required on "ATAR engine" for the calibration of the C.A.C. test cell ?

Answer .- The engine is "standard" but for the calibration test it has to be fitted.-

a) with a calibrated air-intake duct, provides with a "Prandtl" tube and a thermo-couple.-

.../...

The Prandtl tube is used only for measuring the total pressure by calibration at SNECMA and to compare it with the C.A.C. installation.-

The thermocouple is used to insure that there is no recycling of burnt gas.-

These two instruments are not used during serie testing.-

During serie testing the static pressure of the engine in the air intake duct and also the temperature on the air intake and the ambient temperature are checked. If the difference between these two is not  $\geq 1^{\circ}\text{C}$  the bench air condition is acceptable ; if not it is necessary to search a third point which is consider as ambient temperature reference point.-

The thermo-couples are preferred to resistance measurement systems.-

b) For calibration, it is recommended to check temperature T2 at several points about the engine (after compressor), because temperature have to be compare with the temperature during the test at SNECMA.-

c) With fixed nozzles of about :

- 2400 - 3200 - 3500 - 3800 cm2 of section.-

These nozzles are used only for the calibration and are SNECMA supply.-

d) With nozzle position indicator.-

The using of this indicator is recommended (flying test model could probably supply).-

1.2.- Question.- Merits of a deep test engine ?

Answer .- The deep test is only recommended.-

The test process can be :

- Test 1 with engine own jet pipe.-

- Visit.-

- Calibration test (see § 1.5).-

It is suggested to fit two engines for the first calibration.-

.../...

1.3.- Question.- Necessity to have a jet pipe with a fixed nozzle ?

Answer .- The use of fixed nozzles is recommended for normal (dry) and post-combustion (P.C.) running by reason of :

- Elimination of the influence of the regulation of temperature.-
- Permit to compare performances with standard values.-

1.4.- Question.- Is calibration possible using the standard variable nozzle ?

Answer .- During calibration a performance curve is necessary to be done with serie variable nozzle, but as it is not sufficient it is necessary to use fixed nozzles.-

1.5.- Question.- Extent of test running normally done by SNECMA during a test cell calibration?

Answer .- The calibration test process pursuant to :

- a) Checking of bench instruments and producing of correction curves. Tightness of installation is tested.-
- b) Preliminary test of the engine according to SNECMA specification (DT 61-11). It is more advisable if the engine have done that test before on a reference bench.-
- c) Performances curves (dry running) are done with a fixed nozzle about 2400 cm<sup>2</sup> section for :

$$N\sqrt{T} = 425 - 450 - 475 - 485 - 495 - 505 - 515 \\ 510 - 500 - 490 - 480 - 460.-$$

(T4 and N maxi - safety running speed - are respected ; see specification DT 61-11, § 3.5).-

- d) Performances curves (post-combustion running are done with fixed nozzles section about :

$$3200 - 3500 - 3800\text{cm}^2 \text{ for } N\sqrt{T} = 495.-$$

N = effective speed has to be adjusted in case of variation with the air intake temperature T1.-

- e) Five thrust points with regular interval of time will be recorded between the ignition post-combustion load and the T4 maximum equivalent lead.-

.../...

## f) Regulation curve with serie variable nozzle :

- Setting maxima without after burning.-
- Setting maxima with after burning.-

(Both according to SNECMA specification DT 61-11 - 61-12).-

Perform the following running points :

- Maxi after burning (P.C.)
- F-TOT-INA 5700 and 5300
- Slow run after burning (P.C.)

} P.C.

- Maxi without P.C.
- Intermediate
- Continu maxi
- Cruise

- Speed : RPM = 6000
- Slow speed I

## g) Bench vibrations testing :

Vibrations are recorded on the reference point during :

- A slow acceleration from slow speed to maximum speed (without P.C.).-
- At maximum speed (without P.C.) after 3 minutes stabilisation.-
- Eventually on resonance speed after three minutes stabilisation.-

This test will be carry out :

- On the normal engine standard.-
- After adjonction on the turbine wheel of a balance determine at SNECMA during performance testing.-

This process is the minimum requirement ; additional testing may be required in consideration of C.A.C. installation.-

1.6.- Question.- Procedure normally adopted by SNECMA during a test cell calibration ?

Answer .- Remarks and measures must be done only after 5 minutes stabilisation on the running point to check.-

Each performance curve, after a new start will be produced only after 15 minutes, at a maximum continuous speed, to set the temperature of the whole assembling.-

Results are checked immediatly in case of errors which may necessity of rechecking.-

.../...

Calibration test on reference bench ends with the regulation curve, then the engine is run on the bench to be calibrated and the test begins with this regulation curve.-

1.7.- Question.- The extent of engine adjustment which can be made without affecting the test cell calibration ?

Answer .- Minors adjustments are allowed (starting, oil circuit), but generally the only engine work permitted before the regulation curve is disassembling of the canal and the fixed nozzle.-

During curves with fixed nozzles readjustment are only allowed on fuel control unit (if necessary remove of fuel control unit is authorised but not recommended).-

Calibration tests must be homogeneous between SNECMA and C.A.C. and for this reason are made with all orifices sealed and drives kept free of load.-

1.8.- Question.- Hysteresis obtained during thrust calibration ?

Answer .- During calibration testing with SNECMA, thrust device, thrust hysteresis is 20 kg maximum with verification scale, (manometer + hydraulic jack + bench).-

1.9.- Question.- The extent of thrust variation between periods of calibration ?

Answer .- Thrust variation between calibration test can be about  $\pm 10$ kg with regard to the previous static calibration curve.-

Calibration is done each two months. The temperature of the whole part is an important factor.-

The test standard can vary in course of time  $\leq 5$  kg or for 5 T. for 6 months.-

The coefficient of the bench can vary from 1.01 to 1.02 for the same bench between several calibration with engine.-

The difference between SNECMA and customer benches sets the value of the correction (coefficient). This is expressed in percentage of the indicated value.-

1.10.- Question.- The extent of thrust variation from the calibration standard during static check ?

Answer .- See enclosed curve.-

1.11.- Question.- The extent of any variations between static calibration and dynamic operation of engine?

Answer .- The extent admitted is :  $\pm 10$  kg.-

The C.A.C. equipment :

- Statimeter (hydraulic capsule type)
- Baldwin load cells (electronic type)

is suitable.-

1.12.- Question.- Probable limits of accuracy of engine thrust as obtained from engine performance runs.-

Answer .- Causes of error can be the same as for the above points with in addition the influence of vibrations, but these have been tested and proved that they have no effect upon the precision of measures.-

Consequently the admitted precision is  $\pm 20$  kg or  $3/1000$  of measured thrust .-

1.13.- Question.- Recommended method of thermo-couple calibration to obtain laboratory standard?

Answer .- The actual process by SNECMA during thermo-couple manufacture is :

a) Check of each components by heating in water or melting metals bath. In that condition, the solidification point is plot :

- Boiling water :  $100^{\circ}\text{C}$ .-
- Zinc solidification point :  $418^{\circ}\text{C}$ .-
- Antimony solidification point :  $629^{\circ}\text{C}$ .-

b) Check the coil on several places :

- Temperature extent :  $\leq 2^{\circ}\text{C}$ .-

c) On thermo-couple fitted in sheath, the checking is comparative to a standard thermocouple, both heated at same temperature :

- Margin of temperature in these conditions :  
 $\pm 4^{\circ}\text{C}$  for  $600^{\circ}\text{C}$ .-

- Method enclosed in Inspection Document MCR-39-W.-

It is suggested that C.A.C. furnace and standard thermo-couple will be both compared in SNECMA laboratory.-

.../...

2.- Engine "accessories".-

2.1.- Question.- Determination of spare accessories to be held for replacement purpose ?

Answer .- A large supply of accessories is not necessary if :

- Adequate rigs are available
- Trained personnel are available
- Sufficient replacement parts are available

If all of these conditions are fulfilled one set of accessories should be sufficient.-

{ 2.2.- Question.- To enable priorities to determine construction of rigs in connexion with problems encountered during trouble shooting on accessories requiring adjustment or alteration .-

Answer .- Hereunder a statistic point out the removing of accessories during 100 ATAR B2.B3 serie testing runs.-

- A - 17 fuel control unit (principal) readjustement
- B - 14 after-burning control unit (P.C.) readjustement
- C - 20 high pressure oil pump - adjustment-sealness
- D - 12 Stop corrector - readjustement
- E - 18 speed detector (control unit) adjustment
- F - 3 speed detector (starting system) adjustment
- G - 3 Miscellaneous electrical valves - functioning

On these basis, it should be recommended to provide :

- 1 rig fit for A and B
- 1 rig fit for C
- 1 rig fit for D - E - F
- 1 fuel circuit rig fit for miscellaneous testing include G.-

.../...

2.4.- Question.- The extent to which accessories may be adjusted during engine operation on test bench ?

Answer .- The adjustment only authorized on engine during testing on the bench are :

- Air pressure reducer (dry engine) on fuel control unit.-
- Air pressure reducer (after-burning) on after-burning control unit.-
- Gradient adjusting on P2 reducer on fuel control unit.-
- Adjusting slow speed (dry engine) on fuel control unit.-

STATISTICS :

- For 1 engine with 2 tests the average of test is : 2,53 for 2 theoretically.-
- For 1 engine with 1 test the average of test is : 1,18 for 1 theoretically.-

(Visits, deep tests not included).-

*J. Laverne*  
J. LAVERNE.-

Enclosure : 1 curve (§ 1.10.).-

COPIES : KL  
CW  
CD  
CDR