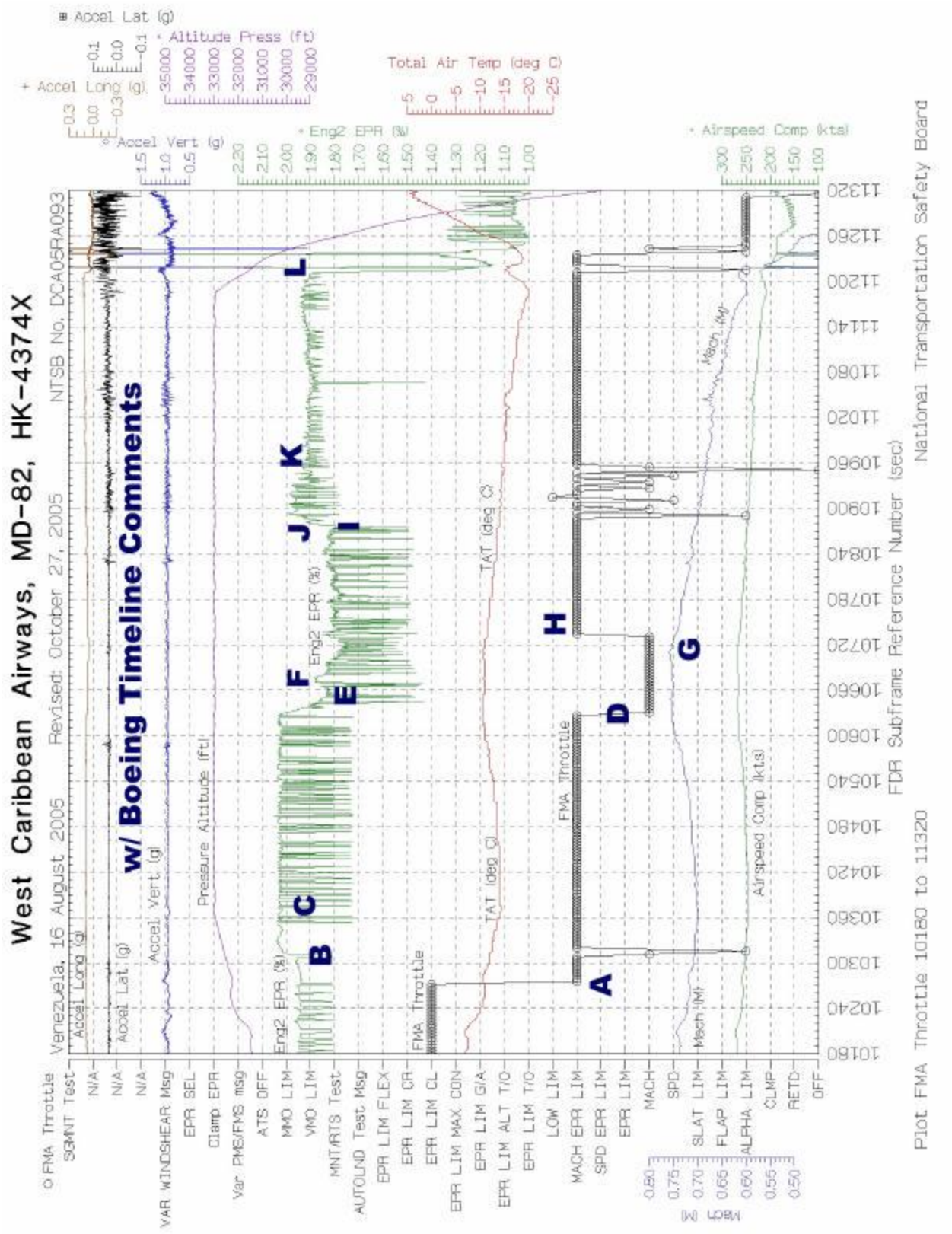
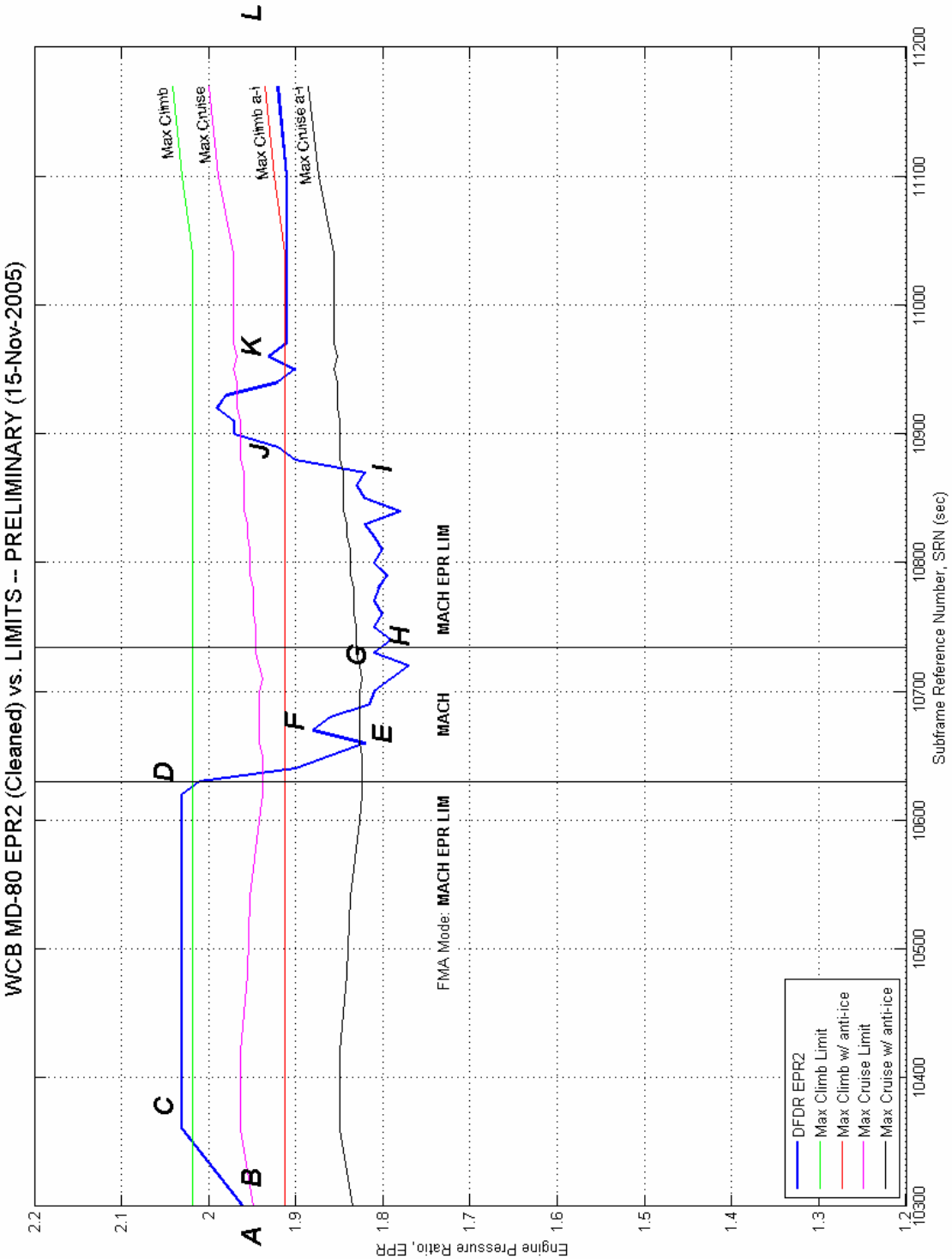
WCB MD-82/JT8D-217A/C Venezuela Event
Analysis of Engine EPR and ATS Modes - Subframes 10000 to 11200
Based on NTSB FDR processed data from 27Oct 2005 (EPR2 data "cleaned up")

Marker	Subframe Ref Number	Commentary
A	10270	During the step climb from FL310 to FL330, the Auto Throttle System (ATS) mode automatically changed from *EPR Limit (Climb)* to *Mach EPR Limited*. The airplane could not maintain the selected target Mach (in climb) within the existing EPR limit constraint. Prior to the mode switch, the EPR limit corresponded to Max Climb (MCL) with engine ice protection on.
B	10315	It appears that Engine Anti-Ice (EAI) was switched off (~45 seconds after mode change) which resulted in the observed EPR increasing to MCL (no anti-ice).
C	10370	The ATS would normally automatically revert from *EPR Limit (Climb)* to *Speed* or *Mach* mode as a pre-selected target altitude is reached. At the FL330 level-off, since the airspeed was below target Mach (~ 0.76, as determined by the PMS), the thrust remained at MCL until the target Mach was attained.
D	10630	The ATS reverted to *Mach* mode. The throttles maintained an EPR sufficient to sustain the target Mach in level flight. At this time, the Max Cruise (MCR) EPR limit is typically manually selected on the Thrust Rating Panel (TRP).
E	10660	This initial undershoot (to 1.82) of the apparent desired EPR of 1.85 to 1.90 is not unusual during mode changes in similar conditions.
F	10670	Over the next 30 seconds, EPR rose back to 1.88 EPR, then reduced to a level at or below the MCR limit with both engine and airfoil ice protection (EAI and AAI) on. It is possible that the engine and airfoil ice protection was switched on near this time and would account for the initial large EPR fluctuation.
G	10720	The airplane maintained the target Mach for roughly 90 seconds then the airspeed began to decrease.
H	10735	The ATS mode changed to *Mach EPR Limited*, meaning that the current selected EPR limit (on the TRP) was insufficient to maintain the target Mach number. The EPR appears to have been constrained to the MCR (EAI+AAI) limit. The airspeed continued to decrease.

Marker	Subframe Ref Number	Commentary
I	10870	The MCR (EAI+AAI) limit increased slowly as the airspeed dropped, allowing a marginal amount of extra thrust. Mach number had dropped to 0.70. Since the *Mach EPR Limited* mode was still active, presumably at the MCR (EAI+AAI) limit, the ATS should not have been able to accelerate the engines at this point without additional crew actions. These might have included a combination of: 1) pilot pushing the throttles forward manually, or 2) pilot turning off ice protection (providing an additional 0.115 cruise EPR), or 3) pilot selecting MCL or MCT on the TRP (presumably while leaving all ice protection on).
J	10880	During the engine accel, the EPR is seen to hesitate at the MCL (EAI+AAI) limit on the way to an EPR above MCR (no AI). The hesitation is **not** typical of an ATS accel directly to the MCR (no AI) EPR limit, suggesting crew action of some sort at this point.
K	10960	The EPR level is observed to retreat to a level consistent with MCL (EAI+AAI), and this EPR limit was maintained as airspeed (and TAT) continued to decline.
L	11220	The airplane continued to slow down with thrust constrained by the MCL (EAI+AAI) EPR limit, until dual engine rollbacks occurred as the airplane descended through FL320. The engines do not appear to go sub-idle. They maintained an above-idle EPR, in the 1.0 to 1.2 range.


West Caribbean Airways, MD-82, HK-4374X
w/ Boeing Timeline Comments
Venezuela, 16 August 2005
Revised: October 27, 2005
NTSB No. DCA05RA093
Plot FMA Throttle 10180 to 11320
FDR Subframe Reference Number (sec)
National Transportation Safety Board
Accel Lat (g)
Altitude Press (ft)
Accel Long (g)
Accel Vert (g)
Total Air Temp (deg C)
Eng2 EPR (%)
Airspeed Comp (kts)
Pressure Altitude (ft)
TAT (deg C)
FMA Throttle
Mach (M)
A
B
C
D
E
F
G
H
I
J
K
L


WCB MD-80 EPR2 (Cleaned) vs. LIMITS -- PRELIMINARY (15-Nov-2005)
Engine Pressure Ratio, EPR
Subframe Reference Number, SRN (sec)
FMA Mode: MACH EPR LIM
MACH
MACH EPR LIM
Max Climb
Max Cruise
Max Climb a-i
Max Cruise a-i
A
B
C
D
E
F
G
H
I
J
K
L
DFDR EPR2
Max Climb Limit
Max Climb w/ anti-ice
Max Cruise Limit
Max Cruise w/ anti-ice