Alitalia

Cbm Oriented Engines Fleet Maintenance Plan

Pisa, September 26th, 2000

The current Alitalia Engines Fleet (slides 2-3) is composed by qty 334 Operating Turbofan Engines and it is maturing an average of 519K engine yearly cycles corresponding to a more than 250K Fleet Revenue Flights per year; this mission is supported by a total of 60 spare engines.
The engines are in the thrust rating from 20000 to 60690 Lbs and are of General Electric, Pratt & Whithney and CFMI (G.E. – SNECMA Consortium) manufacture; the oldest entered the fleet in 1978 (CF6-50E2/B747-200), the youngest in 1999 (CFM56-5B4P/A320).

All the engines in the fleet (slide 4) are being managed under Maintenance Programs oriented to CBM Philosophy; these programs are customized by engine/aircraft model and continuously adjusted in looking for the best reliability of the propulsion system and in the respect of the Air Carrier maintenance cost saving criteria. The Engineering Department of Alitalia takes the responsibility of such a continuos activity.

The Engine Maintenance Program includes time based and upon-condition detail tasks to perform; these are generally inspections, checks, tests and are mostly performed by NDT practices; some external engine components are also soft time based replaced for bench test and then repaired or overhauled if-when necessary. The Life Limited Rotating Parts and Airworthiness Directives are those imposing Hard Time Limits requiring scheduled removals of engines; on spot special hard time maintenance tasks could also be part of the Maintenance Plan like in the case of OEM recommended Campaign Change or Special Inspection Program; in these cases, the application of the maintenance special task will be upon the modification standard of the individual engine in the fleet.

As part of the Engine on-condition Maintenance Program (slide 5), Alitalia Engineering implemented and is still using ECM and SAGE diagnostic tools; these are on wing engine monitoring devices developed by PWA and G.E./SNECMA, respectively, and offered to customers as additional engine equipment. The main advantage from operating both the ECM and SAGE in preventing engine malfunctions and premature failures could be directly measured in the reduced aircraft delays and cancellations as well as in the reduced engine maintenance material cost. Performances of these computer diagnostic tools are of similar capability; the most recent G.E. Release of SAGE is here presented in more details.

The SAGE program (slides 6-7-8) is performed by means of data retrieval from magneto-optical supports (OQAR) and, as an additional method, by crew instrumental manual readings (IRD); however, the IRD is for cruise data recording only.
At each aircraft transit to main-bases, OQAR supports are removed and sent to AZ Computer Center at FCO; the main frame computer recognizes the logical flight criteria needed to extract take-off and stable cruise data; the cruise and takeoff data are then downloaded directly into PC/Workstation for SAGE computing; the SAGE outputs are analyzed by engineer on daily basis.

The SAGE measures the main engine parameters deviations versus expected trend and gas generator lines; these deviations are computed at takeoff and cruise phases of each flight during which also the vibration levels of both low and high pressure rotor groups are recorded and in trend plotting presented; at takeoff, the SAGE computes the individual engine Exhaust Gas Temperature

(EGT) and provides the relevant Margin to Takeoff E.G.T. Red Line (e.g. 960 °C for CF6 Engines); the Outside Air Temperature Limit (OATL) at which the engine is able to perform a full power takeoff by not exceeding the EGT Red Line is also computed by the SAGE.

The Cruise Trend Report (CTR) shows (slide 9) how much the EGT, F/F and N2 (high press spool expressed as percentage of RPM) deviate from the gas generator line and from the initialized reference value; it also reports the fan vibration level "V" and the core vibration level "R", as well as the lubricating oil Pressure PRS (psi) and Temperature TMP (°C). The data are presented in both Raw and Smoothed Mode for better evaluating the actual single flight data and the relevant deviation from the previous trend; all the data are bias N1.

The Takeoff Trend Report (TTR) shows (slide 10-11) both the Raw and Smoothed single takeoff EGT Margin and relevant OATL; the actual N1K and the percentage of Thrust Derating (FNDR) and N1 Derating (N1DR) are also reported per each takeoff.

Both CTR and TTR are provided with an Alerting Device; it counts how many parameter exceeded the reference value (alerting windows) during cruise or takeoff; details on such occurences can be analyzed into SAGE data base; the alerting windows can be customized by the operator.

The tight relationship (slide 12) between the Takeoff EGT Margin (EGTM), OATL and Engine Time Since Installation (TSI) allows the engineer to predict the potential residual life of the individual engine in the fleet; the residual on wing engine life is computed by limiting the OATL at the corner point value (e.g. 30 °C for CF6-50E2,-80C2) corresponding to a "Zero EGTM Engine".

When applied on the entire engine fleet (slide 13-14), the Time to Zero EGTM computation allows to build up the figure on the potential short-long term removals forecast allowing a better plan of the shop activity and avoiding unacceptable engine removals concentration.

An additional way to monitor the engine vibration levels (slide 15-16) is provided by SAGE with the Last Fifty Takeoff Data Report. This report, the Fan Vib and the Core Vib are being presented for analysis on both raw and smoothed trend plotting.
The Vib Data of both Cruise and Takeoff Reports are being stored in a dedicated Data Base for any further technical analysis; a long term Vib Trend can be of great help to the engineer when it is necessary to verify the effectiveness of a Vib trouble shooting corrective action applied on the engine.

If compared to the past (slide 17-18), the workscope management during an Engine Shop Visit (ESV) today is based more on engineering parameters; the single main engine group (module) workscope can be identified and the best combination of these groups on marshalling can be achieved. The improved modularity design, that the most modern engines provide, allows the implementation of this concept; the availability of more reliable data detailing the status of the engine under shop visit provide a very useful decision tool to define the workscope level to be applied.

FCO, Sep1/00

G. de Filippis A. Tateo

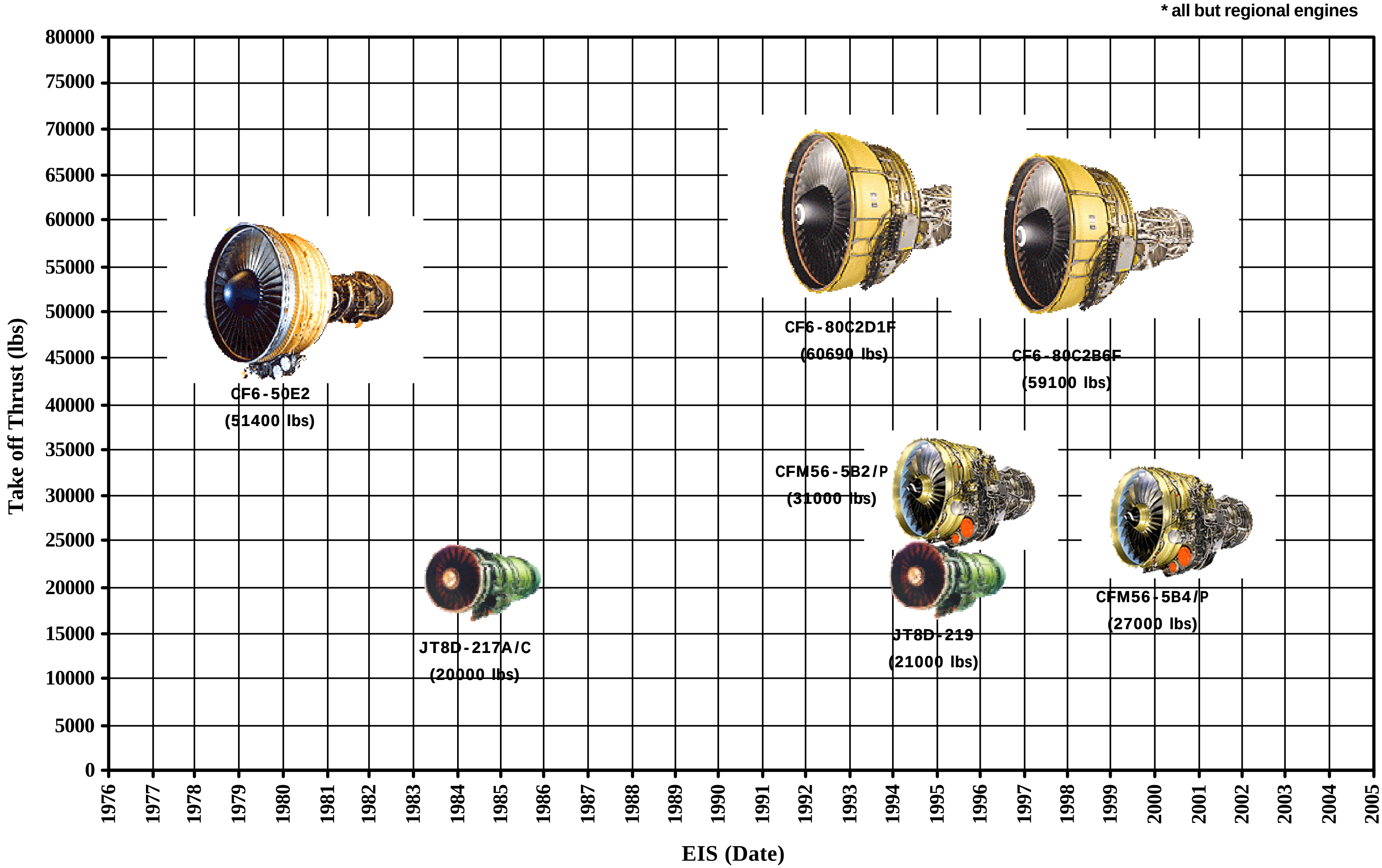
# ENGINES FLEET

# C.B.M. ORIENTED MAINTENANCE PLAN

***Pisa, September 26th, 2000***

**Authors: G. de Filippis A. Tateo**

# Alitalia - Current Engine Families*

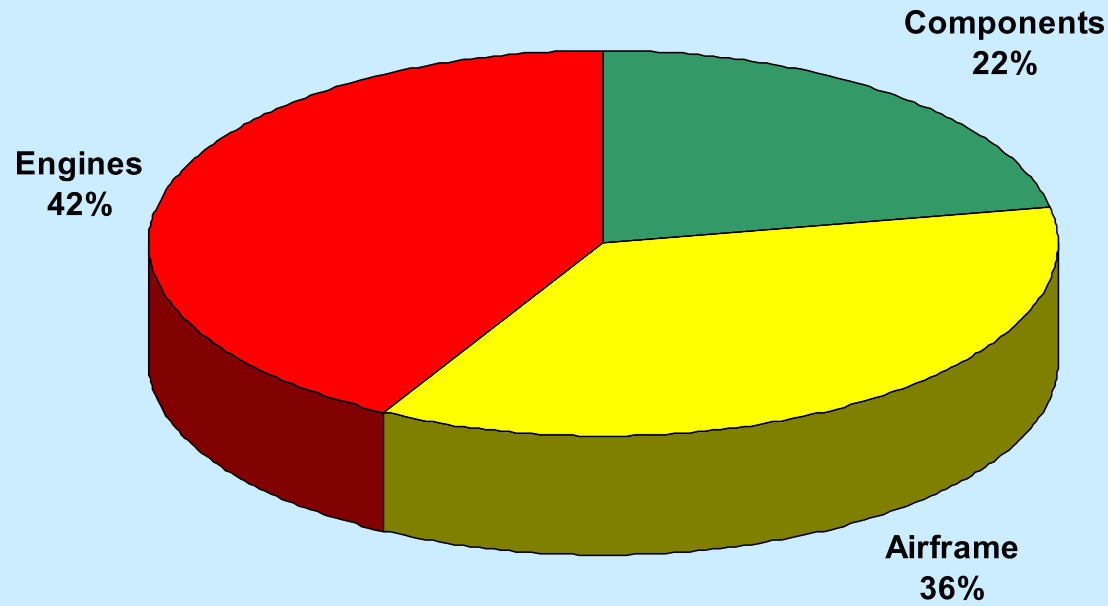


# Alitalia - Current Engines Fleet *

| model | thrust (lbs) | a/c | EIS | Cys x Year = | eng fleet | a/c fleet | f/l |
|---|---|---|---|---|---|---|---|
| JT8D-217A/C | 20000 | MD82 | dec83 | 2026x2x 89= | 360628 | 180314 | 1.0 |
| JT8D-219 | 21000 | MD83 | mar94 | 1079x2x 5= | 10790 | 5395 | 2.3 |
| CFM56-5B2/P | 31000 | A321 | mar94 | 1618x2x23= | 74428 | 37214 | 1.6 |
| CFM56-5B4/P | 27000 | A320 | mar99 | 1900x2x 6= | 22800 | 11400 | 2.0 |
| CF6-50E2 | 51400 | B747 | oct78 | 546x4x10= | 21840 | 5460 | 7.1 |
| CF6-80C2D1F | 60690 | MD11 | dec91 | 540x3x 8= | 12960 | 4320 | 9.0 |
| CF6-80C2B6F | 59100 | B767 | nov96 | 661x2x12= | 15864 | 7932 | 7.2 |

* all but regional fleet

# Aircraft Maintenance Cost - Breakdown (typical)




The Engine Maintenance Cost is the most impacting AMC

**Alitalia**

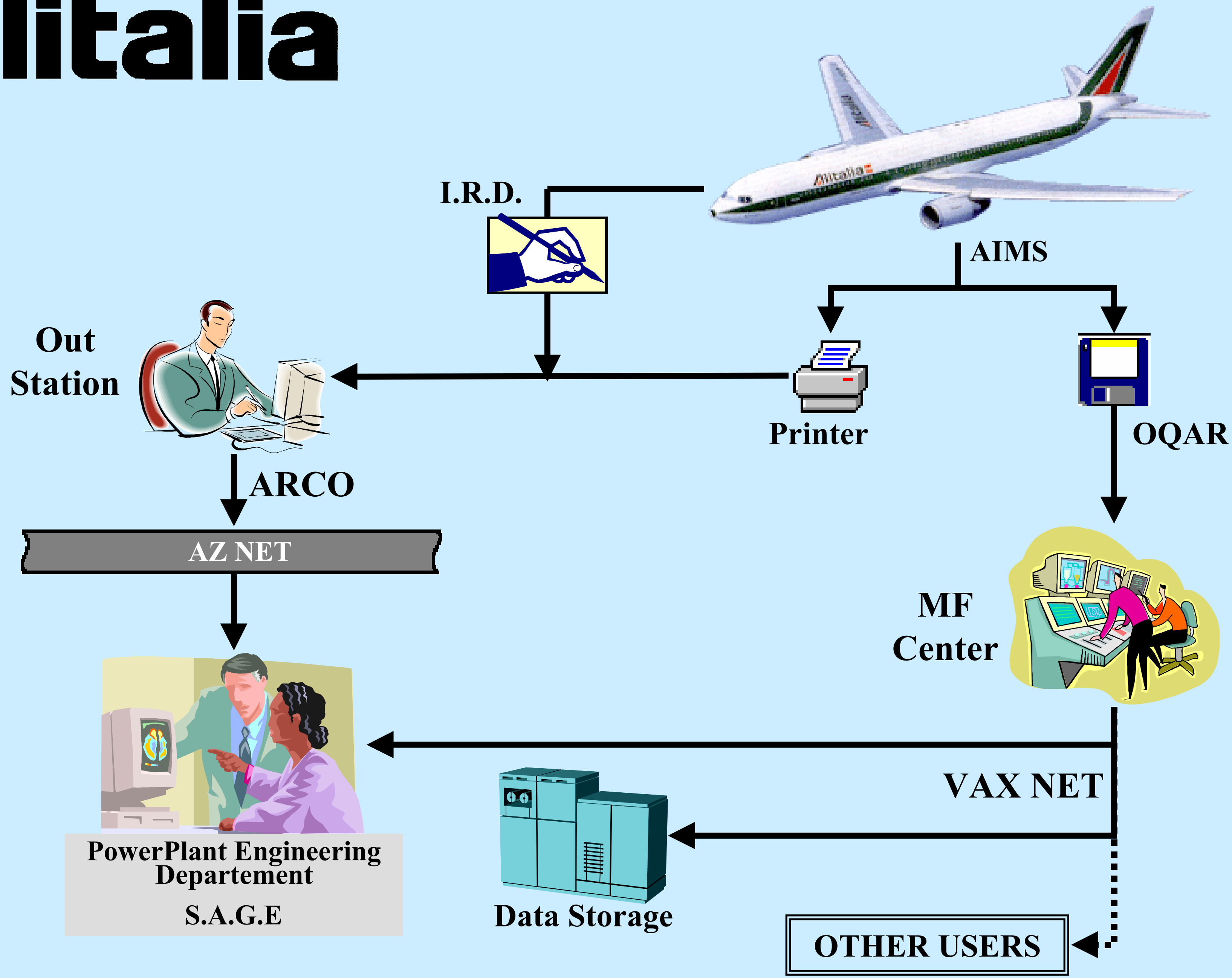
**S**ystem for **A**nalysis of **G**as turbine **E**ngines (SAGE)

The SAGE is the most helpful tool in supporting the "on-condition based maintenance plan" for General Electric & CFMI engines.

The SAGE software is OEM developed and it is offered to operators as an additional engine equipment.

The SAGE provides a method of:

- monitoring the individual on wing eng performance deterioration
- predicting the relevant remaining time to shopvisit
- checking the individual eng rotor unbalance level
- preventing eng in service failure
- saving engine maintenance cost


I.R.D.
AIMS
Out Station
Printer
OQAR
ARCO
AZ NET
MF Center
VAX NET
PowerPlant Engineering Departement
S.A.G.E
Data Storage
OTHER USERS

Alitalia

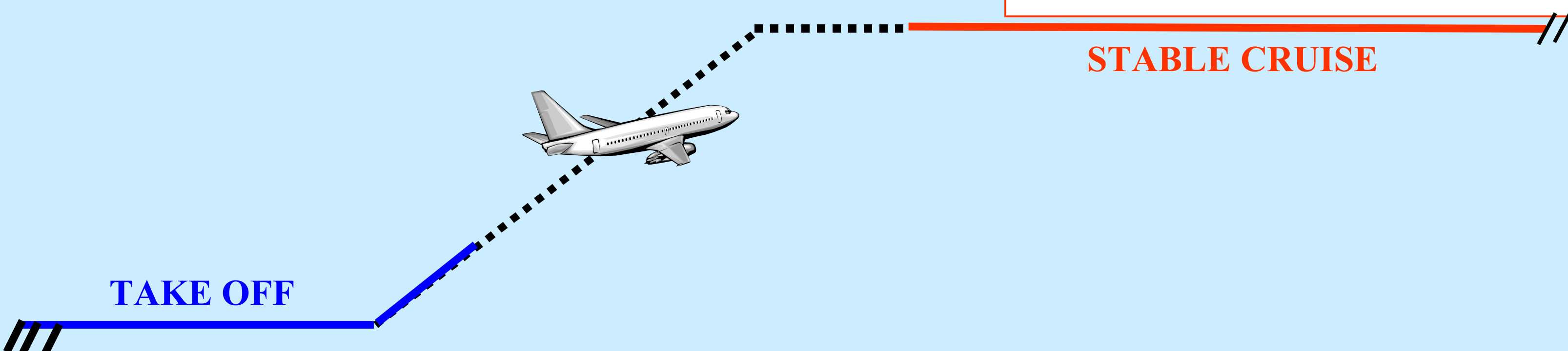
**STABLE CRUISE**

**A.** Verify following conditions for 2 minutes minimum…:

| PARAMETER | Tolerance Range |
|---|---|
| ALT > 25000 Feet | +/- 100 Feet |
| 81.5 < (N2#1 and N2#2) < 98.1 | +/- 1% |
| TAT | +/- 1°C |
| 0.6 < MACH < 0.9 | +/- 0.005 |
| N1 and N2 of engines | +/- 1% |
| ENGAICE1 and ENGAICE2 | = OFF (0) |
| WAICEL and WAICER | = OFF (0) |
| ISOV1 and ISOV2 | = CLOSED (0) |

**B.** …then the following conditions for 60 seconds minimum:

| PARAMETER | Tolerance Range |
|---|---|
| ALT > 25000 Feet | +/- 100 Feet |
| 81.5 < (N2#1 and N2#2) < 98.1 | +/- 0.5% |
| TAT | +/- 0.5øC |
| 0.6 > MACH < 0.9 | +/- 0.004 |
| N1 and N2 of engines | +/- 0.5% |
| ENGAICE1 and ENGAICE2 | = OFF (0) |
| WAICEL and WAICER | = OFF (0) |
| ISOV1 and ISOV2 | = CLOSED (0) |

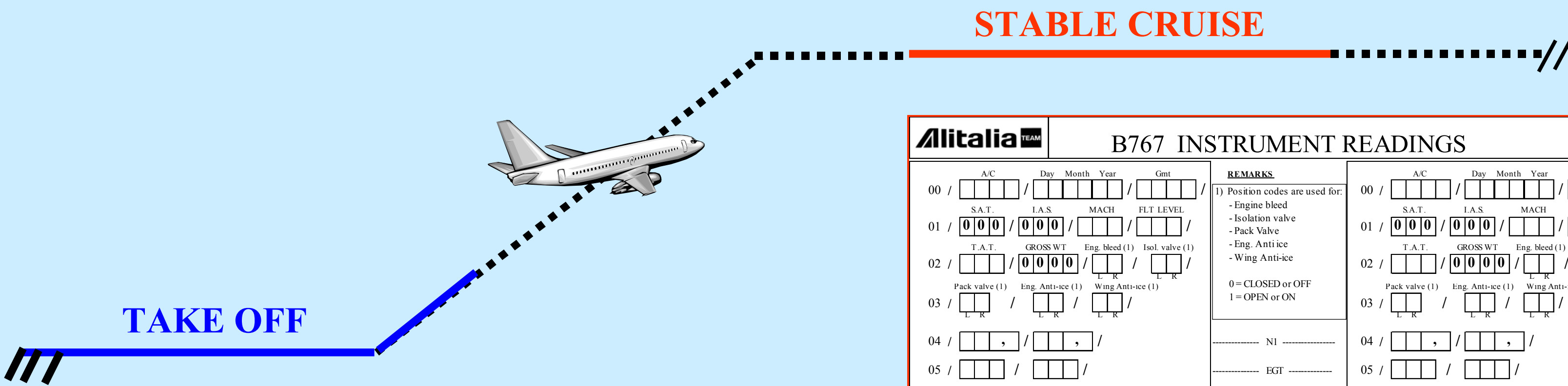


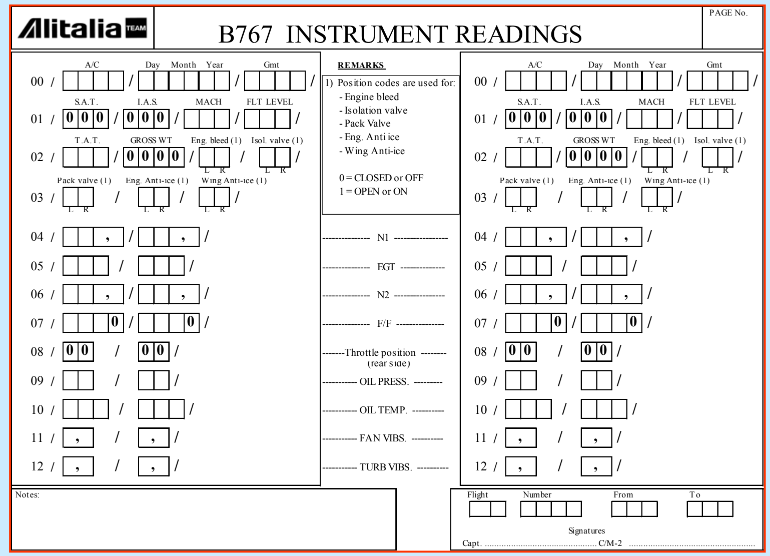

**TAKE OFF DATA**

During the period of 60 seconds following the CAS has reached 100 Kts, identify the highest EGT peak value between engines; all data but logical should be recorded during the period of 2 seconds before-after the EGT Peak ref point; the average 4 seconds data are computed for OAT'L.

**Alitalia**

| STABLE CRUISE REPORT | STABLE CRUISE REPORT |
|---|---|
| 00/ ACID/ DATA/ GMT/ | 00/ B767/ 120497/ 1642/ |
| 01/ SAT/ CAS/ MACH/ ALT/ | 01/ -40/ 283/ 796/ 330/ |
| 02/ TAT/ GROSSWT/ ENGBLD1/ ENGBLD2/ ISOV1/ ISOV2/ | 02/ -11/ 1469/ 11/ 00/ |
| 03/ PACK1/ PACK2/ ENGAICE1/ ENGAICE2/ WAICEL/ WAICER/ | 03/ 11/ 00/ 00/ |
| 04/ N1#1/ N1#2/ | 04/ 0919/ 0919/ |
| 05/ EGT#1/ EGT#2/ | 05/ 656/ 654/ |
| 06/ N2#1/ N2#2/ | 06/ 0979/ 0978/ |
| 07/ FF#1/ FF#2/ | 07/ 2545/ 2502/ |
| 08/ PLA#1/ PLA#2/ | 08/ 00/ 00/ |
| 09/ OILP#1/ OILP#2/ | 09/ 56/ 54/ |
| 10/ OILT#1/ OILT#2/ | 10/ 108/ 112/ |
| 11/ VIBF#1/ VIBF#2/ | 11/ 07/ 02/ |
| 12/ VIBT#1/ VIBT#2/ | 12/ 01/ 02/ |




| TAKE OFF REPORT | TAKE OFF REPORT |
|---|---|
| 00/ ACID/ DATA/ GMT/ | 00/ B767/ 120497/ 1342/ |
| 01/ SAT/ CAS/ MACH/ ALT/ | 01/ 006/ 190/ 284/ 001/ |
| 02/ TAT/ GROSSWT/ ENGBLD1/ ENGBLD2/ ISOV1/ ISOV2/ | 02/ 010/ 1346/ 11/ 00/ |
| 03/ PACK1/ PACK2/ ENGAICE1/ ENGAICE2/ WAICEL/ WAICER/ | 03/ 11/ 00/ 00/ |
| 04/ N1#1/ N1#2/ | 04/ 1051/ 1051/ |
| 05/ EGT#1/ EGT#2/ | 05/ 920/ 931/ |
| 06/ N2#1/ N2#2/ | 06/ 1032/ 1031/ |
| 07/ FF#1/ FF#2/ | 07/ 8991/ 9002/ |
| 08/ PLA#1/ PLA#2/ | 08/ 00/ 00/ |
| 09/ OILP#1/ OILP#2/ | 09/ 63/ 64/ |
| 10/ OILT#1/ OILT#2/ | 10/ 075/ 072/ |
| 11/ VIBF#1/ VIBF#2/ | 11/ 02/ 03/ |
| 12/ VIBT#1/ VIBT#2/ | 12/ 08/ 04/ |
| 13/ 00/ 00/ | 13/ 00/ 00/ |
| 14/ 00/ 00/ | 14/ 00/ 00/ |

```
REPORT ID:  CRTRND           GE ENGINE CONDITION MONITORING PROGRAM        SAGE  V3.0.3 PC - Jan 99     REPORT DATE:   8/22/ 0
                                   CRUISE PERFORMANCE MONITORING - MOST RECENT RECORDS                         PAGE:     1

             AIRTYP        ENGTYP       ENGSN    INSDAT  N1MOD   TCC  FNRAT  CONFIG      CONTROL      SELECTOR
AAAA   -1  B767-300ER    CF6-80C2B6F   XXX182    990309   5       * *******                                          (SCALES VARIED)
SMOOTH         -30..-20..-10...EGT..10...20...30                  -1....X....0....X...N2....X....2....X....3  CRZ  OIL OIL MAINT ALT
 DATE   VIB..1....2....3                  0....2....4...F/F...8...10...12    3....4...VSV...6....7          SLOATL TMP PRS CODES CTR
 31499A R=     0.8 V=     0.3  -8.8                      4.61               VSV=-999.00 N2=   1.49
 31499B R=     0.8 V=     0.3  -8.8                      4.61               VSV=-999.00 N2=   1.49
 40100C . V R                   .  G      .               F                  .         X       2
 50100C . V R                   .G        .                F                 .         X      2
 60100C . V R                   .   G     .               F                  .         X       2
 70100C . V R                   .   G     .               F                  .         X        2
 80900  . V R                   .   G     .                F                 .         X      2                    118  57.        0
 80900  .  *                    .   G     .                F                 .         X      2                    112  56.        0
 80900  .  *                    .   G     .                F                 .         X      2                    102  57.        0
 81000  .  *                    .    G    .                F                 .         X      2                    108  56.        0
 81000  .  *                    .    G    .                F                 .         X      2                    112  55.        0
 81100  . VR                    .    G    .                F                 .         X      2                    104  56.        0
 81100  .  *                    .    G    .                F                 .         X      2                    112  56.        0
 81100  .  *                    .    G    .                F                 .         X      2                    111  57.        0
 81100  .  *                    .    G    .                F                 .         X      2                     89  55.        0
 81200  .  *                    .    G    .                F                 .         X      2                    104  56.        0
 81200  . VR                    .    G    .                F                 .         X      2                    100  55.        0
 81300  .  *                    .    G    .                F                 .         X      2                     70  57.        0
 81300  .  *                    .    G    .                F                 .         X      2                     80  55.        0
 81300  .  *                    .    G    .                F                 .         X       2                   112  54.        0
 81300  . VR                    .    G    .                F                 .         X       2                   112  54.        0
 81300  . V R                   .   G     .                F                 .         X       2                   108  53.        0
 81400  . V R                   .   G     .                F                 .         X       2                   119  55.        0
 81400  . VR                    .   G     .                F                 .         X       2                   116  54.        0
 81400  . VR                    .   G     .                F                 .         X       2                   103  57.        0
 81400  . VR                    .   G     .                F                 .         X       2                   108  55.        0
 81500  . VR                    .   G     .                F                 .         X       2                   104  56.        0
 81500  . VR                    .   G     .                F                 .         X       2                   112  55.        0
 81500  . VR                    .   G     .                F                 .         X        2                  102  56.        0
 81500  . VR                    .   G     .                F                 .         X       2                   108  56.        0
 81500  . VR                    .   G     .                F                 .         X       2                   104  56.        0
 81500  . VR                    .   G     .                F                 .         X       2                   104  56.        0
 81600  . VR                    .   G     .                F                 .         X      2                    114  56.        0
 81800  .  *                    .   G     .                F                 .         X      2                    118  56.        0
 81900  .  *                    .   G     .                F                 .         X      2                    108  58.        0
 81900  .  *                    .   G     .                F                 .         X       2                   110  57.        0
 81900  .  *                    .   G     .               F                  .         X      2                    102  55.        0
 82000  .  *                    .  G      .                 F                .         X       2                   111  58.        0
 82000  .  *                    .  G      .                 F                .         X       2                   104  56.        0
 82000= .  *                    .  G      .                 F                .         X       2                   103  58.        0
 82000= .  *                    .  G      .                 F                .         X       2                    97  56.        0
RAW DATA       -30..-20..-10...EGT..10...20...30                  -1....X....0....X...N2....X....2....X....3 CRZ     MODULE CHG  ALT
 DATE   VIB..1....2....3                  0....2....4...F/F...8...10...12    3....4...VSV...6....7          SLOATL   MAINT CODES CTR
 81500  *                       .   G     .                F                 .         X     2                                    0
 81600  V  R                    .   G     .               F                  .         X     2                                    0
 81800  *   V                   X         X                                  X         X                                          0
 81900  *   V                   X         X                                  X         X                                          0
 81900  *                       G         .                  F               .         X        2                                 0
 81900  *                       .   G     .                       F          .         X    2                                     0
 82000  *   V                   .G        .                    F             .         X        2                                 0
 82000  *   V                   X         X                                  X         X                                          0
 82000= V   R                   .G        .                   F              .         X        2                                 0
 82000= V   R                   . G       .                    F             .         X     2                                  0
```

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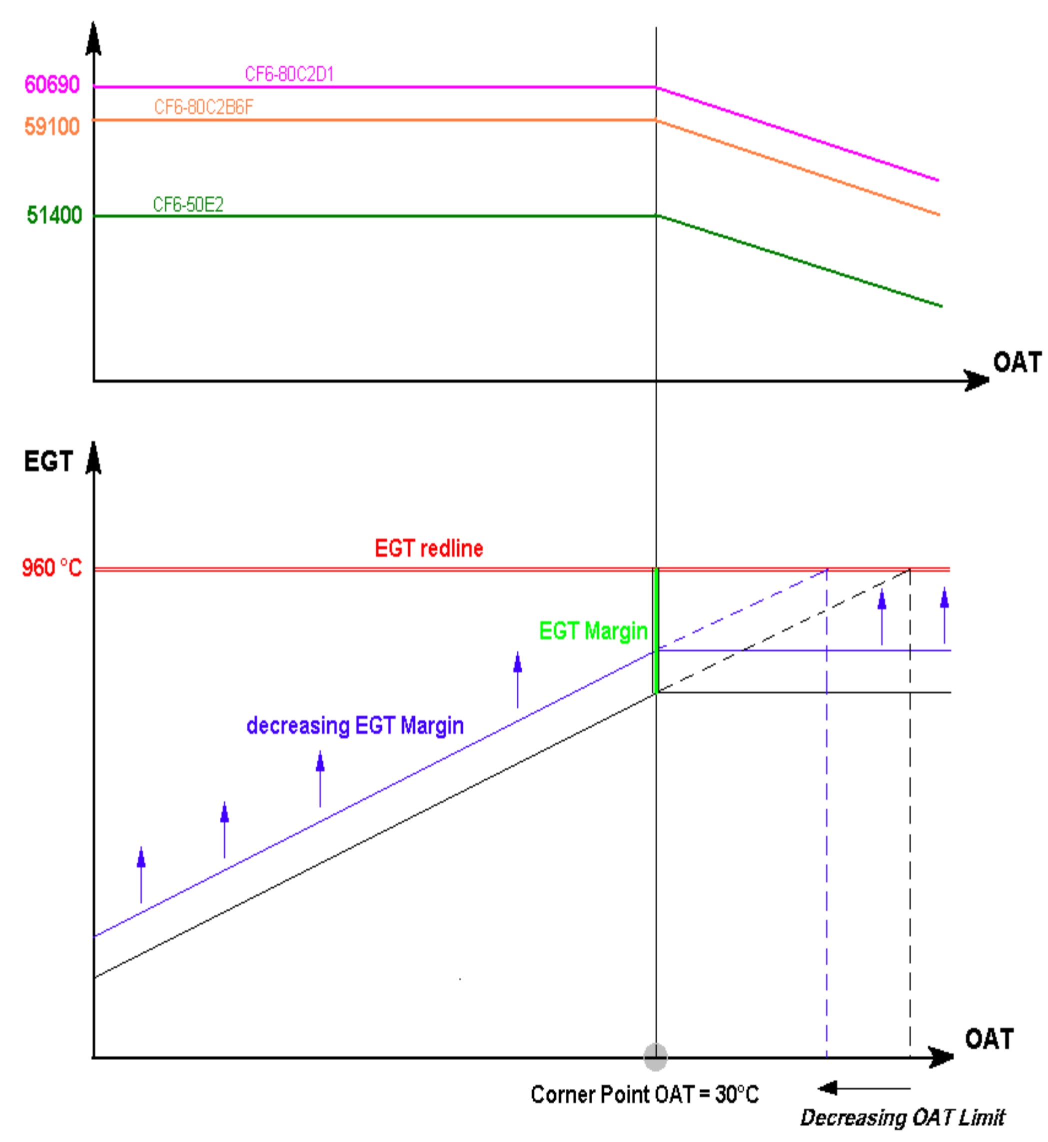
1
 REPORT ID:  TKTRND           GE ENGINE CONDITION MONITORING PROGRAM        SAGE V3.0.3 PC - Jan 99      REPORT DATE:   8/22/ 0
                                   TAKEOFF PERFORMANCE MONITORING - MOST RECENT RECORDS                         PAGE:     1

              AIRTYP        ENGTYP       ENGSN    INSDAT  N1MOD   TCC  FNRAT  CONFIG        CONTROL      SELECTOR
 AAAA   -1  B767-300ER    CF6-80C2B6F   XXX182    990309   5       * *******                                          (SCALES VARIED)
 SMOOTH                         EGT        0...10...20..OATL..40...50...60              N2               ACTUAL            MAINT ALT
  DATE    CSI     0...10...20...MAR..40...50...60                              0....5...MAR..15...20      N1K   FNDR  N1DR CODES CTR
  31499A                      46.10                    43.74                        -999.00
  31499B                      46.10                    43.74                        -999.00
  30800C          .                 H      .                   O               X
  40100C          .              H         .                   O               X
  50100C          .               H        .                   O               X
  60100C          .              H         .                  O                X
  73100  -5555    .              H         .                  O                X                           102.5   7.2   3.6       0
  80100  -5555    .              H         .                  O                X                           105.3   0.8   0.5       0
  80100  -5555    .              H         .                  O                X                           101.8   8.9   4.4       0
  80200  -5555    .              H         .                   O               X                           100.3  13.3   6.4       0
  80200  -5555    .               H        .                   O               X                            98.0  18.5   8.1       0
  80200  -5555    .               H        .                   O               X                           101.9  14.9   9.1       0
  80200  -5555    .               H        .                   O               X                            97.4  19.6   8.5       0
  80300  -5555    .               H        .                   O               X                           105.5   0.3   0.2       0
  80300  -5555    .               H        .                   O               X                           101.9   8.4   4.1       0
  80400  -5555    .               H        .                   O               X                           105.5   0.5   0.3       0
  80400  -5555    .               H        .                   O               X                           102.1   8.1   4.1       0
  80500  -5555    .               H        .                   O               X                           103.5   4.8   2.5       0
  80500  -5555    .               H        .                   O               X                           101.1  11.0   5.3       0
  80700  -5555    .               H        .                   O               X                           100.2  14.3   7.0       0
  80700  -5555    .               H        .                   O               X                           105.1   0.4   0.3       0
  80700  -5555    .               H        .                   O               X                           100.0  12.8   5.8       0
  80800  -5555    .               H        .                   O               X                           104.8   0.7   0.4       0
  80900  -5555    .               H        .                   O               X                           107.0   0.6   0.3       0
  80900  -5555    .               H        .                   O               X                           100.3  14.8   7.5       0
  80900  -5555    .               H        .                   O               X                           103.7   4.6   2.4       0
  81000  -5555    .               H        .                   O               X                            99.5  15.1   7.0       0
  81000  -5555    .               H        .                   O               X                           102.0   8.5   4.3       0
  81100  -5555    .               H        .                   O               X                            99.8  14.1   6.5       0
  81100  -5555    .               H        .                   O               X                           102.3   8.0   4.1       0
  81200  -5555    .               H        .                   O               X                           102.7   6.2   3.1       0
  81200  -5555    .              H         .                  O                X                           105.9   0.2   0.1       0
  81300  -5555    .              H         .                  O                X                           102.6   6.4   3.2       0
  81300  -5555    .              H         .                   O               X                           100.4  14.0   7.0       0
  81300  -5555    .               H        .                   O               X                           100.0  14.3   7.0       0
  81300  -5555    .               H        .                   O               X                           100.7  14.3   7.4       0
  81400  -5555    .              H         .                   O               X                           103.5   4.0   2.0       0
  81400  -5555    .               H        .                   O               X                           101.6   8.9   4.3       0
  81500  -5555    .              H         .                   O               X                           105.3   0.6   0.3       0
  81500  -5555    .               H        .                   O               X                           107.6   0.2   0.1       0
 RAW DATA                       EGT        0...10...20..OATL..40...50...60              N2                                       ALT
  DATE    CSI     0...10...20...MAR..40...50...60                              0....5...MAR..15...20                 MAINT CODES CTR
  81200  -5555    .              H         .                  O                X                                                   0
  81200  -5555    .             H          .                  O                X                                                   0
  81300  -5555    .             H          .                  O                X                                                   0
  81300  -5555    .                H       .                   O               X                                                   0
  81300  -5555    .                 H      .                   O               X                                                   0
  81300  -5555    .               H        .                   O               X                                                   0
  81400  -5555    .             H          .                  O                X                                                   0
  81400  -5555    .               H        .                   O               X                                                   0
  81500  -5555    .              H         .                  O                X                                                   0
  81500  -5555    .                 H      .                   O               X                                                   0
```

# OAT'L CONCEPT & COMPUTATION




**EGTM / OAT'L BASIC FORMULA**

$$EGTMargin(°C) = 1233.15 - \left( \frac{EGT + 273.15}{(\theta_0)^x} + K\left( N1Kpm - \frac{(N1)}{(\theta_0)^{0.47}} \right) \right) \cdot (\theta_{peak})$$

$$Where : \theta_0 = \frac{(TAT + 273{,}15)}{288{,}15}$$

$K$ = EGT (°C) per Δ % N1

$\theta_{peak}$ = Hot Day Theta

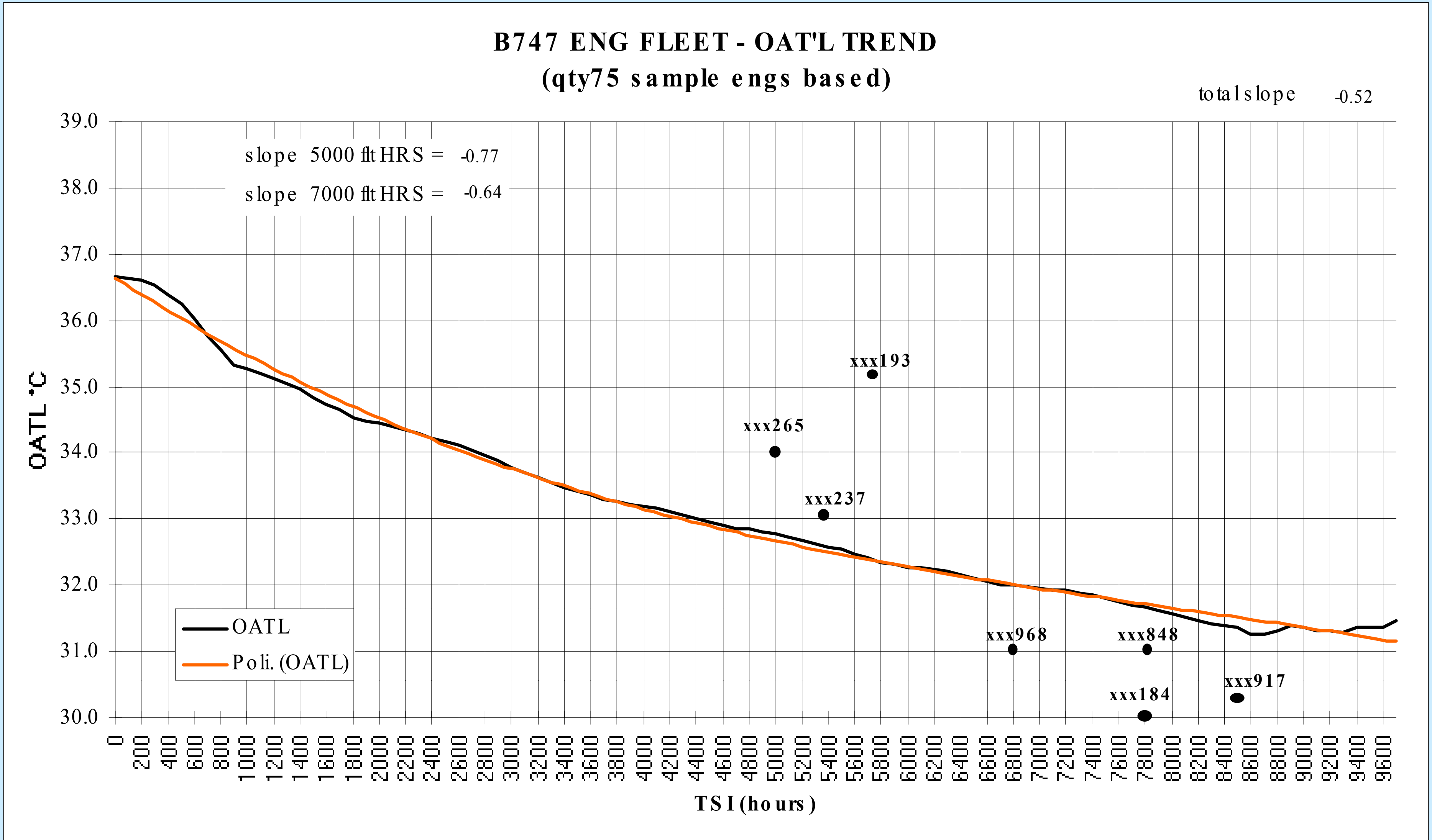
$X$ = EGT exponential foctor by engine model

$$OATL(°C) = \left( \frac{EGT_{RL}}{EGT_{RL} - EGTMargin} \right)^{1/0.95} \cdot (CP_{HD} + 273.15) - 273.15$$

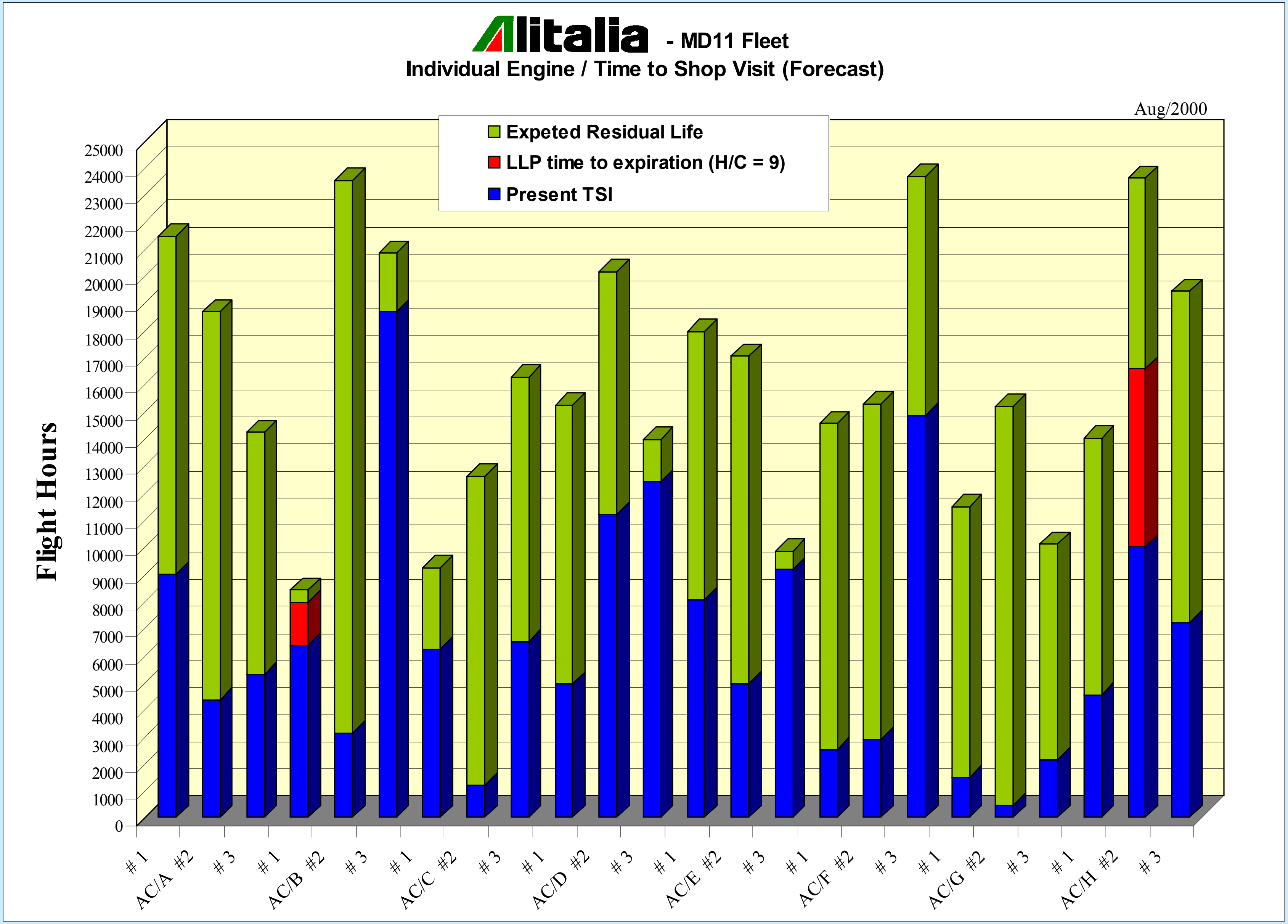
| | | N1Kpm% | | | | |
|---|---|---|---|---|---|---|
| | | Bleed | | | | |
| Engine Rating | K | ON | OFF | $(\theta_{peak})$ | $CP_{HD}$ | X of $(\theta_0)$ |
| CF6-80C2 B6F | 8.1 | 106.55 | 107.55 | 1.058850 | 30.0 | 0.921 |



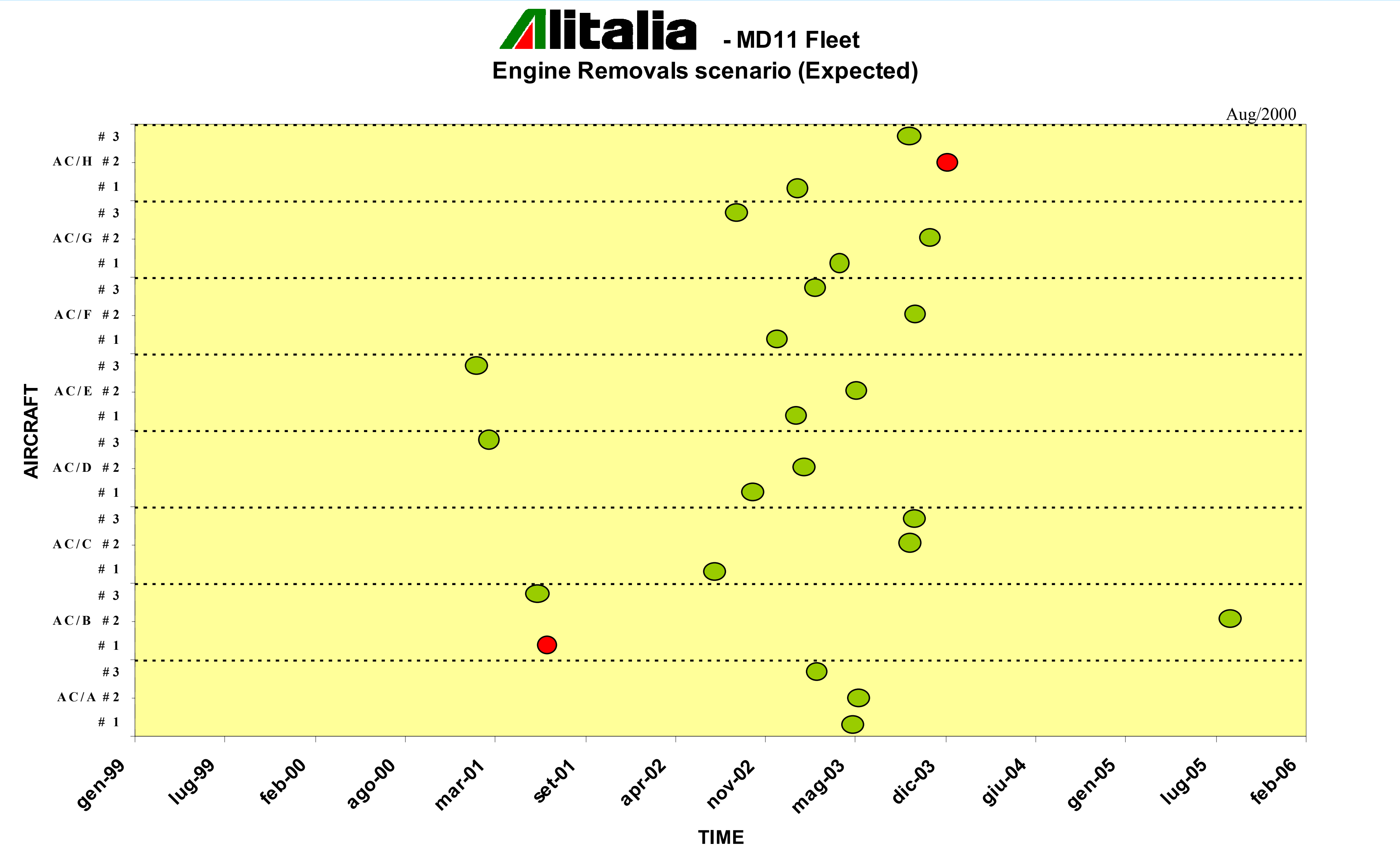
Pisa,Sep26/00



B747 ENG FLEET - OAT'L TREND
(qty75 sample engs based)
total slope -0.52
slope 5000 flt HRS = -0.77
slope 7000 flt HRS = -0.64
OATL °C
39.0
38.0
37.0
36.0
35.0
34.0
33.0
32.0
31.0
30.0
xxx193
xxx265
xxx237
xxx968
xxx848
xxx184
xxx917
OATL
Poli. (OATL)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
4200
4400
4600
4800
5000
5200
5400
5600
5800
6000
6200
6400
6600
6800
7000
7200
7400
7600
7800
8000
8200
8400
8600
8800
9000
9200
9400
9600
TSI (hours)

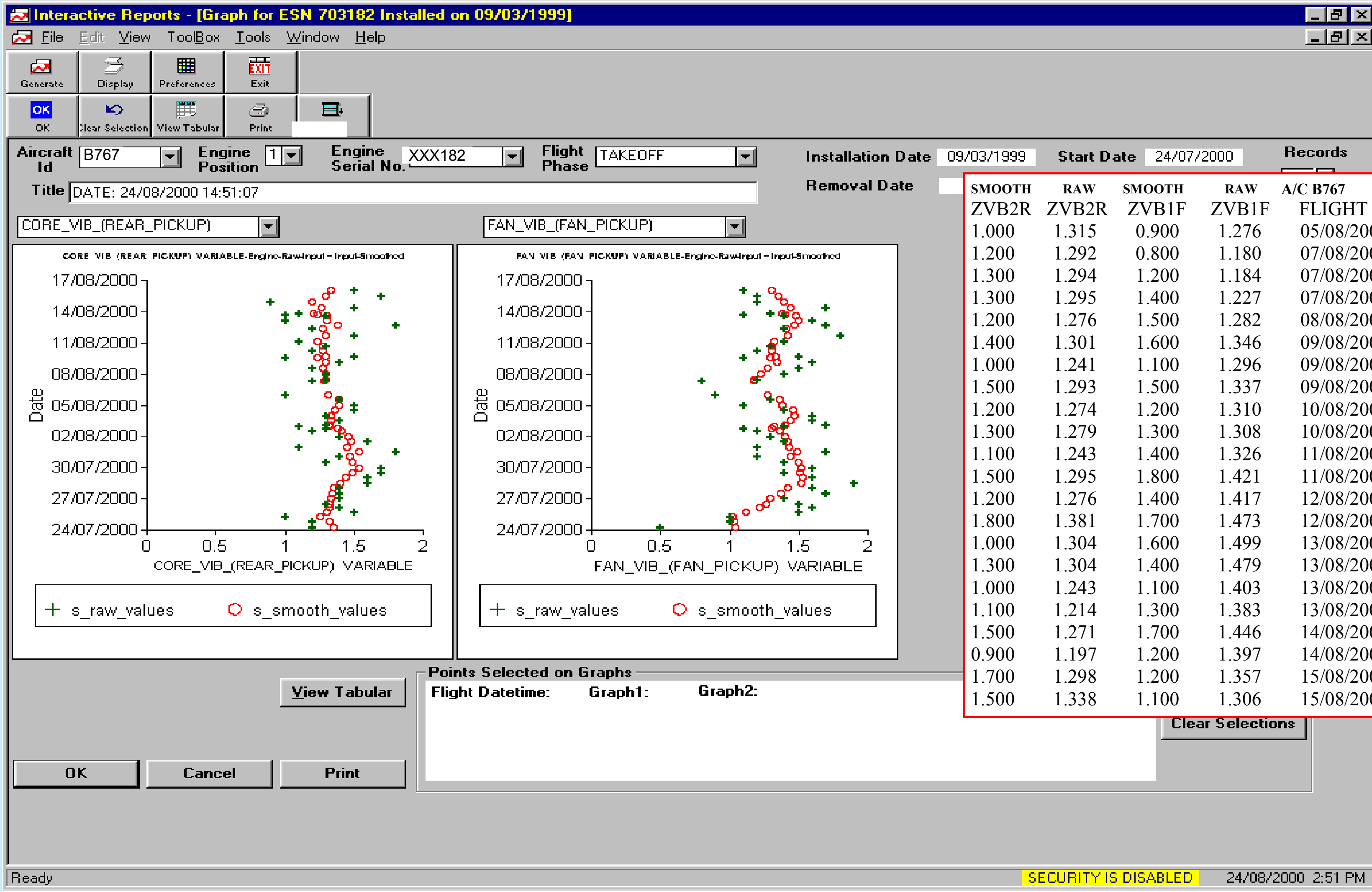


Alitalia - MD11 Fleet
Individual Engine / Time to Shop Visit (Forecast)
Aug/2000
Expeted Residual Life
LLP time to expiration (H/C = 9)
Present TSI
Flight Hours
25000
24000
23000
22000
21000
20000
19000
18000
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
# 1
AC/A #2
# 3
# 1
AC/B #2
# 3
# 1
AC/C #2
# 3
# 1
AC/D #2
# 3
# 1
AC/E #2
# 3
# 1
AC/F #2
# 3
# 1
AC/G #2
# 3
# 1
AC/H #2
# 3



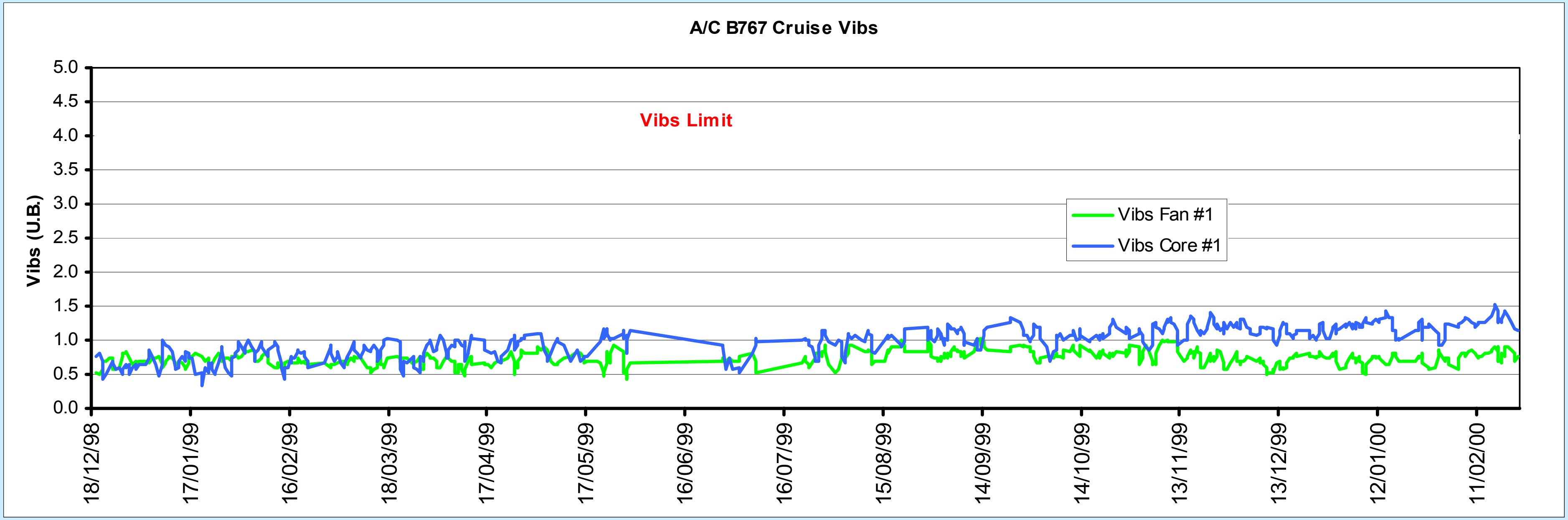
Alitalia - MD11 Fleet
Engine Removals scenario (Expected)
Aug/2000
AIRCRAFT
AC/H #3
#2
#1
AC/G #3
#2
#1
AC/F #3
#2
#1
AC/E #3
#2
#1
AC/D #3
#2
#1
AC/C #3
#2
#1
AC/B #3
#2
#1
AC/A #3
#2
#1
gen-99
lug-99
feb-00
ago-00
mar-01
set-01
apr-02
nov-02
mag-03
dic-03
giu-04
gen-05
lug-05
feb-06
TIME

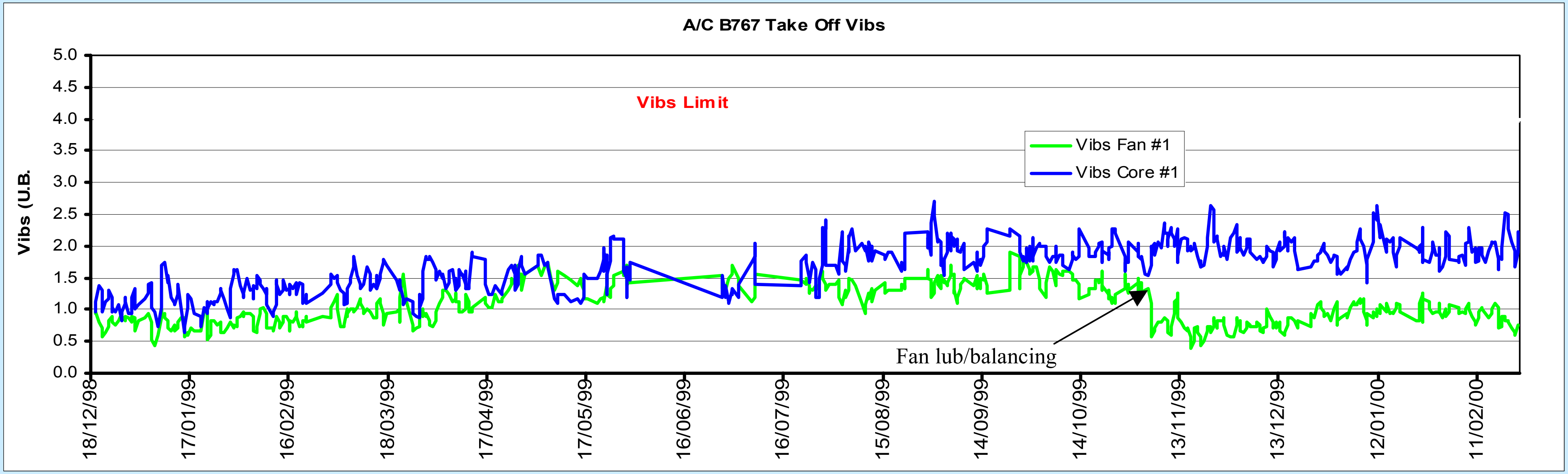
# B767 ENG - VIB SURVEY / LAST SIXTY DATA



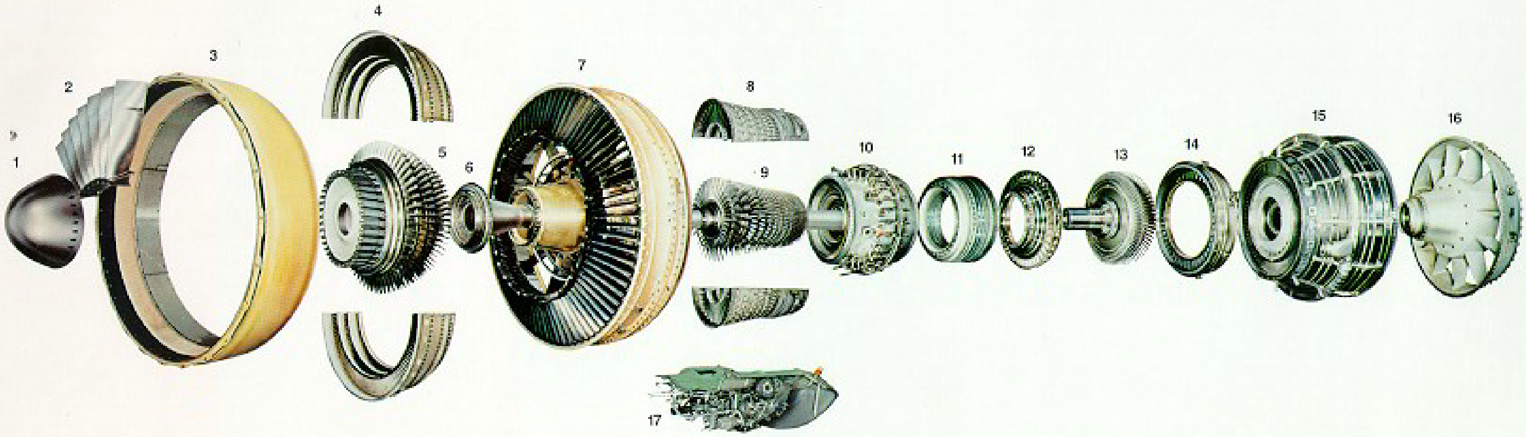

| SMOOTH | RAW | SMOOTH | RAW | A/C B767 ESN XXX182 |
|---|---|---|---|---|
| ZVB2R | ZVB2R | ZVB1F | ZVB1F | FLIGHT DATETIME |
| 1.000 | 1.315 | 0.900 | 1.276 | 05/08/2000 21:27:00 |
| 1.200 | 1.292 | 0.800 | 1.180 | 07/08/2000 05:13:00 |
| 1.300 | 1.294 | 1.200 | 1.184 | 07/08/2000 08:52:00 |
| 1.300 | 1.295 | 1.400 | 1.227 | 07/08/2000 20:44:00 |
| 1.200 | 1.276 | 1.500 | 1.282 | 08/08/2000 10:57:00 |
| 1.400 | 1.301 | 1.600 | 1.346 | 09/08/2000 00:24:00 |
| 1.000 | 1.241 | 1.100 | 1.296 | 09/08/2000 12:49:00 |
| 1.500 | 1.293 | 1.500 | 1.337 | 09/08/2000 15:37:00 |
| 1.200 | 1.274 | 1.200 | 1.310 | 10/08/2000 03:15:00 |
| 1.300 | 1.279 | 1.300 | 1.308 | 10/08/2000 14:53:00 |
| 1.100 | 1.243 | 1.400 | 1.326 | 11/08/2000 02:17:00 |
| 1.500 | 1.295 | 1.800 | 1.421 | 11/08/2000 15:15:00 |
| 1.200 | 1.276 | 1.400 | 1.417 | 12/08/2000 05:57:00 |
| 1.800 | 1.381 | 1.700 | 1.473 | 12/08/2000 15:35:00 |
| 1.000 | 1.304 | 1.600 | 1.499 | 13/08/2000 02:47:00 |
| 1.300 | 1.304 | 1.400 | 1.479 | 13/08/2000 12:07:00 |
| 1.000 | 1.243 | 1.100 | 1.403 | 13/08/2000 15:42:00 |
| 1.100 | 1.214 | 1.300 | 1.383 | 13/08/2000 18:34:00 |
| 1.500 | 1.271 | 1.700 | 1.446 | 14/08/2000 08:44:00 |
| 0.900 | 1.197 | 1.200 | 1.397 | 14/08/2000 20:44:00 |
| 1.700 | 1.298 | 1.200 | 1.357 | 15/08/2000 10:06:00 |
| 1.500 | 1.338 | 1.100 | 1.306 | 15/08/2000 23:13:00 |

# Alitalia B767 ENG - LONG TERM VIB SURVEY (3 values m.a.)



## GE CF6-80C2 High Bypass Turbofan Engine




Legend

1. Spinner cone
2. Fan blades (7 of 38)
3. Fan forward case
4. Low pressure compressor (LPC) booster stator
5. LPC booster rotor
6. Fan shaft
7. Fan frame, aft case and outlet guide vanes
8. High pressure compressor (HPC) stator
9. HPC rotor
10. Compressor rear frame
11. Combustor
12. High pressure turbine (HPT) stage 1 nozzle
13. HPT rotor
14. HPT stage 2 nozzle
15. Low pressure turbine (LPT)
16. Turbine rear frame
17. Accessory gearbox and fire shield

Alitalia

# ENGINES FLEET
# MAIN BUILD GROUPS
# SHOP MAINTENANCE THRESHOLDS