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NATIONAL TRANSPORTATION SAFETY COMMITTEE

AIRCRAFT ACCIDENT REPORT

PT. Lion Air

Boeing 737-200 PK-LID

Sultan Syarif Kasim II Airport, Pekanbaru, Riau

14 January 2002

NATIONAL TRANSPORTATION SAFETY COMMITTEE
DEPARTMENT OF COMMUNICATIONS
REPUBLIC OF INDONESIA
2003

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GLOSSARY OF ABBREVIATIONS

AD	Airworthiness Directives
AGL	Above Ground Level
AMSL	Above Mean Sea Level
AOC	Air Operator Certificate
ATC	Air Traffic Control
ATPL	Air Transport Pilot License
CPL	Commercial Pilot License
CSN	Cycles Since New
CVR	Cockpit Voice Recorder
DGAC	Directorate General of Air Communications
DME	Distance Measuring Equipment
F/O	first officer
FDR	Flight Data Recorder
hrs	time (24 hour clock)
IFR	Instrument Flight Rules
IIC	Investigator-In-Charge
ILS	Instrument Landing System
kg	kilogram(s)
km	kilometre(s)
kts	knots (nm/hour)
mm	millimetre(s)
MTOW	Maximum Take-Off Weight
nm	nautical mile(s)
NTSC	National Transportation Safety Committee
^{o}C	degrees Celcius
PIC	Pilot-In-Command
QFE	Height above airport elevation (or runway threshold elevation) based on local station pressure
QNH	Altitude above mean sea level based on local station pressure
RPM	Revolutions Per Minute
S/N	Serial number
TS/RA	thunder strom and rain
TSN	Time Since New
TT/TD	ambient temperature/dew point
UTC	Universal Time Co-ordinated
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

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SYNOPSIS

On January 14, 2002, at 03:15 UTC a B737-200 registered PK-LID tried to take-off from Syarif Kasim II, Pekanbaru, Riau. Feeling the A/C was unable to leave the ground the flight crew aborted take-off, the A/C went out of runway, hit the fences, and stopped at 240 m from the end of the runway 18.

Indonesian NTSC and DGAC sent investigation team to Pekanbaru, later the investigation team from Boeing joined the site investigation. NTSB was appointed as accredited representative for the case, as the investigation involve the use of laboratory facility at AAIB, UK and Boeing.

1 FACTUAL INFORMATION

1.1 History of Flight

The A/C registered PK-LID departing for Batam from Pekanbaru at 03:15 UTC, flight number JT-386. The previous flight was from Jakarta and arrived at Pekanbaru on schedule, and schedule to transit at Pekanbaru for about 30 minutes. At 10.05 local time, the boarding process completed, and the first officer asked for start clearance. After start completed, the aircraft taxi to R/W 18. The flight crew set V1, VR, V2 and V2+15 speed bugs according to the load sheet. It is decided to use "reduced take off power" with assumed temperature 35^0 C (initial temperature was 27).

FO acted as pilot flying. The PIC opened power and adjusted to the required take off setting. The aircraft rolled normal and there was no abnormal indication. The PIC called "V1" and "ROTATE" at speed bugs value setting and the FO rotated the control column to 15^o nose up. The aircraft's nose was lifted up but the aircraft did not airborne. The FO felt stick shaker (stall warning). Realizing the aircraft did not airborne, PIC added power. The speed increase and passed the speed bug setting for V2+15 (158 kts) but the aircraft still did not airborne. The PIC decided to abort the take off and retarded the power lever to idle and set to reverse, extended the speed brake and applied the brake. The nose went down hard and the crew turned the aircraft slightly right to avoid approach lights ahead.

<the chronology of the flight>

The flight was a second route of four routes on a first day of two days schedule flight for the crew. All crew have flight schedule on the previous day and returned to Jakarta.

The first flight was from Jakarta to Pekanbaru with departure schedule on 08.00 LT (01.00 UTC). All crew did the pre-flight check completely but did not check the audio warning and departed Jakarta on schedule. The flight was normal and landed in Pekanbaru on schedule. There was no problem reported.

Transit in Pekanbaru for about 30 minutes and the flight was ready to continue the next flight to Batam. At 10.15 LT (03.05) the boarding process has been completed and all flight documents have ready. First Officer asked for start clearance and received weather information in Syarif Kasim Airport. The weather was fine, wind calm and clear.

After start completed, the aircraft taxi to the beginning of runway 18. Flight crews have set the V1, VR, V2 and V2+15 speed bugs according to the load sheet. Take off power decide to use "reduced take off power" with assumed temperature 35^o C while the actual temperature was 27^o C. flight Attendance have completed the passenger briefing includes rearrange seat for the seats near the "over wing exit windows". The checklist was done, but flight crews were not sure the indication of flap setting.

When ready for take off, flight crew gave a warning to the flight attendants to take their seats. First Officer acted as "Pilot Flying". PIC opened the power and adjusted to the required take off power setting. The aircraft rolled normal and there was no abnormal indication.

PIC called "V1" and "ROTATE" at speed bugs value setting, and the First Officer rotated the control column and set to 15^0 ANU (Aircraft Nose Up) pitch. The aircraft's nose was lifted up but the aircraft did not airborne. Flight attendant who was sitting at the rear felt that the nose was higher than normal. Officer also felt stick shaker, warning for approaching stall. First Officer suddenly noticed a warning light illuminated and cross-checked. He found than the warning came from the problem on the air conditioning system. Both pilots also felt pain in the ear. Recognizing this situation, PIC decided to continue the take off and called to the First Officer "disregard".

Realized that the aircraft did not airborne PIC added the power by moving power levers forward. The speed was increasing and passed the speed bug setting for V2+15 ($\pm$ 158 KIAS) but the aircraft did not get airborne. PIC noticed that the runway end getting closer and he thought that the aircraft would not airborne, he decided to abort the take off and called "STOP".

PIC retarded the power levers to idle and set to reverse thrust, extended the speed brake and applied brake. Nose of the aircraft went down hard and made the front left door (L1) opened and 2 trolleys at front galley move forward and blocked the cockpit door.

Flight crew turns the aircraft slightly to the right to avoid approach lights ahead. The aircraft moved out or the runway to the right side of the approach lights. After hit some trees the aircraft stopped at ±275 meters from the end of runway on heading 285^0.

One passenger had serious injury and the rest had minor injury, all crew were safe and not injured. No one killed in this accident, while the aircraft considered total loss.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	0	0	0
Serious	0	1	0
Minor/None	7	95	0
Total	7	96	0

1.3 Damage to Aircraft

The A/C was found at heading 090, 240 m from the end of runway 18. The two engines were detached from the wings. The RH engine was found 50 m from the main wreckage with its inlet detached. The LH engine was found below the main landing gear bay. The main landing gears were detached. The outboard side of the RH wing was broken, apparently due impacting the fences. The tail cone was punctured by approach lights beam. There were scratch marks at the lower part of the empennage.

By the time the investigation team arrived, the aircraft vertical stabilizer has been removed. This was done since the stabilizer blocking the view path of approaching aircraft to the approach light. The removal of the stabilizer has been consulted to NTSC.

1.4 Other Damage

Four approach lights were damaged due to the impact with the A/C.

In the runway, there were aluminum and paint scrap marks. The first mark is at approximately 1700 from threshold, 10 inches wide, 57 ft long, 12 ft right of centerline. The second is at1800 ft, 10 inches wide, 54 ft long, 9 ft right of centerline. The first blue paint marks at 1900 ft, 8 inch wide, 58 ft long, 9 ft right of centerline. The second paint mark is at 2000 ft, 9.5 inch wide, 24 ft long, 7.5 feet right from centerline. The marks are identified as result of the bottom side of the empennage scraping the runway. At 135o ft from threshold, there was first confirmed braking mark from the right main gear.

1.5 Personnel Information

1.5.1 Captain Pilot

Sex	:	Male
Age	:	47
Date of joining Company	:	June 1, 2001
License	:	ATPL 2276
Validity period of license	:	April 19, 2002
Ratings	:	B 737
Last Medec	:	Oct 10, 2001

Last Line check	:	June 2001
Last Prof check	:	December 2001
Aeronautical experience	:	17266:30 (total time)
Experience on type	:	
Last 90 days	:	275:20
Last 28 days	:	197:25
Last 24 hours	:	7:55

1.5.2 First Officer

Sex	:	Male
Age	:	29
Date of joining Company	:	June 2, 2000
License	:	ATPL 4003
Validity period of license	:	April 28, 2002
Ratings	:	B 737 200
Last Medec	:	Oct 28, 2001
Aeronautical experience	:	3700 hrs
Experience on type	:	2500 hrs
Last 24 hours	:	7:55
Last 30 days	:	86:17
Last 90 days	:	209:06
Last line check	:	2 July 2000

1.6 Aircraft Information

1.6.1 Aircraft Data

Manufacturer	:	Boeing
Model	:	737-200
Serial Number	:	
Registration	:	PK-LID
Country of manufacture	:	US
Date of manufacture	:	
Certificate of airworthiness	:	Valid until 7 June 2002
Certificate of registration	:	Valid until 7 June 2003
Total airframe hours	:	68133.53
Total airframe cycles	:	66998
Last Inspection	:	C check on June 12, 2001 A check on December 26, 2001
Hours since last inspection	:	278.53 since C check 36.08 since A check
Cycles since last inspection	:	
Engines	:	
Engine # 1 type	:	JT8D-9a
Engine # 1 S/N	:	665246
Total engine hours	:	57608.28
Engine #1 TSO	:	2628.28
Total engine cycles	:	40611
Engine #2 type	:	JT8D-9a
Engine # 2 S/N	:	665179
Total engine hours	:	63757.56

Engine #1 TSO	:	4647.31
Total engine cycles	:	44545

1.6.2 Aircraft History

PK-LID was an ex-Continental Airlines bought from National Air (US). The aircraft was grounded in Batam for three months after an engine failure caused it to RTB. The problem later found as compressor blade rubbing. PK-LID became operational again just only one and a half-month before this accident

1.6.3 Weight and Balance

		Maximum	Actual
Take-off weight	:	46760	456545
Zero fuel weight	:	39909	39066
Empty Weight	:		28685
CG from MAC	:		18.4%

1.7 Meteorological Information

Surface wind	:	Calm
Horizontal visibility	:	7 km
Present weather	:	Hazy
Cloud	:	4 SC 1500 ft
Temperature	:	28^0 C
Dew point	:	24
QNH	:	1007/29.75
QFE	:	1007/29.63

1.8 Aids to Navigation

Not relevant.

1.9 Communications

Not relevant

1.10 Aerodrome Information

Airport Name	:	Syarif Kasim II
Airport Identification	:	WIBB
Airport Operator	:	Angkasa Pura II
Certificate Number	:	-
Runway Direction	:	18/36
Runway Length	:	2150 meter
Runway Width	:	30 meter
Surface Condition	:	Asphalt

1.11 Flight Recorders

1.11.1 FDR

Sundstrand UFDR, model G, PN 980-4100-GQUS, SN 9870

1.11.2 CVR

Fairchild, model A 100, PN 93-A100-80, SN 5269

1.12 Wreckage and Impact Information

1.12.1 Aircraft Structures & Systems

The LH and RH flap were found stowed. Inspection of the flap ball nut number 4 and 5 confirmed that the flap is at zero position (touching the up position). Left wing leading edge # 1 slat measured 3/8-inch gap between leading edge and fixed wing. Right wing leading edge were damage extensively. The leading edge actuator number 8 hydraulics tubes severed. Actuator was visible and was in a retracted position.

The spoilers are found flushed. Photographs taken about half an hour after the accident (after evacuation) however show that the spoilers are deployed. The same photographs show the flaps were retracted. Interview with Airforce personal (a pilot) who helped during evacuation also confirmed that the flap was retracted.

The rudder pedals were found to the full right, the steering at full left, and the power levers were found at full reverse. All the fire handles (engines and APU) were pulled and turned to the left. The flap selector was in detent 5, and the system is in good condition.

On the fuel control panel, all pumps were off and cross feed valve closed. On the pressurization panel, the engine bleed 1 on, pack left on, isolation valve auto, pack right off, engine bleed 2 on, APU bleed off.

The airspeed indicators were reset to zero. Speed bugs indicate to 135, 143 and 158 kts.

The wheel well was damaged severely due to impact with the engine. On the wheel well, the FCU and PCU show no physical damage. The torque tubes from PDU were in good condition as also the torque tubes to/from the transmitter on the right wing. The flap asymmetry system was upgraded to electrical component with bypass valve.

Aural warning circuit breaker was found disengaged and could not hold in engaged. The CB was found with guard in place.

1.12.2 Powerplants

The dried soil and plants ingested in the RH engine indicates that the engine components were at high temperature at the time of ingestion. Little rotational damages also observed on the RH engine.

1.13 Medical and Pathological Information

The passenger that broke her legs gets the injury during evacuation.

1.14 Fire

There is no indication of pre-impact fire on the airframe and engines, even though fuel was spilled from wing damage.

1.15 Survival Aspects

When PIC realized the emergency situation and shouted "EMERGENCY, EVACUATE" for several times since there was no electrical power available. He tried to set the power lever to normal, but left power lever was stuck, set the start lever to shut but both of them were stuck and pull and rotate the fire discharge of both engines and APU. The First Officer heard the crowded and opened the sliding window, he saw a policeman (one of the passengers) and ask him to help the evacuation. He took the QRH (Quick Reference Handbook) but then they heard that someone calling from the outside asked them to leave the aircraft since the fuel has been spilled out.

The window exit was open by a passenger; majority of the passenger went out through the window exit. Door 3 was open by F/A 2, but the slide did not deploy. It is noted that the slides deployed after 3 hours and all the slides have no expiration date (or marked last inspection date-as regulated in CASR 121.309 (4). The F/A have checked the pressure indicator before flight.

Hearing that someone asked to leave the aircraft, the airborne mechanic tried to open the cockpit door, but did not success. He then kicked the door many times and the door opened. They saw that no one left in the aircraft and evacuated the aircraft through right over wing exit window.

The evacuation all crew and passenger was relatively successful. One passenger broke her leg during evacuation. The accident was considered survivable.

1.16 Tests and Research

1.16.1 Interviews

ATC Operators

The interview was done on January 15, 2002 at Pekanbaru airport. The communication between ATC and the crew on 118.1 MHz frequency was done according to the procedure (see tower communication transcript). The A/C was given clearance to taxi to RW 18 and take-off. The ATC observed that there is something different as the A/C roll to take-off. At about 1500 m the ATC observed that A/C nose pitched up. The A/C then observed to be stall and roll out to the right side of RW 18. The ATC then sounded the crash bell.

Fire Brigade

The interview was done on January 15, 2002 at Pekanbaru airport. The fire brigade responded to the crash bell in 1 minute 35 second. The men observed thick black smoke came up from the detached no.1 engine that was under the A/C belly. They responded by spraying with 11000 liters of water. The firemen observed that the passengers went out from the emergency exits while none of the slides were deployed.

Cabin Crews

F/A 1:	Experience	: 5 years
F/A 2:	Experience	: 5 years
F/A 3:	Experience	: colleague 1 year
F/A 4:	Experience	: colleague 1 year

The interview was done on 22 January 2002 in KNKT office in Jakarta.

All the F/A observed no anomaly in the condition of the A/C prior to the accident. After the A/C stop, the door 1 was slightly open but can not be opened due to obstacle (tree branches), in addition to the F/A observed smoke outside. One of the trolleys in the front pantry loose and blocking the cockpit's door. F/A 1 suspected that the trolley loose due to bad safety lock and strap. The lock was not carefully checked before take-off due to "rush".

After the aircraft stopped, FA1 checked outside through the front left side door and she saw that the exit was blocked by trees. She asked FA4 to checked the front right side through the door, FA4 saw smoke on this side and report it to the FA1. FA1 then decided to keep this exit close. She took megaphone and gave command to the passengers to keep calm and proceed to the middle exit.

FA3 was fell down from her seat and sat on the floor when the aircraft stopped. FA2 gave command to the passengers to remain calm. FA2 checked the left side and she saw that the door was too high. FA2 then asked FA3 to block this exit. FA2 then checked the right side through right aft door (R3) and she considered that this door was safe for evacuation. She open this door but the slide did not inflated. She waited for few seconds, but the slide kept not inflated. She looked down and she thought that this was not too high for passengers to jump. Suddenly one passenger pushes FA3 aside and opened the left aft door (L3). He jumped through this door.

Most of the passengers were evacuated the aircraft through the over wing emergency exits.

After all passengers evacuated the aircraft, all flight attendants evacuated the aircraft through right over wing emergency exit.

During the evacuation, F/A 1 tend to help the flight crews rather than the passengers, even asked the passenger to help the flight crews.

F/A also mentioned that the aircraft's air condition system was not working very well, so that the cabin was very hot.

FO

FO asked for start clearance. After start completed, the aircraft taxi to RW 18. The flight crew set V1, VR, V2 and V2+15 speed bugs according to the load sheet. It is decided to use "reduced take off power" with assumed temperature 35° C (initial temperature was 27° C).

FO acted as pilot flying. The PIC opened power and adjusted to the required take off setting. The aircraft rolled normal and there was no abnormal indication. The PIC called "V1" and "ROTATE" at speed bugs value setting and the FO rotated the control column to 15° nose up. The aircraft's nose was lifted up but the aircraft did not airborne. The FO felt stick shaker (stall warning). Realizing the aircraft did not airborne, PIC added power. The speed increase and passed the speed bug setting for V2+15 (158 kts) but the aircraft still did not airborne. The PIC decided to abort the take off and retarded the power lever to idle and set to reverse, extended the speed brake and applied the brake. The nose went down hard and the crew turned the aircraft slightly right to avoid approach lights ahead.

PIC

Mostly the same as the story told by FO. PIC felt the aircraft took off for 1-2 meters on ¾ of RW then stall and came back to the ground. On second interview, the PIC remembered to set the flap to 5, but did not remember verifies with flap position indicator on the panel.

Onboard Engineer

He sat on the jump seat. He did not heard any aural warning upon take off. Somewhere on the take off sequence, he heard the FO expressing something when wrong and then heard the sound of aircraft impacting the ground.

1.16.2 Flap and aural warning system examination

Visual inspection to flap system cables was done. The cables were in good condition and under tension. However, the tension is not measured due to absent of test gauge.

There are no sign of damaged in the electrical plugs for the FCU switch (T/O warning) in the wheel well.

Pictures taken hours after the accident show that the needle on the flap indicator split and the alt arm was in not arm position. The left pointer of the flap indicator was at 0.2 degrees and right pointer was at 15.3 degrees. Boeing engineer performed continuity check on the connector of flap position indicator and flap bypass valve. The flap position indicator connector is functional. The bypass valve connectors are concluded to be functional.

For further hardware test, the components of the flap system were taken out of the aircraft and sent to Boeing facilities at Seattle, Washington for examination. NTSB representative at Seattle supervises the examination. The parts, examination plan, and results are tabulated as follows :

Part Name Part Number Serial Number	Inspection/Test	Results
Flap Control Unit 65-51602-12 0014	Detailed internal inspection will focus on the drive shaft, operating cams and linkages, internal springs and take-off warning switch.	The FCU was determined to function properly.
Flap Control Valve 65-44821	Removal and functional inspection of the flap control valve.	
Power Drive Assembly	Reconnect the PDU and the hydraulic motor and verify correct operation of the devices.	
Power Drive Unit 65-63851-2 0263	Disassemble the PDU and check for general condition of the internal gears.	The PDU was functionally acceptable with 200 psi applied. Its operation was smooth, but it made a clicking noise when operated in CCW direction (viewed from motor mounting side). The noise did not alter normal operation and its source was not identified.
PDU Hydraulic Motor MS9-3911-30ZE-4C MX120156A	During operational test, the leakage through the case drain will be monitored and, if excessive, further breakdown of the motor will be done	The hydraulic motor was functionally acceptable.
Flap Bypass Valve 10-60710-2 D549838	Provide conditions to simulate operating environment and actuate the valve. Verify valve operates per Para. 4.3.3 of the SCD	The valve operated normally when the electrical power was applied.
Flap Position Indicator 10-61926-4 2180	Test the Flap position indicator as a stand-alone device with a test box input. Run at least the tests called out in section 4.2.5 of the SCD. This section confirms correct operation of the asymmetry shutdown output from the indicator.	The flap position indicator passed the acceptance test. It is noted that the indicator pointer position could be changed by lightly shaking the instrument after disconnecting power.
Flap Position Gearbox L: 65-80055-5 5823B R: 65-80055-5 0426C	General disassembly and inspection of the internal gears	Both gearboxes were determined to be functionally acceptable condition. Corrosion in one of the bearings caused a rough feel when rotating the shaft of left gearbox by hand.
Flap Position Sensor L: 10-61841-3 0284 R: 10-61841-4 0187	Verify accuracy per paragraph 4.2.5 of the SCD	Both transmitters were functionally acceptable.

Part Name Part Number Serial Number	Inspection/Test	Results
Flap Bypass Relay 96774-18-1798 0340	Perform a visual and operational test of relay to supplier specification	The relay was functionally acceptable.
CB panel w/ aural warning CB N/A N/A	Perform a visual and operational performance of circuit breaker C451 (AURAL WARNING).	♦ The aural warning CB can not be reset ♦ The reset button latch mechanism exhibit significant wear on the latch component that retains the reset button ♦ No other discrepancies were noted on the CB ♦ The mechanical and electrical test conducted on the CB did not identify any functional problems
Aural Warning Module 65-54499-15 R00022S	Perform (1) a visual of the Aural Warning Module (AWM) and (2) operational performance test of the Take Off Warning (intermittent horn) and Crew Call (high tone).	The crew call (high chime) and take off configuration functioned normally.
Landing Gear Acc. Unit 65-52811-30M M00197	Perform (1) a visual of the landing gear module and (2) operational test of the Take Off Warning logic to activate the AWM.	The landing gear take-off warning logic discrete function operated normally.
Annunciator lights (6) Full ext:not labeled Transit:10-61803-65 Ext:10-61803-64	Perform visual inspection and operational check of the bulbs.	Five of the bulbs functioned properly. One of the two bulbs in the “flap full extend” had open filament, causing partially litted lens face.

1.16.3 CVR readout

The read out was performed at the AAIB facility in Farnborough, UK.

The CVR was in a good condition, therefore, the tape can be taken out and read without any difficulty.

The channel from the cockpit area microphone is blank. Apparently the cockpit area microphone was not working. Such failure makes it impossible to find out whether the flight crews made proper take-off checklist and to confirm whether there is any aural warning due to improper take-off configuration.

The P1 and P2 microphone only recorded when there is radio transmission, therefore, most of the recording obtained was conversation between flight crew of PK-LID and other traffic with ATC

Detail of the transcript is as follows:

Time	Source	Conversation
00.00.11 – 00.01.04 *EMI (Electro Magnetic Interference) from a mobile phone.*		
00:09.24	RI 071	Syarief Tower Mandala zero seven one.
:09.29	ATC	Mandala Zero seven one go ahead
.31	RI 071	Request your Quebec Alpha Mike, destination Soekarno-Hatta Jakarta, stand by flight level three - three zero
38	ATC	Roger. Mandala zero seven one. Temperature now two six due point two three altimeter one zero – zero seven, pressure one zero-zero three, wind calm, call ready for start.
51	RI 071	Thank you very much
53	RI 071	Copy Quebec Alpha Mike call you for start, Mandala zero seven one
00:19.51	RI 071	Syarief Tower Mandala Zero seven one Requesting start the engine
00:19.58.11	ATC	Zero seven one clear to start expect runway one eight
:20.01.13	RI 071	Clea……
:20.03.03	RI 071	For runway one eight Mandala zero seven one
:22.24.07	JT 386	Syarief Tower selamat pagi Lion three eight six
:22.30.01	ATC	Lion three eight six go ahead
.32	JT 386	Lion Three eight six to Batam stand by flight level one nine zero request start clearance and Quebec Alpha Mike.
41.05	ATC	Three eight six clear to start. Temperature now two seven due point two four one zero-zero seven and one zero-zero three wind calm call taxi.
00:22.50.07	JT 386	Clear for start Lion three eight six
55.13	RI 071	Zero seven one ready for taxi
58.06	ATC	Zero seven one, taxi runway one eight via alpha, clear to enter back track.
:23.03.13	RI 071	One eight via alpha and clear backtrack one eight Mandala zero seven one.
15.06	JT 386	Empat Lapan (*four eight*) *EMI on background.*
19.07	RI 071	Yo……
00:23.41.14	RI 071	Fi…….
.43.03	JT 386	Ya….
EMI on background for 2 minutes (00:23.16.09 – 00:25.17.08)		
43.14	ATC	Mandala zero seven one clear to enter and clearance available.
.45.12	JT 386	Siapa?
48.03	RI 071	Clear to enter backtrack go ahead for clearance, sir.
49.00	JT 386	Hallo.

Time	Source	Conversation
50.08	RI 071	Kemana, Fi?
51.13	ATC	Zero Seven One clear to Soekarno Hatta Jakarta Alpha Five Eight Five, level three- three zero is approved by Medan squawk six two three one, report ready
52.10	JT 386	Ke Batam. Dengan siapa?
55.02	RI 071	Bruri
56.07	JT 386	Oh... Brur. Waduh..... Pa kabar Brur?
00:24.01.01	RI 071	Kenapa?
02.07	JT 386	Pa kabar?
:24.02.09	RI 071	Clear to Sukarno Hatta Jakarta, Alpha five eight five level three-three zero and squawk six two three one Mandala zero seven one.
03.08	RI 071	Baik ... baik
04.09	JT 386	Sama siapa Brur?
06.07	RI 071	Sama Rofikul.
08.11	JT 386	Oooh.... Anak itu.. Wah bilangin Brur. Pengadu.
12.09	ATC	PTT sounds
17.05	RI 071	Ha... ha... ha...
:24.20.05	RI 071	Ada apa Fi?
21.08	JT 386	Kenapa Brur?
23.10	RI 071	Terbang sama siapa?
24.25	JT 386	Iye... Dia ngadu sama ceweknya, ceweknya ngadu sama Direktur Operasi gue. Pengadu bilangin.
36.03	RI 071	Ah lu gitu
37.13	JT 386	Emut Brur.
43.04	RI 071	Nggak boleh habis lebaran
46.06	JT 386	Gue udah bilangin mi. Momo biar diemut
50.10	RI 071	Ha....ha... Terbang ama siapa Fi?
54.12	JT 386	Sama Zayarlie Zain.
59.06	RI 071	Oh... ya... ya... ya.
:25.05.12	Unknown	Beeek
00:25.11.02	RI 071	OK deh Fi. Happy landing ya, salam buat semua crew
:25.15.00	JT 386	OK Brur. Tolong diemut Brur.
.17.09	RI 071	Ha..ha...
:26.23.14	RI 071	Zero Seven One line up ready for departure
27.12	ATC	Mandala Zero Seven One left turn after clear for take off.
31.04	RI 071	Left turn after clear for take off Mandala Zero Seven One
38.09	Electrical noise	
59.10	Sounds of igniters (00:26.59.10 – 00:27.09.08)	
:27.27.03	JT 386	Jangan lupa diemut Brur!
48.00	ATC	Mandala zero seven one airborne time one zero. Contact one two zero eight. Happy landing sir.
27.44.13	RI 071	One two zero eight. Selamat siang pak
48.04	ATC	(PTT sound)
51.04	JT 386	Lion three eight six request taxi.
54.06	ATC	Runway one eight via bravo clear to enter backtrack
58.14	JT 386	Clear to backtrack one eight via bravo lion three eight six.
00:28.34.02	ATC	Lion three eight six clearance. Clear to Batam whiskey two-two Level one nine zero squawk six two three six.
00:31.40.00	EMI	
00:32.04.07	JT 386	Lion Three Eight Six ready for departure.
00:32.17.10	F.O	Cabin crew take off position.
.09.09	ATC	Clear for take off, left turn after, after airborne contact one two zero eight. Happy Landing, see you return.

Time	Source	Conversation
18.07	JT 386	Clear for take off, left turn after, contact approach. Selamat pagi see you return.
23.11	ATC	Selamat pagi (unclear)
00.33.15.08	*Electrical disturbances and EMI*	
00:33.24.13	PIC	Stop
		Shit

Printed in blue (write as non-related colloquial conversation) are the communications of the JT 386 first officer with RI 071 crew in the radio communication.

1.16.4 FDR readout

The read out was performed at the AAIB facility in Farnborough, UK. Eleven parameters were recorded and successfully read out as attached in the appendix. Highlights of the data are as follows:

Sub-frame	Data	Symptoms
18		Beginning of the flight
80	Changing of heading	Aircraft start to taxi
272	Changing heading toward runway heading	Turning to line up position
297.5	Changing heading toward runway heading and increasing of N1 & N2	Turning to line up position and opening power.
322.5	Peak EPR indication (1.95)	Take off power set
327.25	Initial indication of speed	Initial take off roll
348	Increasing pitch	Initial rotation
352.875	Highest pitch setting and reducing.	Peak pitch rotation (18.166)
354	Peak speed and start to deceleration. Reducing of EPR indication	Initial rejected take off Peak speed 144.48
355.875	Stabilize pitch	Nose stay on the runway.
358.5	Re-increasing of EPR	Initial of reverse thrust
362.5	Stabilize EPR	Maximum reverse thrust EPR 1= 2.06717 EPR 2 = 2.13052
364.5	Decreasing of EPR 2	From 2.02948 (SF 363.5) to 1.53555
365	Last heading data	180º.
365.25	Last speed data	51.0638
365.625	Last EPR data	EPR 1= 2.07773 EPR 2= 1.29075
365.875	Last pitch data	-2.23697

The maximum pitch recorded is 18 degree.

1.17 Organizational and Management Information

Aircraft Owner	:	PT. NATCO
Address	:	
Aircraft Operator	:	PT. Lion Air
Address	:	Gedung Jaya 7th floor, Jl. M.H Thamrin No.12 Jakarta 10340
Certificate Number	:	
Aircraft Designator	:	Regular Flight

1.18 Other Information

none

2 ANALYSIS

2.1 Failure to lift-off

Load manifest data shows that A/C did not exceed its MTOW, and the CG position is sufficient to provide stability. The speed bugs setting found in the investigation also confirm the flight crew interview on the proper take-off speed selection.

The FDR data on engine power and pitch profile match with flight crew interview. Wreckage and the FDR confirmed that engine failure was not the cause of the failure to lift-off.

Aircraft performance derived from FDR data conclude that the A/C tried to take-off with zero flap or should the aircraft had flap 5, it should be able to airborne. This supports the finding on the wreckage that the flap is at zero position. **Therefore, it is concluded that the aircraft fail to lift off due to flap at zero position.**

2.2 Flap at zero position

There are three possibilities of why the flap did not travel to take-off configuration upon take-off preparation.

The first is flap asymmetry. Asymmetry on the LH/RH flap of more than 2.4-degree would cause the flap system to stop flap movement. Investigation finding, that both LH and RH flap was found at zero position, however, indicate that **flap asymmetry was not the cause of the flap failed to travel to take-off configuration**.

The second possibility is the failure of the flight crew to select the flap to take-off position. Due to the lack of recording from cockpit area microphone, **the investigation could not confirm whether the take-off checklist**, which include flap selection, was done properly. Radio transmission record shows that at 00.27.54 the flight crew informed ATC that they have entered the runway. The next radio transmission is at 00.32.04 when the crew informed the ATC that they were ready for departure and slightly after that they performed take-off roll. Therefore, they have about four minutes in between the radio transmission, which was **enough time to do proper take-off checklist**.

The third possibility is the failure of the flap system. Meaning that the flap selector has been selected to take-off configuration but the system does not respond. All examination to the flap system components (see 1.16.2), however, shows that **there is no component failure in the flap system**.

2.3 Take-off configuration recognition

Should the take-off configuration, such flap, not properly selected when take-off power was selected, an aural warning should be emitted by the aircraft system to alert the flight crew. The interviews to three people in the cockpit at the time (PIC, FO, engineer on-board) yield that they did not hear any aural warning. This led them to believe that the aircraft has been properly configured to take-off.

The components of the take-off aural warning system were checked (see 1.16.2). All the components, except the aural warning CB, were found to be functioned properly. The aural warning CB was found unable to latch in. This would open the circuit and, therefore, caused any aural warning in the aircraft can not be emitted.

2.4 Aural warning CB

The examination on the aural warning CB shows that the CB can not latch in due to wear on the latching mechanism. Such wear should be remedied by replacing the CB. This, however,

was not done. Instead, for some reason, the maintenance of the previous owner/operator installed pull-out guard on the CB. Such failure to understand the problem contributes to the accident.

2.5 Pilot procedures

In the COM (Company Operation Manual) Sub chapter 4.10.3.1 General Procedures Calls, (b) Flap Selection states:

PF	PNF
Call "FLAP UP/ FULL DOWN or (…)°"	Reply "SELECTED" (After selected)
	Reply " FLAP UP or (…)° SET" (after operation)

This conversation was not found in the CVR since the cockpit area mike did not work.

In the Boeing 737-200 Pilot's Handbook, Chapter Normal Operating Procedures, sub chapter General states:

"The pilot's checklist is designed to verify that checks and procedures essential for safe flight have been accomplished. Inherent in this concept is the requirement of that each crew member has a clear understanding of two basic tenets of checklist philosophy as it relates to the "Challenge and Response" concept:

- *The pilot reading the checklist should visually verify the required switch position or action while reading the CHALLENGE portion of the checklist.*
- *The pilot responding to the checklist should visually verify each specific switch position or action matches the correct checklist response.*

Also in the Boeing 737-200 Pilot's Handbook, Chapter Normal Operating Procedures, sub chapter Before Take Off Checklist, states:

FLAPS …… FO/C …… _____, GREEN LT, DETEND
Take off setting, LE FLAP green light illuminated, and physically check flap lever in the appropriate detent.

In the accident site, it was found that the flaps were at zero position. Should pilot select the flap to take-off configuration and the flap system failed and caused the flap to remain at zero position, the crew would not see the green light illuminate and flap indicator would indicate zero position. Therefore, had one of the above procedures been performed, the crew would have identified the flap's zero position, regardless the failure of the take-off configuration aural warning.

2.6 Similar accident

NTSB database shows that similar accident has happened in the US. It was the accident of N473DA, Boeing 727 of Delta Airlines, in August 31, 1988 at Dallas Airport, Texas. The flight reported to be normal on the take-off roll. The crew stated that after the rotation and main gear left the ground, they heard explosion and rapid deceleration. The aircraft struck the ILS antenna 1000 ft beyond the runway and came to rest 3200 ft beyond the runway. Investigation found the flap and slat were not configured to take off. Investigation found that due to inadequate discipline on take-off procedure, the crew failed to configure the flap and slap to take-off configuration. The fact that the crews were not alerted on the improper configuration was due to failure of take-off warning system

2.7 Passenger evacuation

The after the accident came to rest with the right main landing gear and right engine were separated from the main wreckage, which make the right wing broken tip touch the ground. Crew interview yield that none of the escape slide deployed during the evacuation. ***Upon arrival of the investigation team, all escape slides were deployed due to tampering of the wreckage. Investigation could not determine the reason of the failure of the slides deployment.*** Therefore, right wing exit was the safest way for the evacuation.

FA4 perceived to see smoke from front right side exit door (R1), in which FA1 then decided to keep the exit close. However, there was no evidence of fire at neither the accident site nor the wreckage. It is very probable that the aircraft scraping the earth movement before it stopped had produced dust, which was **misinterpreted by the FA4 as smoke, and lead to isolation of the front exit.**

FA2 checked the aft left side and she saw that the door was too high. FA2 then asked FA3 to block this exit. FA2 then checked the right side through right aft door (R3) and she considered that this door was safe for evacuation. She opened this door but the escape slide did not deploy. She waited for few seconds, but the slide kept not inflated. She looked down and she thought that this was not too high for passengers to jump. The decision lead to one passenger broke her leg jumping from this exit. The height of the door to the ground was about 2 meters.

Knowing that left exit doors were too high to be used, front left exit was isolated, and no slide on the aft left door, most of passengers and all crew were evacuated trough the right wing exit.

3 CONCLUSIONS

3.1 Findings

1. The flight crews have proper qualification to fly the aircraft.
2. The aircraft did not exceed its Maximum Take-Off Weight limitation specified in the AOM.
3. Cockpit area microphone did not function at the time of the accident. Therefore, the only sounds/conversations recorded were only when there were radio transmissions.
4. FDR data show that the engines operated normally.
5. FDR data show similar trajectory with an aircraft of the type and loading condition tried to take-off with zero flap.
6. The aircraft flap system was found to function normally. Therefore, should the flap selector moved to non-zero position, the flap should move to the selected position.
7. The crew did not perform Before Take-off Checklist as stated in the Boeing 737-200 Pilot's Handbook, Chapter Normal Operating Procedures.
8. The aural warning system, except its circuit breaker, function normally. Therefore, the cause of the absence of take-off warning is the wear out latch on the CB that caused it to open.
9. The food trolley safety lock and food trolley safety strap on the front galley did not function properly that the trolley loose upon impact and blocking the cockpit door.
10. The escape slides fail to deploy. All the slides have no expiration date or marked last inspection date-as regulated in CASR 121.309.
11. Shear pins on the engines mounting function properly to separate the engine from the wing and therefore minimize the risk of fire in the accident.

3.2 Final Remarks

Since there is no indication that flaps system failure or flap asymmetry contributes in the failure of flap to travel to take-off configuration, the most probable cause for the failure is the improper execution of take-off checklist.

Failure of the maintenance to identify the real problem on the aural warning CB, causes the CB to open during the accident and therefore is a contributing factor to the accident.

4 RECOMMENDATION

As result of this investigation, the following safety actions were recommended for:

4.1 Directorate General of Air Communications:

1. Ensure that the trolley stowage in the cabin were strong enough so that the trolley would not lose easily.
2. Ensure that the escape slides on the airplane function and certified properly.
3. To ensure that the number of flight and cabin crews are sufficient with the number of aircraft in the fleet.
4. To re-evaluate the emergency training of PT Lion Air as accordance to CASR 121.717 Crew Member Emergency training.

4.1 Operator:

1. Emphasize the checklist and standard call outs procedures for all pilots.
2. Provide CRM (Crew Resource Management) training to all crew.
3. Performed Crew Member Emergency Training to the crew as accordance to the company's and manufacturing company's manual.
4. Identify and record the cause of special modification, such as pull out guard on the aural warning CB. Should the operator has any doubt, it should questions the previous owner, the manufacturer, or the authority.
5. Ensure that the escape slides on the airplane function and certified properly.

Appendix

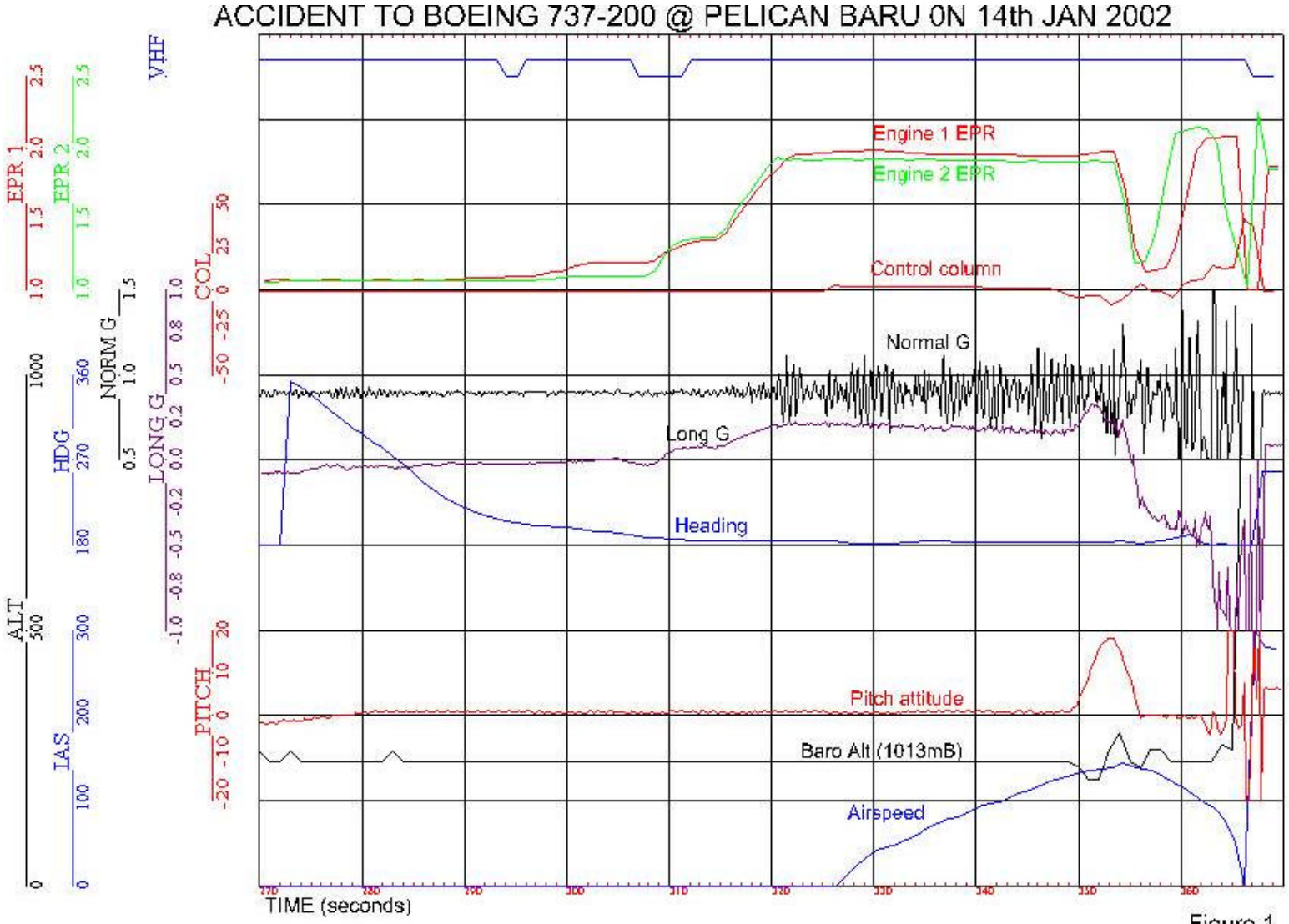
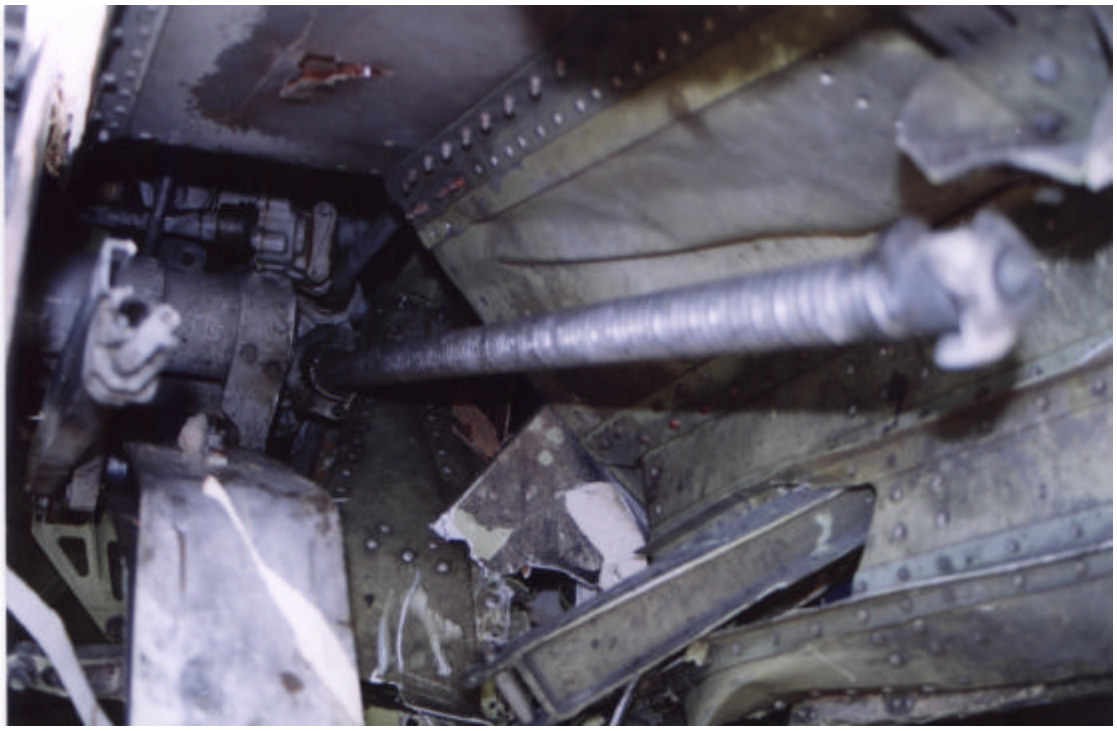


Figure 1

RH wing position

Flap position of the RH wing

Flap screw jack of the LH wing



Pedestal, when NTSC investigation team arrived