Aviation Safety Council

Taipei, Taiwan

CI611 Accident Investigation

Factual Data Collection

Group Report

Recorders Group

June 03, 2003

ASC-AFR-03-06-001

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I. Team Organization

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II. History of Activities

Date	Description
05/25/02	● ASC requested CSIST's assistance in recorders searching
05/26/02	● Contacted flight data engineers at ATSB, NTSB and BFU, to request FDR database for Boeing 747-200
05/26/02	● CSIST launched search operation
05/27/02	● Received FDR database from ATSB, Australia
05/28/02	● ROC Navy launched recorders search operation
05/29/02	● The ULB signal was found in area Lat: 23D59'03"N Long:119D41'19"E
06/10/02	● Received FDR database from NTSB, USA
06/11/02	● Contacted Safety Department of China Airlines (CAL) and requested to use a Lockheed model 209F digital flight data recorder for the database verification.
06/13/02	● Visited Maintenance Shop of China Airlines and requested for the Lockheed FDR.
06/14/02	● Received document of FDR database from Boeing company.
06/16/02	● Global Industry Salvage Ship, Jan Steen, joined recorders search operation
06/17/02	● Received FDR database from Thiel Axel, BFU Germany

06/18/02	● The CVR was recovered at position: Lat: 23°58'58.612"N Long:119°41'36.736"E
06/19/02	● The FDR was recovered at position: Lat: 23°58'58.464"N Long: 119°41'17.711"E ● The distance between two recorders is about 610 meters.
06/19/02	● Both recorders arrived at the ASC's Investigation Lab. ● Engineers started removing tapes from recorders as well as cleaning and drying process.
06/20/02	● Downloaded both recorders ● CVR Group commenced tape readout ● FDR Group commenced data readout.
06/22/02	● Completed digitization of entire 25 hours of FDR data.
06/23/02	● Completed preliminary CVR transcript of total 31 minutes and 51 seconds of recording.
06/24/02	● Time synchronization with CVR and radar data.
06/25/02	● Confirmed FDR parameters of the accident flight and sync. With the CVR events.
06/28/02	● CVR transcript verified.
06/28/02	● Simulation flight utilizing CAL's B747-200 Freighter ferried from Taipei to Hong Kong for cockpit instrument sound spectrum recognition and FDR data comparison.

06/29/02	● Published CVR final transcripts on the ASC web site.
07/02/02 - 07/04/02	● CVR spectrum comparison at NTSB Recorders Lab, USA.
08/26/02	● The CVR group including members from ASC, CAA, NTSB, Boeing, and CAL re-listened to the CVR from time 00:25:43 to 00:25:44（07:21:50UTC to 07:21:51UTC） and concluded that no changes to the transcript were necessary.

III. Factual Description

1.11 Recorders

1.11.1 Cockpit Voice Recorder

The Fairchild model A100A cockpit voice recorder (CVR), serial number 60156 was brought to the Investigation laboratory of the Aviation Safety Council on June 19, 2002. Quality of the recording was good and a transcript was prepared of the entire 31minutes and 51 seconds as shown in Appendix 4-1.

The CVR unit arrived at the ASC lab in a water cooler submerged in fresh water (Figure 1.11-1). The exterior of the CVR was seriously dented and distorted. The front panel including the handle and underwater locator beacon was still attached. The protective dust cover had to be cut in several places before it could be removed. The interior crash enclosure appeared to be in good condition. There were only a few minor scratches and dents noted. The interior tape reel assembly was wet. The recording media was wet but otherwise appeared to be in good condition. The tape was not broken but had minor damages. There were no signs of any fire or heat damage noted to either the exterior or the interior of the unit. The Dukane underwater locator beacon that was installed on the CVR was seriously contaminated but operated normally during underwater recovery process.

Figure 1.11-1 Damaged CVR in the cooler

The recording tape consisted of four channels of good quality audio information. One channel contained the cockpit area microphone audio information. The other three channels contained the Captain's, the First Officer's, and the Flight Engineer's radio/intercom audio information.

The recording started at 1456:12[1] and continued uninterruptedly until 1528:03. When the recording started, the prerecorded announcement just started to announce “Welcome aboard, ladies and gentlemen…”. The crew requested taxi clearance at 1457:06. The flight was cleared for takeoff on runway 06 at CKS Airport, Taipei at 1507:10. The takeoff and climb appeared normal. The flight contacted Taipei Approach at 1508:53. Taipei Approach instructed CI611 direct to CHALI at 1510:34. At 1512:12, the flight contacted China Airlines Operations the time of off-block, airborne and estimated time arrive Hong Kong. The flight again contacted Taipei Area Control Center at 1516:18, and the Taipei Area Control instructed the crew to continue their climb and maintain FLIGHT LEVEL 350 from CHALI direct to KADLO at 1516:24. The acknowledgment of this transmission at 1516:31 was the last radio transmission received from the aircraft. The recording stopped at 1528:03.

The original tape was brought to NTSB Vehicle Recorder Lab for spectrum comparison. The purpose is to compare the last moment of the accident CVR with databank from NTSB. The last five seconds of CAM(Cockpit Area Microphone) signature from CVR recording 1527:58 to 1528:03 is shown in Appendix 4-2.

The group also sampled sound spectrum signatures from a ferry flight from Taipei to Hong Kong on June 28, 2002 on a CAL B747-200 freighter.

1.11.2 Flight Data Recorder

The accident aircraft was equipped with a Lockheed model 209F Flight Data Recorder (FDR), model number 10077A500-107, serial number 2537, which was configured to record 21 parameters. Even though the FDR case was damaged by impact force, data could be retrieved and analyzed. Examination of the data indicated that the FDR had operated normally. About 32 minutes of data were transcribed for the accident flight.

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[1] The time reference is base on the Makung radar station time.

1.11.2.1 Description of the Data

The FDR records information digitally on a 0.25 inch-wide magnetic tape that has a recording duration of 25 hours before the existing data are overwritten. There are 6 distinct, individual tracks written bi-directionally. It contains approximately 4.17 hours of data on each track until reaching end-of-tape, then reverses direction, changes to other recording track, and writes data in the reverse direction. With this method, the FDR records even-numbered tracks in one direction, odd-numbered tracks in the opposite direction.

The FDR records 64 words of digital information every second, with each word 12 bits in length. Each grouping of 64 words (or 768 bits) is called a sub-frame, a sub-frame is equivalent to one second of recording time. Each sub-frame has a unique 12-bit synchronization (sync) word to identify it as sub-frame 1, 2, 3, or 4. The sync word is the first word in each sub-frame. Each grouping of consecutive 1, 2, 3 and 4 sub-frames comprises a frame (i.e., four seconds of data). The data stream is "in sync" when successive sync words appear at the proper 64-word intervals. Each data parameter (e.g. altitude, heading, and airspeed) has a specifically assigned word number within the sub-frame.

If the data stream is interrupted, the sync words will not appear at the proper interval or sequence and synchronization will be lost along with the surrounding data. A loss of data synchronization can result from either a mechanical or electrical interruption of the data. Foreign matter between the tape recording medium and the heads during the record or playback process can cause a mechanical interruption. Mechanical interruptions can also be caused by airframe vibration, which can introduce wow and flutter to the tape transport and distort the recorded signal. An interruption of electrical power to the recorder will also interrupt the serial data stream and cause a loss of sync. Finally, an interruption of the serial data stream to the FDR will also cause a loss of synchronization.

For this aircraft, the FDR receives a serial binary data stream from the Digital Flight Data Acquisition Unit (DFDAU) before being sent to the FDR via ARINC 542 serial binary data stream at a rate of 768 bits/sec.

The DFDAU retrieves data sent from various sources (e.g. data buses, analog sensors, etc.) throughout the aircraft. The DFDAU collects, conditions, and converts these analog and digital signals into the serial data stream. The data stream is then sent to the FDR, which converts the digital data stream into

analog, Harvard Bi- Phase waveforms. The waveforms are then recorded on the FDR tape. The aircraft manufacturer (Boeing Company) provided document number 747-AV-SD-CI, Flight Recorder/AIDS. A listing of the parameters recorded by the FDR is shown in Appendix 4-3.

The data stream is "in sync" when the sync words appear at the proper 64-word interval. If the data stream is interrupted or corrupted in some way, the sync word will not be found at the proper interval, and the time reference will be lost until the pattern can be re-established.

1.11.2.2 Examination and Readout

(1) Examination

FDR was recovered from the seabed of the Taiwan Strait on June 19, 2002 at position of N23°58.976’/E119°41.28’. The enclosure was immediately transported to the ASC Investigation Lab in Taipei. Since the FDR was not waterproof, the tape media was exposed to water. To protect the tape from corrosion, the FDR enclosure was submersed in a water cooler filled with fresh water during transportation.

Once arrived at the ASC Investigation Lab, the FDR was removed from the cooler and were examined for damage. The FDR broken into two major pieces, only the memory module with driven motor and underwater locator beacon (ULB) were still attached. The FDR’s outer sleeve and internal electronics were damaged. The FDR’s faceplate was partially torn from the casing; only the ULB held the faceplate to the FDR. The faceplate which indicates the part number and serial number was lost. After removal of the armored closure, the casing of tape reel was found intact. However some of the tape was out of the reel and stuck on the top of the reel. Six minor damages were found along 2.5 meters of the tape, which did not include the data of the accident flight (only for the previous flight, CI645). Pictures of the damaged FDR were shown in Figure 1.11-2 to 1.11-4. There are six crinkle marks located on the oldest part of the tape.

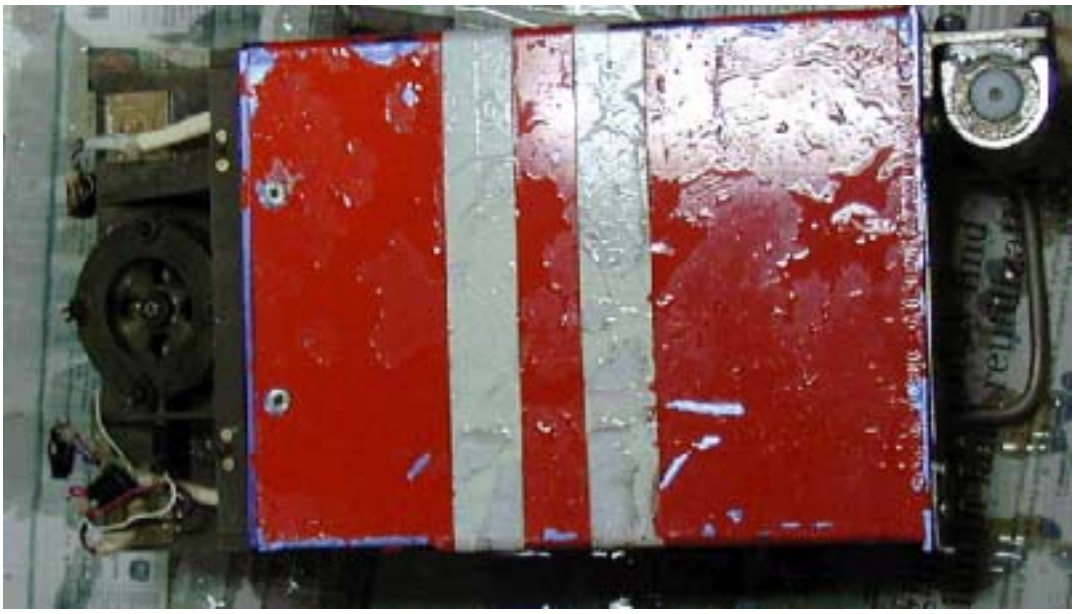


Figure 1.11-2 Damaged FDR in the cooler

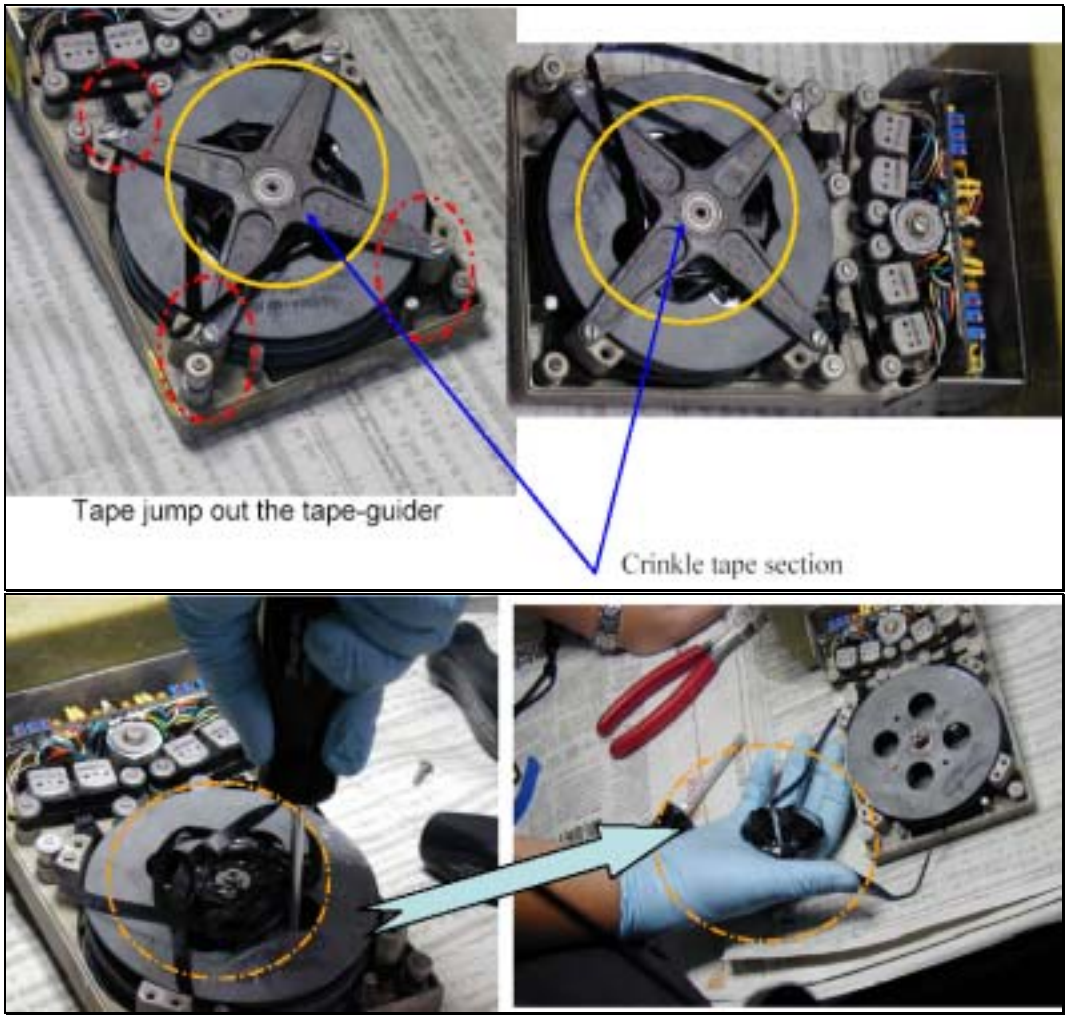


Figure 1.11-3 Photographs of damaged magnetic tape

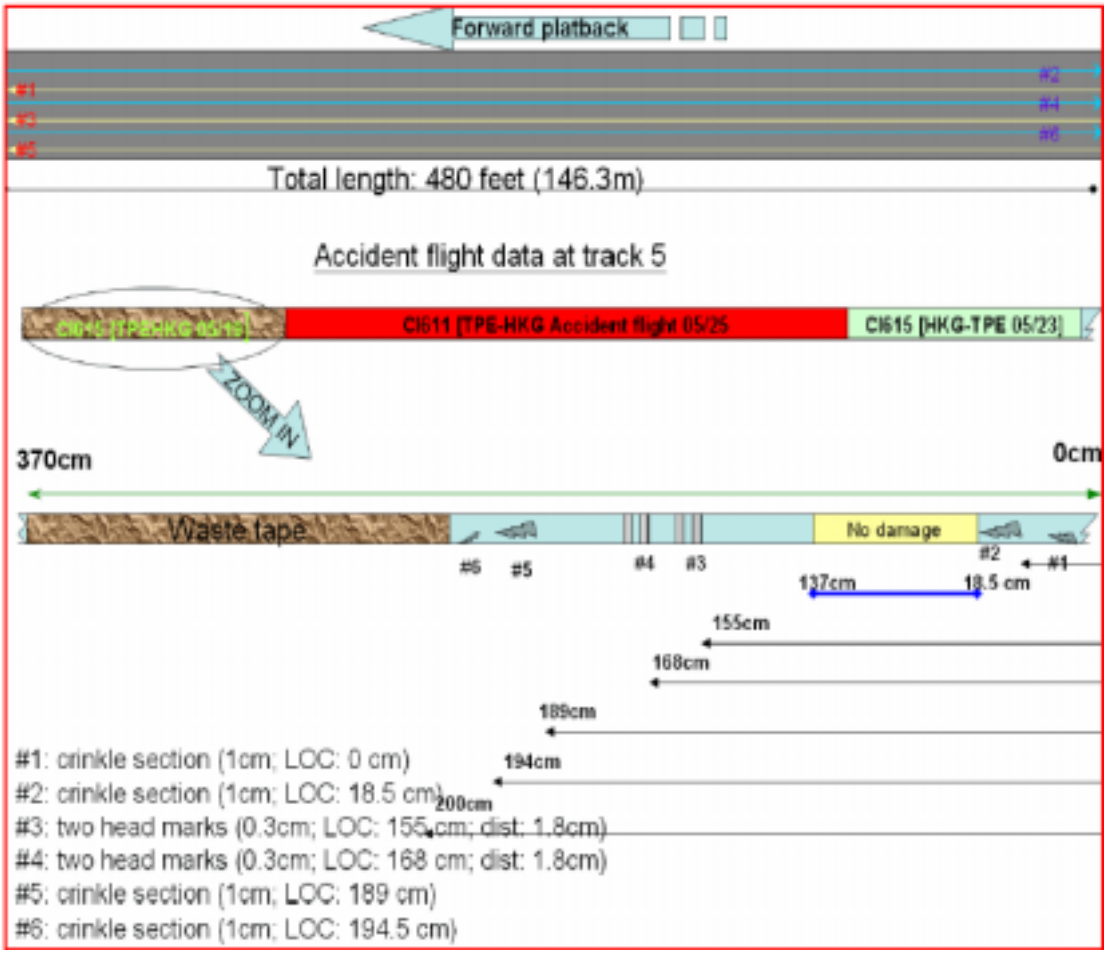


Figure 1.11-4 Sketch of damaged tape locations and conditions

(2) Readout

Readout of the FDR was accomplished with the laboratory's playback hardware, NAGRA-T tape machine connecting to a Hewlett-Packard HP C240 workstation using the Transportation Safety Board (TSB) developed Recovery Analysis and Presentation System (RAPS) software. All six tracks were checked to see if the data was consistent with the accident flight followed by a data transition (from the newest to the oldest data). Once the transition was discovered (on track 5), the tape was repositioned to the area prior to the takeoff point of the accident flight. The previous approach, landing, and the entire accident flight through the data transition were then transcribed into a computer file. Several transcriptions were attempted to acquire a complete waveform through the accident sequence and transition from the newest to the oldest data.

The transcribed data were reduced from the recorded binary decimal values (0

to 4095) to engineering units (e.g., feet, knots, degrees, etc.) using the conversion formulas (747-AV-SD-CI) obtained from Boeing and the FDAU manufacturer. An automated process that incorporates the C240 work station and associated software completed the actual conversion.

The Bi-Phase data output produced by the FDR is digitized and decoded into binary data. When sync is lost, the digitized wave form of the problem data will then be stored for further analysis- bit stream recovery.

Each of the tape's six recording tracks was then searched for data consistent with the accident flight, followed by a data transition (from the newest to the oldest data).

The elapsed time, or FDR sub-frame reference number (SRN), from the beginning of the data transcription was initially used as the time base for data output. A time correlation with the cockpit voice recorder (CVR) and radar timing were compared to the FDR Very High Frequency (VHF) microphone keying and for time correlation.

Each second of FDR data was adjusted using the following equation:

UTC Time（Makung Radar Time） = (FDR SRN) + 23986 seconds

Inspection of the transcribed data revealed that the recorder operated normally, except for several minor losses of synchronization throughout the accident flight. Utilizing RAPS’s bitwave analysis module (described below), the synchronization losses were corrected.

RAPS Bitwave Analysis of Data Inspection of the final subframes of data prior to the transition to oldest data indicated that RAPS digitized the waveforms, but was unable to determine whether the waveforms were “0” or “1”. The transcription indicated the recorded signal was weak in this area of the tape. Further inspection revealed that several subframes of data were digitized but not fully decoded. Therefore, it was necessary to manually decode the data.

The waveform recovery utility in the RAPS software was used to correct the areas of weak FDR signals, especially at the end of the accident flight and into the area of the old data.

In addition, each synchronization loss throughout the accident flight was inspected for erroneously transcribed data. All errors were corrected. When completed, the corrected frame data were combined with the in-sync data to form a composite transcription file. The resultant composite data file is

error-free from the moment of FDR start through the end of the recorded accident flight data. Normal data reduction techniques were then used to convert the composite data to engineering units and discrete values.

Function of the bit-wave analysis is also used to determinate the condition of FDR stop recording. Figure 1.11-5 shows the weak signal and bad data for the accident flight CI611 exist between words 61 to 64. Therefore, the FDR stop recording time of CI611 was 1527:58.94. It also illustrates a “more than four second” weak signal between flights CI611 and CI615.

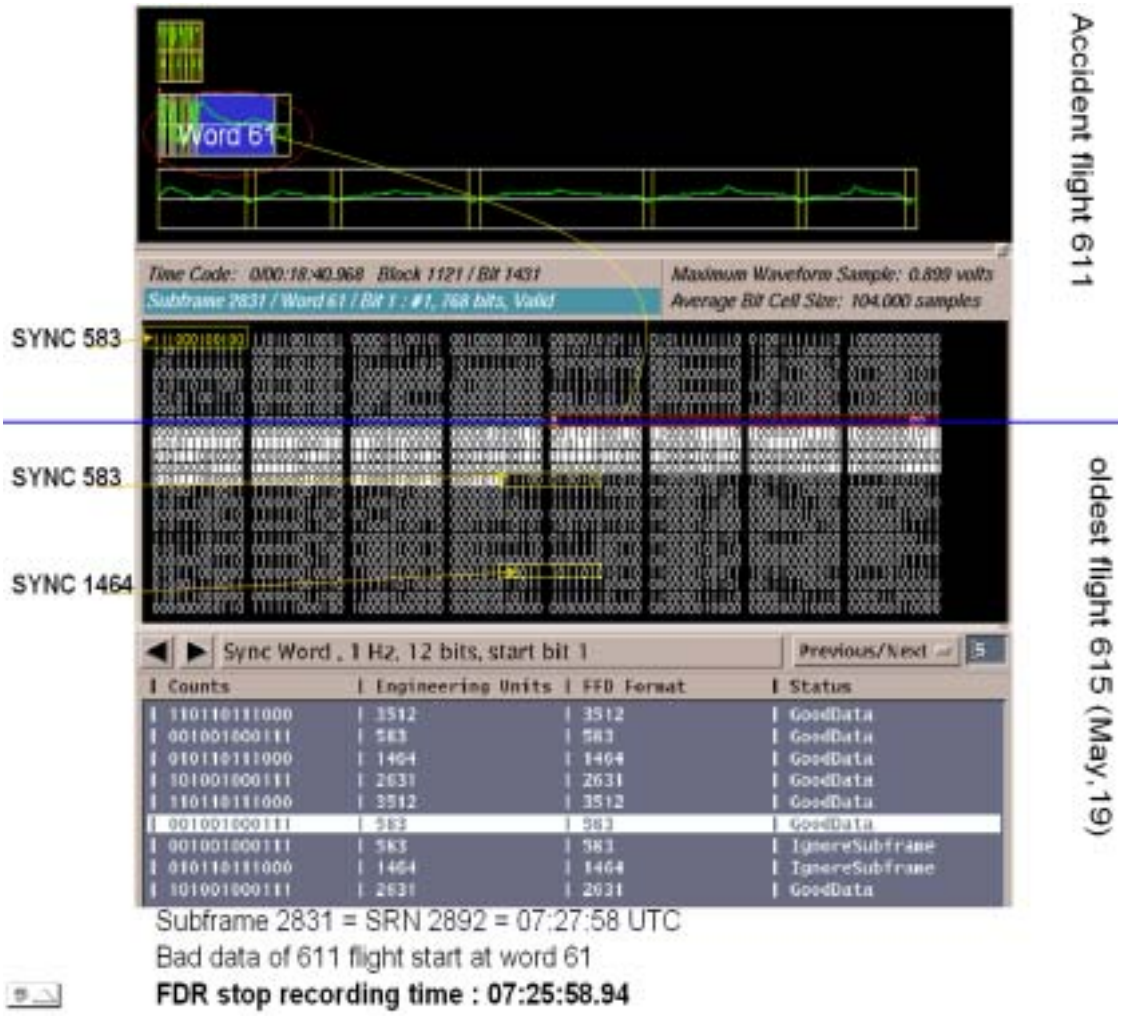


Figure 1.11-5 Weak signal and bad data for the accident flight 611 (word 61-64)

1.11.2.3 Tabular Printouts and Data Plots

Tabular sets and plots of selected FDR parameters for approximate 32 minutes recorded data of the accident flight from 1456:26 to 1527:58 were prepared

according to the readout. The plots of selected parameters covering the entire accident flight are shown in Appendix 4-4.

1.11.3 Performance Calculation based on FDR and Radar Data

The FDR recorded 21 parameters. Other parameters can be derived from the recorded parameters. However, the FDR parameters can suffer from inherent measurement errors and must be corrected for further calculations.

The performance parameters derived from the corrected FDR data include:

- True airspeed
- Mach number
- Dynamic pressure
- Rate of climb

The results of these corrections and derivations are presented in Figure 1.11-6 to 1.11-9. The “A” Figures present the results for the entire flight; the “B” Figures show the last 3 minutes of the FDR data in more detail.

1.11.3.1 Calculation - Mach Number, Dynamic Pressure, Static Temperature, and True Airspeed

True airspeed equals to the Mach number multiplied by the speed of sound; the speed of sound is a function of the static temperature, and the static temperature can be derived from total temperature and Mach number. Mach number can be calculated from calibrated airspeed and static pressure. Total temperature and calibrated airspeed are recorded directly by the FDR. The static pressure can be determined from the FDR pressure altitude and known reference pressure of 29.92”Hg (1013 mbar). Once static temperature and pressure are known, the static density can be calculated, and then dynamic pressure can be calculated using density and true airspeed.

Figures 1.11-6 and 1.11-7 show the results of these calculations. In Figure 1.11-6, the recorded indicated airspeed points are shown. The True Airspeed is also shown in Figures 1.11-6 and 1.11-7, which is derived from air density ratio and indicated airspeed. The rate of climb is derived from the altitude change rate in feet per minute.

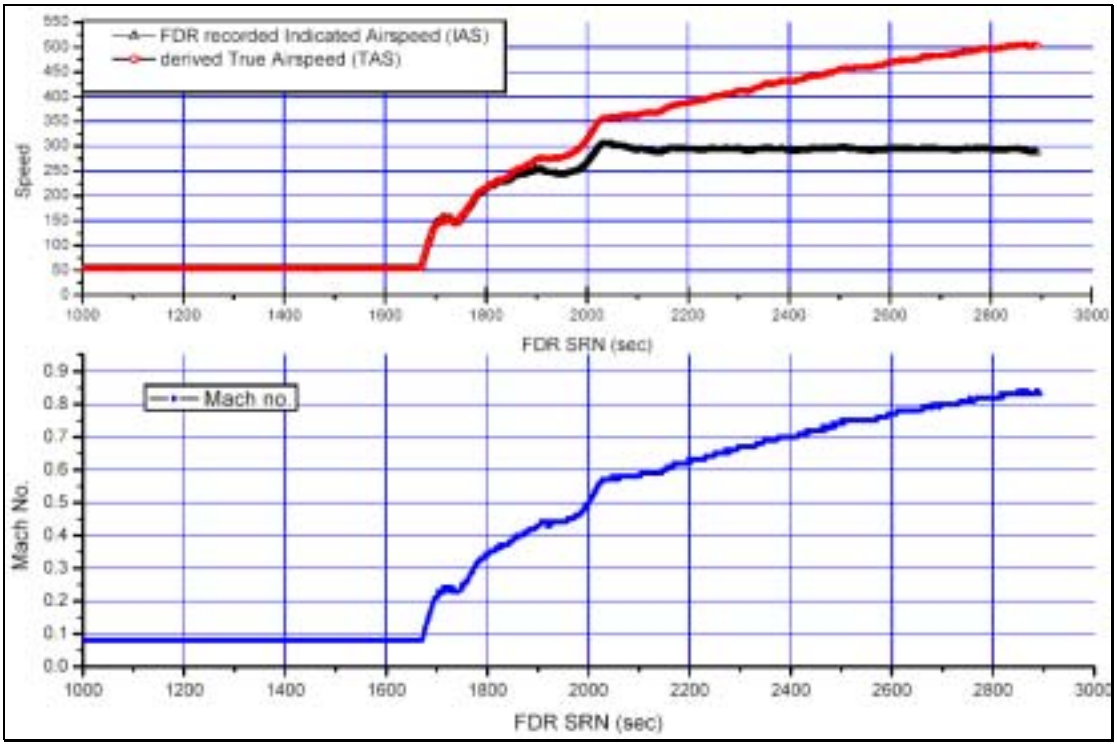


Figure 1.11-6 (a) China Airline 611- Airspeed, True airspeed and Mach number

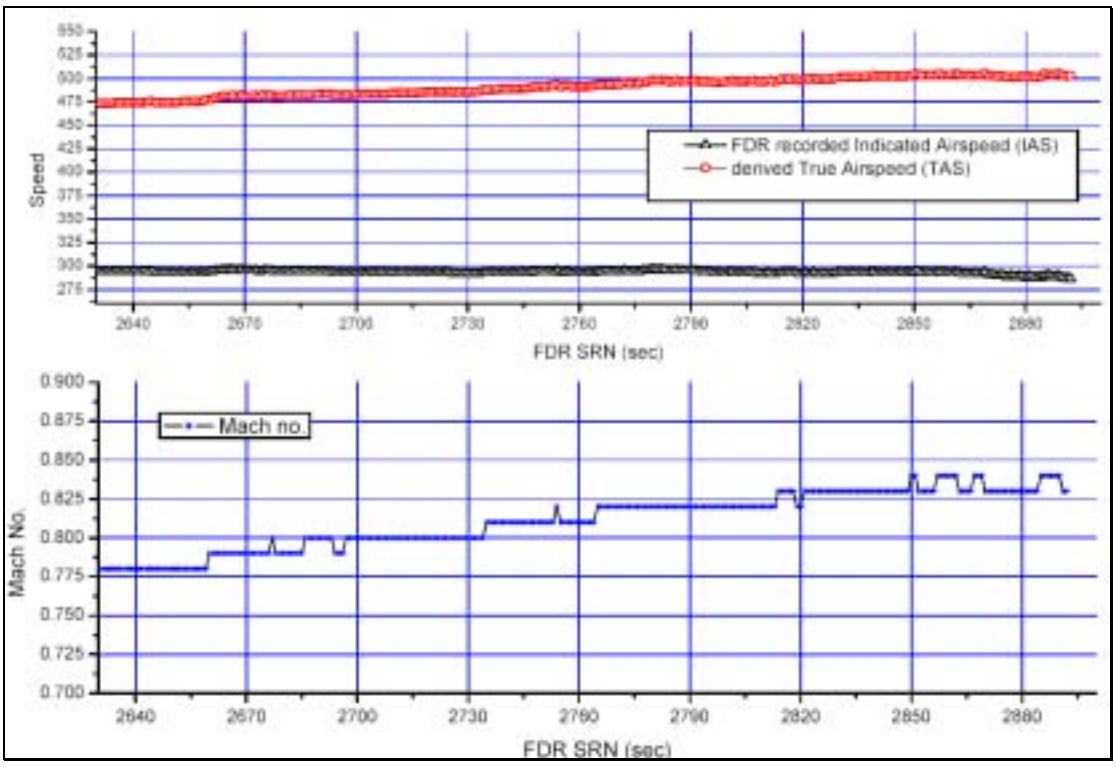


Figure 1.11-6 (b) China Airline 611- Airspeed, True airspeed and Mach number (detail)

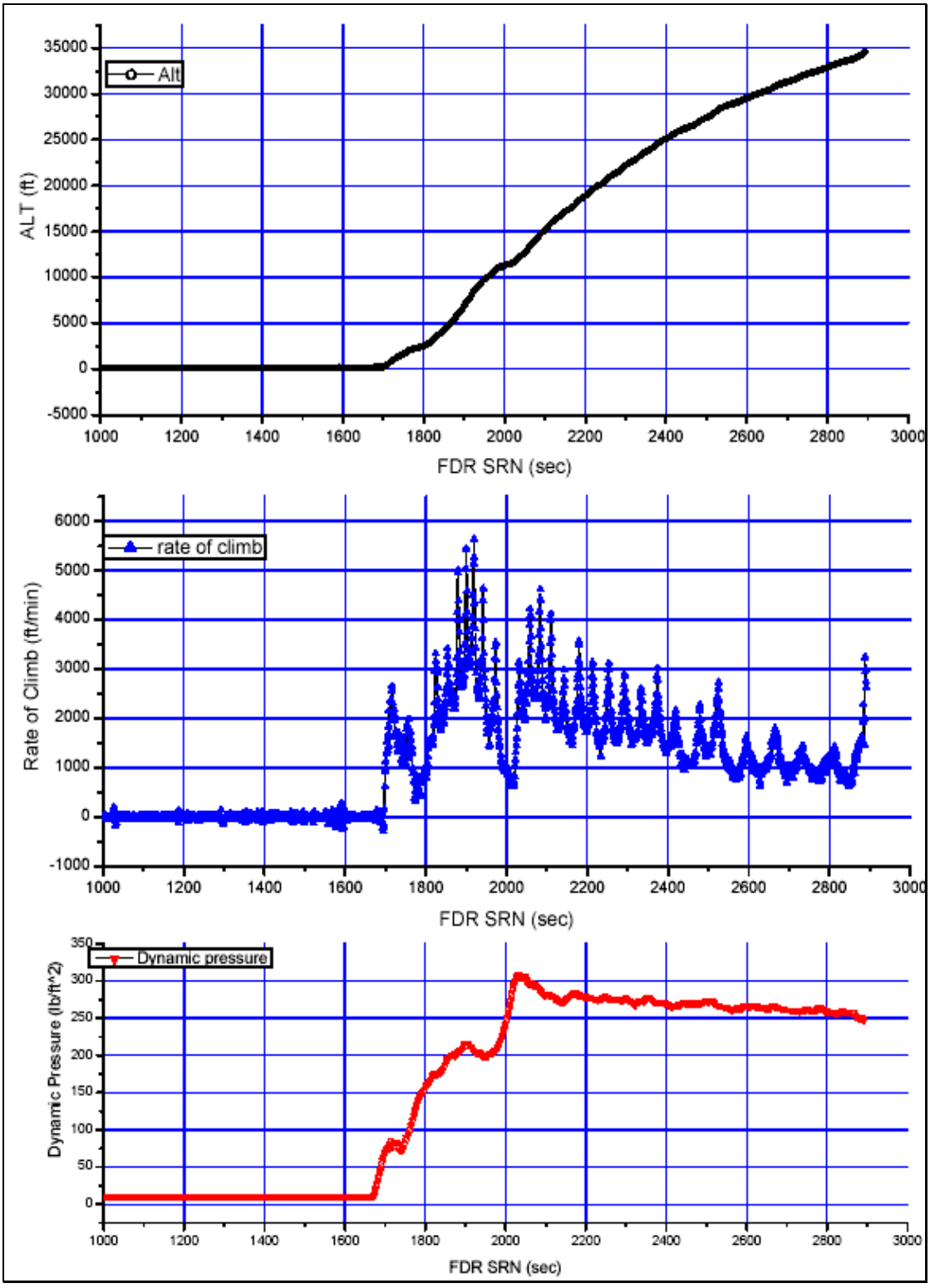


Figure 1.11-7 (a) China Airline 611- Altitude, rate of climb and dynamic pressure

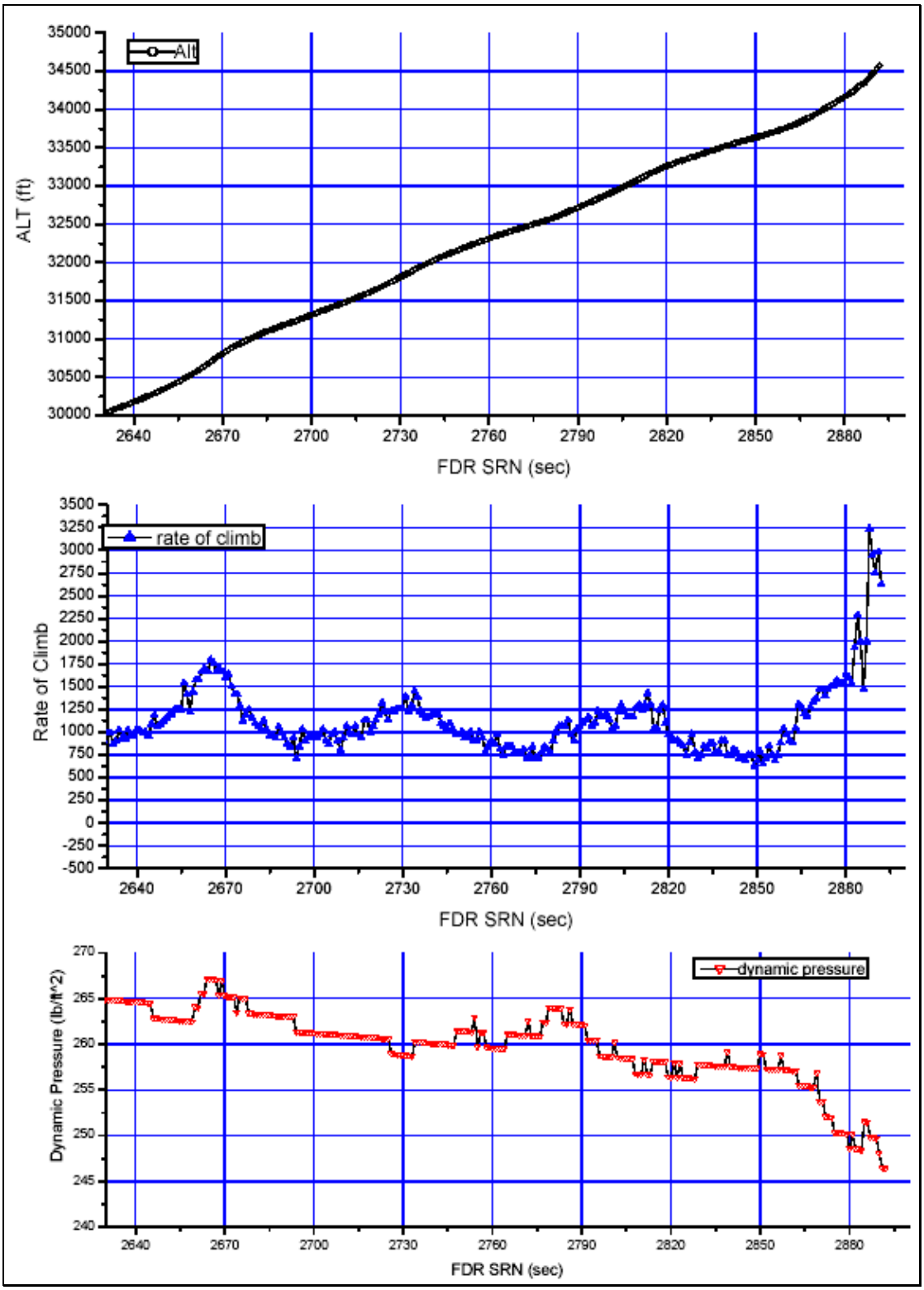


Figure 1.11-7 (b) China Airline 611- Altitude, rate of climb and dynamic pressure (detail)

1.11.3.2 Pressure Altitude Correction

The altitude recorded by the FDR is pressure altitude; i.e., altitude in the standard atmosphere corresponding to the static pressure sensed at the aircraft's static port (1013 mbar). The altitude in the actual atmosphere corresponding to the local static pressure generally does not equal to the pressure altitude, and it is insufficient to simply adjust the pressure altitude for the local sea level pressure. Since the lapse rate of pressure with altitude does not match the lapse rate in the standard atmosphere to estimate the actual altitude of CI611, the recorded pressure altitude is adjusted to account for the 1010mbar altimeter setting.

The results of this calculation are shown in Figure 1.11-8 as the line labeled "FDR corrected alt" The line labeled "FDR recorded alt" is the readout parameter of FDR. Figure 1.11-9 shows the pressure altitude of FDR and Mode C altitude of the aircraft transponder. FDR stopped recording at time 07:27:58.9 UTC (34573 ft), and last transponder beacon was received at time 07:28:14 UTC (34843 ft or 10620m, Xiamen site), and 07:28:03 UTC (34900ft, Makung site).

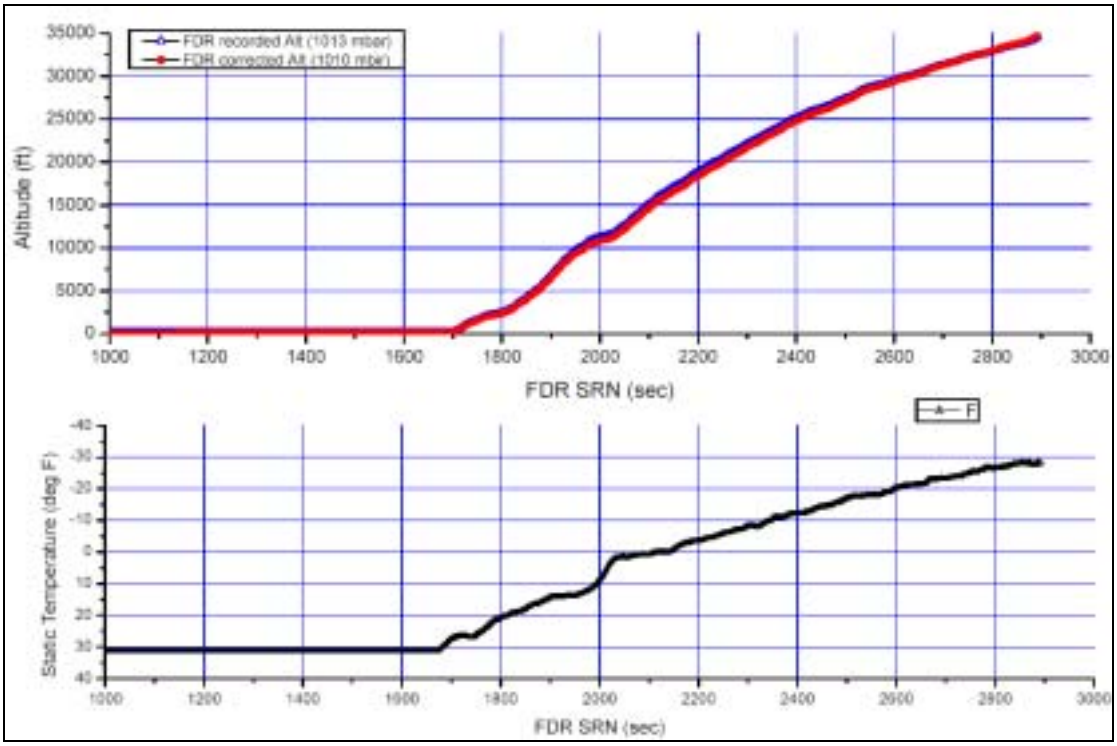


Figure 1.11-8 (a) China Airline 611- pressure altitude, corrected altitude and static temperature

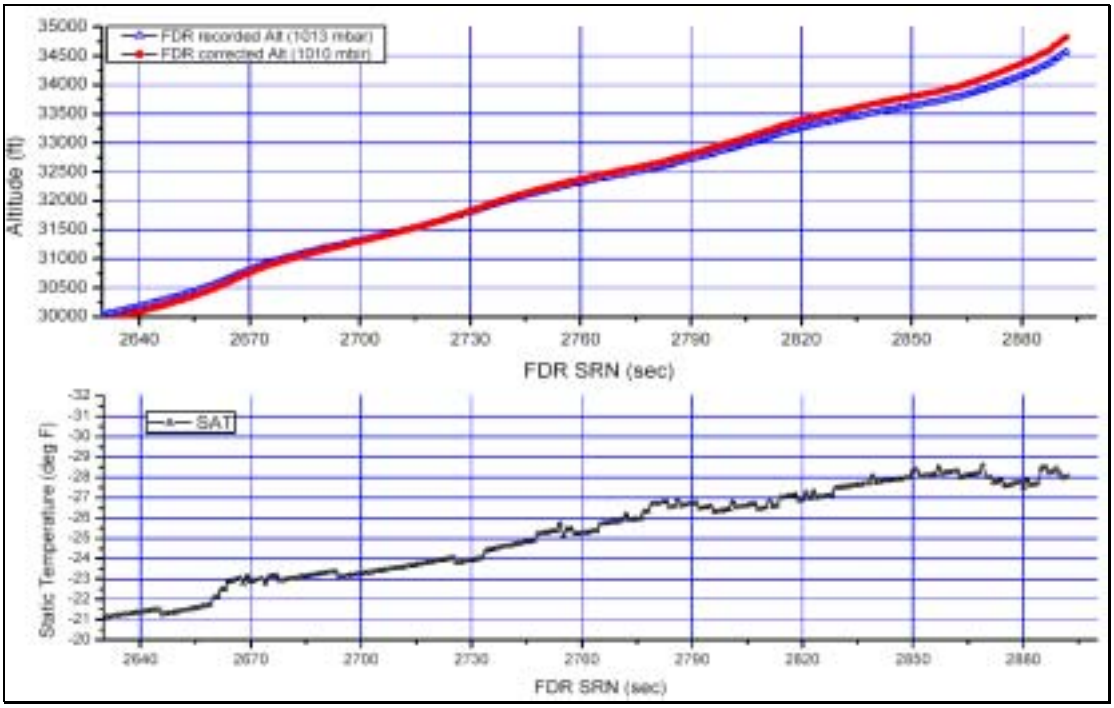


Figure 1.11-8 (b) China Airline 611- pressure altitude, corrected altitude and static temperature

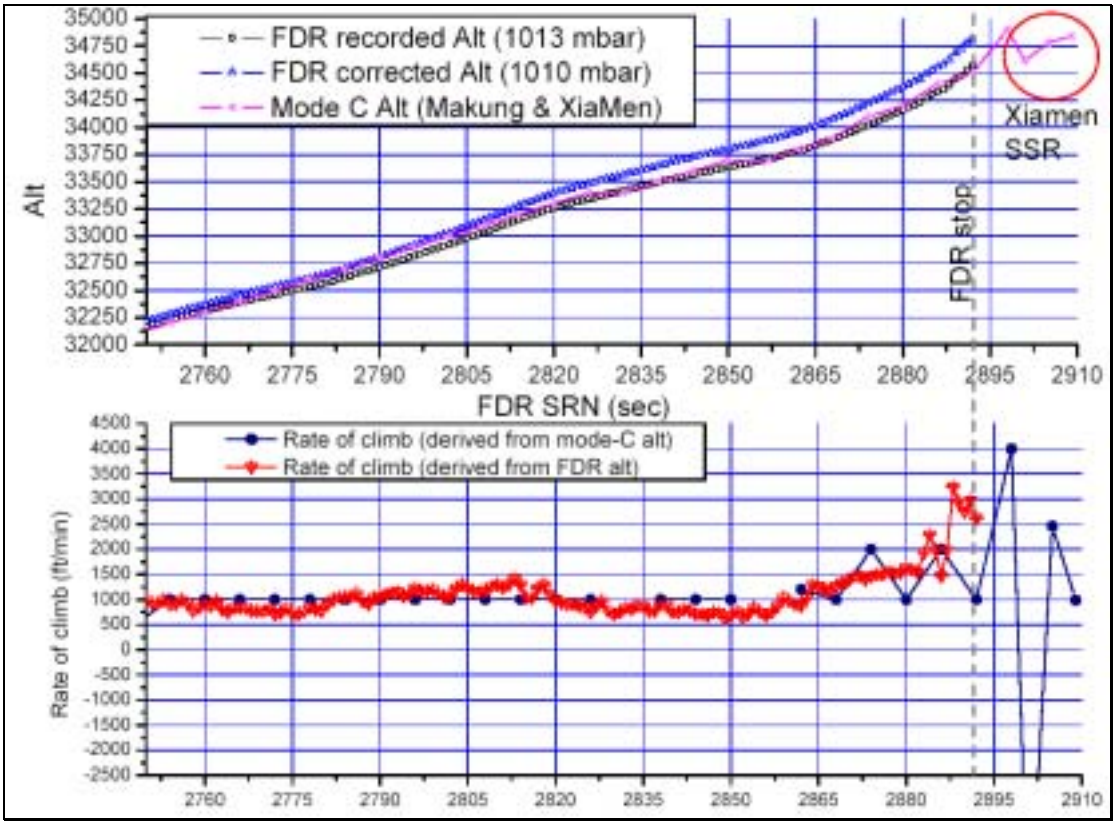


Figure 1.11-9 China Airline 611- comparison of altitude, rate of climb (FDR Vs. Radar)

In summary, between FL300 and FL 330, the average rate of climb and dynamic pressure of CI611 flight is 1080 ft/min, and 262.7 lb/ft^2, respectively. In 30 seconds, the average rate of climb and dynamic pressure of CI611 flight is 1672 ft/min, and 251.9 lb/ft^2, respectively.

1.11.3.3 Wind profile collected from other aircrafts near the accident site

Wind profile data is calculated by the ground-based observation data or from the recorded flight data recorder of other aircrafts. Figure 1.11-10 shows the time history plots of wind speed, wind direction and altitude. Twelve minutes before the CI611 accident, UIA608 took-off and climbed to FL160, at southwest airspace (denote as region B). According to wind profile of the UIA608, below FL100, wind direction varied from 330 degree to 180 degree with wind speed increased from 5 knots to 15 knots. From FL100 to FL160, wind direction was 270 degree with wind speed increased to 26.5 knots. At the time of the CI611 accident, UIA608 was at the northeast airspace (denote as region A). Average wind profile from FL120 to FL160 was 270 deg at 28 knots. .

After the CI611 crashed, a Boeing 747-400 (registration no. NL467) took-off from CKS airport, followed “A1” route and landed at Hong Kong Airport. At 07:50 UTC, NL467 was at FL310 and flew over the CI611 accident site. Figure 1.11-11 shows the time history plots of wind speed, wind direction and altitude (FL310). At region A, the average wind direction and wind speed was 265 degree and 37.5 knots, respectively.

Based upon meteorological data collected from Makung Airport, CAA and NTSB performed similar wind profile calculation along CI611 flight path, Figure 1.11-12 compares the wind profile between the UIA608 and the ground based calculation results).

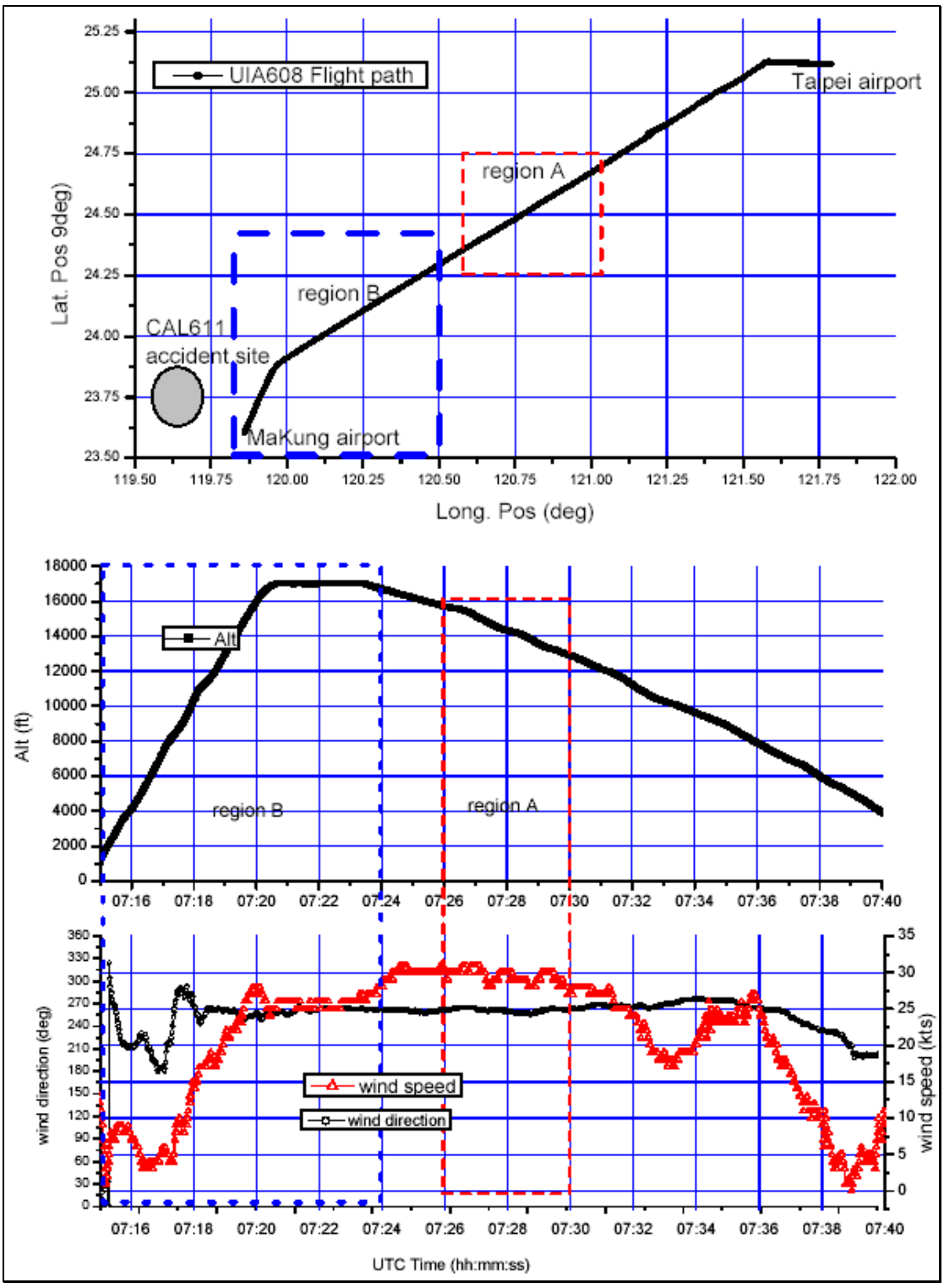


Figure 1.11-10 Wind profile of the UIA608 (Makung to Taipei Airport)

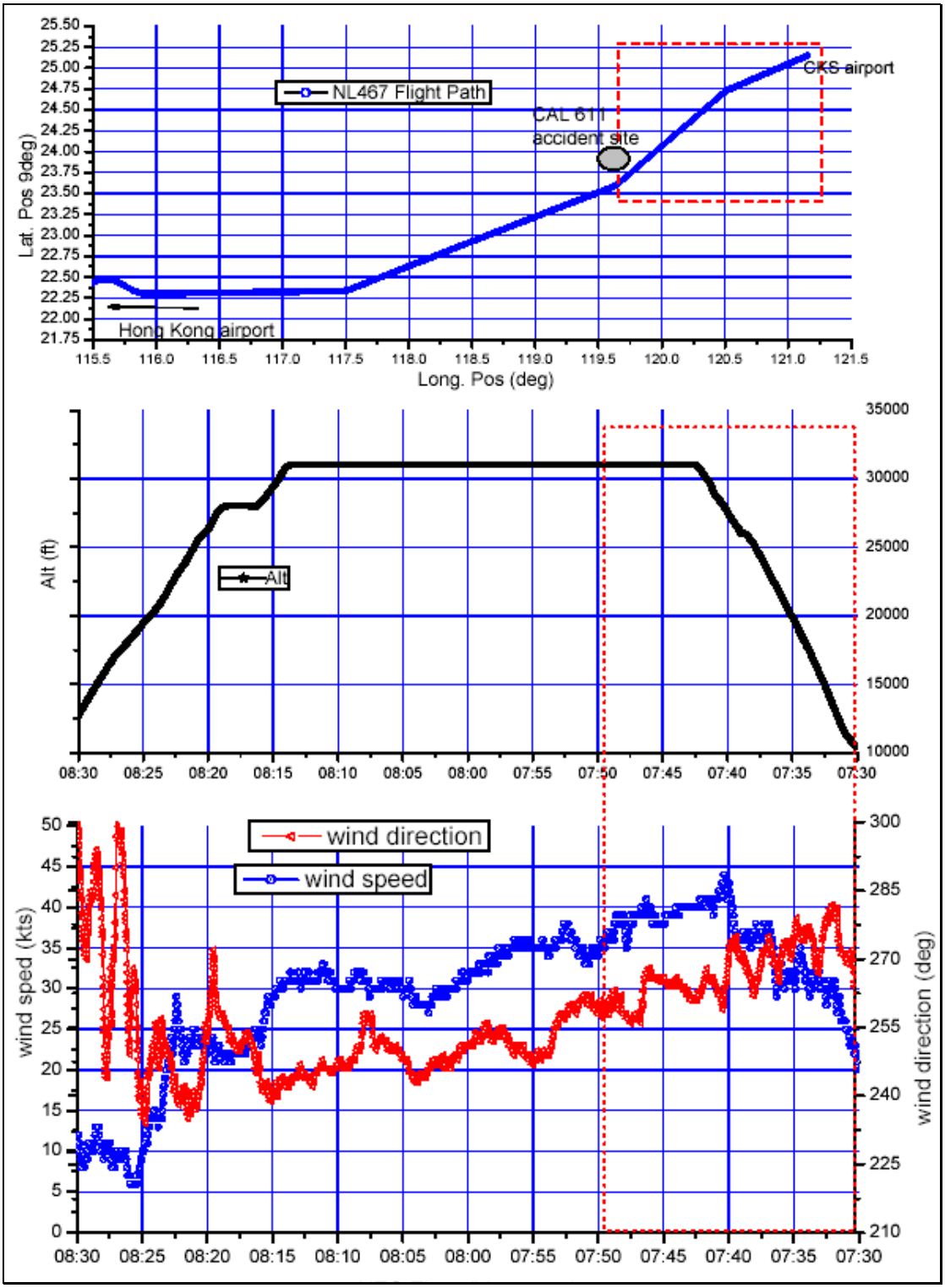


Figure 1.11-11 Wind profile of the NL467 (CKS to Hong Kong Airport)

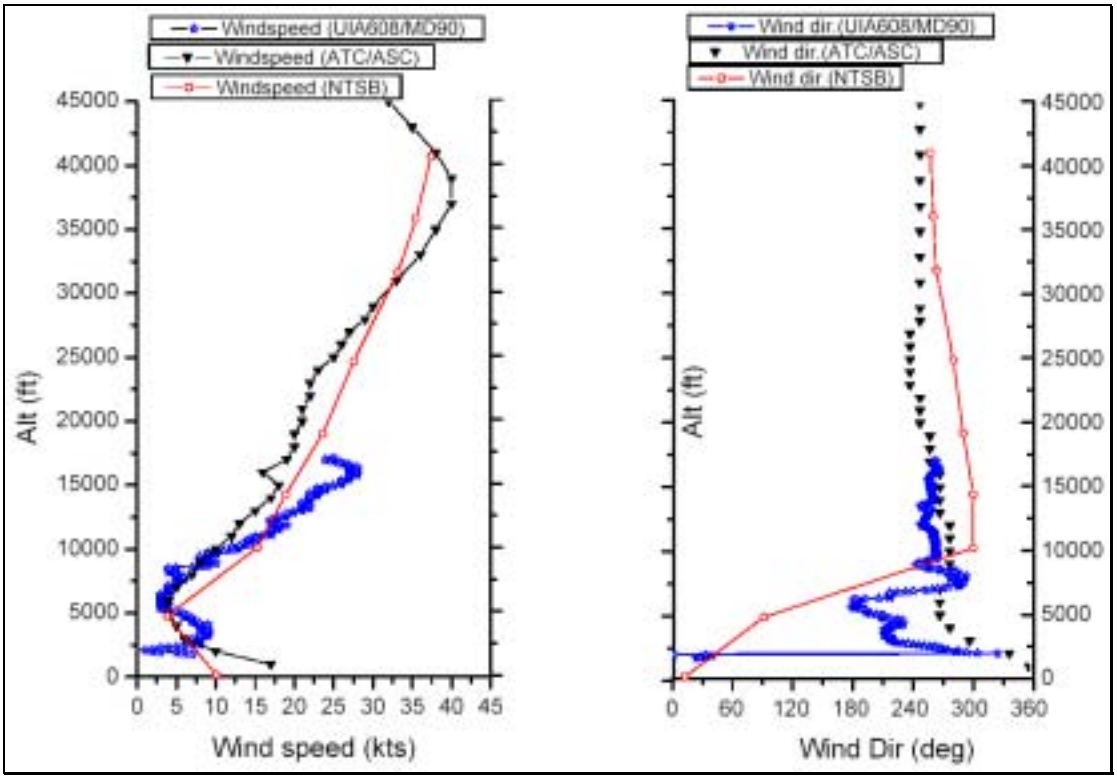


Figure 1.11-12 Comparison of wind profile (ground based calculation Vs. On-board data of UIA608)

1.16.1 Tests and Research

The recorders' group requested a simulation flight utilizing CAL's B747-200 freighter ferried from Taipei to Hong Kong for cockpit instrument sound spectrum recognition and FDR data comparison. The simulation flight was carried out on June 28, 2002.

IV. Appendix

4-1 CI 611 CVR TRANSCRIPT

Legend

CM1: Captain
CM2: First Officer
CM3: Flight Engineer
RDO1: Radio transmission from CM1
RDO2: Radio transmission from CM2
RDO3: Radio transmission from CM3
MAINT: Gound marshall
GND: Taipei Ground Control
TWR: Taipei Tower Control
APP: Taipei Approach
ACC: Taipei Area Control Center
PRAM: Prerecorded announcement
FA: Flight attendant
VOLMET: Meteorological information for aircraft in flight
OPS: China Airlines' Operations Center
CAM: Cockpit Area Microphone
CAM1: CM1 through cockpit area microphone
CAM2: CM2 through cockpit area microphone
CAM3: CM3 through cockpit area microphone
MFXXX: an unknown flight of Xiamen Airlines
XX FOC: unknown airlines flight operations center
XX 057: unknown airlines flight 057
--: unintelligible words
ALL_TK: source including track1, track2, track3 and track4
()：remarks or translation

Local Time (radar time)	SOURCE	CONTENT
14:56:12		(beginning of record)
14:56:13	PRAM	您好歡迎搭乘華航…*(Welcome on board China Airlines)*
14:56:13	CAM	(sound similar to engine ignition switch movement)
14:56:14	CAM3	starter cutout
14:56:15	GND	(conversation with BR 802)
14:56:15	CAM1	after start items
14:56:17	CM1	ground cockpit
14:56:18	MAINT	go ahead
14:56:19	CM1	ready for flaps check leading edge
14:56:21	MAINT	roger ground cleared
14:56:21	BR 802	(conversation with TPE GND)
14:56:22	CAM1	flaps twenty
14:56:22	CAM	(sound similar to flap lever movement)
14:56:23	CAM2	twenty
14:56:29	CAM	(unidentified sound)
14:56:31	CAM1	ok after start check list
14:56:32	CAM2	after start anti ice
14:56:34	CAM1	off off
14:56:35	MAINT	yes sir we are confirm leading edge flaps extended
14:56:36	CAM2	electrical panel
14:56:37	CAM3	all check
14:56:38	CAM2	cargo heat
14:56:38	CAM3	normal
14:56:38	CM1	leading edge extended and prepared aircraft for taxi see your signal bye bye
14:56:39	CAM2	hydraulic system
14:56:39	CAM3	check
14:56:43	MAINT	yes sir -- bye bye
14:56:44	PRAM	--收發報--遙控器全程禁用—*(transmitter.. remote control devices are prohibited at all time)*
14:56:45	CAM2	after start check list complete
14:56:47	CAM	(unidentified sound)
14:56:48	CAM	(unidentified sound)
14:56:50	CAM	(sound similar to electric seat motor)

Local Time (radar time)	SOURCE	CONTENT
14:56:54	CAM	(unidentified sound)
14:57:02	CAM	--
14:57:06	RDO2	taipei dynasty six one one taxi
14:57:09	GND	dynasty six one one taxi via taxiway sierra sierra hold short taxiway sierra five
14:57:10	CAM	(sound similar to parking brake release)
14:57:15	RDO2	taxi via sierra sierra hold short sierra five dynasty six one one
14:57:20	CAM2	sierra papa 下面一個轉彎（*next turn*）
14:57:21	GND	(conversation with BR 2196)
14:57:23	CAM	--
14:57:26	BR 2196	(conversation with TPE GND)
14:57:30	CAM1	taxi items flight controls
14:57:33	CAM3	ya left -- right one down
14:57:36	CAM3	left -- down right two up two down two up
14:57:38	CI 031	(conversation with OPS)
14:57:42	CAM1	rudder
14:57:44	CAM3	full left full right neutral
14:57:45	CI 031	(converation with OPS)
14:57:48	CAM	(sound similar to seat motor)
14:57:48	OPS	(conversation with CI 031)
14:57:49	CAM1	taxi check list please
14:57:50	CI 031	(conversation with OPS)
14:57:56	OPS	(conversation with CI 031)
14:57:56	CI 031	(conversation with OPS)
14:57:57	CAM1	taxi check list
14:57:58	CAM3	check list
14:58:04	CAM3	flight instruments
14:58:05	CAM1	check
14:58:06	CAM2	check
14:58:07	CAM3	flight controls
14:58:08	CAM1	check
14:58:08	CAM2	check
14:58:10	CAM3	flaps
14:58:11	CAM1	twenty twenty green

Local Time (radar time)	SOURCE	CONTENT
14:58:12	CAM2	twenty twenty green
14:58:13	CAM3	twenty twenty green
14:58:15	CAM3	trim
14:58:16	CAM1	four zero zero
14:58:18	NX628	(conversation with TPE GND)
14:58:19	CAM2	four zero zero
14:58:20	CAM3	ok apu out
14:58:22	CAM3	adp check
14:58:22	GND	(conversation with NX628)
14:58:23	CAM3	brake temp check
14:58:24	CAM3	taxi check completed
14:58:25	CAM1	thank you
14:58:28	CAM1	takeoff briefing
14:58:29	CAM2	okay
14:58:30	CAM2	okay after takeoff maintain runway heading until number two dme 四浬 *(four nautical miles)*
14:58:31	NX628	(conversation with TPE GND)
14:58:36	CAM2	左轉兩三五攔截 *(left turn 235 to intercept)*
14:58:37	CAM1	number one dme
14:58:38	CAM2	oh number one dme
14:58:38	GND	(conversation with BR 2196)
14:58:42	BR 2196	(conversation with TPE GND)
14:58:43	CAM2	四浬左轉兩三五攔截鞍部兩六洞 *(four nautical miles left turn 235 to intercept APU 260)*
14:58:46	CAM	(unidentified sound similar)
14:58:47	CAM2	到 *(to)* jessy after jessy direct 到 *(to)* chali 馬公 *(Makung)*
14:58:52	CAM2	我們的第一點改為 *(our first waypoint change to)* jessy
14:58:54	CAM1	Jessy
14:58:55	CAM2	第二點 *(second waypoint)* chali
14:58:55	GND	dynasty six one one continue taxi via taxiway whiskey charlie sierra papa to runway zero six
14:58:57	CAM	(unidentified sound)
14:59:02	RDO2	via whiskey charlie sierra papa to runway zero six dynasty six one one

Local Time (radar time)	SOURCE	CONTENT
14:59:06	CAM1	一直走 *(straight forward)*
14:59:10	CAM2	transition is
14:59:11	CAM3	等一下客艙誰廣播 *(later who will make passenger announcement)*
14:59:12	FA	cabin attendant complete safety check
14:59:13	CAM1	一萬呎 *(ten thousand feet)*
14:59:15	CAM3	我來我來我來好了 *(let me do it I will do it)*
14:59:16	CAM3	等一下起飛前要廣播 *(later make the announcement before take off)*
14:59:18	CAM2	okay 起飛以前 *(before take off)*
14:59:20	CAM3	我們很少飛容易忘記了 *(we seldom fly easy to forget)*
14:59:22	CAM2	現在改成起飛前通通是 CM2 廣播 *(Now it changed to CM2 making all passenger announcement before take off)*
14:59:24	CAM3	是要是要廣播 *(yes have to announce)*
14:59:28	CAM3	上次就忘了一次 -- -- -- 會忘 *(last time we forgot---forgot)*
14:59:35	CAM1	常飛又-- *(fly often yet--)*
14:59:36	CAM3	多少架 一二三四五第五架 *(how many planes one two three four five the fifth)*
14:59:39	CAM3	好 又有落地的 *(ok one landing again)*
14:59:41	CAM1	試飛的第二架--六么-- *(the second test flight–six one-)*
14:59:43	CAM3	又有落地的 一二三第四架 *(another landing again one two three the fourth)*
15:00:09	CAM3	(sound of cough)
15:00:19	CAM1	那個你這擺 arm *(that you set at arm)*
15:00:21	CAM2	哦對好 什麼位置 *(oh right ok at position)*
15:00:25	CAM2	聲音比較大一點 *(sounds a little louder)*
15:00:26	CAM1	沒關係 -- *(no problem)*
15:00:42	CI 666	(conversation with OPS)
15:00:43	FA	組員請就座 *(cabin crew please be seated)*
15:00:46	CAM2	whiskey Charlie
15:00:48	CAM	(sound similar to high low chime)
15:00:48	OPS	(conversation with CI 666)
15:00:50	CI 666	(conversation with OPS)

Local Time (radar time)	SOURCE	CONTENT
15:00:50	CAM	(sound similar to handset being removed from cradle)
15:00:52	CAM3	請講 *(go ahead)* thank you cabin ready
15:00:55	CAM	(sound similar to handset being returned to cradle)
15:00:56	OPS	(conversation with CI 666)
15:01:01	CAM	(unidentified sounds)
15:01:20	CAM	(sound similar to yawn)
15:01:25	CAM	(sound similar to cough)
15:01:33	CAM	(unidentified sounds)
15:01:38	GND	dynasty six one one contact tower one one eight point seven good day
15:01:42	RDO2	one eighteen seven dynasty six one one good day ma'am.
15:01:47	CAM	(sound similar to switch being rotated)
15:01:47	TWR	(conversation with BR 817)
15:01:52	BR 817	(conversation with TPE TWR)
15:01:56	RDO2	taipei good afternoon dynasty six one one on sierra papa
15:02:00	TWR	dynasty six one one taipei tower hold short runway zero six
15:02:03	RDO2	hold short runway zero six dynasty six one one
15:02:16	CAM	(unidentified sounds)
15:02:22	TWR	(conversation with GE 354)
15:02:28	GE 354	(conversation with TPE TWR)
15:02:42	TWR	(conversation with BR 817)
15:02:46	BR 817	(conversation with TPE TWR)
15:03:01	CI 196	(conversation with TPE TWR)
15:03:07	TWR	(conversation with CI 196)
15:03:18	CI 196	(conversation with TPE TWR)
15:03:28	CAM	--
15:03:32	CAM	(unidentified sounds)
15:03:43	CAM	(unidentified sounds)
15:04:12	CAM	(sound similar to seat motor)
15:04:21	TWR	(conversation with BR 2196)
15:04:26	BR 2196	(conversation with TPE TWR)
15:04:44	TWR	(conversation with GE 354)

Local Time (radar time)	SOURCE	CONTENT
15:04:50	GE 354	(conversation with TPE TWR)
15:04:52	CAM	(unidentified sounds)
15:05:09	TWR	(conversation with BR 2196)
15:05:17	BR 2196	(conversation with TPE TWR)
15:05:31	CX 466	(conversation with TPE TWR)
15:05:36	TWR	(conversation with CX 466)
15:05:46	CX 466	(conversation with TPE TWR)
15:05:49	TWR	dynasty six one one runway zero six taxi into position and hold
15:05:52	CAM	(sound similar to handset being removed from cradle)
15:05:52	CM3	cabin crew please be seated for takeoff
15:05:53	RDO2	into position hold runway zero six dynasty six one one
15:05:56	CAM	(sound similar to handset being returned to cradle)
15:05:58	CAM1	before takeoff items
15:05:59	CAM	(sound similar to seat motor)
15:06:00	FA	各位貴賓我們即將準備起飛請您確實的將安全帶繫好謝謝 ladies and gentlemen we are ready for take off please make sure that your seatbelt is securely fastened
15:06:06	CAM	(unidentified sounds)
15:06:08	CAM1	before takeoff check list
15:06:11	CAM3	okay cabin report received takeoff data
15:06:14	CAM1	confirmed
15:06:15	CAM2	confirmed
15:06:15	CAM3	confirmed ignition flight start transponder
15:06:18	CAM2	on
15:06:18	CAM3	fuel panel set two packs on
15:06:23	TWR	(conversation with BR 2196)
15:06:28	BR 2196	(conversation with TPE TWR)
15:06:24	CAM	(sound similar to cough)
15:06:40	CAM3	body gear steering
15:06:40	CAM	(sound similar to switch movement)
15:06:41	CAM1	disarm
15:06:42	CAM3	annunciator lights
15:06:43	CAM1	check
15:06:44	CAM2	check

Local Time (radar time)	SOURCE	CONTENT
15:06:44	CAM3	check
15:06:45	CAM3	runway identification
15:06:46	CAM1	identification check
15:06:47	CAM3	check
15:06:47	CAM2	check
15:06:48	CAM3	takeoff clearance standby
15:06:51	CAM	(unidentified sounds)
15:06:53	CAM	(sounds similar to seat motor)
15:07:10	TWR	dynasty six one one runway zero six wind zero five zero at niner cleared for takeoff
15:07:16	RDO1	cleared for takeoff dynasty six one one
15:07:18	CAM3	okay received takeoff clearance
15:07:20	CAM1	takeoff
15:07:21	CAM3	takeoff checklist complete
15:07:23	CAM	(sound similar to engine noise increasing)
15:07:34	CAM3	takeoff thrust set
15:07:35	CAM1	check
15:07:44	CAM1	eighty
15:07:45	CAM2	check
15:07:52	CAM1	vee one
15:07:56	CAM1	rotate
15:07:57	CAM	(unidentified sounds)
15:08:01	CAM	(sound similar to landing gear unlock retract solenoid)
15:08:02	TWR	(conversation with CX 466)
15:08:07	CX 466	(conversation with TPE TWR)
15:08:03	CAM1	positive rate
15:08:04	CAM2	gears up
15:08:06	CAM	(sound similar to gear lever movement)
15:08:07	CAM2	ias
15:08:08	CAM1	ias
15:08:17	CAM	(unidentified sound)
15:08:19	TWR	(conversation with CI 196)
15:08:25	CI 196	(conversation with TPE TWR)
15:08:32	TWR	dynasty six one one contact taipei approach one two five point one good day

Local Time (radar time)	SOURCE	CONTENT
15:08:36	RDO1	good day
15:08:37	APP	(conversation with CI 682)
15:08:41	CI 682	(conversation with TPE APP)
15:08:43	APP	(conversation with B7 303)
15:08:46	CAM2	climb thrust vertical speed one thousand
15:08:49	B7 303	(conversation with TPE APP)
15:08:51	APP	(conversation with B7 303)
15:08:53	RDO1	taipei approach dynasty six one one airborne passing one thousand six hundred
15:08:57	APP	dynasty six one one taipei approach radar contact climb and maintain flight level two six zero cancel flight level two zero zero restriction
15:09:04	RDO1	reclear two six zero cancel two zero zero restriction dynasty six one one
15:09:07	CAM3	climb power set
15:09:09	APP	(conversation with 5X 6884)
15:09:09	CAM2	okay flap five flap ten
15:09:11	CAM	(sound similar to flap lever movement)
15:09:12	5X 6884	(conversation with TPE APP)
15:09:17	CAM3	ten ten
15:09:18	CAM2	flap five
15:09:19	CAM	(sound similar to seat motor)
15:09:21	CAM1	five
15:09:21	CAM	(sound similar to flap lever movement)
15:09:23	CAM2	左轉兩三五 *（left turn two three five）*
15:09:26	CAM3	five five
15:09:34	CAM2	flap one
15:09:36	APP	(conversation with EF 032)
15:09:36	CAM	(sound similar to flap lever movement)
15:09:40	EF 032	(conversation with TPE APP)
15:09:49	APP	(conversation with CI 321)
15:10:00	CI 321	(conversation with TPE APP)
15:10:07	APP	(conversation with CI 652)
15:10:10	CI 652	(conversation with TPE APP)
15:10:10	CAM3	one one green

Local Time (radar time)	SOURCE	CONTENT
15:10:10	CAM1	one one green
15:10:11	CAM2	okay flap up
15:10:13	CAM	(sound similar to flap lever movement)
15:10:19	APP	(conversation with EF 032)
15:10:21	CAM3	up up light out
15:10:23	EF 032	(conversation with TPE APP)
15:10:30	CAM3	(sound similar to seat motor)
15:10:34	APP	dynasty six one one proceed direct to chali resume own navigation
15:10:38	RDO1	proceed direct chali resume own navigation dynasty six one one
15:10:42	CAM2	第二點 *(second waypoint)*
15:10:47	CAM	--
15:10:49	APP	(conversation with CI 652)
15:10:51	CAM2	ias
15:10:53	CI 652	(conversation with TPE APP)
15:10:57	CAM	(sound similar to seat motor)
15:11:04	CI 321	(conversation with TPE APP)
15:11:08	APP	(conversation with CI 321)
15:11:11	CI 321	(conversation with TPE APP)
15:11:13	APP	(conversation with EF 032)
15:11:16	CAM2	autopilot b engage
15:11:19	CAM	(sound similar to autopilot engage switch)
15:11:20	EF 032	(conversation with TPE APP)
15:11:22	CAM3	我們起飛寫幾分啊 *(when did we take off)*
15:11:24	CAM1	那時忘了記洞七是不是 *(I forgot to write down the time, zero seven was it)*
15:11:27	CAM2	洞八 *(zero eight)*
15:11:30	APP	(conversation with EF 032)
15:11:31	CAM2	標準是洞八 *(that should be zero eight)*
15:11:32	APP	(conversation with BR 2196)
15:11:36	CAM	(unidentified sounds)
15:11:37	BR 2196	(conversation with TPE APP)
15:11:40	APP	(conversation with BR 2196)
15:11:52	CM3	cabin crew service check please

Local Time (radar time)	SOURCE	CONTENT
15:11:54	CAM	(sound similar to handset being returned to cradle)
15:12:01	CAM3	flight operation --
15:12:03	RDO3	taipei dynasty operation six one one
15:12:08	CAM	(sound similar to cough)
15:12:11	OPS	-- go ahead
15:12:12	RDO3	six one one taipei zero six five zero diagonal zero eight hongkong zero eight two eight
15:12:15	APP	(conversation with CI 682)
15:12:18	OPS	six one one roger zero six five zero diagonal zero eight hongkong zero eight two eight nice flight
15:12:25	CM3	謝謝 *(thanks you)*
15:12:28	CAM2	報一下 *(announce)* cabin service check
15:12:30	CI 682	(conversation with TPE APP)
15:12:30	CAM3	己經報過了 *(I did)*
15:12:31	CAM2	一萬呎*(ten thousand feet)* check 過了 *(already)*
15:12:39	CAM2	one zero one tree
15:12:47	APP	(conversation with CI 652)
15:12:51	CI 652	(conversation with TPE APP)
15:12:55	CAM	(sound similar to autopilot mode selection movement)
15:12:55	CAM2	speed
15:12:57	SQ984	(conversation with TPE APP)
15:13:01	APP	(conversation with SQ984)
15:13:13	SQ984	(conversation with TPE APP)
15:13:28	BR 1852	(conversation with TPE APP)
15:13:35	APP	(conversation with BR 1852)
15:13:46	BR 1852	(conversation with TPE APP)
15:14:00	ALL_TK	(no signal for 0.3 seconds)
15:14:02	CI 196	(conversation with OPS)
15:14:07	CAM	(unidentified sounds)
15:14:07	OPS	(conversation with CI 196)
15:14:09	CI 196	(conversation with OPS)
15:14:11	CI 682	(conversation with TPE APP)
15:14:15	APP	(conversation with CI 682)
15:14:19	CI 682	(conversation with TPE APP)
15:14:21	APP	(conversation with CI 682)

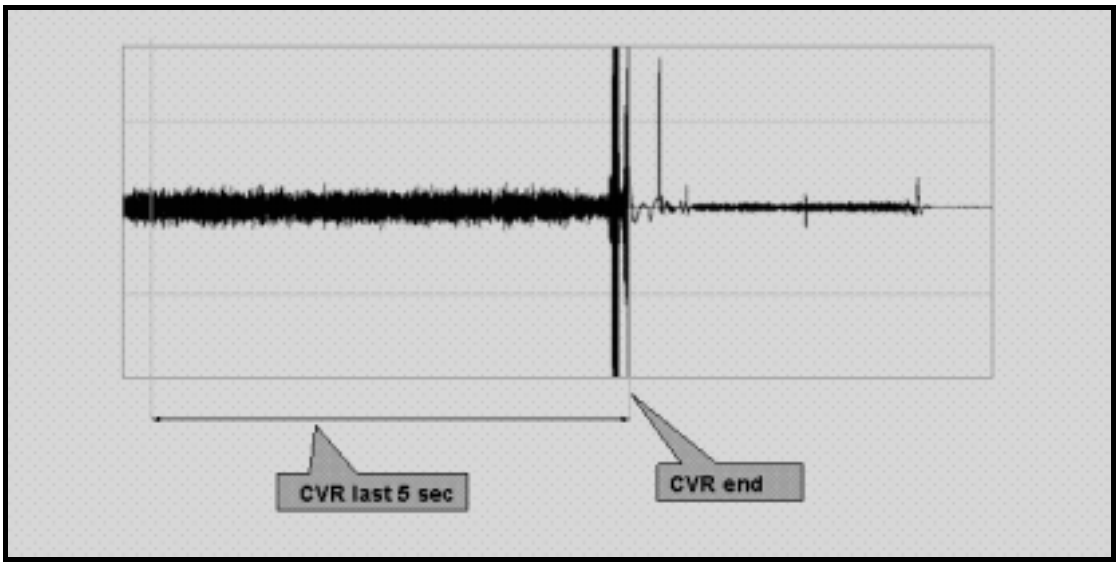
Local Time (radar time)	SOURCE	CONTENT
15:14:26	PRAM	各位貴賓請繫安全帶的指示燈已經熄滅了 *(ladies and gentlemen the seat belt sign has been turned off)*
15:14:34	CAM	(sound similar to seat motor)
15:14:52	APP	(conversation with EF 032)
15:15:02	EF 032	(conversation with TPE APP)
15:15:19	APP	(conversation with SQ984)
15:15:23	SQ984	(conversation with TPE APP)
15:15:27	APP	(conversation with BR 1852)
15:15:30	BR 1852	(conversation with TPE APP)
15:15:41	VOLMET	(hongkong weather report)
15:15:46	APP	(conversation with CI 652)
15:15:57	CI 652	(conversation with TPE APP)
15:16:06	APP	dynasty six one one contact taipei control one two six point seven
15:16:10	RDO1	one two six seven dynasty six one one
15:16:18	RDO1	taipei control dynasty six one one passing level one eight seven continue two six zero
15:16:24	ACC	dynasty six one one taipei control ident climb and maintain flight level tree five zero from chali direct kadlo
15:16:30	CAM	(sound similar to seat motor)
15:16:31	RDO1	from chali direct to kadlo recleared tree five zero dynasty six one one
15:16:35	CAM3	香港 *(hong kong)*
15:16:37	CAM2	thank you
15:16:38	CAM1	-- 下一點 *(next waypoint)* -- kadlo --
15:16:41	CAM2	第三點我們改一下 *(we change the third waypoint)*
15:16:42	CAM3	-- 兩五跑道 *(runway two five)*
15:16:43	CAM2	第三點改為 *(the third waypoint changed to)* kadlo
15:16:55	CAM	-- 經過 *(via)* --
15:16:58	CAM1	三萬五 *(thirty-five thousand)*
15:16:58	CAM2	二二五七三 *(two two five seven three)*
15:17:05	CAM	么么八三二五 *(one one eight three two five)*
15:17:11	CAM2	么么八三二五 *(one one eight three two five)*
15:17:16	CAM	Okay
15:17:22	CAM1	兩八洞洞八 兩五跑道 *(two eight zero zero eight runway*

Local Time (radar time)	SOURCE	CONTENT
		two five）
15:17:24	CAM2	兩五跑道 *（runway two five）*
15:17:24	CAM	--
15:17:25	CAM3	兩五跑道這上面都有 *（runway two five is shown here）*
15:17:28	CAM2	多少度 溫度 *（how many degrees in temperature）*
15:17:30	CAM3	溫度二十八 *（temperature twenty-eight）*
15:17:30	CAM2	二十八謝謝 *（twenty-eight thank you）*
15:17:31	CAM	么洞洞 -- *（one zero zero）*
15:17:36	CAM1	thank you
15:17:55	CAM	(sound similar to singing)
15:18:28	CAM	(unidentified sounds)
15:18:35	CAM	(unidentified sounds)
15:18:58	CAM1	-- 要 direct 才對 *（direct is correct ）*
15:19:01	CAM	--
15:19:02	CAM2	-- 就這樣子啦--那就是 chali 到-- *（that's it that's from chali to ）*
15:19:06	CAM	(unidentified sound)
15:19:07	CAM2	反過來我看少五浬-- *（from the other end I see five nautical miles short）*
15:19:16	CAM	(sound similar to singing)
15:19:27	CAM	(unidentified sounds)
15:19:50	CAM	(sound similar to singing)
15:20:18	EF 126	(conversation with TPE ACC)
15:20:24	ACC	(conversation with EF 126)
15:20:27	EF 126	(conversation with TPE ACC)
15:20:31	B7 608	(conversation with TPE ACC)
15:20:34	CAM	(unidentified sounds)
15:20:35	ACC	(conversation with B7 608)
15:20:38	B7 608	(conversation with TPE ACC)
15:20:40	ACC	(conversation with B7 608)
15:20:53	CAM	(sound similar to signal interference)
15:21:03	CAM	(sound similar to signal interference)
15:21:04	CAM	(sound similar to signal interference)
15:21:07	CAM	(sound similar to signal interference)
15:21:07	CAM	(sound similar to signal interference)

Local Time (radar time)	SOURCE	CONTENT
15:21:11	CAM	(sound similar to signal interference)
15:21:14	CAM	(sound similar to signal interference)
15:21:50	CAM3	okay its okay
15:21:51	CAM1	thank you
15:21:51	TRACK2	(unidentified sound similar to squelch break)
15:21:54	TRACK2	(unidentified sound similar to squelch break)
15:22:00	TRACK2	(unidentified sound similar to squelch break)
15:22:06	TRACK2	(unidentified sound similar to squelch break)
15:22:10	TRACK2	(unidentified sound similar to squelch break)
15:22:13	TRACK2	(unidentified sound similar to squelch break)
15:22:17	GE 536	(conversation with TPE ACC)
15:22:21	MFXXX	(conversation with another unknown flight until 00:27:20)
15:22:22	CAM	(unidentified sound)
15:22:24	ACC	(conversation with GE 536)
15:22:29	GE 536	(conversation with TPE ACC)
15:22:43	CAM2	兩五 -- *(two five)*
15:23:03	CAM2	兩 -- 謝謝 *(two-- thanks)*
15:23:07	CAM1	thank you
15:23:08	CAM	(unidentified sound)
15:23:14	CAM2	收到 atis 以後再來調一點 大概就 direct 第八點第七點就不用如果是兩五的話 *(after receiving atis then adjust most likely direct to waypoint eight waypoint seven no need if using two five)*
15:23:20	ACC	(conversation with B7 608)
15:23:24	B7 608	(conversation with TPE ACC)
15:23:27	ACC	(conversation with BR 817)
15:23:31	BR 817	(conversation with TPE ACC)
15:23:34	ACC	(conversation with TG 7078)
15:23:40	TG 7078	(conversation with TPE ACC)
15:23:42	ACC	(conversation with AE271)
15:23:47	AE271	(conversation with TPE ACC)
15:24:10	CAM	(unidentified sound)
15:24:52	ACC	(conversation with B7 608)
15:24:55	B7 608	(conversation with TPE ACC)
15:24:56	CAM	(sound similar to yawn)

Local Time (radar time)	SOURCE	CONTENT
15:26:16	ACC	(conversation with EF 126)
15:26:21	EF 126	(conversation with TPE ACC)
15:26:24	ACC	(conversation with EF 126)
15:26:25	CAM1	two thousand
15:26:27	EF 126	(conversation with TPE ACC)
15:26:32	XX 057	(conversation with XX FOC)
15:26:36	ACC	(conversation with EF 126)
15:26:39	EF 126	(conversation with TPE ACC)
15:26:40	XX FOC	(conversation with XX 057)
15:26:43	XX 057	(conversation with XX FOC)
15:26:50	XX FOC	(conversation with XX 057)
15:26:54	XX 057	(conversation with XX FOC)
15:27:00	XX FOC	(conversation with XX 057)
15:27:06	CX 418	(conversation with TPE ACC)
15:27:09	ACC	(conversation with CX 418)
15:27:16	CAM	(unidentified sounds)
15:27:33	CAM	(unidentified sound)
15:27:37	ACC	(conversation with EF 126)
15:27:39	CAM	(sound similar to altitude alert)
15:27:40	CAM	(unidentified sounds)
15:27:40	EF 126	(conversation with TPE ACC)
15:27:46	CAM	(unidentified sound)
15:28:03	CAM	(unidentified sound, end of CVR)

4-2 THE LAST 5 SECONDS CAM SIGNATURE



4-3 FDR PARAMETERS

No.	Parameter Name	Resolution	Word Location(s)
1	Time	1/768 sec	1
2	Pressure Altitude Course Pressure Altitude Fine	132.17 Ft 4.88 Ft	23 (S/F 1) 5
3	Airspeed (IAS)	0.56 Knots	19
4	Vertical acceleration	0.00916 G	13, 29, 45, 61
5	Longitudinal acceleration	0.00195 G	2, 18, 34, 50
6	Lateral acceleration	0.00195 G	15, 31, 47, 63
7	Magnetic Heading	0.352 deg	3
8	Pitch	0.352 deg	51
9	Roll	0.352 deg	17
10	Control Column Position (CCP)	0.031 deg	41
11	Control Wheel Position (CWP)	0.797 deg	9
12	Engine Pressure Ratio (EPR) EPR No.1 EPR No.2 EPR No.3 EPR No.4	 0.01 % 0.01 % 0.01 % 0.01 %	 33 (S/F 1) 33 (S/F 2) 33 (S/F 3) 33 (S/F 4)
13	Flap position – L.E. (Extended R set 2) Flap L.E. Extended R#1 Flap L.E. Extended R#2 Flap L.E. Extended R#3 Flap L.E. Extended R#4 Flap L.E. Extended L#1 Flap L.E. Extended L#2 Flap L.E. Extended L#3 Flap L.E. Extended 2#4	 Discrete value EXT= Extended NOT= Not Extended	 11 (bit 1) 28 (bit 1) 43 (bit 1) 59 (bit 1) 63 (bit 1) 29 (bit 1) 8 (bit 1) 17 (bit 1)
14	Flap Position – T.E. (R. Inboard)	Non-Linear Parameter	39 (S/F 1,3)
15	Horizontal Stabilizer Position (Pitch Trim)	0.044 deg	55 (S/F 1,3)
16	Rudder Pedal Position	0.127 deg	27,59
18	Thrust Reverser Position	Discrete value	

	T/R in-transit ENG 1 T/R in-transit ENG 2 T/R in-transit ENG 3 T/R in-transit ENG 4 T/R Unlock ENG 1 T/R Unlock ENG 2 T/R Unlock ENG 3 T/R Unlock ENG 4	Transit = Transit Not = Not Transit Unlock= Unlock Not = Not Unlock	22 51 45 41 7 (S/F 1) 7 (S/F 2) 7 (S/F 3) 7 (S/F 4)
19	VHF 1, 2,3 Transmitter Keying	Discrete value KEY= Keyed OFF= No Keyed	9
20	HF 1, 2 Transmitter Keying	Discrete value KEY= Keyed OFF= No Keyed	15
21	Angle of Airflow	0.352 deg	11 ,43

4-4 FDR plots

Figure 1	FDR data plots of CI611 (entire flight, digital parameters)
Figure 2	FDR data plots of CI611 (entire flight, with discrete signals)
Figure 3	FDR data plots of CI611 (pre-flight section with CVR transcripts)
Figure 4	FDR data plots of CI611 (Taxi section with CVR transcripts)
Figure 5	FDR data plots of CI611 (takeoff section with CVR transcripts)
Figure 6	FDR data plots of CI611 (pass though 18,000 ft with CVR transcripts)
Figure 7	FDR data plots of CI611 (during 22,000 ft and 28,000ft, with CVR unidentified sound and interference signal)
Figure 8	FDR data plots of CI611 (during 25,000 ft and 28,000ft, with CVR signal interference)
Figure 9	DR data plots of CI611 (during 27,000 ft and 32,000ft, with CVR squelch signal)
Figure 10	FDR data plots of CI611 (during 32,000 ft and 35,000ft, with CVR unidentified sound)
Figure 11	FDR data plots of CI611 (last 30 seconds, with CVR unidentified sound)

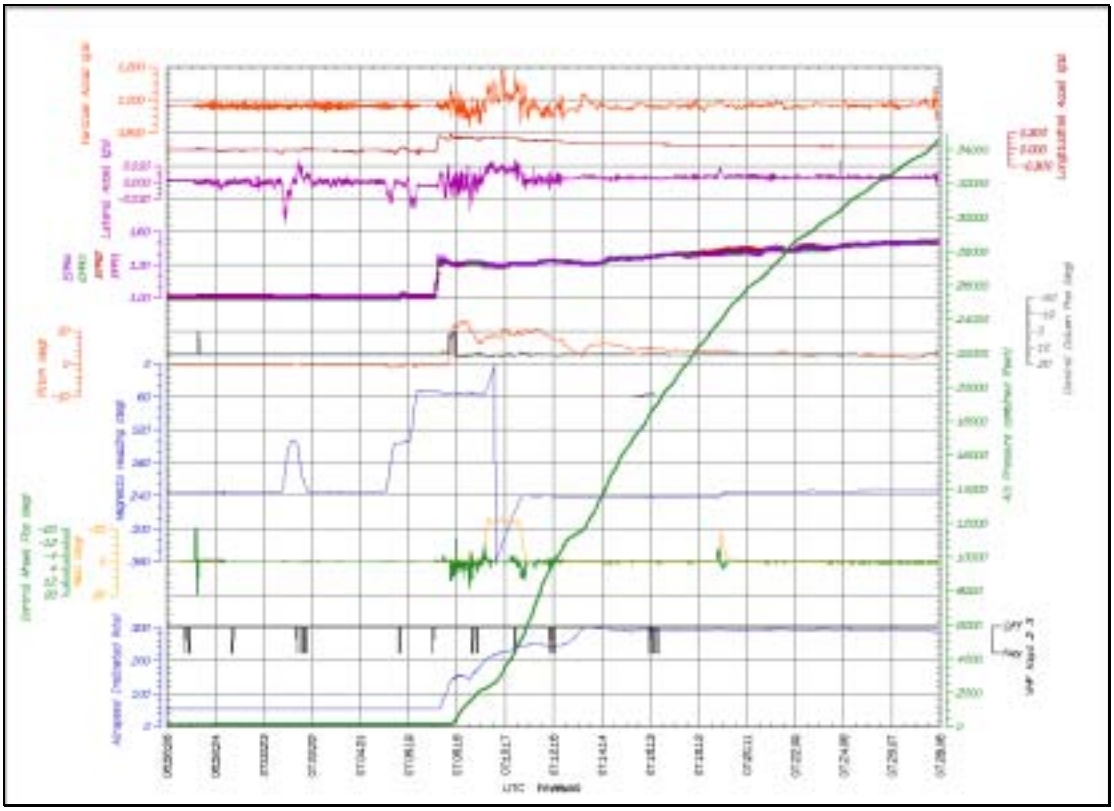


Figure 1 FDR data plots of CI611 (entire flight, digital parameters)

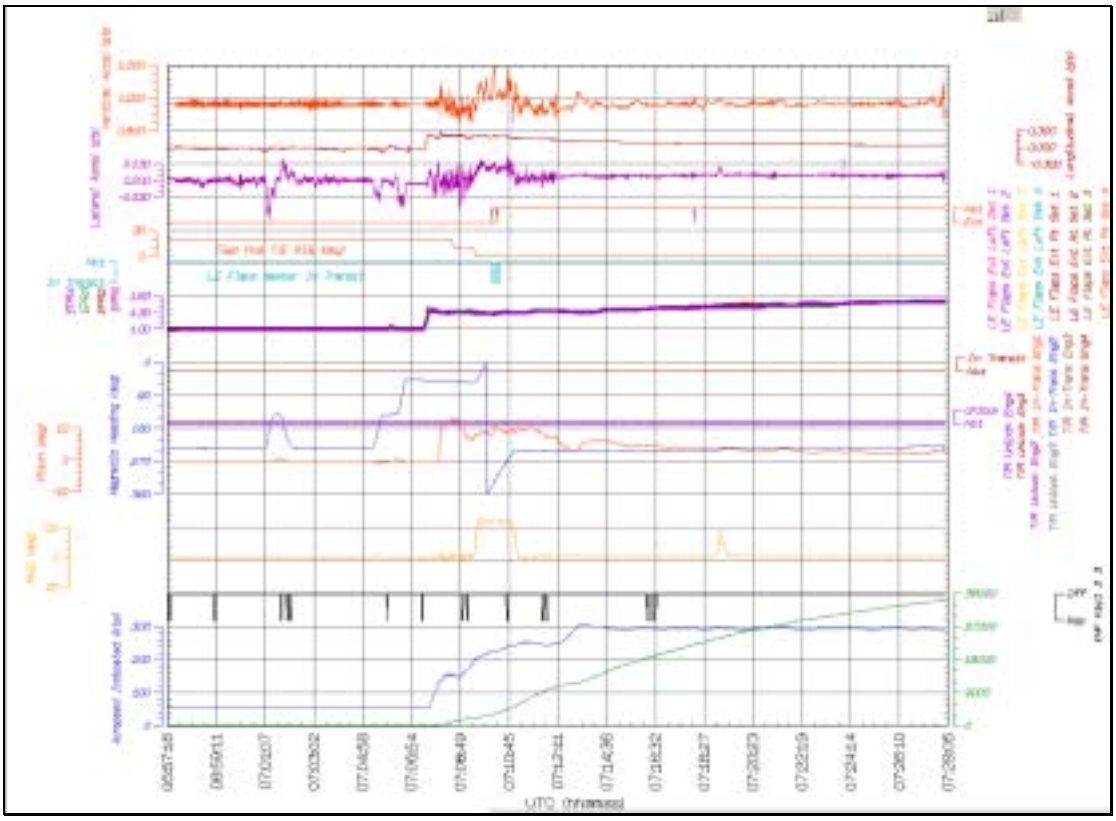


Figure 2 FDR data plots of CI611 (entire flight, with discrete signals)

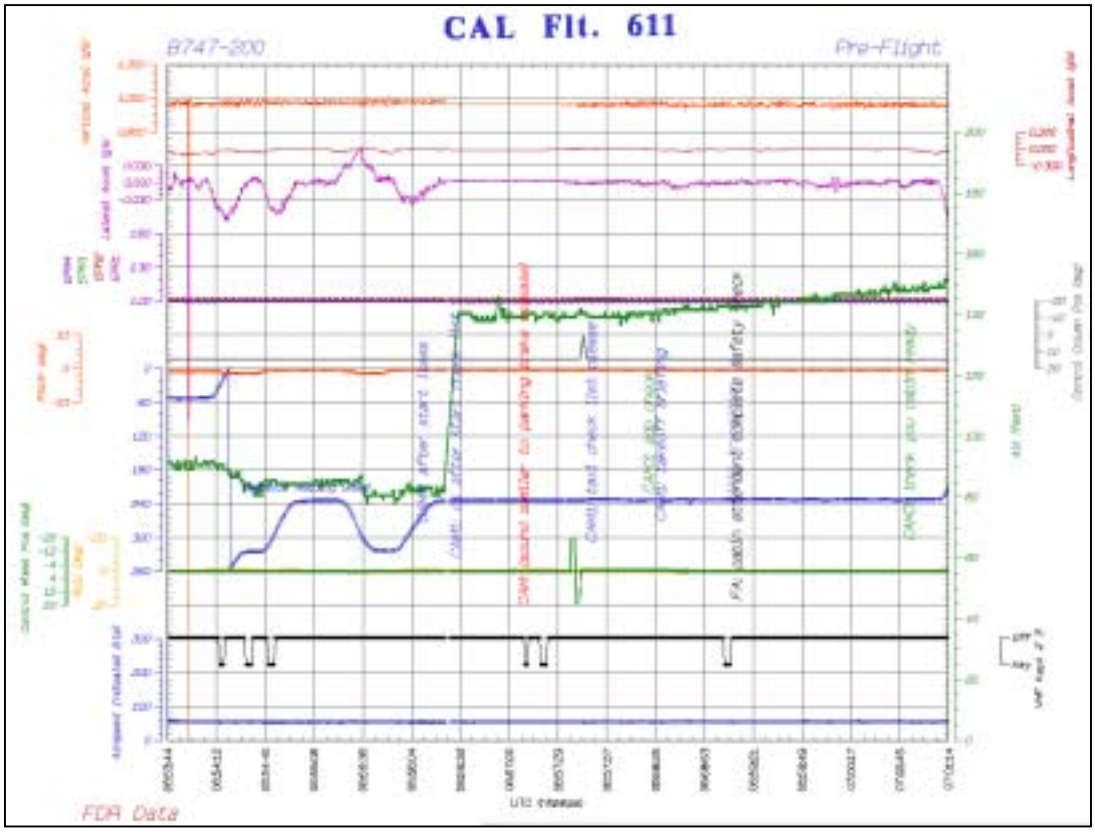


Figure 3 FDR data plots of CI611 (pre-flight section with CVR transcripts)

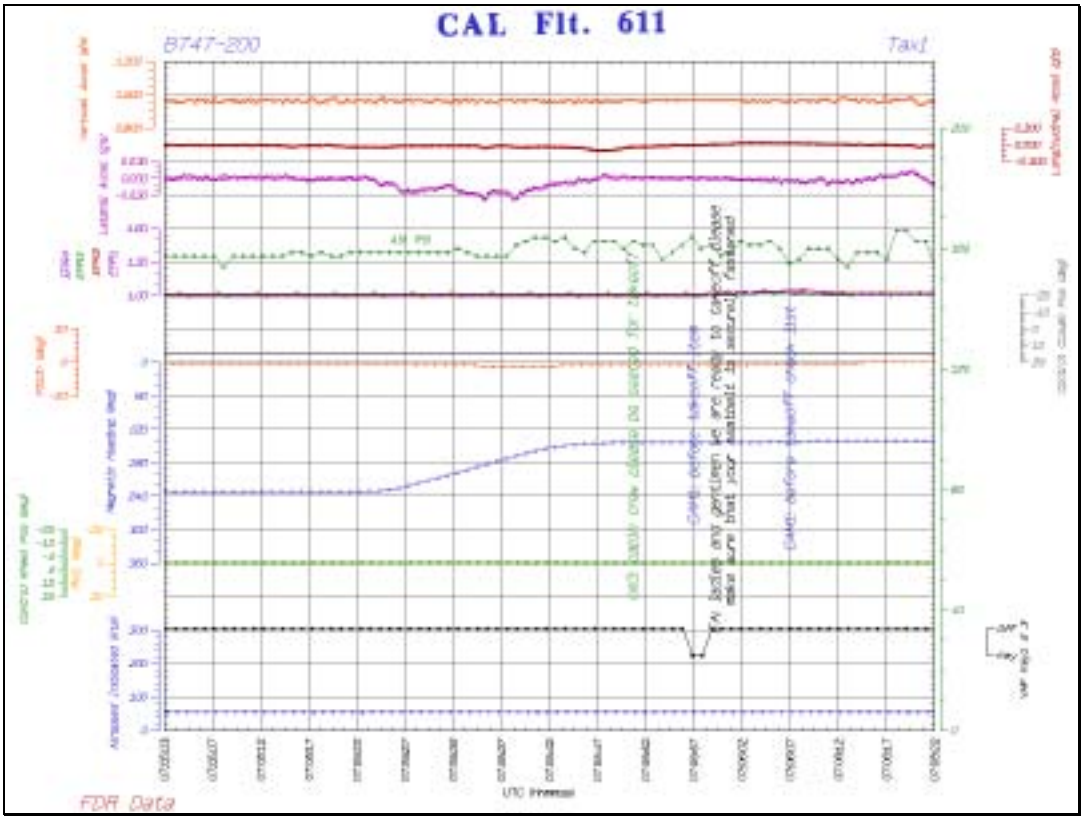


Figure 4 FDR data plots of CI611 (Taxi section with CVR transcripts)

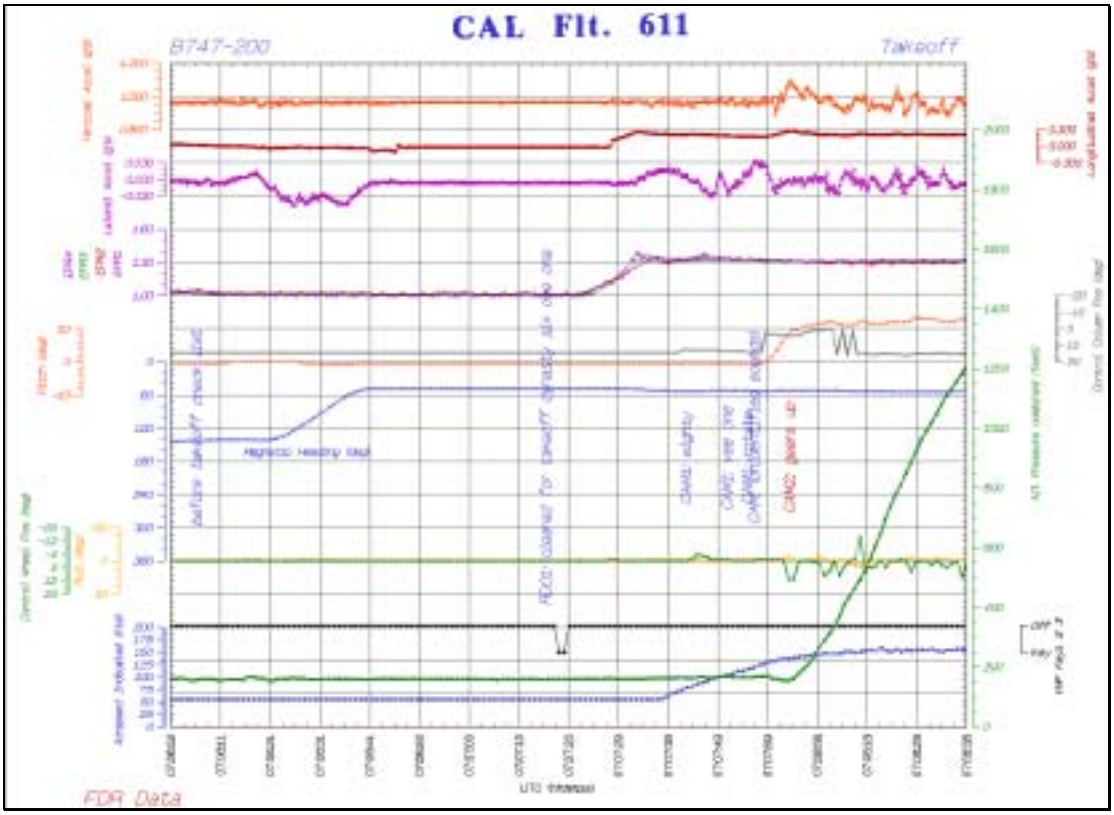


Figure 5 FDR data plots of CI611 (takeoff section with CVR transcripts)

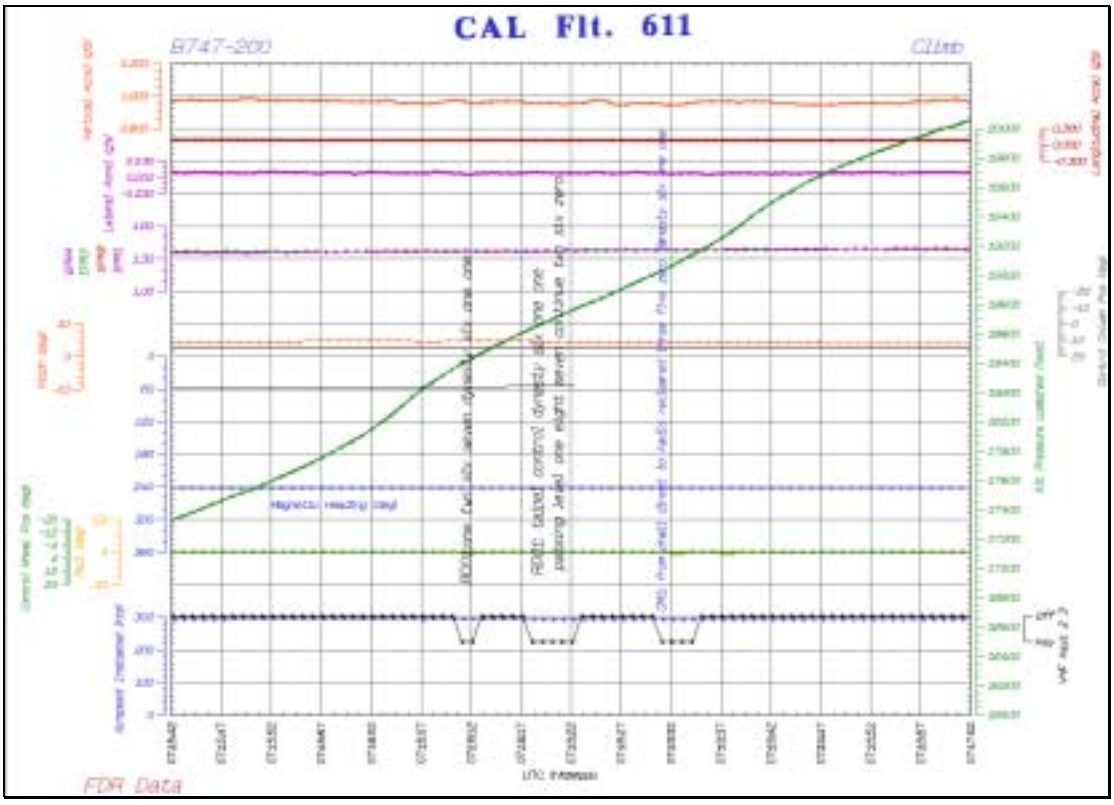


Figure 6 FDR data plots of CI611 (pass though 18,000 ft with CVR transcripts)

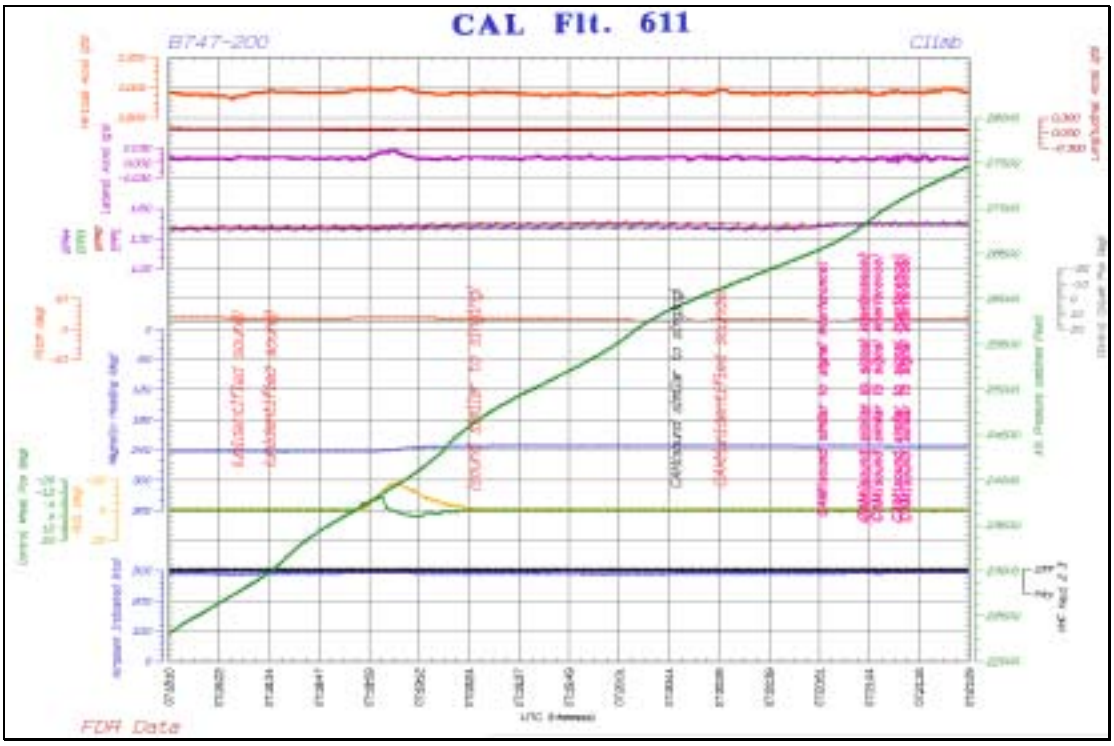


Figure 7 FDR data plots of CI611 (during 22,000 ft and 28,000ft, with CVR unidentified sound and interference signal)

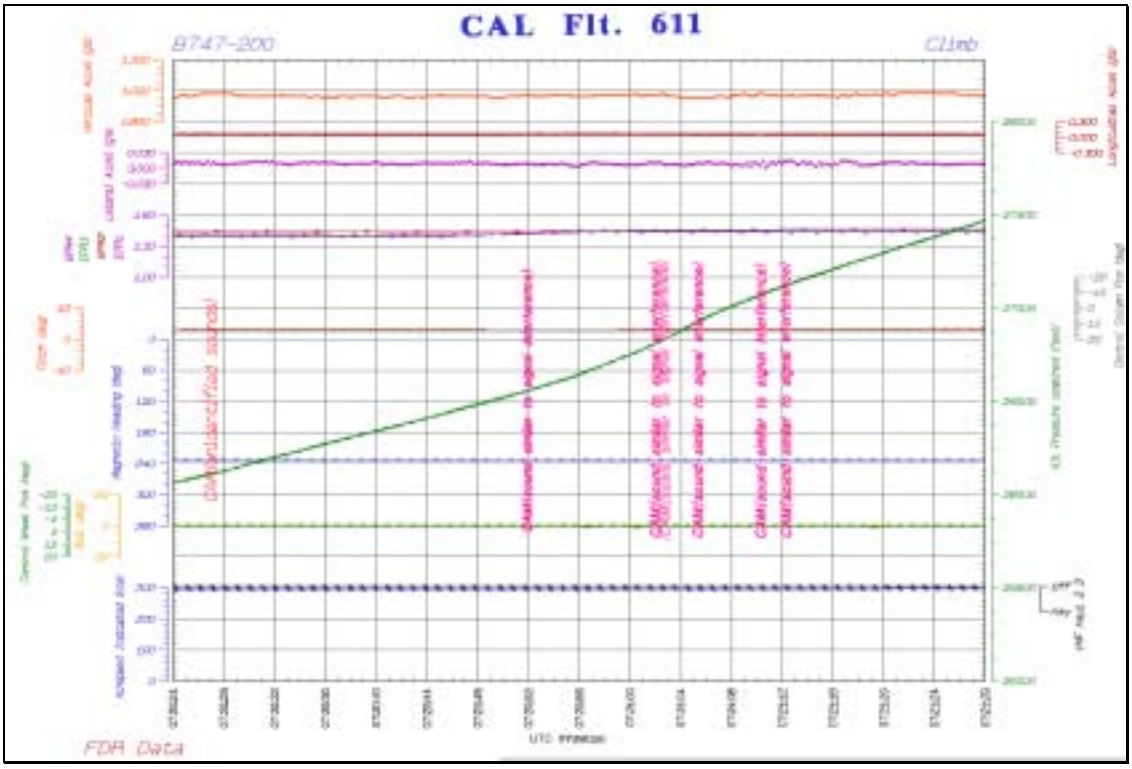


Figure 8 FDR data plots of CI611 (during 25,000 ft and 28,000ft, with CVR signal interference)

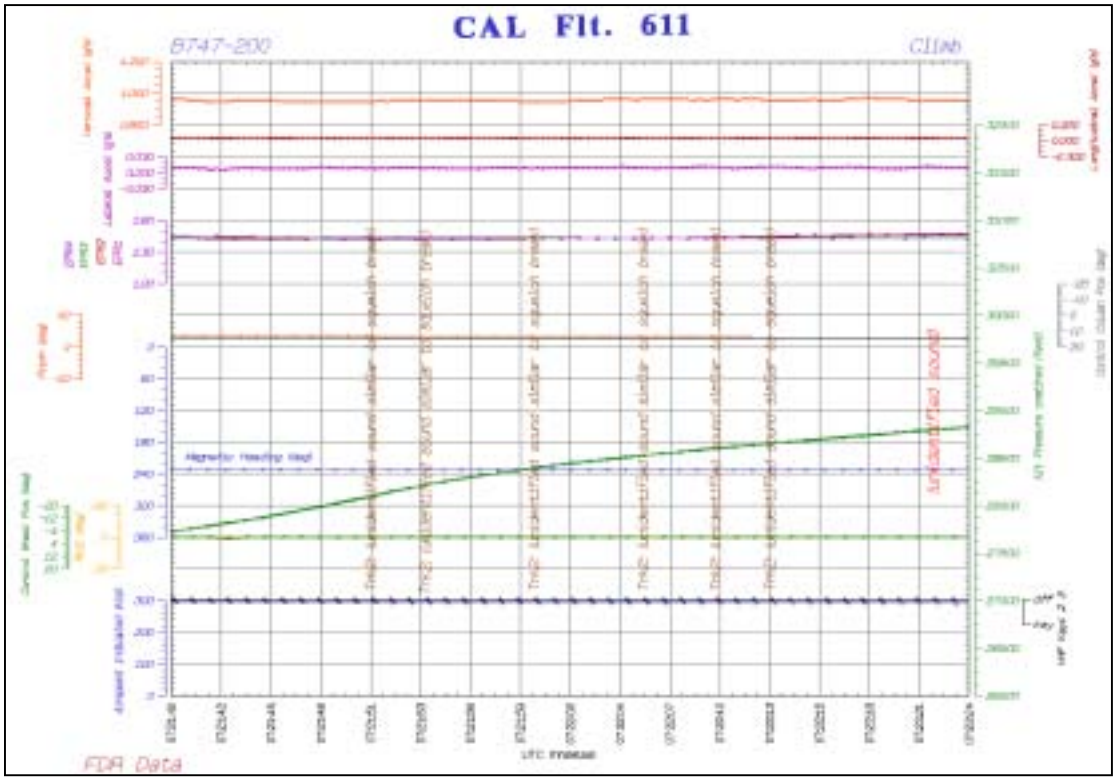


Figure 9 FDR data plots of CI611 (during 27,000 ft and 32,000ft, with CVR squelch signal)

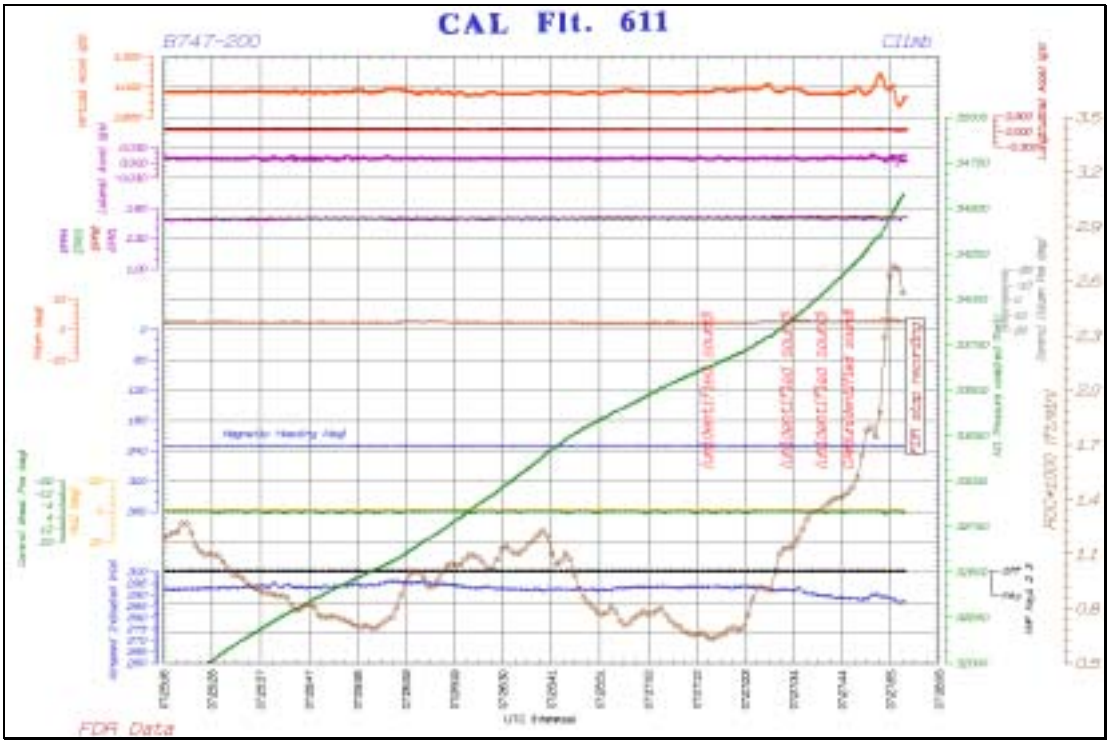


Figure 10 FDR data plots of CI611 (during 32,000 ft and 35,000ft, with CVR unidentified sound)

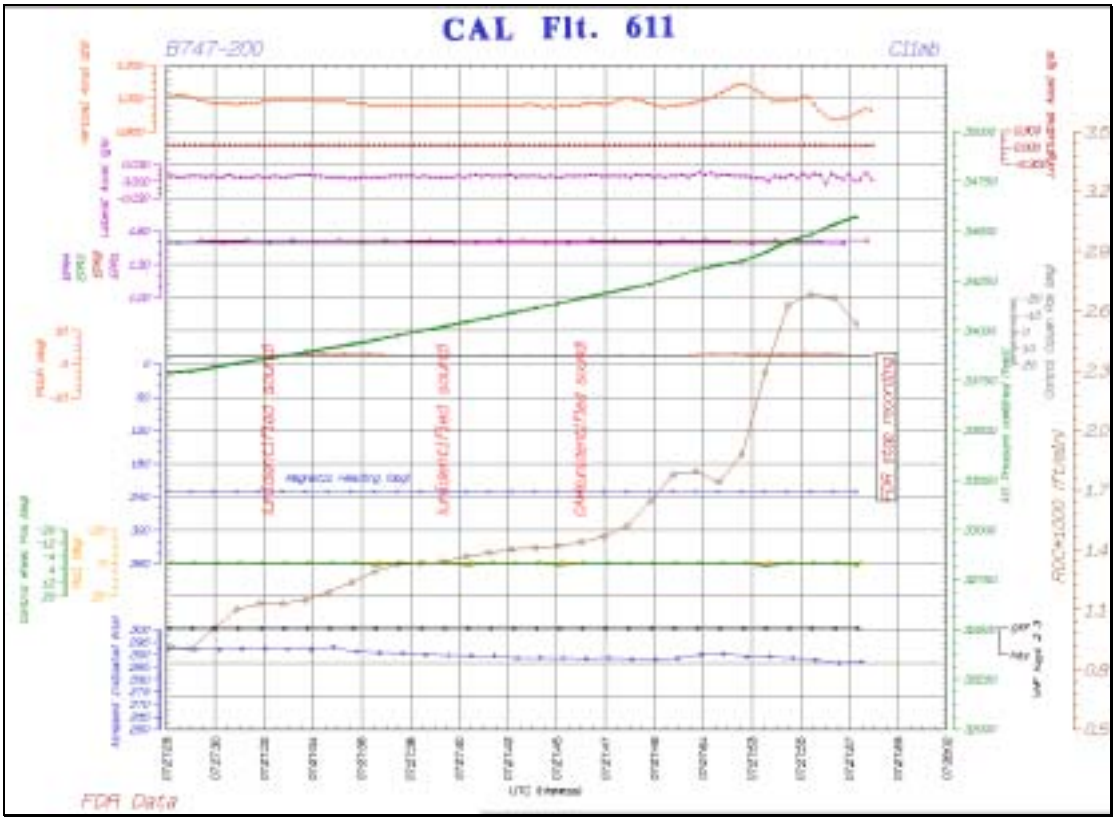


Figure 11 FDR data plots of CI611 (last 30 seconds, with CVR unidentified sound)

V. Attachments

No	Item
4-1	FDR Tabular data sets of the CAL611 (entire flight, 1Hz)
4-2	FDR Tabular data sets of the CAL611 (from FL330 to FL350, 8Hz)
4-3	Sound spectrum data from June 28, 2002 B747-200 simulation flight