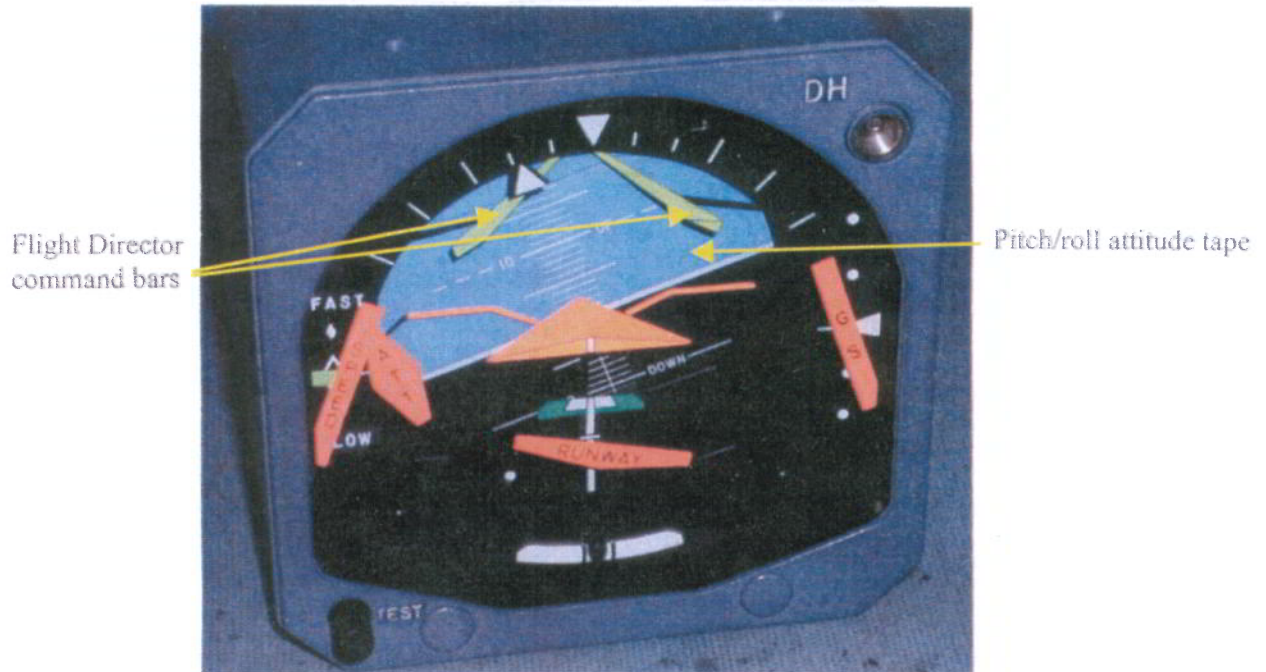


KOREAN AIR B747 TRANSIT CHECK LIST

A/C No. HL _____		STATION _____		DATE _____		KEY IN _____	
W/S	DD/MM	FROM	TO	EMPLOYEE NUMBER			
DESCRIPTION							CHECKED BY
1. GENERAL 1) Check the A/C for parking & ground safety condition. ; Wheel chocks, gear lock pins & door levers, static grounds, fire extinguishers, control surface locks, equipment / obstructions removed, tow bar, etc. 2) Check the maintenance & flight log and rectify all flight squawk items.							T3 T1
2. COCKPIT 1) Check the crew & passenger oxygen system pressure and hydraulic fluid quantity indicator in normal range, and service as required. (hydraulic fluid spec : SKYDROL LD4) 2) Check engine oil level and service as required within 2 hours after engine shutdown. (spec : ESSO 2380) Add/Total QTY : # 1 _____ / _____ # 2 _____ / _____ # 3 _____ / _____ # 4 _____ / _____							T2 T2
3. ENGINE & NACELLE 1) Check engine inlet area, fan blades & rotor spinner, exhaust area & NO.6 stage turbine blades, cowling & fairings, drain holes & masts for condition, obstruction, fluid leaks & FOD. 2) Check the strut / nacelle access panels and the engine fire extinguisher bottle discharge indicator disks are intact. 3) Check the engine fan blade shrouds for shingling. (JT9D-7R4G2 engine only) 4) Check thrust reversers are in stowed position. 5) Check the indication stripe between strut and AFT fairing for proper alignment. If misaligned, inspect the midspar fuse pin and attachment fitting for integrity.							T2 T2 T3 T3 T3
4. L/G & W/W 1) Check nose, wing & body landing gears, wheel wells, wheels, tires, doors, brakes and linkages for damage, leaks, condition & leakage 2) Check shock struts and extensions for proper extension, leaks and condition. 3) Wipe the exposed chrome portion of the strut piston with a clean cloth moistened with MIL-H-5606 hydraulic fluid per strut nameplate, and wipe clean with a dry cloth.							T2 T2 T3
5. FUSELAGE, WING & EMPENNAGE 1) Check the fuselage exterior surfaces including cargo compartments, radome, access panels & doors, and electronic compartments for condition. 2) Check the fuselage openings & fixtures including pitot-static probes, static ports & total air temperature probes, antennas, drain masts & drains, ram air inlets & outlets, pressurization out-flow opening, and angle of attack sensor for condition & safety. 3) Check external lighting fixtures for damage & condition. a) Clearance lights (Runway turnoff lights) b) Navigation lights c) Anti-collision beacons / strobe lights d) Landing lights 4) Check oxygen blow-out disks and APU fire extinguisher disks for presence. 5) Check the wing exterior surfaces including wing tip surfaces, tank vents, surge tank indicators, T/E flaps & ailerons, L/E flaps, static dischargers, and access panels & doors for damage, leakage, and condition. 6) Check the empennage exterior surfaces including vertical fin & rudders, horizontal stabilizer & elevators, static dischargers, and access panels & doors for damage & condition.							T2 T2 T2 T2 T2 T2
6. DISPATCH 1) Check the fuel quantity indicator in normal range. 2) Accomplish final walk around inspection. a) Check all access doors, service panels, cargo compartment doors, water fill & drain caps, toilet drain plugs are safely closed & locked. b) Ensure that the landing gear safety lock pins are removed before flight.							T2 T1

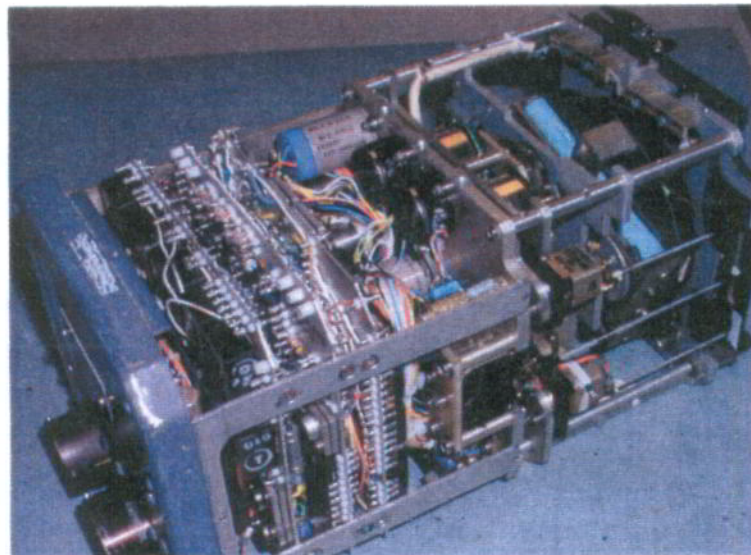
Flight Director Indicator 329B-8J Display

under a test condition to display warning flags



(note: On HL-7451 the ATT flag is labelled GYRO)

Figure 1

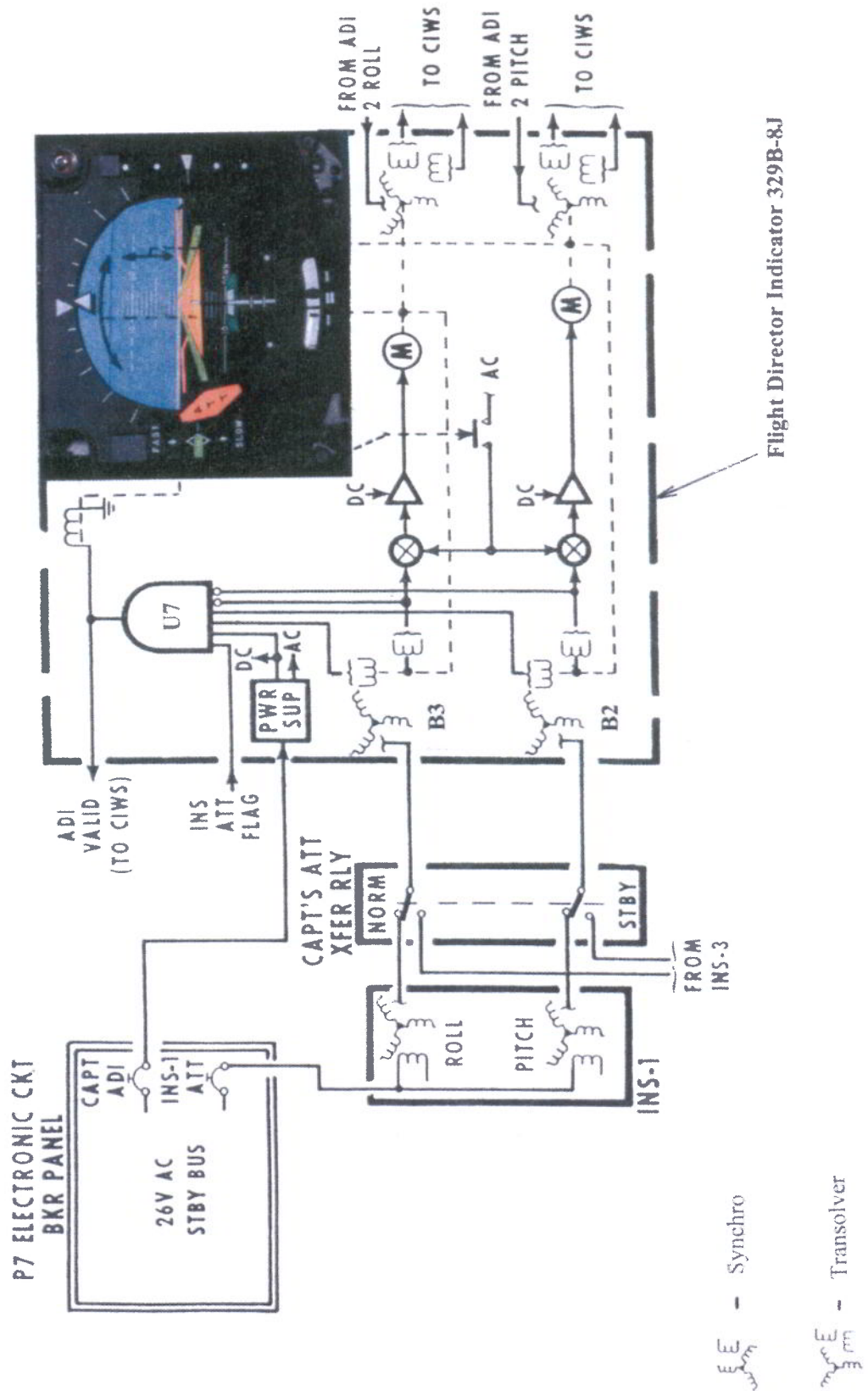


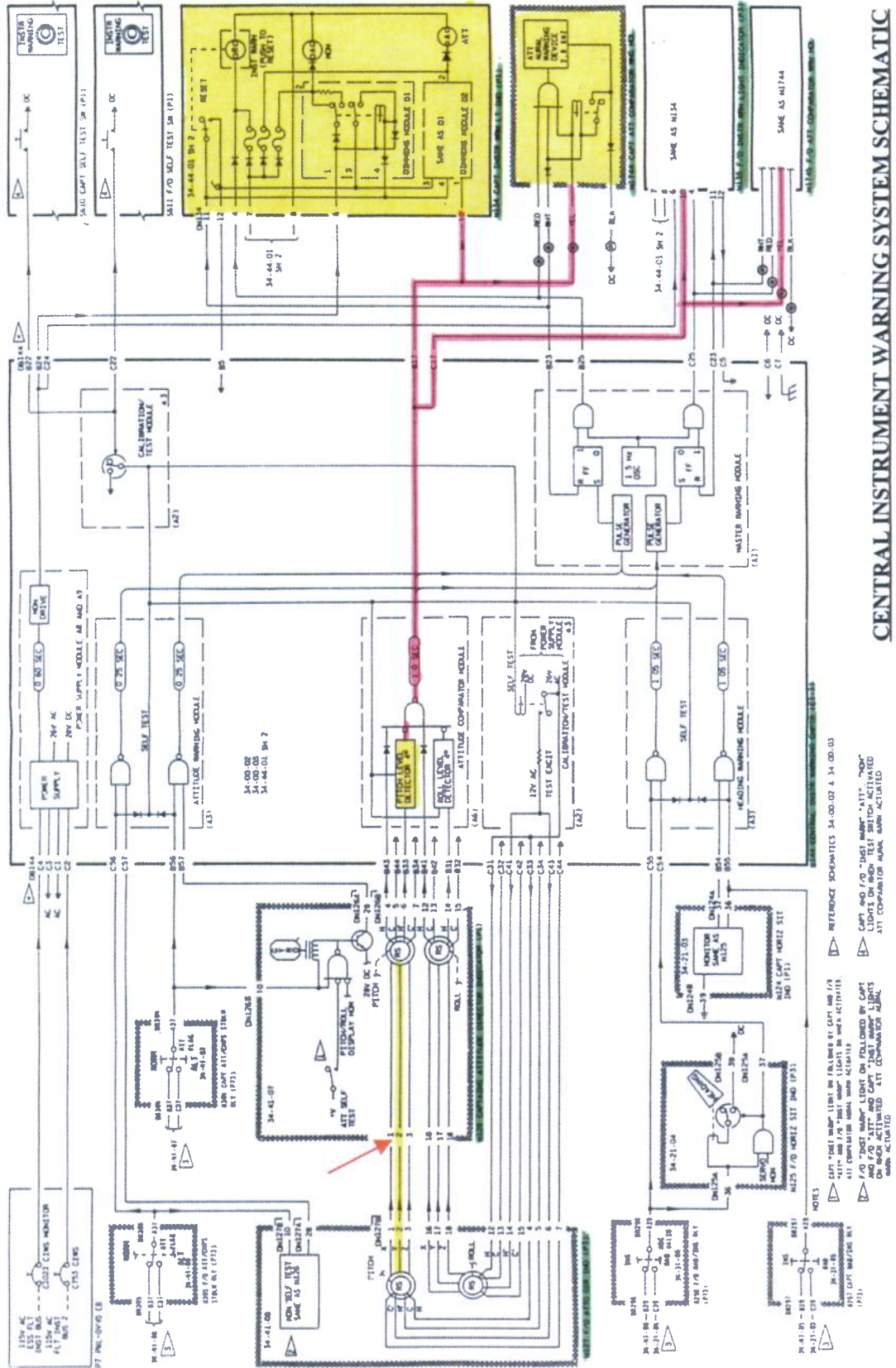
General view of indicator with outer protective cover removed

Figure 2

OUTLINE FUNCTIONAL DIAGRAM OF COLLINS FLIGHT DIRECTOR INDICATOR 329B-8J, Part No. 772-5005-001

(Captain's Position)





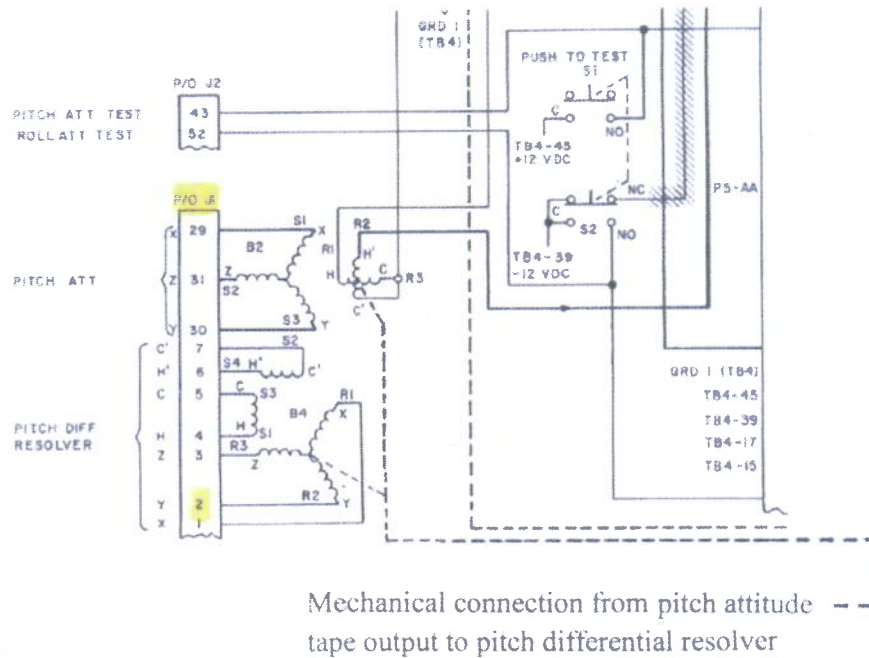
CENTRAL INSTRUMENT WARNING SYSTEM SCHEMATIC
(taken from KoreanAir Boeing 747 wiring manual)

Location of 'displaced' pin No 2, plug J1, arrowed

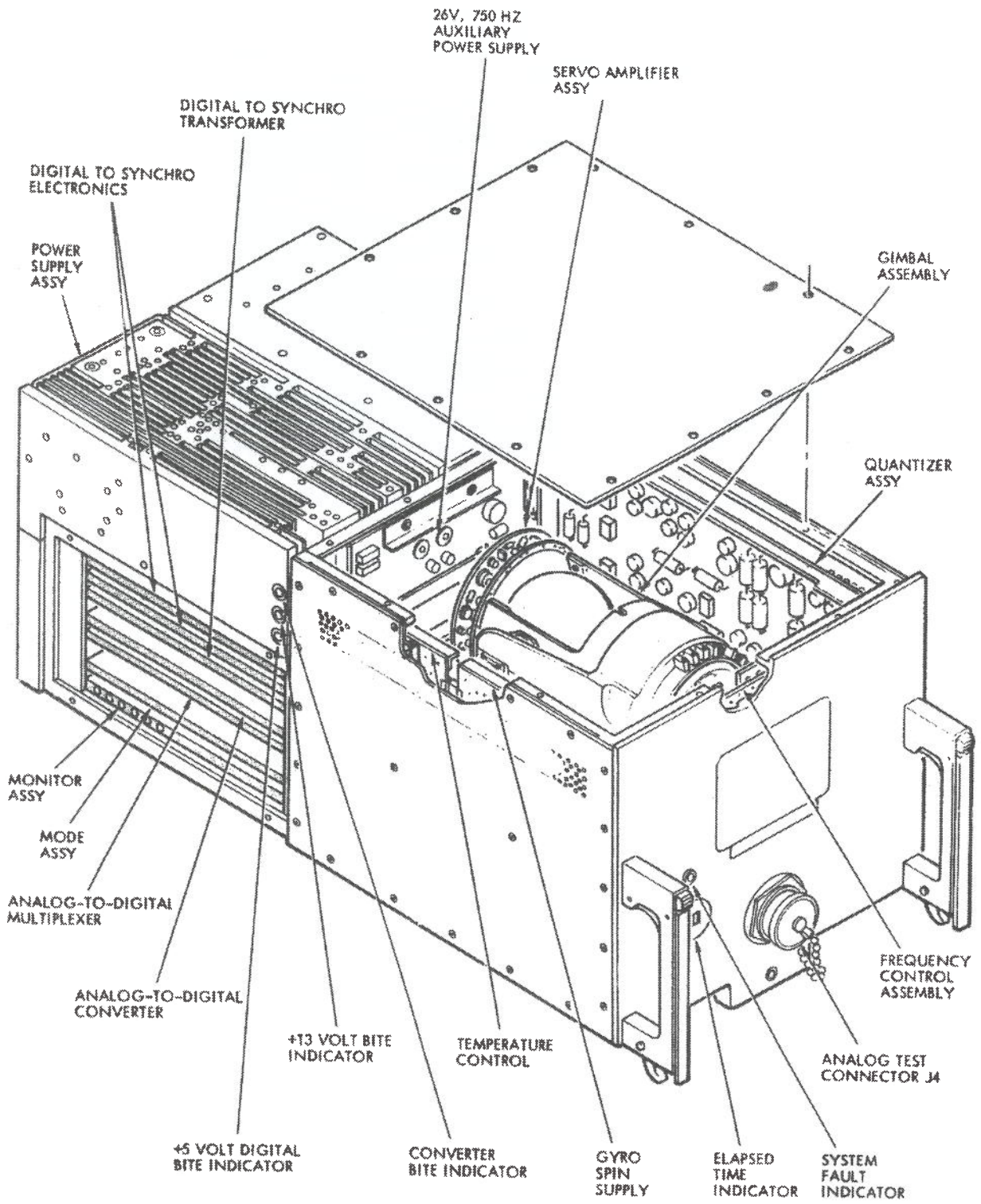


Rear view of 329B-8J Flight Director Indicator

Illustrating location of multi-pin connectors J1 and J2



Section of Indicator Circuit Diagram Showing Internal Wiring from Connector J1 pin 2



Inertial Navigation Unit (INU)

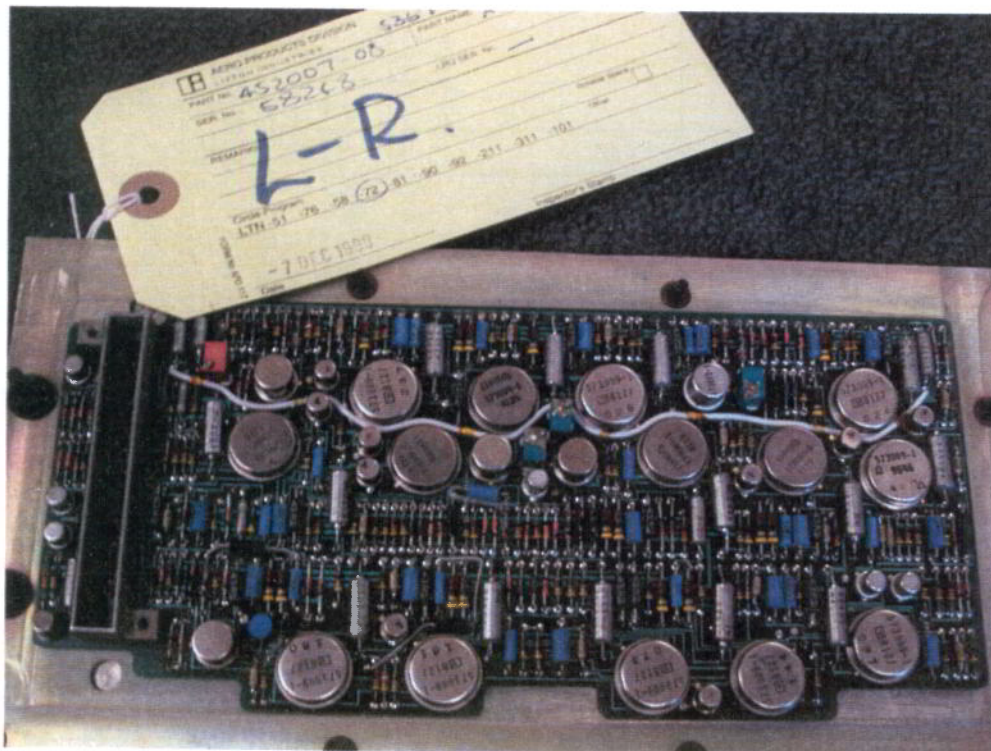
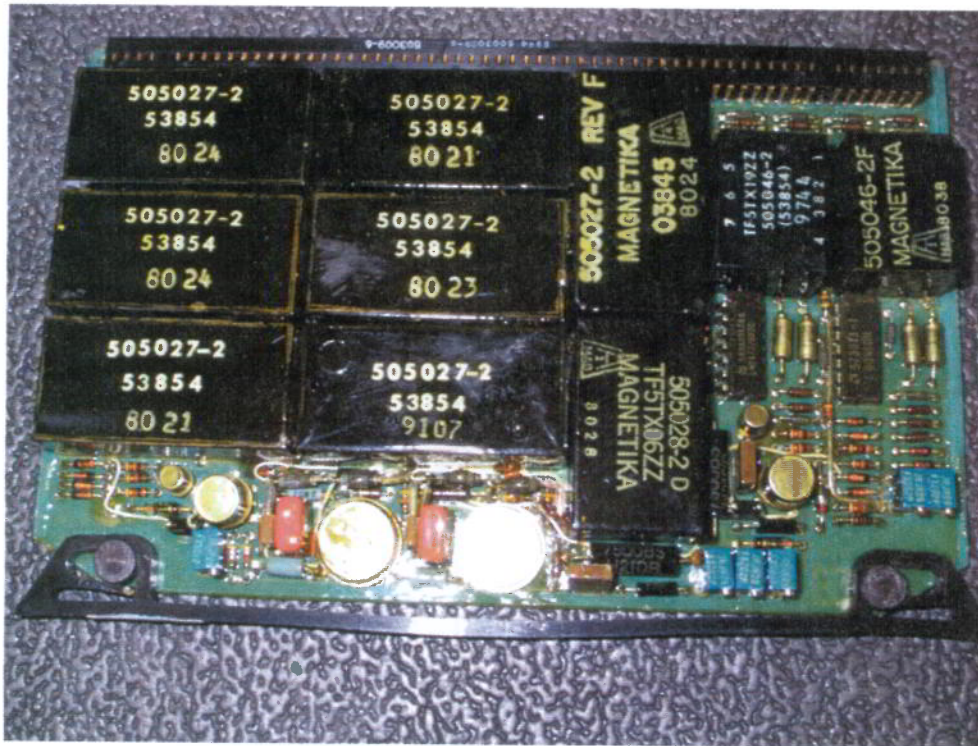
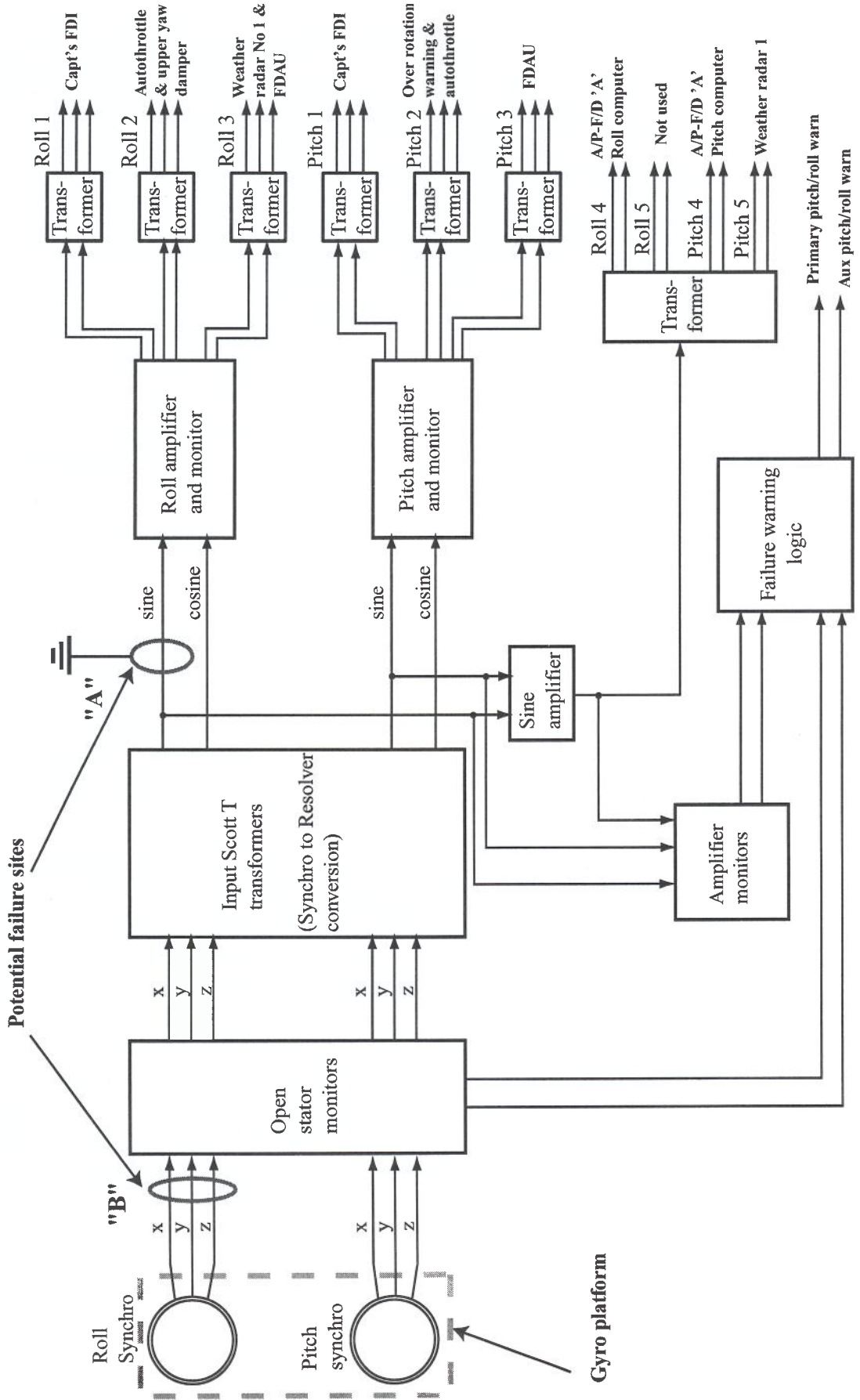


FIGURE 2 Attitude Interface (top) and Attitude Repeater circuit boards

SCHEMATIC DIAGRAM OF INU ATTITUDE SIGNAL FLOW

(NOTE: Output functions are shown for INU No 1)



DOVER SIDs/LYDD SIDs

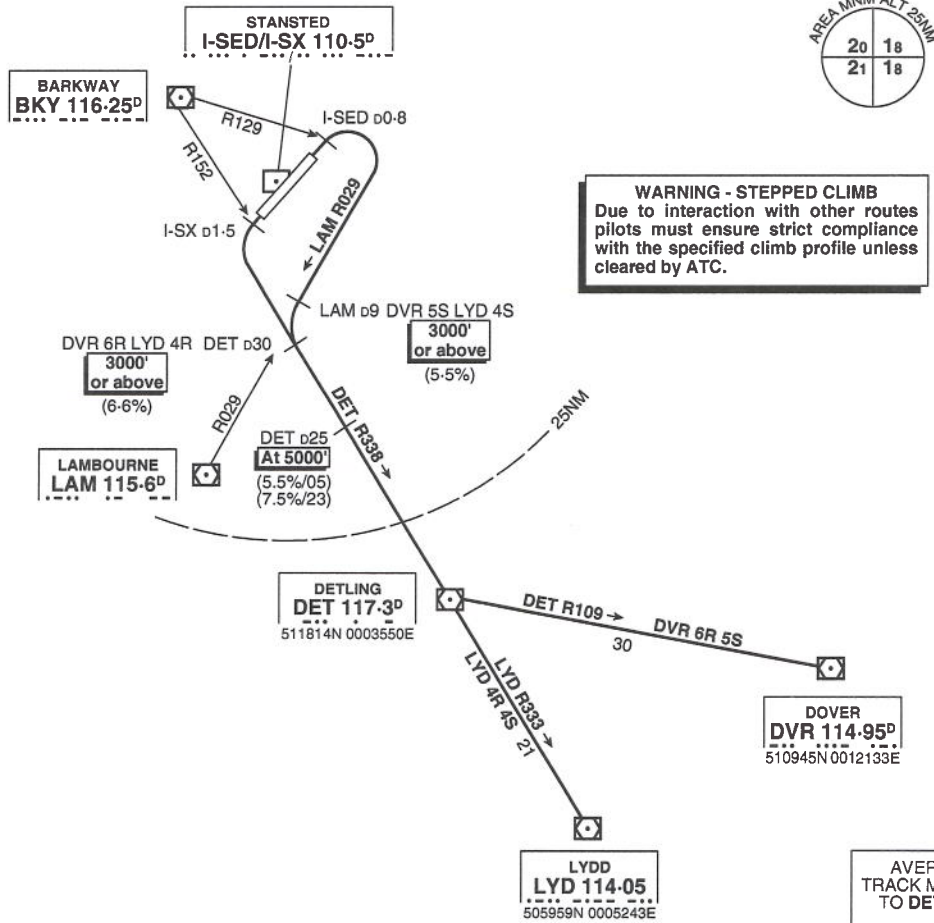
LONDON STANSTED

GENERAL INFORMATION

- 1 SIDs reflect Noise Preferential Routings. See EGSS AD 2.21 for Noise Abatement Procedures.
- 2 Initial climb straight ahead to 848' QNH (500' QFE).
- 3 Climb gradients in excess of 3.3% are necessary for ATC separation purposes.
- 4 Callsign for RTF frequency use when instructed after take-off 'London Control'. Occasionally aircraft may be required to communicate with 'Essex Radar' as instructed by ATC. Report callsign, SID designator, current altitude and cleared altitude on first contact with 'London Control' or 'Essex Radar'.
- 5 En-route cruising level will be issued after take-off by 'London Control'. **Do not climb above SID levels until instructed by ATC.**
- 6 Maximum IAS 250KT below FL100 unless otherwise authorised.
- 7 Also for positioning flights to London Gatwick. Follow LYD SID to DET VOR then join TIMBA 2E STAR maintaining 5000FT.

NOT TO SCALE

TRANSITION ALT 6000'



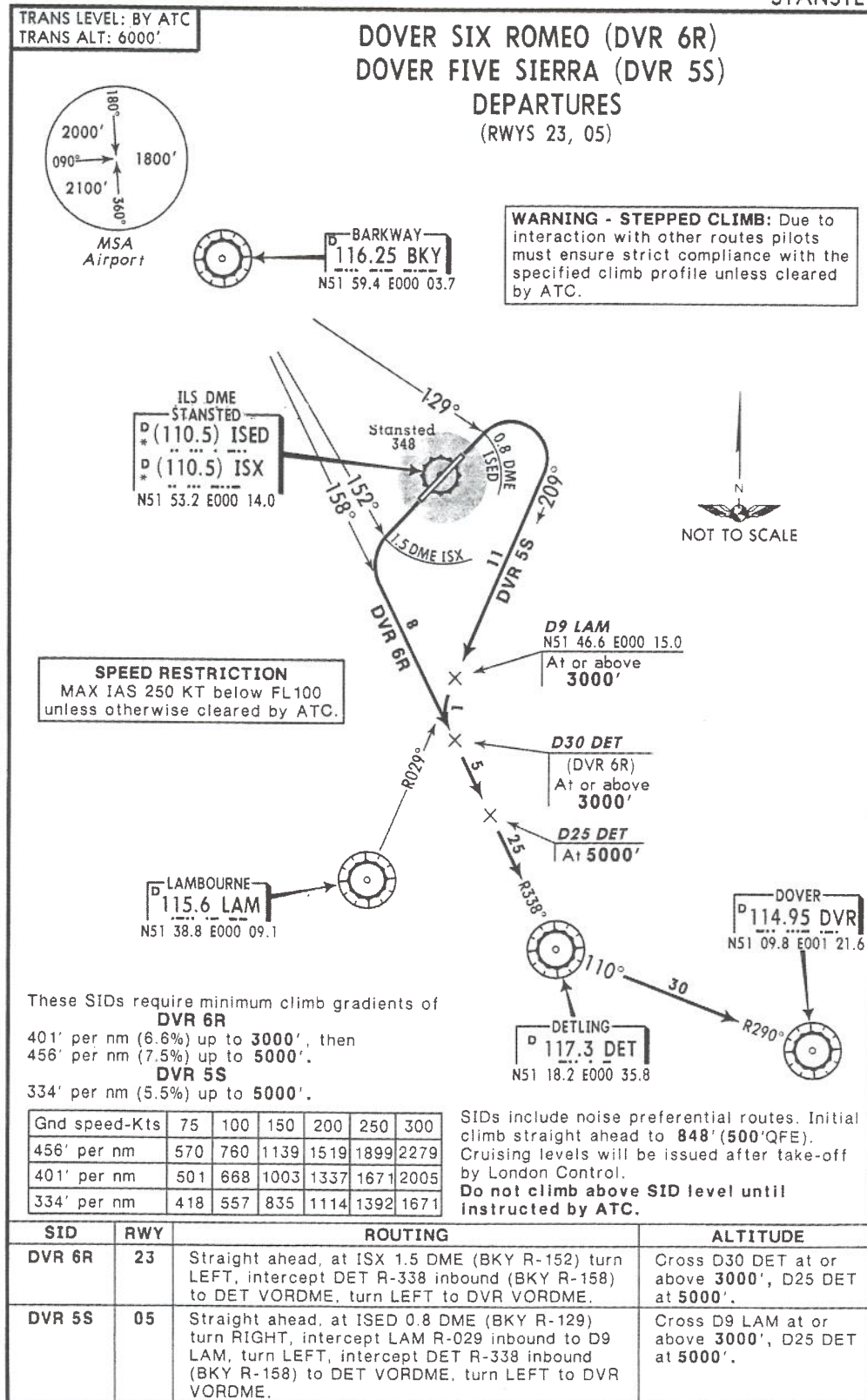
AVERAGE TRACK MILEAGE TO DET VOR	
DVR 6R	38
DVR 5S	42
LYD 4R	38
LYD 4S	42

SID	RWY	ROUTEING (Incl. Noise Preferential Routing)	ALTITUDES	AIRWAY ROUTE
DVR 6R	23	Straight ahead to I-SX 01-5 (BKY VOR R152), then turn left onto DET VOR R338 (BKY VOR R158) to DET VOR, then turn left to DVR VOR.	Cross DET 030 3000' or above DET 025 at 5000'	G1 B3 Eastbound W71.
DVR 5S	05	Straight ahead to I-SED 00-8 (BKY VOR R129), then turn right onto LAM VOR R029 to LAM 09, then turn left onto DET VOR R338 to DET VOR, then to DVR VOR.	Cross LAM 09 3000' or above DET 025 at 5000'	
LYD 4R	23	Straight ahead to I-SX 01-5 (BKY VOR R152), then turn left onto DET VOR R338 (BKY VOR R158) to DET VOR, then to LYD VOR.	Cross DET 030 3000' or above DET 025 at 5000'	A1/A34 (FL170 and below) UM605/ M605 G27, R803.
LYD 4S	05	Straight ahead to I-SED 00-8 (BKY VOR R129), then turn right onto LAM VOR R029 to LAM 09, then turn left onto DET VOR R338 to DET VOR, then to LYD VOR.	Cross LAM 09 3000' or above DET 025 at 5000'	

CHANGE AIRWAY A47/UA47 REDESIGNATED M605/UM605. RADIALS UPDATED. NOTE 7.

AERO INFO DATE 6 OCT 99

EFFECTIVE DATE 2 DEC 99

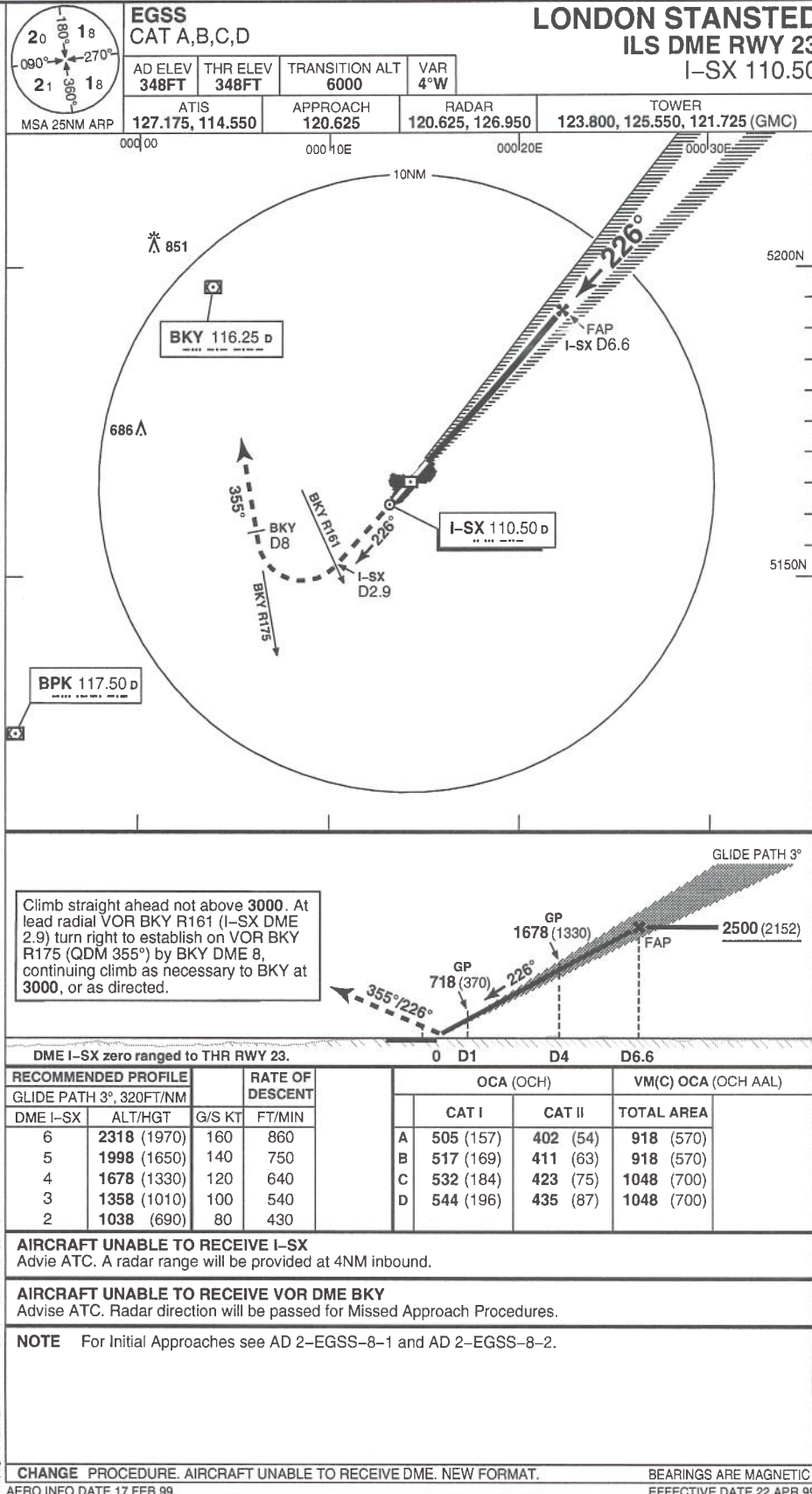


CHANGES: Chart reindexed.

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AD 2-EGSS-8-6 (22 Apr 99)

UK AIP



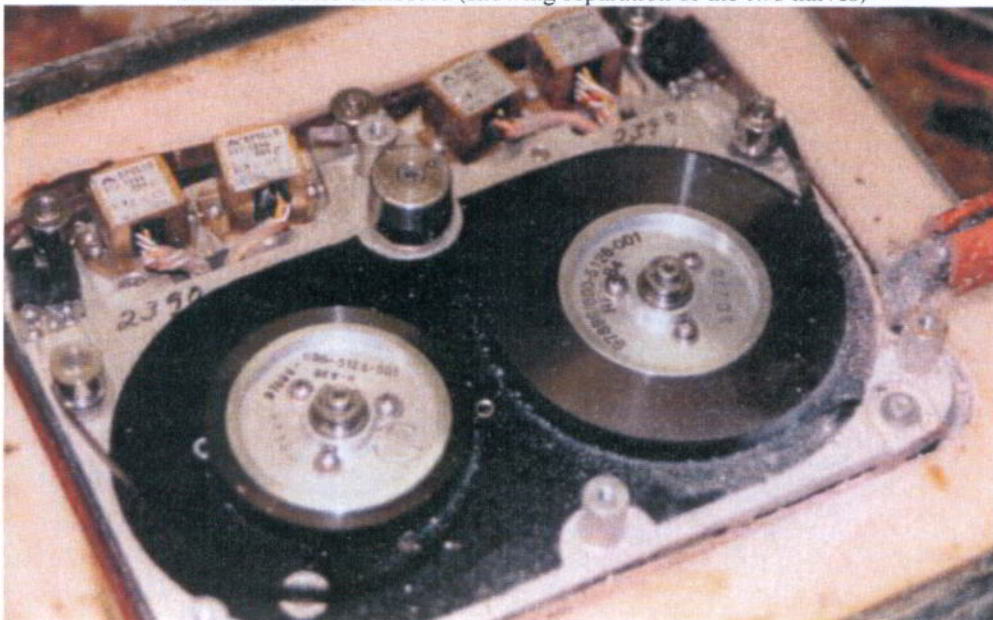
INSTRUMENT APPROACH CHART-ICAO



FDR unit (crash protected enclosure normally located on right hand side (front of unit))



Crash Protected enclosure (showing separation of the two halves)



Magnetic tape inside crash protection



CVR unit

KAL 747 Accident on 22 December 1999 Provisional CVR Transcript
 Italics denote translation from Korean language, brackets denote uncertain words
 p1 = Captain p2 = First Officer F Eng = Flight Engineer G Eng = Korean Ground Engineer on-board aircraft

TIME	TO END	ATC UTC	SOURCE	ATC	SOURCE	INTELLIGENCE	COMMENTS
31:11.4	02:03.5	18:35.5	stansted tower	Korean eight five zero nine surface wind one nine zero one eight knots clear take off runway two three			
31:17.4	01:57.5		KAL8509 (p2)	Clear to take off runway two three koreanair eight five zero nine			
					p1	CHAM	
					p1	<i>it is strange the surface looks damp but is slippery</i>	
				OTHER ATC TRANSMISSIONS	p2	Clear for take off	
					p1	CHA - GULO GAB NI DA Now Rolling	
					p1	body gear steering	
					F Eng	body gear steering	
					F Eng	Compass cross check	
31:45.0	01:29.9				F Eng	time check three seven	
					F Eng	Before take off check list complete	
							sound of engine power increase
					F Eng	stabilised -	
					p1	set take off thrust	
					F Eng	set	
					F Eng	(reduced) thrust	
							switch noise
31:57.0	01:17.9				F Eng	Check	
32:02.5	01:12.4				P2	eighty knots	
					p1	roger	

KAL 747 Accident on 22 December 1999 Provisional CVR Transcript
 Italics denote translation from Korean language, brackets denote uncertain words
 p1 = Captain p2 = First Officer F Eng = Flight Engineer G Eng = Korean Ground Engineer on-board aircraft

TIME	TO END	ATC UNIT	SOURCE	ATC	OTHER ATC TRANSMISSIONS	SOURCE	INTELLIGENCE	COMMENTS
32:10.0	01:04.9					P2	v one rotate	
32:12.7	01:02.2							noise(maybe door banging)
32:16.4	00:58.5					p2	V two	two noises(maybe trim movement)
32:16.8	00:58.1							click
32:17.8	00:57.1							noise (seat moving)
32:18.6	00:56.3					P2	positive climb	
32:20.4	00:54.5					P1	gear up	
						P2	gear up	
						P1	set IAS	
						P2	IAS	
32:28.5	00:46.4					p1	oh	
						p1	<i>IL JEOM one decimal</i>	means I didn't
						p1	CHUM NA	expect this
32:33.0	00:41.9					P2	passing nine hundred feet	
32:35.0	00:39.9							warning starts
32:36.7	00:38.2							warning ends
32:38.5	00:36.4					p1	<i>we should turn at one point five DME</i>	(sounds three times)
32:41.4	00:33.5					p2	yes sir	
32:44.2	00:30.7					p1	<i>DME not working</i>	warning starts
32:45.3	00:29.6							warning ends
32:45.4	00:29.5					p2	<i>one five eight</i>	(sounds twice)
						p1	eh?	
32:46.8	00:28.1					p2	heading standby sir	
32:48.8	00:26.1					p2	heading one five eight	

KAL 747 Accident on 22 December 1999 Provisional CVR Transcript
 Italics denote translation from Korean language, brackets denote uncertain words
 p1 = Captain p2 = First Officer F Eng = Flight Engineer G Eng = Korean Ground Engineer on-board aircraft

TIME	TO END	ATC UNIT	SOURCE	ATC	SOURCE	INTELLIGENCE	COMMENTS
32:51.0	00:23.9						warning starts
32:53.4	00:21.5		stansted	Korean eight five zero nine contact london			
			tower	one one eight decimal eight two			
				good night			
32:54.1	00:20.8				F Eng	BANK AN MEOG NE Bank is not working	
32:57.0	00:17.9						warning ends
32:58.0	00:16.9				F Eng	Bank Bank	(sounds nine times cut off as tenth chime begins)
32:59.4	00:15.5		KAL.8509	one one eight eight two koreanair eight five			
33:02.4	00:12.5		(p2)	zero nine			
33:03.3	00:11.6				p1	YA (eh you)	two click noises
33:04.7	00:10.2				F Eng	Standby Indicator (DO) also not working	
33:06.4	00:08.5					(OH)	mechanical noise
33:08.0	00:06.9				p1	Request Radar vector	
33:10.0	00:04.9				p1	YA (eh you)	
33:10.5	00:04.4						static noise??
33:11.3	00:03.7				?	??	
33:11.6	00:03.3						increasing wind noise
33:13.4	00:01.5				F Eng	OY Bank	
33:14.9	00:00.0						end

M-cab – Summary of Runs**Simulator Log for the Morning of 2-8-2000 (Full Backdrive Simulation):**

The morning session consisted of 14 cases, all using the full backdrive (No Pilot Interaction) scenario. The results of each case are identical and are shown in Appendix I, Figures 1 and 2.

Simulator Log for the Afternoon of 2-8-2000 (Pilot Interaction Simulations):

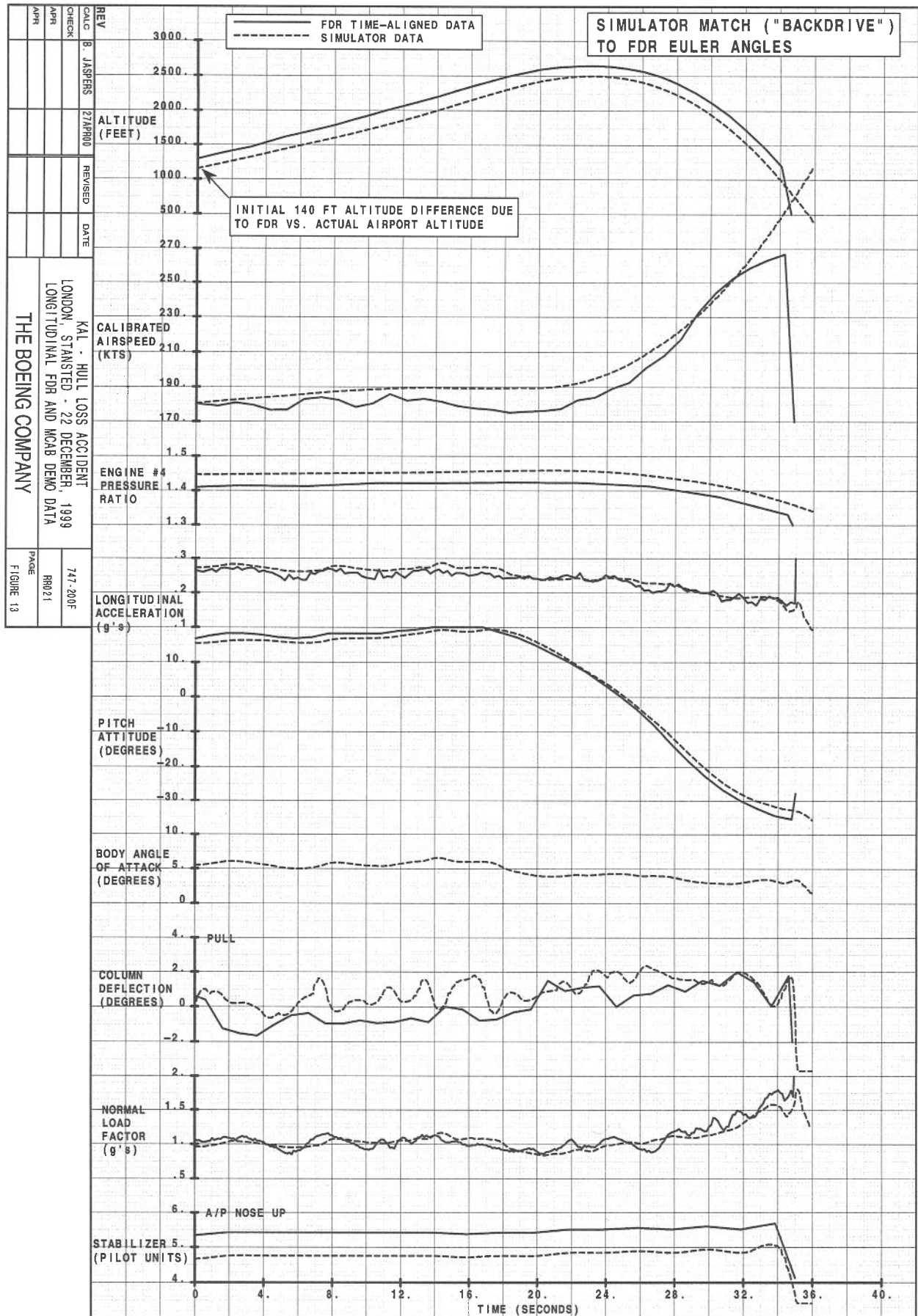
Note: The pilot flying the manoeuvre was in the right seat for each case. All cases except for the last two (23 and 24) were backdriven with the pilot taking over at the designated recovery point. Cab motion was used for all but the last two cases.

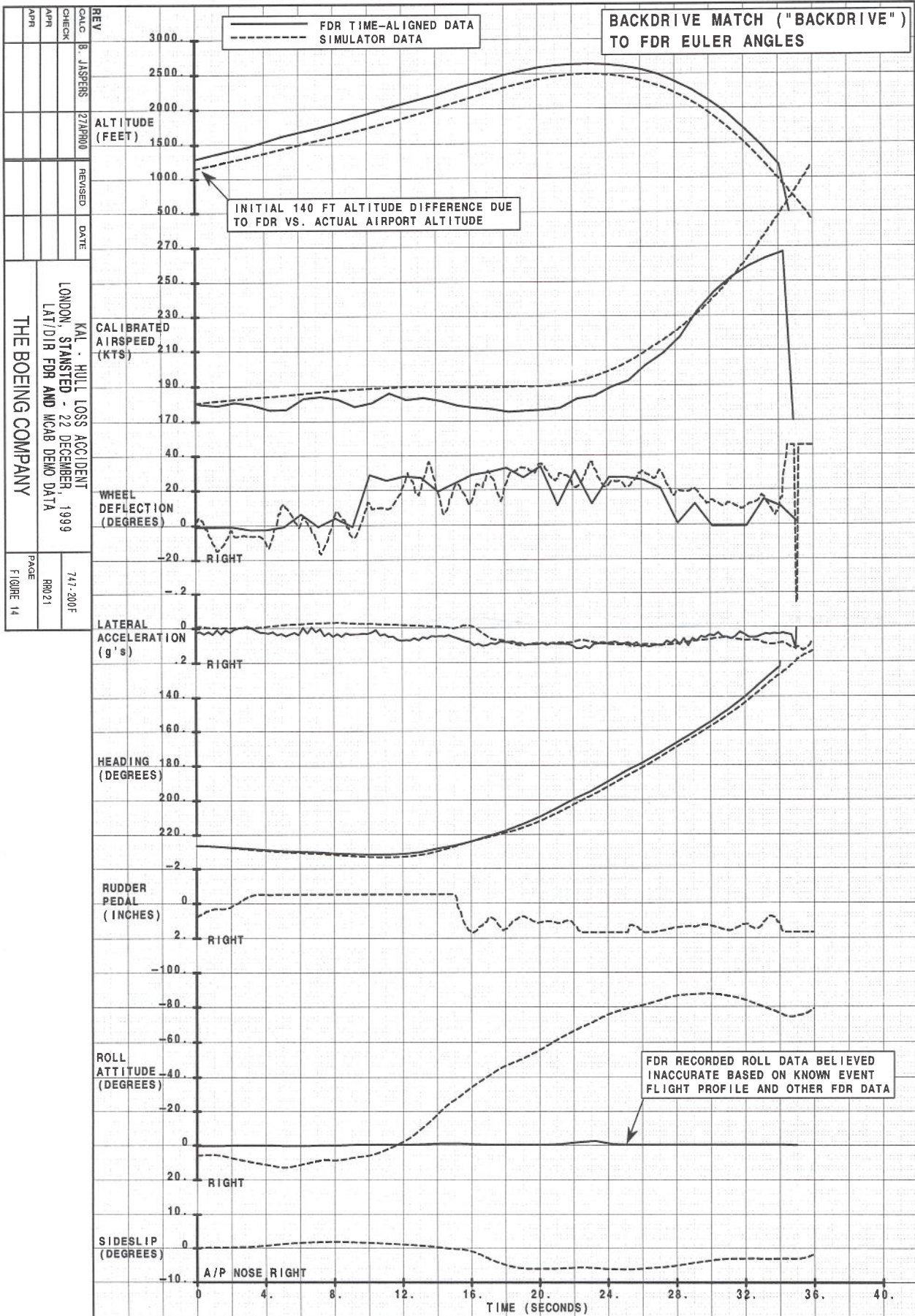
Case #	Clock Time	Comments	Minimum Height (Feet)	Maximum g's	Maximum Velocity (KCAS)
1	13:03	Recover From 45 Deg. Bank	-	1.2	-
2	13:05	Recover From 60 Deg. Bank	2500	-	-
3	13:07	Recover From Peak Altitude	2250	1.6	-
4	13:08	Recover From Peak Altitude + 2 Seconds RUN NOT VALID, REDO AS CASE 5	-	-	-
5	13:09	Recover From Peak Altitude + 2 Seconds	1920	1.7	-
6	13:11	Recover From Peak Altitude + 5 Seconds	1000	2.75	-
7	13:14	Recover From Peak Altitude + 7 Seconds	640	4.0	-
8	13:18	Recover From Peak Altitude	2280	1.6	-
9	13:19	Recover From Peak Altitude + 5 Seconds	1100	3.5	-
10	13:21	Recover From Peak Altitude + 7 Seconds	770	3.5	-
11	13:22	Recover From Peak Altitude + 7 Seconds With Rudder Pedal	1040	3.0	-
12	13:27	Recover From Peak Altitude	2240	-	-

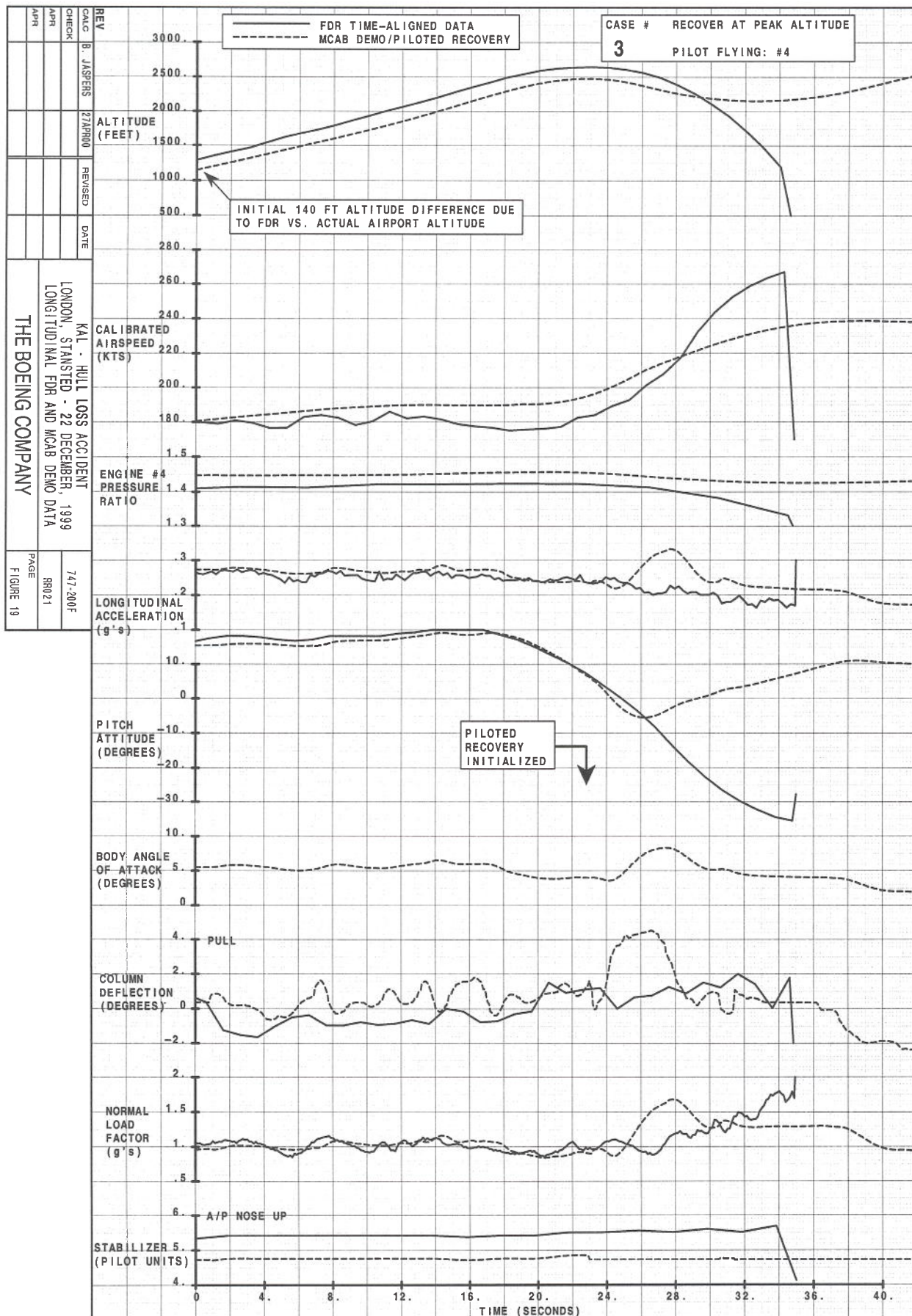
**Appendix I
(cont)**

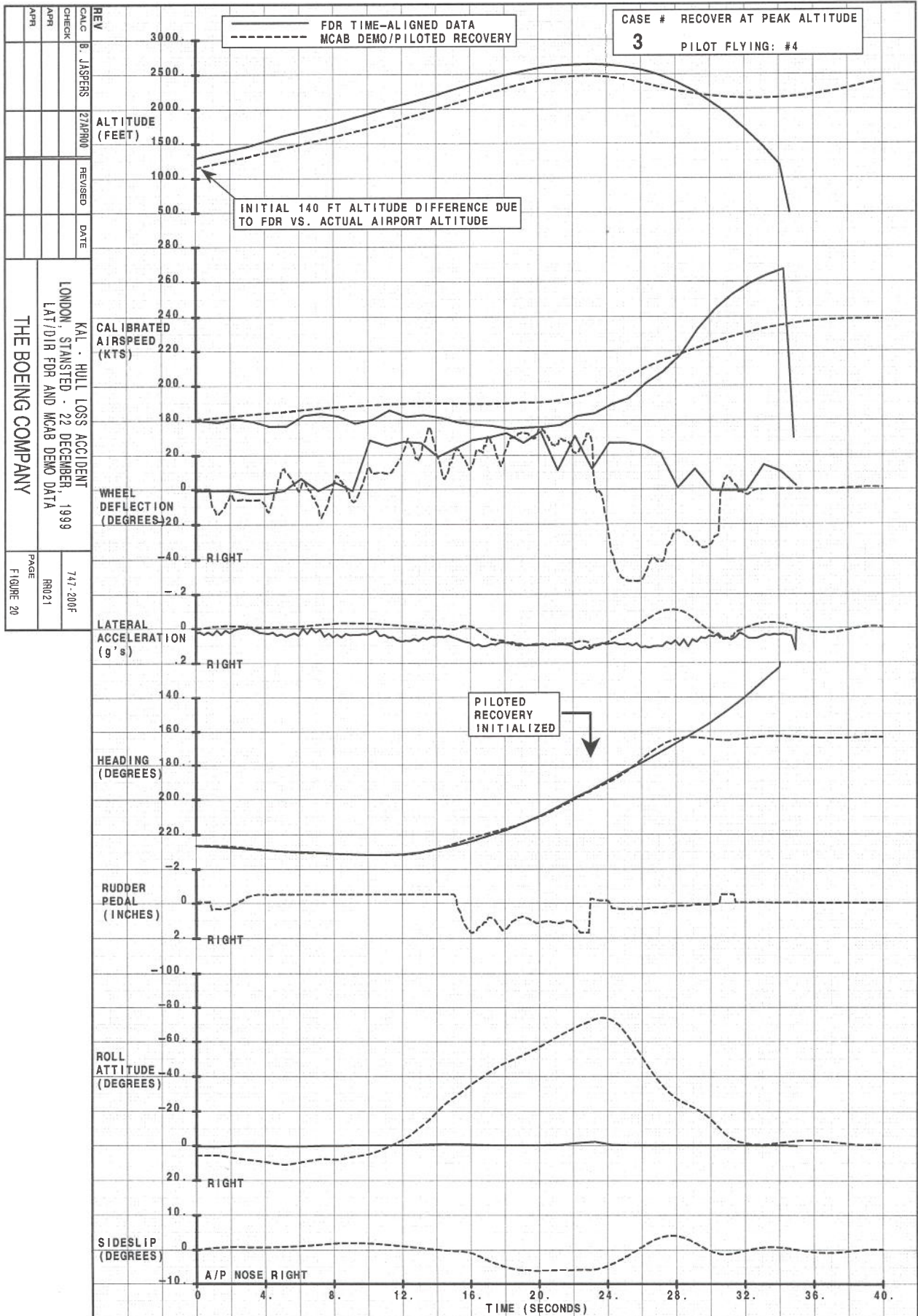
Case #	Clock Time	Comments	Minimum Height (Feet)	Maximum g's	Maximum Velocity (KCAS)
13	13:29	Recover From Peak Altitude + 5 Seconds Stick Shaker Fired During Recovery	1450	3.0	-
14	13:30	Recover From Peak Altitude + 7 Seconds Stick Shaker Fired During Recovery	660	4.0	-
15	13:31	Recover From Peak Altitude + 7 Seconds With Rudder Pedal	720	3.8	-
16	13:35	Recover From Peak Altitude	2360	3.0	-
17	13:37	Recover From Peak Altitude + 5 Seconds	1390	2.5	260
18	13:38	Recover From Peak Altitude + 7 Seconds	820	3.2	280
19	13:40	Recover From Peak Altitude + 7 Seconds With Rudder Pedal	560	4.0	300
20	13:42	Recover From Peak Altitude + 7 Seconds With Rudder Pedal	520	3.7	290
21	13:43	Recover From Peak Altitude + 7 Seconds With Rudder Pedal	720	4.0	280
22	13:47	Recover From Peak Altitude + 8 Seconds Aircraft Not Recovered / Ground Impact	-	-	-
23	13:50	Full Backdrive (No Pilot Interaction) AAIB Videotaping FlightViz M-Cab Motion OFF	-	-	-
24	13:52	Full Backdrive (No Pilot Interaction) AAIB Videotaping FlightViz M-Cab Motion OFF	-	-	-

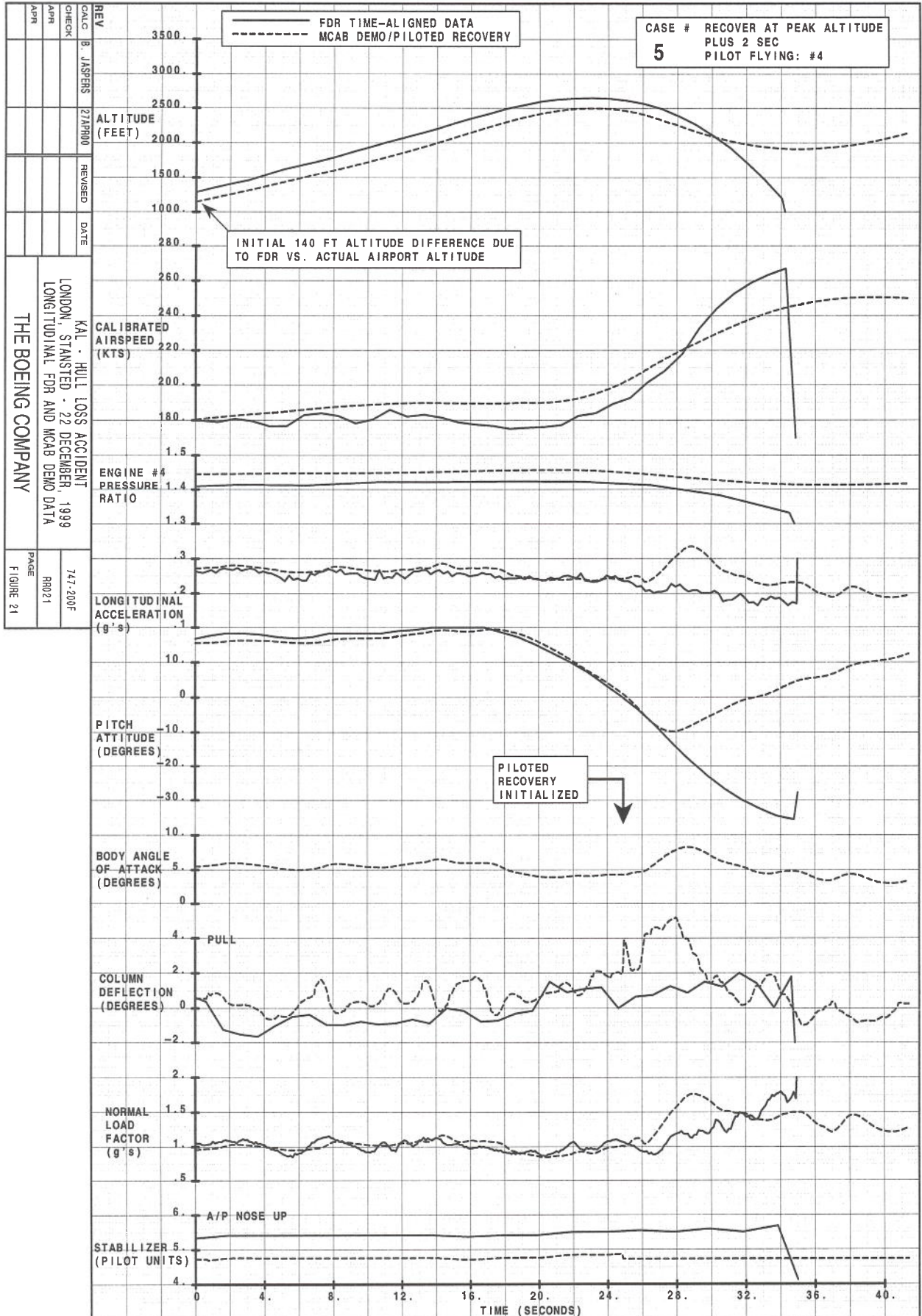
Appendix I, Figures 3 and 4 and Appendix I, Figures 5 and 6 show runs 3 and 5 respectively.

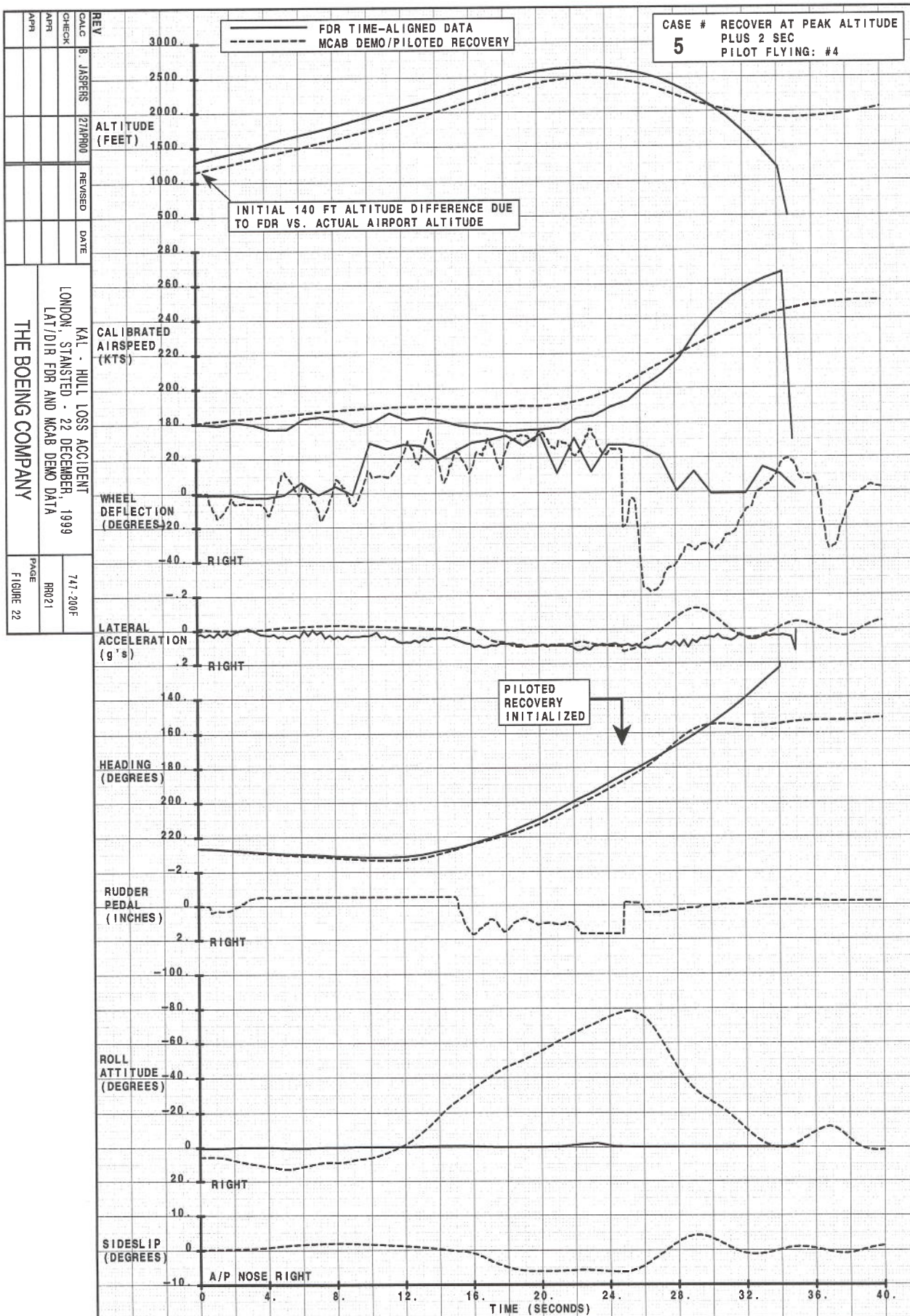




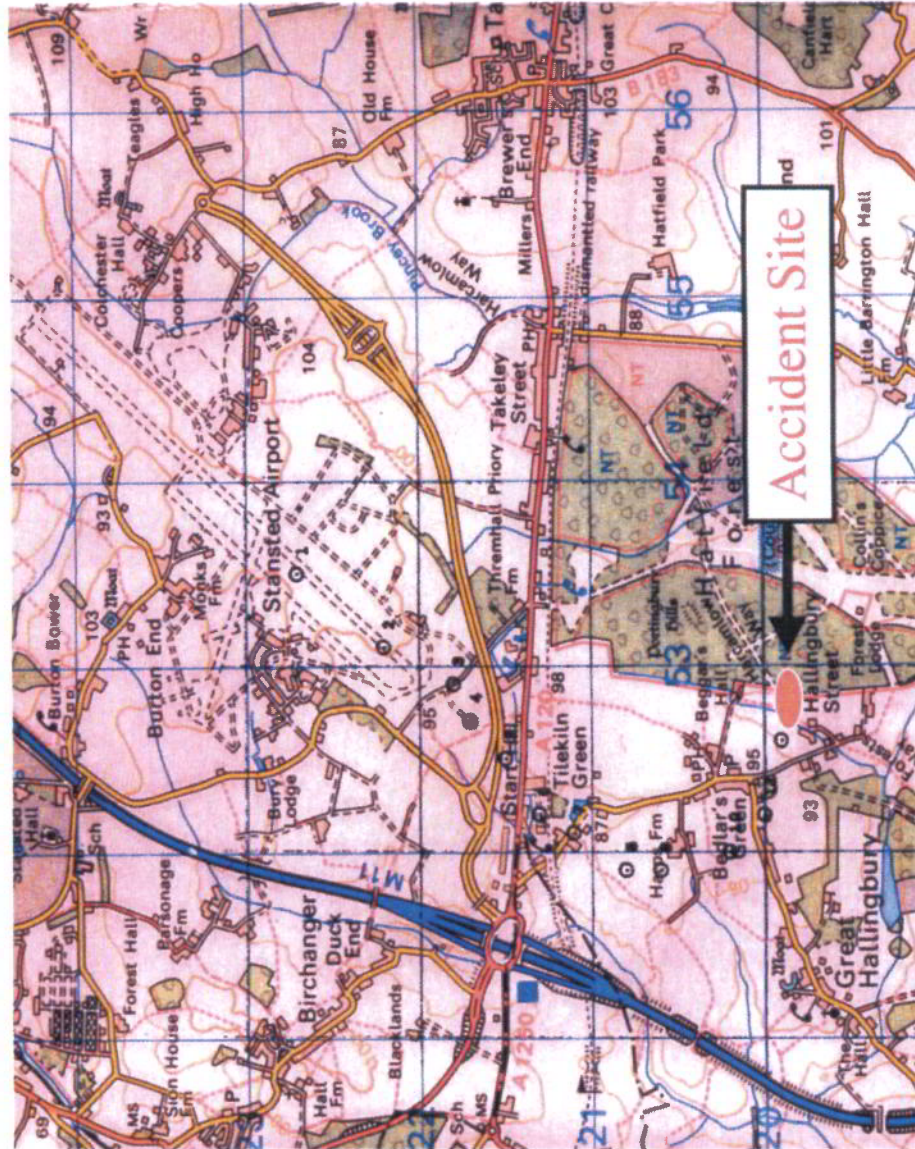








RADAR PLOT (Stansted Watchman)

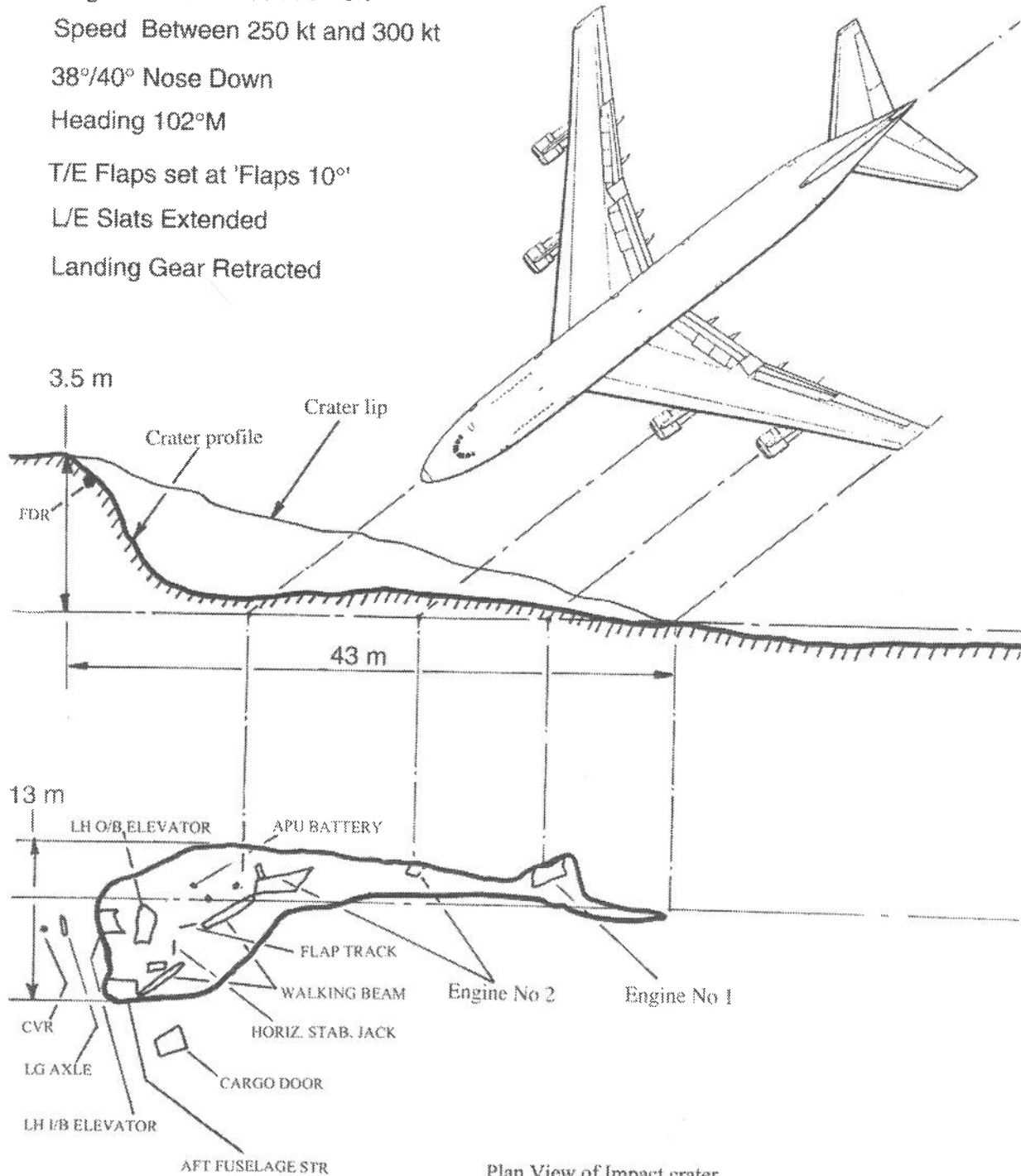


	Time	Height (1013)
1.	1837.47	660 feet
2.	1837.55	960 feet
3.	1837.59	1160 feet
4.	1838.3	1360 feet
5.	1838.7	1660 feet
6.	1838.11	1860 feet
7.	1838.15	2160 feet
8.	1838.19	2360 feet
9.	1838.22	2460 feet
10.	1838.26	2360 feet
11.	1838.30	1960 feet
12.	1838.34	1060 feet

SUMMARY OF IMPACT PARAMETERS --- KoreanAir BOEING 747 HL-7451

STANSTED 22 DECEMBER 1999

- Angle of bank - 80°/90° left
- Speed Between 250 kt and 300 kt
- 38°/40° Nose Down
- Heading 102°M
- T/E Flaps set at 'Flaps 10°'
- L/E Slats Extended
- Landing Gear Retracted



Plan View of Impact crater



FRONT VIEW OF INDICATOR AS FOUND

(Compare with Appendix O Figure 1)

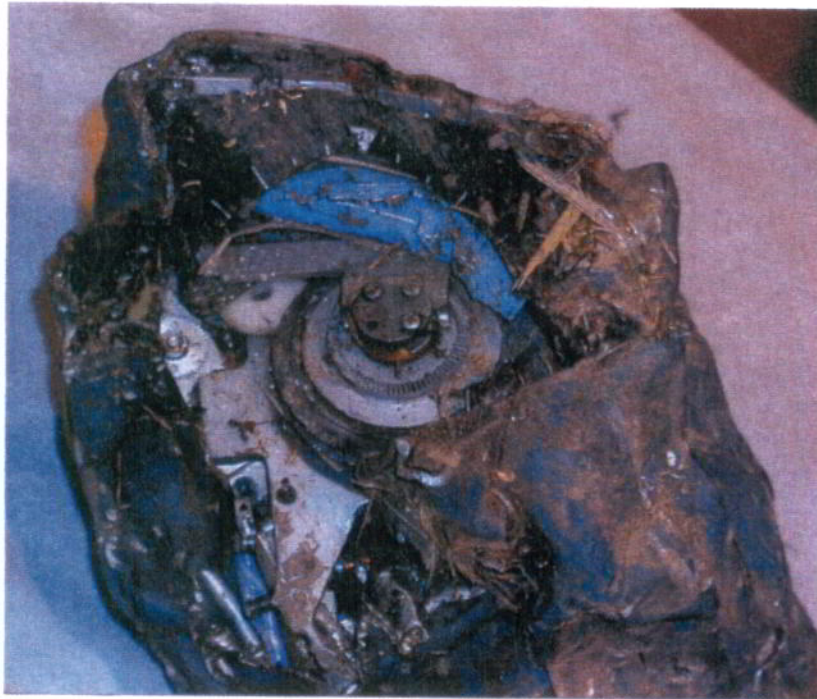
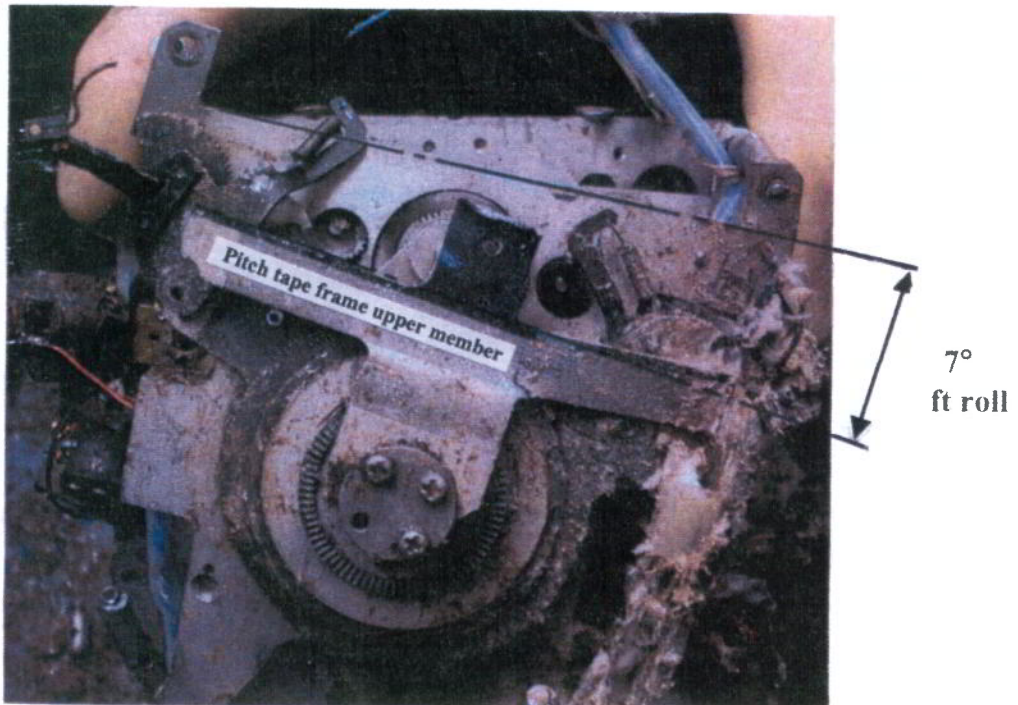


Figure 1



**ASSESSMENT OF INDICATED ROLL ANGLE
ALLOWING FOR DISTORTION**

Figure 2



Figure 3

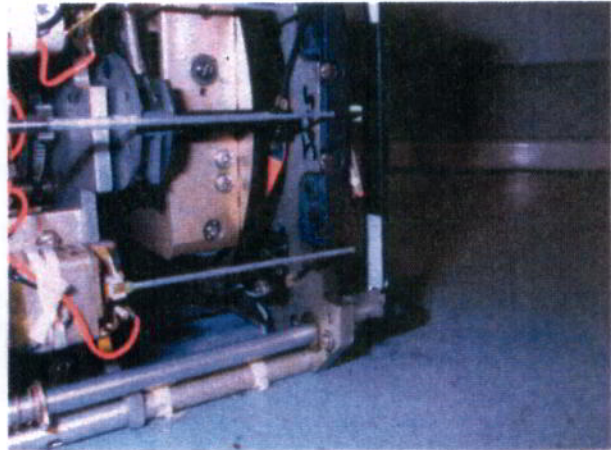


Figure 4

GYRO flag in view seen from front and rear

GYRO flag as-found, seen from the front, crimped between the folds of the FDI case sidewall. Angle of flag, in relation to front and top edge of the casing, is similar to the flag out of view position

GYRO flag out of view seen from the rear



Figure 5

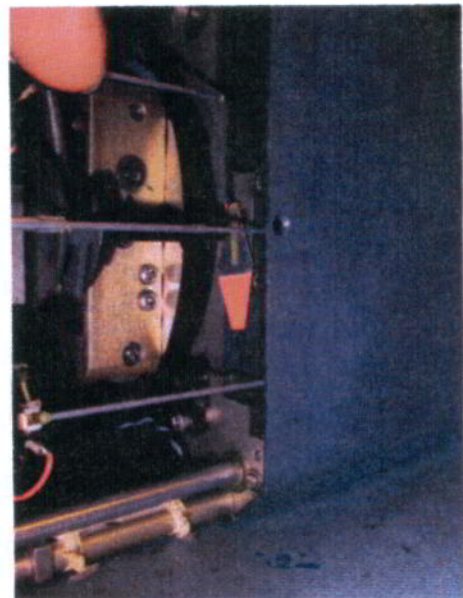


Figure 6

ASSESSMENT OF GYRO FLAG POSITION PRIOR TO IMPACT

SECTION 9. AIRCRAFT MAINTENANCE

9.1 Routine Services

- 9.1.1 Perform line inspection in accordance with the Carrier's current instructions.
- 9.1.2 Enter in aircraft log and sign for performance of line inspection.
- 9.1.3 Enter remarks in aircraft log regarding defects observed during the inspection.
- 9.1.4
 - (a) Performs pre-departure inspection immediately before aircraft departure according to the Carrier's instructions.
 - (b) Perform ice-check immediately before aircraft departure according to the Carrier's instructions.
- 9.1.5 Provide skilled personnel to assist the flight crew or ground staff in the performance of the Inspection.

9.2 Non-routine Services

- 9.2.1 Rectify defects entered in the aircraft log as reported by the crew or revealed during the inspection, to the extent requested by the Carrier. However, major repairs must be separately agreed upon between the Parties.
- 9.2.2 Enter in aircraft log and sign for the action taken.
- 9.2.3 Report technical irregularities and actions taken to the Carrier's maintenance base in accordance with the Carrier's instructions.
- 9.2.4 Maintain the Carrier's technical manuals, handbooks, catalogues, etc.
- 9.2.5 Provide engineering facilities, tools and special equipment to the extent available.
- 9.2.6 Move aircraft under its own power in accordance with the Carrier's instructions.

9.3 Material Handling

- 9.3.1
 - (a) Obtain Customs clearance for
 - (b) Administer
the Carrier's spare parts, power plants and/or equipment.
- 9.3.2 Provide periodic inspection of the Carrier's spare parts and/or spare power plant.
- 9.3.3 Provide suitable storage space for the Carrier's spare parts and/or special equipment.
- 9.3.4 Provide suitable storage space for the Carrier's spare power plant.

9.4 Parking and Hangar Space

- 9.4.1
 - (a) Provide
 - or
 - (b) Arrange for suitable parking space.

Figure 1

FLS AGREEMENT NO: 2045

DATED: 01/12/1999

PARAGRAPH 6 – INTERFACE PROCEDURES

- 6.1 FLS Aerospace shall send two mechanics of whom at least one should have FAA, A&P or JAR 145 B747 Licence (hereinafter referred to as the “FLSA crew”)
- 6.2 FLS Aerospace shall inform KAL London Maintenance Manager when any change takes place as to equipment and materials which FLSA is to provide to KAL.
- 6.3 The FLS Aerospace crew shall meet the aircraft upon arrival on site and stay with the aircraft until it’s departure. If the total downtime of the aircraft exceeds three hours the FLS Aerospace crew may leave the aircraft, subject to the approval KAL Maintenance Manager. In the case the crew leaves the aircraft they will be in permanent contact with the aircraft while it’s on the ground.
- 6.4 The four Manhours mentioned in clause 1.1 to this agreement only relates to the FLS Aerospace crew and can not be transferred to any other FLS Aerospace personnel. If the time the FLS Aerospace crew is with the aircraft exceeds a total of four manhours and the Carrier wishes to keep the FLS Aerospace crew with the aircraft or if any additional mechanics are required alongside the FLS Aerospace crew the Manhour rate in clause 1.2 will apply.
- 6.5 The FLS Aerospace crew shall contact the pilots when the aircraft stops at position to inquire the condition of the aircraft, possible by interphone.
- 6.6 The FLS Aerospace crew shall perform transit check in accordance with KAL transit check sheet.
- 6.7 The FLS Aerospace crew shall inform the KAL Maintenance Manager of defect as soon as they find it for instructions.
- 6.8 The FLS Aerospace crew shall brief the KAL Maintenance Manager on the condition of the aircraft after completion of check and/or defect rectification’s if such are to be carried out during check. Then do the same briefing on pilots.
- 6.9 After doors are closed, the FLS Aerospace crew shall make contact with pilots for engine start and confirm that conditions are normal, possible by interphone.

Figure 2



Captain's FDI

DIAGRAM OF ESTIMATED FDI PRESENTATION AT MOMENT OF IMPACT

Yellow command bars drawn at maximum normal fly UP (15°) and RIGHT (20°) position, roll attitude indicating approx. 2.5° LEFT roll
 (White command bars represent as-found position, derived from FDI strip examination)

Figure 1

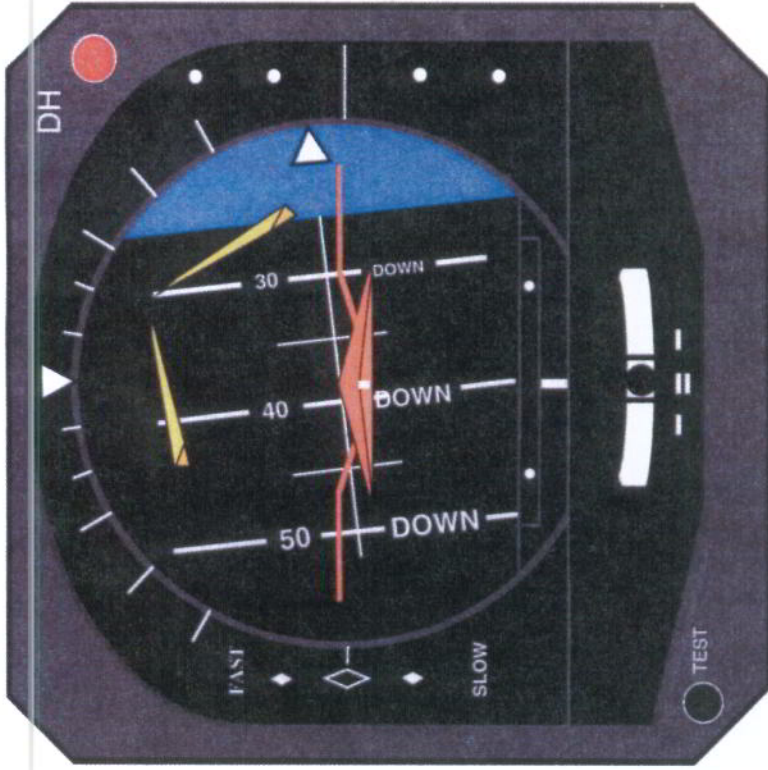


Captain's FDI

DIAGRAM OF PRESENTATION WITH 0° PITCH ATTITUDE LINE AT INTERSECTION OF FIXED BLUE SEGMENT AND UPPER VISIBLE LIMIT OF ATTITUDE TAPE

Yellow command bars drawn at maximum normal fly UP (15°) and RIGHT (20°) position, roll attitude indicating approx. 2.5° LEFT roll

Figure 2



First Officer's FDI



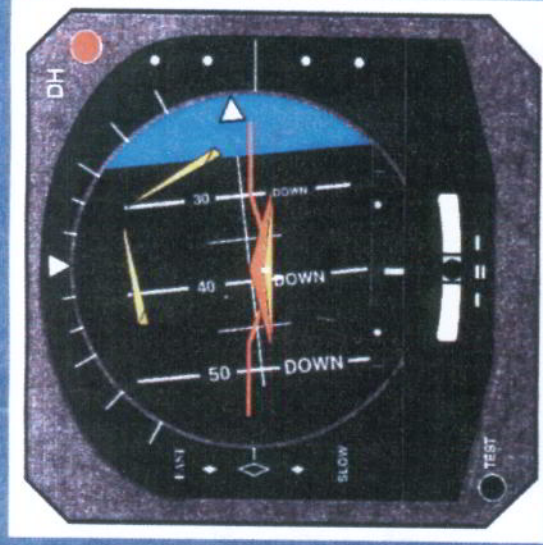
Captain's FDI

DIAGRAM OF ESTIMATED FDI PRESENTATIONS AT MOMENT OF IMPACT

Yellow command bars drawn at maximum normal fly UP (15°) and RIGHT (20°) roll
(White command bars represent as-found position, derived from FDI strip examination)

Figure 2

Figure 1



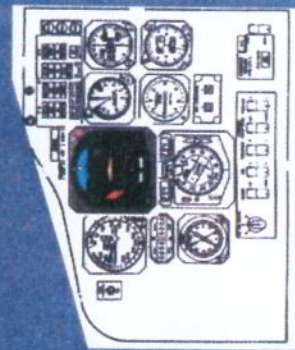
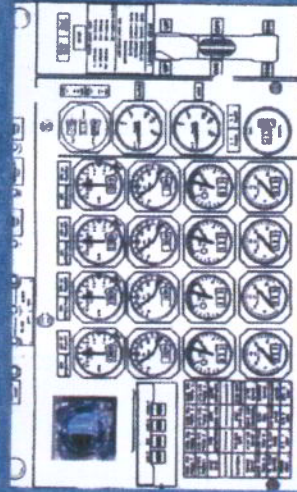
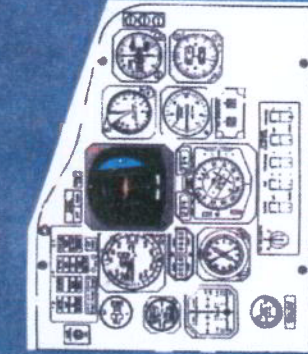
CO-PILOT's ADI - indications assumed from FDR data



STANDBY HORIZON - as found indication



CAPTAIN's ADI - indications derived from strip examination and FDR data



Relative locations of attitude references on main instrument panel

Attitude Reference Data at Moment of Impact