METEOROLOGICAL OFFICE

INVESTIGATIONS DIVISION TECHNICAL NOTE NO 5

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Meteorological Conditions on Concorde 001 Flights 105 and 121

1. In IDTN No 2 para 7 attention was drawn to difference in type between the ambient temperature graphs for 001 flights 105 and 121 and 002 flights 114 and 115. The British graphs had been obtained from a "quick-look" computer programme giving temperatures in steps of 0.6°C, and showed no striking temperature ramps. The French graphs had been obtained from a computer programme which produced fine scale oscillations in temperature and also some steep temperature gradients. Both pairs of flights had been over Bay of Biscay, but on different dates. Data for 001 flights 105 and 121 were therefore processed at Toulouse by a "quick-look" programme and the results are directly comparable with those given in Note de Depouillement Perf No 38.

2. For flight 105 the period 1623 to 1638 is shown in Fig 1(Perf 38) and Figs 2.1 and 2.2 (quick look). For flight 121 the period 1535 to 1545 is shown in Fig 3 (Perf 38) and Figs 4.1 to 4.5 (quick look). There are numerous differences in detail between the two sets of curves. Some of the more interesting are noted below.

3. Flight 105

a. Pressure Altitude - Z There is fairly good agreement except at about 1626 30s and 1628 to 1628 30s and 1636 to 1636 30s where Fig 1 shows constant height whereas Fig 2.1 does not. The sudden drop in Fig 1 at 1636 48s is absent on Fig 2.1 (but there are much bigger peaks in CAS and Mach on 2.1 at this time than on the corresponding curves in Fig 1. Also Ta on Fig 2.1 falls although total temperature on Fig 2.2 rises.

b. CAS - Vp The large peak on Fig 2.1 at 1629 is entirely absent on Fig 1, and other peaks on 2.1 are much smaller on Fig 1.

c. Static Pressure At about 1626 45s, 1628 and 1635 27s, when the fine scale of static pressure passed through 110 mb, erroneous readings were output and have not been plotted on Fig 2.1. At exactly these times Fig 1 Vp shows jumps which are not likely to be real. However, just before 1635 this feature is absent on Fig 1.

d. Mach Fig 2.1 has higher mach values throughout than Fig 1, the maximum difference being 0.05. The broad peak between 1626 and 1629 on Fig 2.1 is entirely absent on Fig 1.

e. Ambient Temperature Temperatures in Fig 2.1 are about 4°C colder than in Fig 1. The curves are very different between 1626 and 1629; Fig 1 has a maximum at 1626 37s and Fig 2.1 one at 1628 45s (see comment on Mach for this period). The trough on Fig 1 between 1635 and 1636 30s is smoothed out on Fig 2.1. The Kick at 1635 27s on Fig 1 is absent on Fig 2.1 (see comment in para c. above), but both curves have what is probably a genuine temperature Kick 1635 35s.

f. Total Temperature The Ta curve in Fig 1 follows the total temperature curve in Fig 2.2 much more closely than does the Ta curve in Fig 2.1, thus casting doubt on the latter. The peak in Ta at 1629 30s on Fig 1 does not however show on Tt in Fig 2.

4. Flight 121

a. Pressure Altitude Z onFig 3 agrees well with the ADC pressure altitude on Fig 4.1, but the nose probe pressure altitude is mostly about 1000 ft lower. Note the gaps in the traces at 50,000 ft, where rubbish has been output.

b. CAS, IAS - V propre There are considerable differences in the shapes of these curves, especially after 1540 30s when Vp on Fig 3 rises sharply while CAS on Fig 4.2 falls. There are sections of unreliable record in IAS at 500 kt due to irregularities when the fine scale reading changes. These occur at 1535, 1535 23s, 1541 20-34s, and 1544 32s, and at 1540 52-57s, 1543 01-07s and 1543 20-28s. At the first four of these times Kicks (probably unreal) occur in Vp M and Ta on Fig 3. At the other three times these curves appear to have been completed by straight line segments. Oscillation between 1542 40s and 55s in IAS on Fig 4.2 and associated changes in Vp M and Ta on Fig 3 may be real, or they may be associated with irregularities at changeover of fine scale of nose probe pressure altitude.

c. Mach The scale on Fig 4.3 is twice that on Fig 3. The most obvious difference between the two curves occurs between 1535 55s and 1536 40s unless, as is probably the case, the M and Ta curves on Fig 3 have been wrongly labelled in this area. Most of the Fig 3 oscillations mentioned in the previous paragraph are missing or are much reduced in Fig 4.3.

d. Ambient Temperature The temperatures on Fig 4.4 are about 2°C colder than those on Fig 3; otherwise there is a good deal of similarity between the two curves. The spurious oscillations mentioned in para 4b above are missing on Fig 4.4.

e. Total Temperature On this occasion there were considerable variations in Mach number and the curve for Tt on Fig 4.5 reflects these. The similarity between the Ta and Tt curves is therefore not great.

5. Conclusions This comparison of two different methods of computing ambient temperature and other parameters makes it clear that a good deal of uncertainty still exists as to what the true values of the parameters are and how they should be calculated. It would appear that further work by the aircraft companies is needed to resolve these difficulties.

6. Although the total temperature values have a step size of 0.5°C, the ambient temperatures shown on Figs 1 and 3 show small scale fluctuations of a few tenths of one degree C (presumably because some form of smoothing has been used in the computations). Even though it may be convenient to continue to present Ta in this form, it must be remembered that the readings are insufficiently accurate for us to deduce anything about the atmosphere on a finer scale than 0.5°C. If greater accuracy is required we must ensure (a) that the instruments have the required accuracy and (b) that the readings are stored with sufficient bits to retain this accuracy.

7. One of the main reasons for requiring accurate ambient temperature readings is to enable us to ascertain the frequency with which temperature ramps of various magnitudes occur in the atmosphere. Most of the steepest temperature ramps shown on Figures 1 and 3 appear to have been generated by roughness in the basic parameters at change over points on the fine scales. It is important that these spurious temperature ramps be removed so that due weight can be given to the true ramps which remain.

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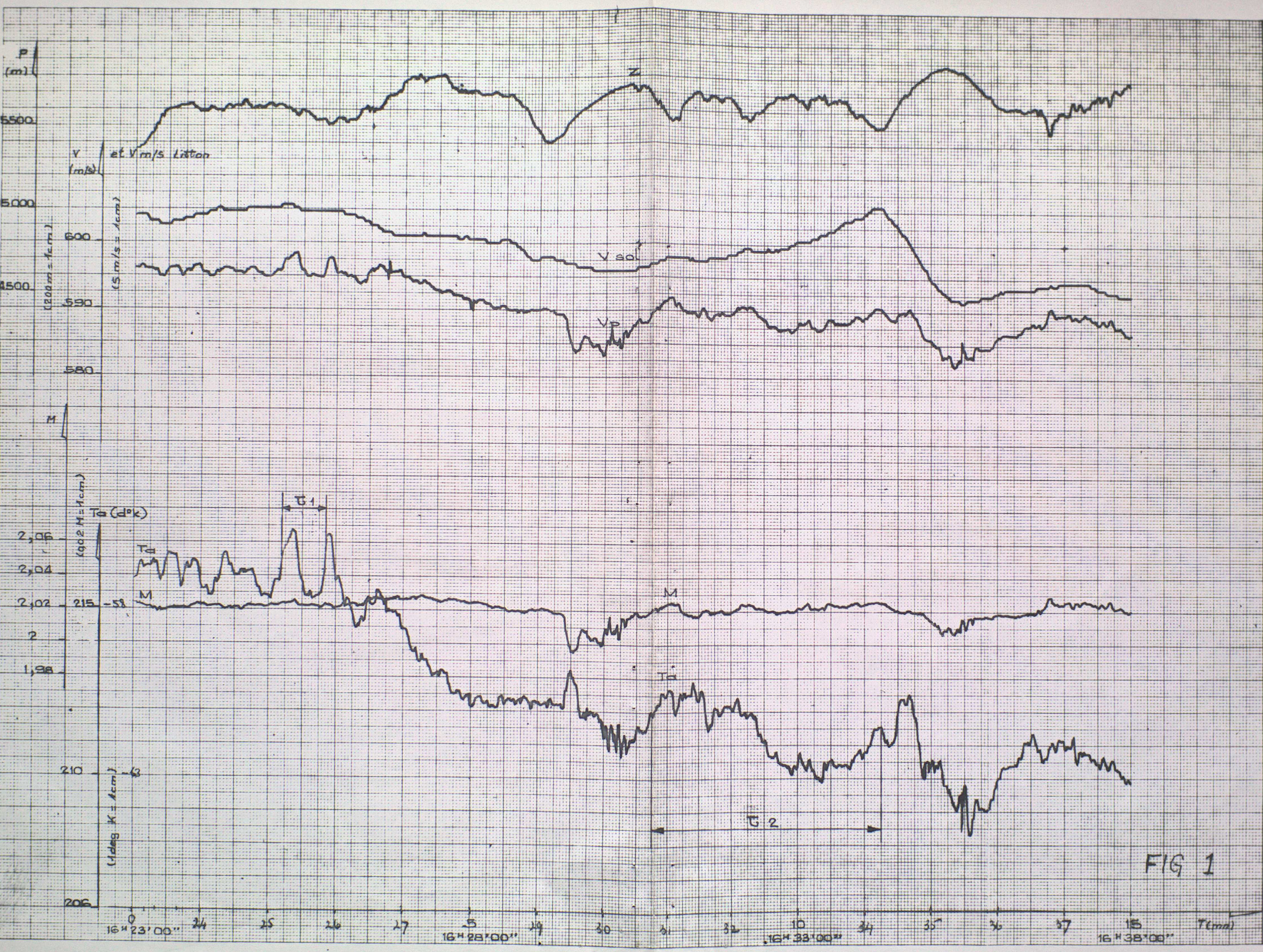


FIG 1

AEROSPATIALE
ESSAIS EN VOL

PLANCHE N° 7

AVION TSS 001

DESIGNATION : Vol n° 105
(16H23' à 16H38')

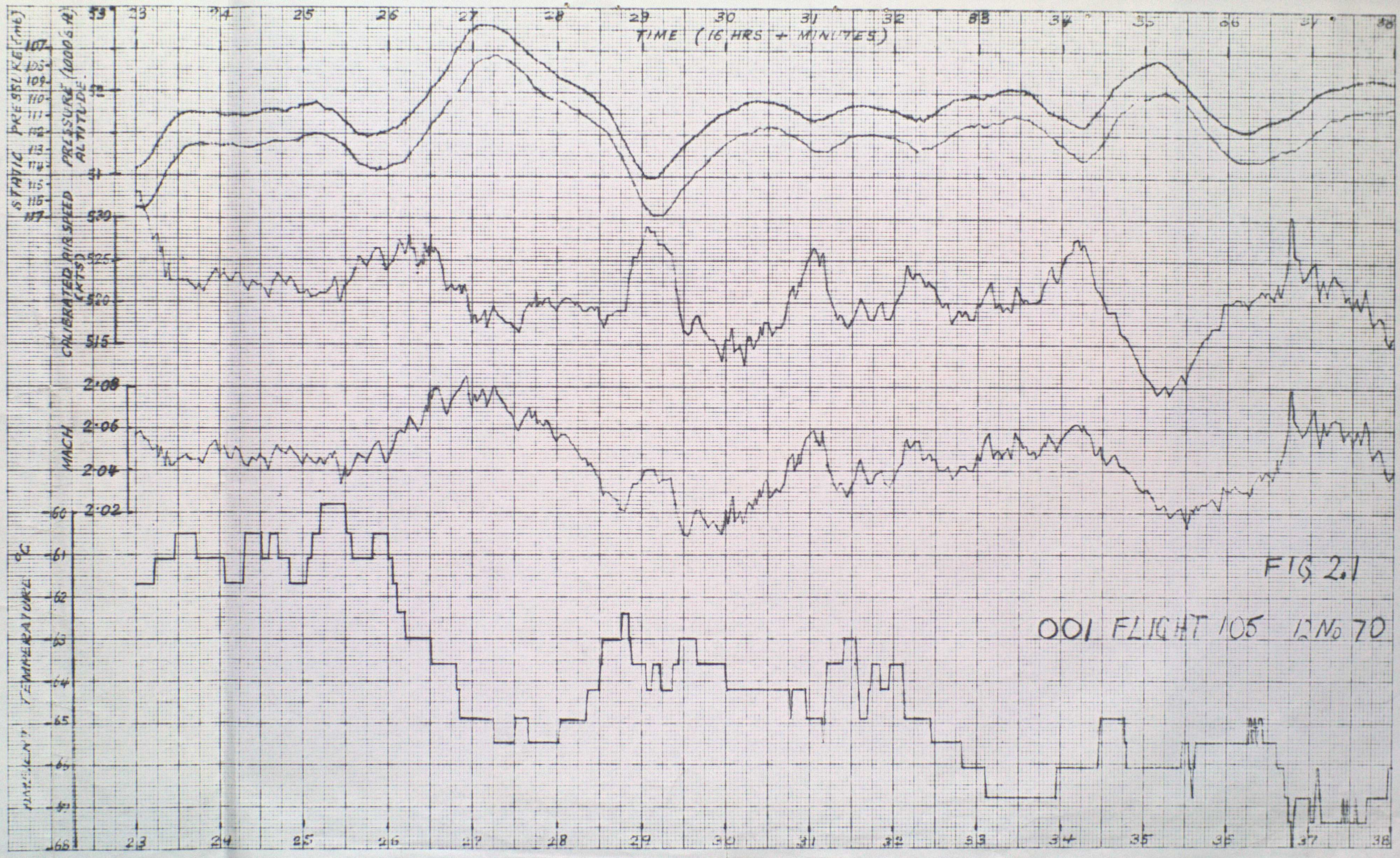
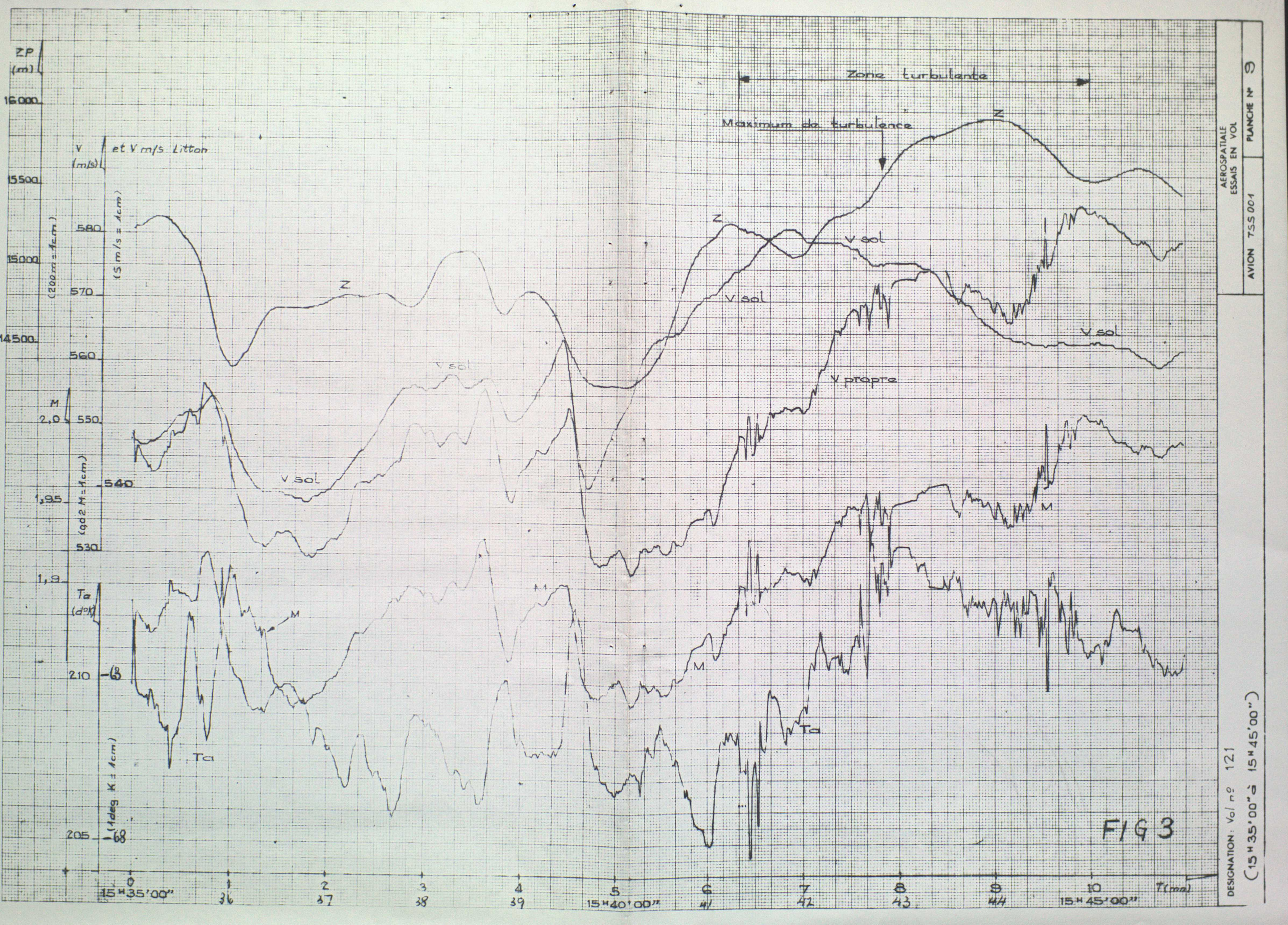


FIG 2.1

001 FLIGHT 105 12No 70

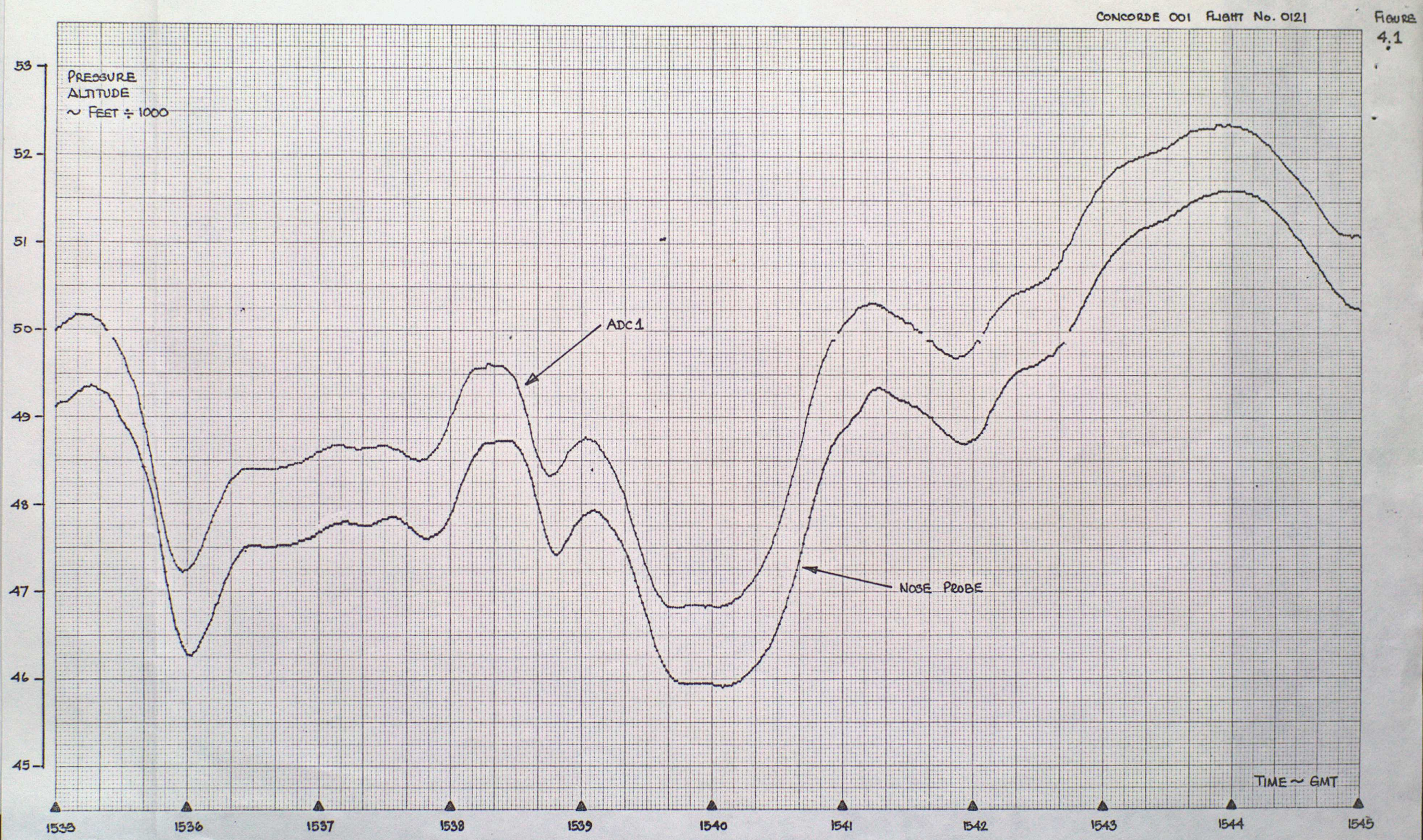
FIG 2.2

001 FLIGHT 105 12 No 70

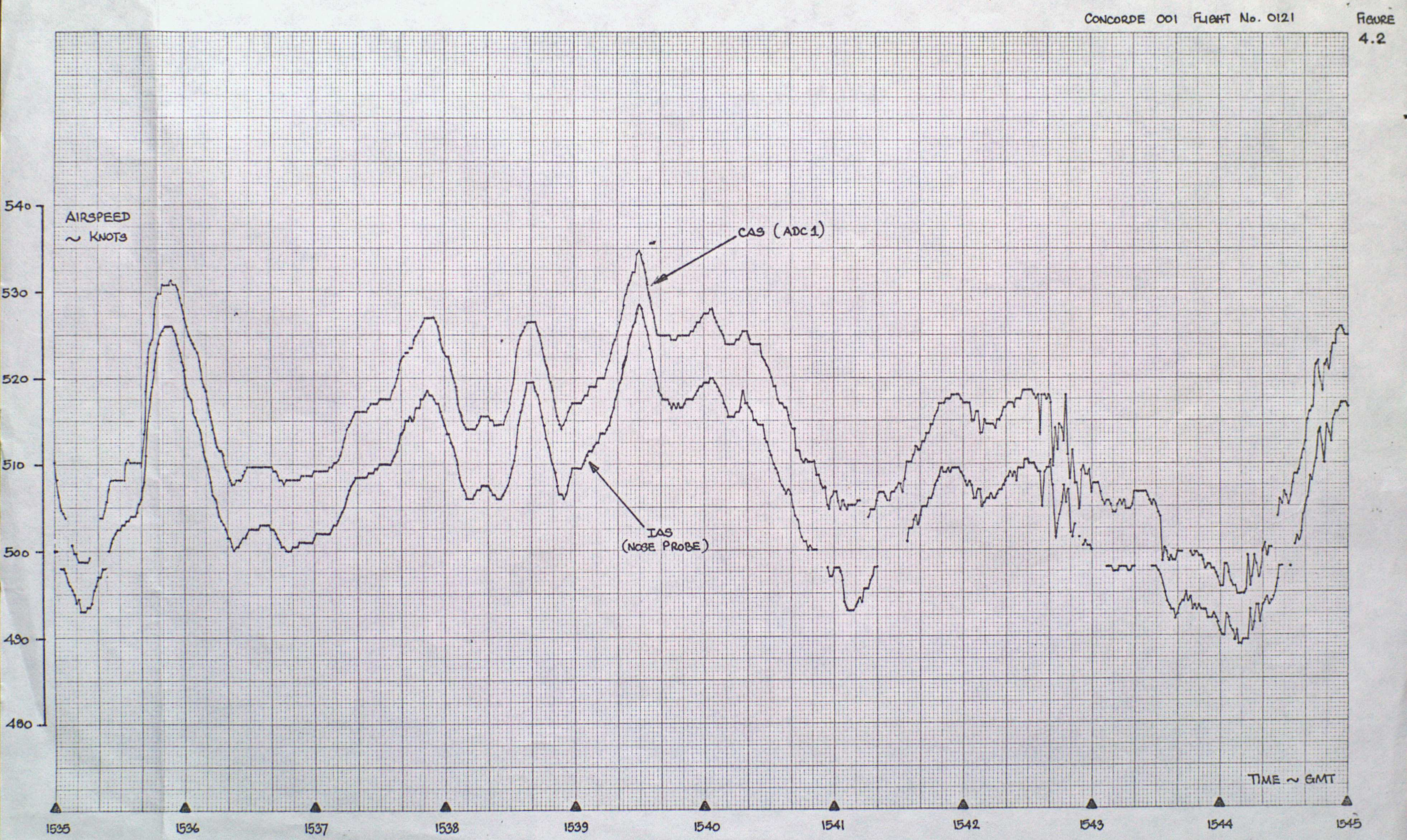


ZP (m)
16000
15500
15000
14500
V (m/s) et V m/s Litton
(200 m = 1 cm)
(5 m/s = 1 cm)
580
570
560
550
540
530
M
2,0
1,95
1,9
(0,02 M = 1 cm)
Ta (d°K)
210
205
(1deg K = 1cm)
Zone turbulente
Maximum de turbulence
Z
V sol
V propre
M
Ta
0
1
2
3
4
5
6
7
8
9
10
T(mn)
15h35'00"
36
37
38
39
15h40'00"
41
42
43
44
15h45'00"
AEROSPATIALE ESSAIS EN VOL
PLANCHE N° 9
AVION TSS 001
DESIGNATION: Vol n° 121
(15h35'00" à 15h45'00")

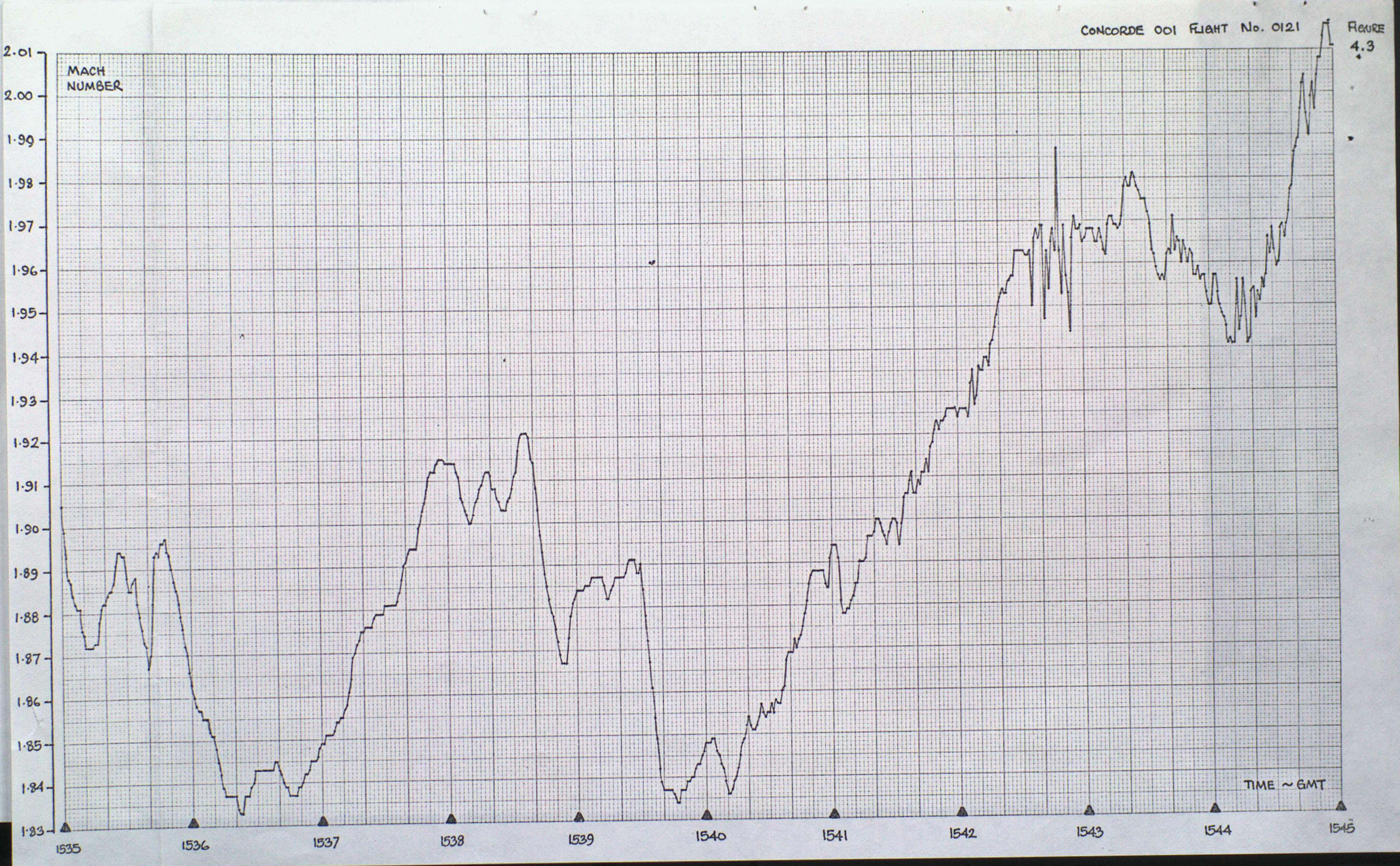
FIG 3



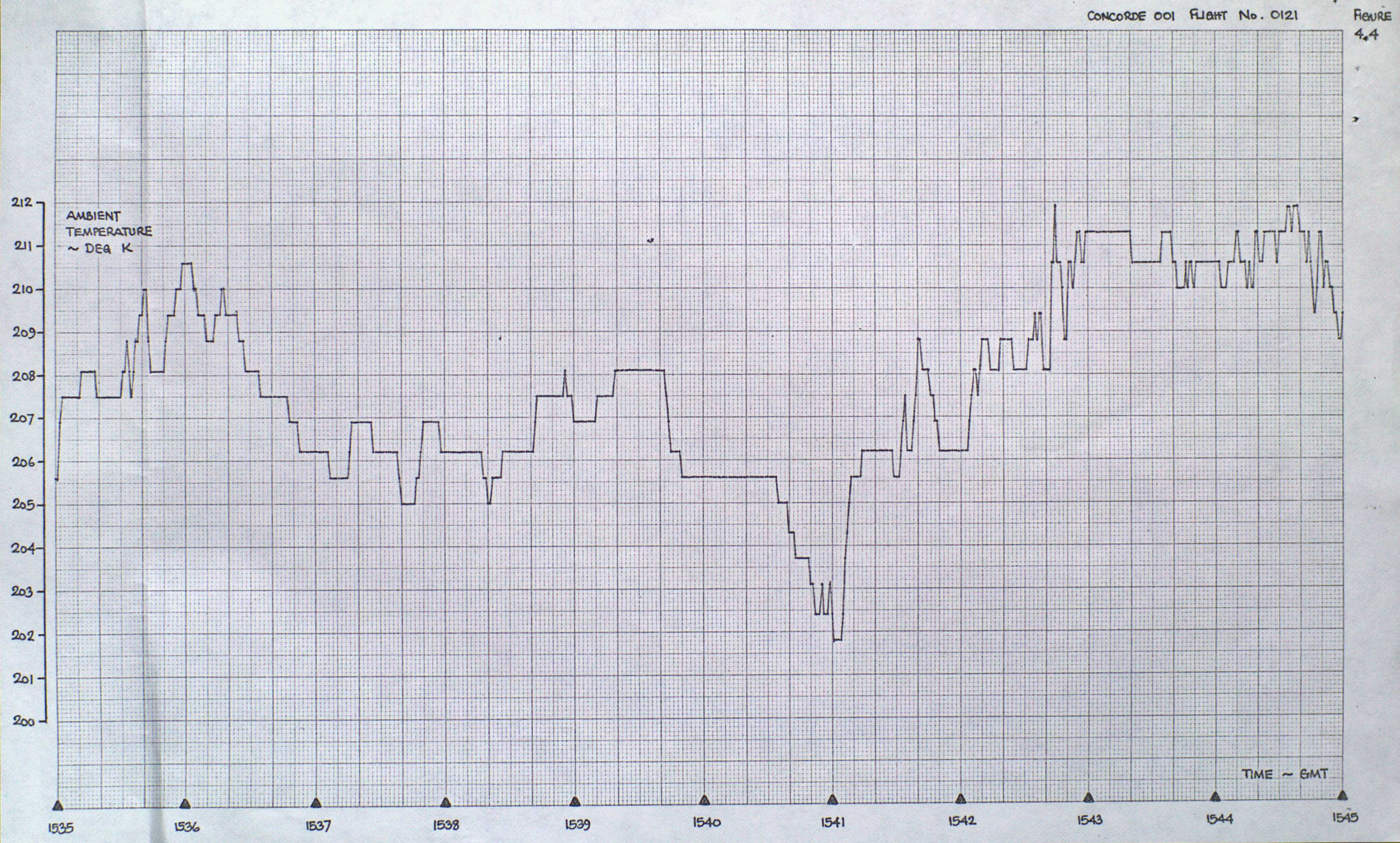
CONCORDE 001 FLIGHT No. 0121
FIGURE 4.1
PRESSURE ALTITUDE ~ FEET ÷ 1000
53
52
51
50
49
48
47
46
45
ADC 1
NOSE PROBE
TIME ~ GMT
1535
1536
1537
1538
1539
1540
1541
1542
1543
1544
1545

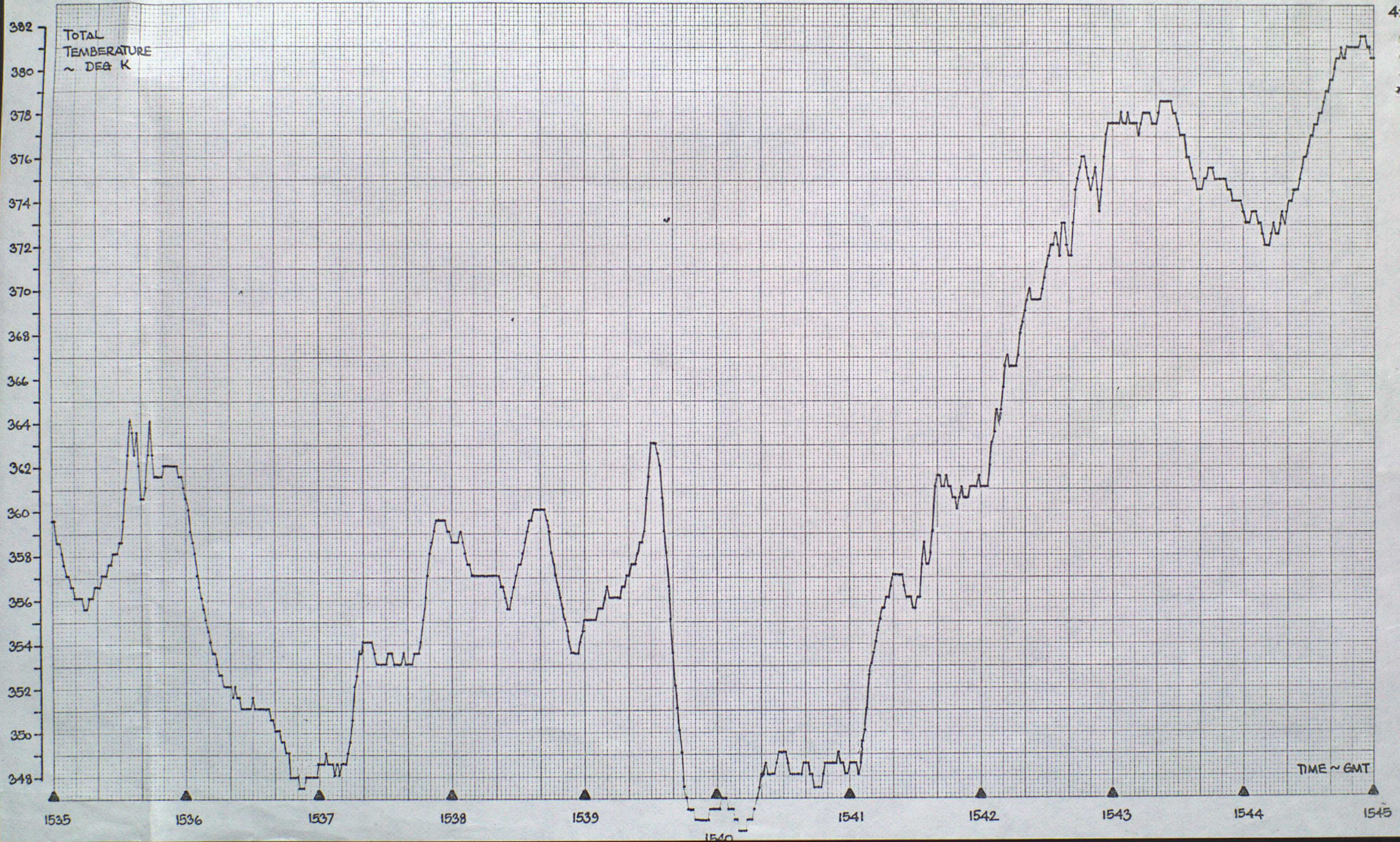


CONCORDE 001 FLIGHT No. 0121
FIGURE 4.2
AIRSPEED ~ KNOTS
540
530
520
510
500
490
480
CAS (ADC 1)
IAS (NOSE PROBE)
TIME ~ GMT
1535
1536
1537
1538
1539
1540
1541
1542
1543
1544
1545



CONCORDE 001 FLIGHT No. 0121
FIGURE 4.3
MACH NUMBER
2.01
2.00
1·99
1·98
1·97
1·96
1·95
1·94
1·93
1·92
1·91
1·90
1·89
1·88
1·87
1·86
1·85
1·84
1·83
TIME ~ GMT
1535
1536
1537
1538
1539
1540
1541
1542
1543
1544
1545


CONCORDE 001 FLIGHT No. 0121
FIGURE 4.4
AMBIENT TEMPERATURE ~ DEG K
212
211
210
209
208
207
206
205
204
203
202
201
200
TIME ~ GMT
1535
1536
1537
1538
1539
1540
1541
1542
1543
1544
1545


TOTAL TEMPERATURE ~ DEG K
382
380
378
376
374
372
370
368
366
364
362
360
358
356
354
352
350
348
TIME ~ GMT
1535
1536
1537
1538
1539
1540
1541
1542
1543
1544
1545