KNKT/99.06/02.04.008

NATIONAL TRANSPORTATION SAFETY COMMITTEE

AIRCRAFT ACCIDENT REPORT

Mandala Airlines MDL493

Boeing B737-200 Adv PK-RIL

Hasanuddin Airport, Ujungpandang, South Sulawesi

5 April 1999

NATIONAL TRANSPORTATION SAFETY COMMITTEE
DEPARTMENT OF COMMUNICATIONS
REPUBLIC OF INDONESIA
2002

When the Committee makes recommendations as a result of its investigations or research, safety is its primary consideration. However, the Committee fully recognises that the implementation of recommendations arising from its investigations will in some cases incur a cost to the industry.

Readers should note that the information in NTSC reports is provided to promote aviation safety: in no case is it intended to imply blame or liability.

This report has been prepared based upon the investigation carried out by the National Transportation Safety Committee in accordance with Annex 13 to the Convention on International Civil Aviation, UU No.15/1992 and PP No. 3/2001.

This report was produced by the National Transportation Safety Committee (NTSC), Gd. Karsa Lt.2 Departemen Perhubungan dan Telekomunikasi, Jalan Medan Merdeka Barat 8 JKT 10110 Indonesia.

CONTENTS

LIST OF FIGURES

GLOSSARY OF ABBREVIATIONS

AAIC	Aircraft Accident Investigation Commission
Adv	Advanced
AGL	Above Ground Level
AOM	Aircraft Operation Manual
APP	approach
ASL	Above Sea Level
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATPL	Air Transport Pilot License
BASI	Bureau of Air Safety Investigation
BKN	broken (clouds)
°C	degrees Celcius
CASR	Civil Aviation Safety Regulations
CB	Cumulo nimbus clouds
CRM	Crew Resource Management
CSN	Cycles Since New
CVR	Cockpit Voice Recorder
EPR	Engine Pressure Ratio
F/O	first officer
FDR	Flight Data Recorder
ft	feet
hrs	time (24 hour clock)
ILS	Instrument Landing System
kg	kilogram(s)
km	kilometer(s)
kts	knots (nm/hr)
L/G	landing gear
L/H	left-hand
LOC	localizer
LT	Local Time
m	meter(s)
MSL	Mean Sea Level

NDB	Non-directional Beacon
nm	nautical mile(s)
NTSC	National Transportation Safety Committee
PF	Pilot Flying
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
R/H	right-hand
SHEL	System-Hardware-Environment-Liveware
sq-cm	square-centimeters
TSN	Time Since New
TT/TD	ambient temperature/dew point
UPG	IATA code for Ujung Pandang
UTC	Universal Time Co-ordinated
VFR	Visual Flight Rules
VOR	Very high omni-directional range

SYNOPSIS

On April 5, 1999, Mandala Airlines Boeing B737-200 Adv, registration PK-RIL, departed from Soekarno Hatta International Airport Jakarta, which bound for Ujungpandang – Manado – Ujungpandang – Surabaya – Cengkareng. On its third sector (Menado – Ujungpandang), the flight and the aircraft's systems were reported to be in good condition. The pilot flying (PF) was the Pilot in Command (PIC). During the descent, the cockpit crew planned an approach on R/W 31. At 2500 ft altitude, the airfield was not in sight due to the cloud formation and local rain over the airport. The PF requested to land on R/W 13, and the aircraft was cleared to join right-hand down wind to R/W 13. After the localizer was established and while flying at 1500 ft altitude with the autopilot engaged, the runway was still not in sight by the crew. At 800 ft, the runway was in sight, and the PF then disengaged the autopilot at 500 ft. It was raining over the airport, and during flare-out the PF felt that the aircraft did not touch the runway surface. The aircraft was reported veering to the right, and the PF failed to bring the aircraft to the R/W centerline. The aircraft came to a standstill at a position of about 15 m to the right of the centerline of Runway 13, and at a distance of 186 m from the end of the opposite runway.

1 FACTUAL INFORMATIONS

1.1 History of Flight

On April 5, 1999, 23:00 UTC/06.00 LT, the Mandala Airlines Boeing B737-200 Adv, registration PK-RIL, departed from Soekarno-Hatta International Airport Jakarta with destinations Ujungpandang – Manado – Ujungpandang – Surabaya – Cengkareng.

At 06:38 UTC/14:38 LT on its third sector and second landing at Hasanuddin International Airport, Ujungpandang (now Makassar), the aircraft veered off to the right and came to rest on the shoulder of the R/W 13. The PIC was interviewed and reported that he had planned to land on R/W 31, as cleared by ATC. At 06:30 UTC the pilot requested to land on R/W 13 instead of R/W 31 given by Ujungpandang approach, due to rain over the airport, and commenced to prepare for the landing. At 06:33 UTC and at a distance of 6 nm Radar APP, altitude 1500 ft, the PF reported that the airport was not in sight yet, but at 06:37 UTC and altitude 800 ft, the PF reported to have the runway in sight.

The autopilot was disengaged at 500 feet altitude. The ATC reported a tailwind of 270/15 kts, but the message was not acknowledged. The PF reported experiencing a tailwind. The PF reported choosing 30° flaps setting instead of full flaps during the landing. The wheels first touched the ground at the taxiway intersection B, approximately 1000 meters from the R/W 13 threshold. At 80 kts speed, the EPR was reduced from EPR 1.8 to a lower setting, as required in the normal landing procedure. However, the aircraft started drifting or veering to the right and the cockpit crew felt the aircraft 'floating'. The pilot attempted to counteract the movement by pushing the right-hand engine power lever forward but did not succeed to control the aircraft. The aircraft left the runway and came to a standstill on the right side of R/W 13 at 186 m from the R/W 31 threshold (the opposite runway). The pilot shut down the engines when he heard an unusual noise. After the aircraft came to a standstill, the first cabin attendant came to the cockpit and requested instructions before evacuating the passengers from the aft exit by the available escape slides, which was at the lowest position from the ground of the aircraft in its final position. All passengers were evacuated safely and transported to the terminal by apron bus and Rescue and Fire Fighting Unit ambulance.

1.2 Injuries to Persons

Injuries	Cockpit Crew	Cabin Crew	Passenger	TOTAL
Fatal	-	-	-	**-**
Serious	-	-	-	**-**
Minor/ None	2	4	60	66
TOTAL	**2**	**4**	**60**	**66**

1.3 Damage to Aircraft

- Landing Gear 1 working beam down lock actuator was broken and found inside the landing gear wheel well.
- L/H flap, leading edge and trailing edge were bent.
- L/H lower wing flap cover was damaged (broken).
- L/H engine nose cone/air intake was damaged.
- L/H ground spoilers were bent.
- Engine #1 was dismounted, fuel tubing was broken.
- Engine #1 pylon was broken.
- Engine #1 house cover was broken.
- L/G tires #1 and #2 were found with the worst worn out spots, followed linearly with less worn spot on # 3 and #4.
- Flight data recorders secured and visually checked (dents in cover).
- Side brace was broken.
- Down lock link was broken.
- L/G windows (outer, inner, and center) were found not attached to frame.
- Inner flap was dented at 30° flap setting.

1.4 Other Damage

A runway light bulb broke at third series from end of R/H side runway lights due to the impact of the main landing gears.

1.5 Personnel Information

1.5.1 Cockpit Crew

1.5.1.1 Pilot-in-Command

Gender : Male

Date of birth : 36 years

Nationality	:	Indonesia
License	:	ATPL 4435
Validation	:	16 May 1995
Type rating	:	B 737-200
Instrument rating	:	Current
Medical certificate	:	First class
Date of last medical	:	23 March 1999
Last proficiency check	:	October 1998
FLIGHT TIME		
Total time	:	8.869 hours
This make & model	:	3.500 hours
This flight	:	5.35 hours

The PIC has had one evacuation training during his aircraft rating course at Lufthansa in 1994 and a CRM course, but has not had any wind shear training.

1.5.1.2 Co-pilot

Gender	:	Male
Date of birth	:	29 years
Nationality	:	Indonesia
License	:	CPL 4037
Validation	:	13 March 1993
Type rating	:	B 737-200
Instrument rating	:	Current
Medical certificate	:	First class
Date of last medical	:	12 February 1999
Last proficiency check	:	October 1998
FLIGHT TIME		
Total time	:	3.833 hours
This flight	:	5.35 hours

The F/O has never had any training in aircraft emergency evacuations, CRM, and wind shear.

1.6 Aircraft Information

Registration Mark	:	PK-RIL
Manufacturer	:	Boeing
Type/ Model	:	B 737-200 Adv
Category	:	Civil Transport
Crew (Cockpit/Cabin)	:	6
Pax seats	:	60

Engine Type	:	Turbo fan
Manufacturer	:	General Electric
Type/ Model	:	JT8D-15
Serial Number #1	:	P702955
▪ **TSN**	:	37,643
▪ **CSN**	:	33,805
Serial Number #2	:	P708306
▪ **TSN**	:	35,077
▪ **CSN**	:	32,989

1.7 Meteorological Information

The wind velocity reported a few minutes before the accident was 270/15-17 kts with 4 km visibility, and a slight rain over the airport. Wind direction and speed was unstable, changing rapidly from 360/04 at 06:00 LT to 300/20 at 06:30 LT and 270/17 at 06:38 LT.

Wind	:	300/20 kts
Visibility	:	3 km
Weather	:	Rain
Cloud	:	Few 017 CB ft BKN 018
TT/TD	:	24/23
QNH	:	1008/2977
QFE	:	1006/2971

1.8 Aids to Navigation

When approaching the UPG VOR the pilot decided to make an ILS approach. The autopilot was disengaged at 500 ft AGL. There was no significant report regarding the navigation availability in relation to the occurrence.

1.9 Communications

See Appendix B for flight crew and ATC communication transcription.

1.10 Aerodrome Information

Airport Name	:	Hasanuddin Ujungpandang Airport
Airport Identification	:	WAAA
Airport Operator	:	PT. Angkasa Pura I
Runway Direction	:	31 / 13
Runway Length	:	2500 meters
Runway Width	:	45 meters
Surface Condition	:	Asphalt
Elevation	:	47 ft MSL

The Hasanuddin International and Domestic Airport is located at longitude E 119 33.3′ and latitude S 05 03.7′, in the province of South Sulawesi. The airport is equipped with an ILS CAT I approach system for R/W 13, VOR and NDB. R/W 31 is restricted for VFR approach procedures only, due to terrain characteristics over the final approach for R/W 31.
The airport has been known to be a difficult for approaches in the months of November to April, which is the rainy season for the region. Westerly winds and turbulence are expected to be encountered on short final to R/W 13.

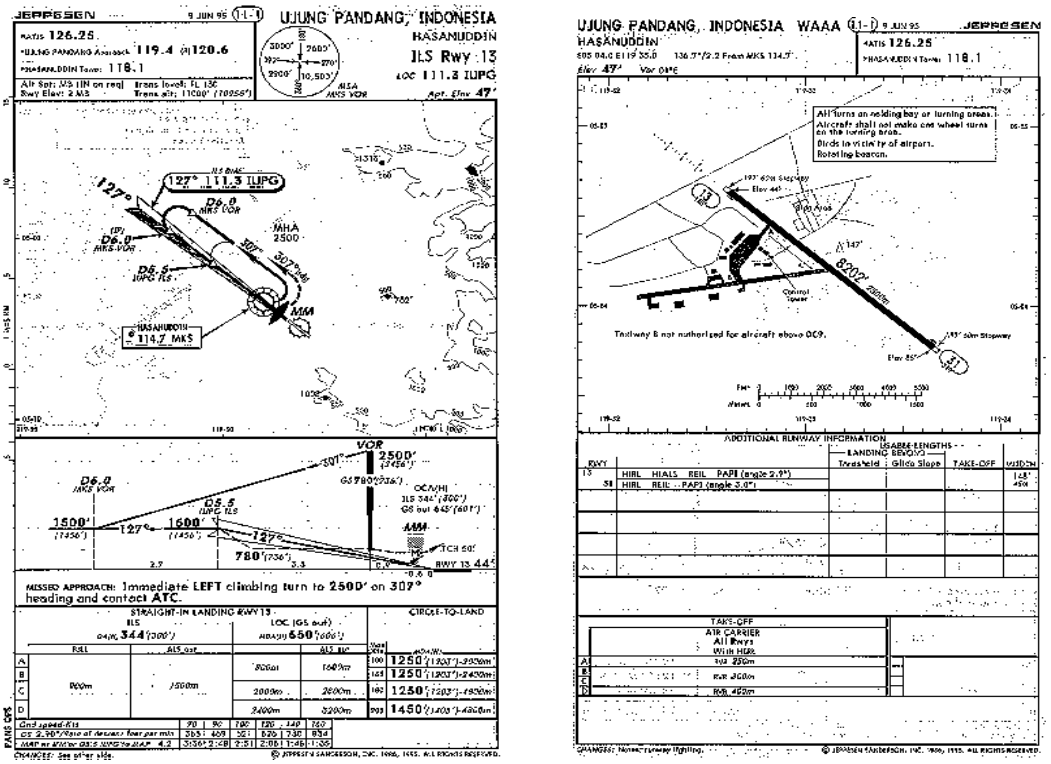


Figure 1. Airport lay out and ILS approach chart R/W 13 (Current Jeppesen approach chart information)

The airport is managed by PT Angkasa Pura II, a state owned airport management enterprise. Past records showed that the airport is known to be a difficult airport to land on, especially during instrument approaches in rainy conditions. The investigation revealed that similar accidents and incidents occurred under similar weather conditions in the past few years. Three landing incidents (overruns, involving three different operators and three different types of aircraft) happened in the last few weeks prior to the occurrence, again all in similar rainy weather.
On several occasions it was reported that during instrument approach in rainy conditions, aircraft were controlled by Ujungpandang Approach, while the local procedures required that Air Traffic Control shall transfer control to the Hasanuddin Tower at least at the point when the aircraft reached decision altitude, which is 344 ft ASL at Ujungpandang.

1.11 Flight Recorders

The Flight Data Recorder/FDR (Sundstrand Data Control Inc., model UFDR, P/N 980-4100-FWUS, S/N 2488) and Cockpit Voice Recorder/CVR were secured and placed under custody of the AAIC for read-outs. The read-outs were done at the facilities of the Bureau of Air Safety Investigation (Australia) on 20 April 1999, revealing that the CVR did not record the thirty minutes crew conversation before the occurrence.

FDR readout and analysis are attached as Appendix A in this report, with the following recorded parameters: pressure altitude, indicated airspeed, magnetic heading, vertical acceleration, and microphone keying.

1.12 Wreckage and Impact Information

Main landing gear was found imbedded in the soft runway shoulder and the left engine was found touching the ground. Rubber deposits were observed at the approximate point of the onset of the change of landing roll track heading. It was observed that the final aircraft position was about the same as a recent aircraft overshoot accident. The aircraft was in repairable condition.

One worn spot in line on all main tires were found and the #1 tire had the worst and followed linearly by #2 tire and #3 tire. The #4 tire was identified having a smaller worn spot mark than the others.

1.13 Medical and Pathological Information

Not relevant.

1.14 Fire

There was no fire prior to, during, or after the accident.

1.15 Survival Aspects

The passengers were evacuated from the aft exit by the available escape slides, which was at the lowest position from the ground of the aircraft in its final position.

1.16 Test and Research

Interviews with cockpit crew and UPG ATC operations division head were conducted. FDR and CVR readouts were done at the BASI laboratories in Canberra. The investigation team also performed an evaluation of Hasanuddin Airport and its surrounding environment.

1.17 Organizational and Management Information

Aircraft Owner	:	PT. PAN Multifinace
Address	:	JL. Cikini Raya No. 11 Jakarta
Aircraft Operator	:	PT. Mandala Airlines
Address	:	Jakarta

1.18 Other Information

None.

2 ANALYSIS

The final position of the aircraft was at 186 meters from the R/W 13/31 threshold. No tire markings of first touch down were found on the runway, although it was reported that the approximate touch-down point was in line with the taxiway B exit, approximately 1000 meters beyond the R/W 13 touch down zone.

No tire brake markings were found along the approximate ground roll trajectory. Rubber deposits were found on R/W 13 at the point where the aircraft started veering to the right, which was at approximately 75 meters before the location where aircraft went off the runway. The significant facts and findings gathered were analyzed. The SHEL concept approach was used in the analysis. The analysis of the events and circumstances which may have contributed to the occurrence were weather conditions, wind measuring equipment, aircraft systems, flight and ground operations procedural deficiencies.

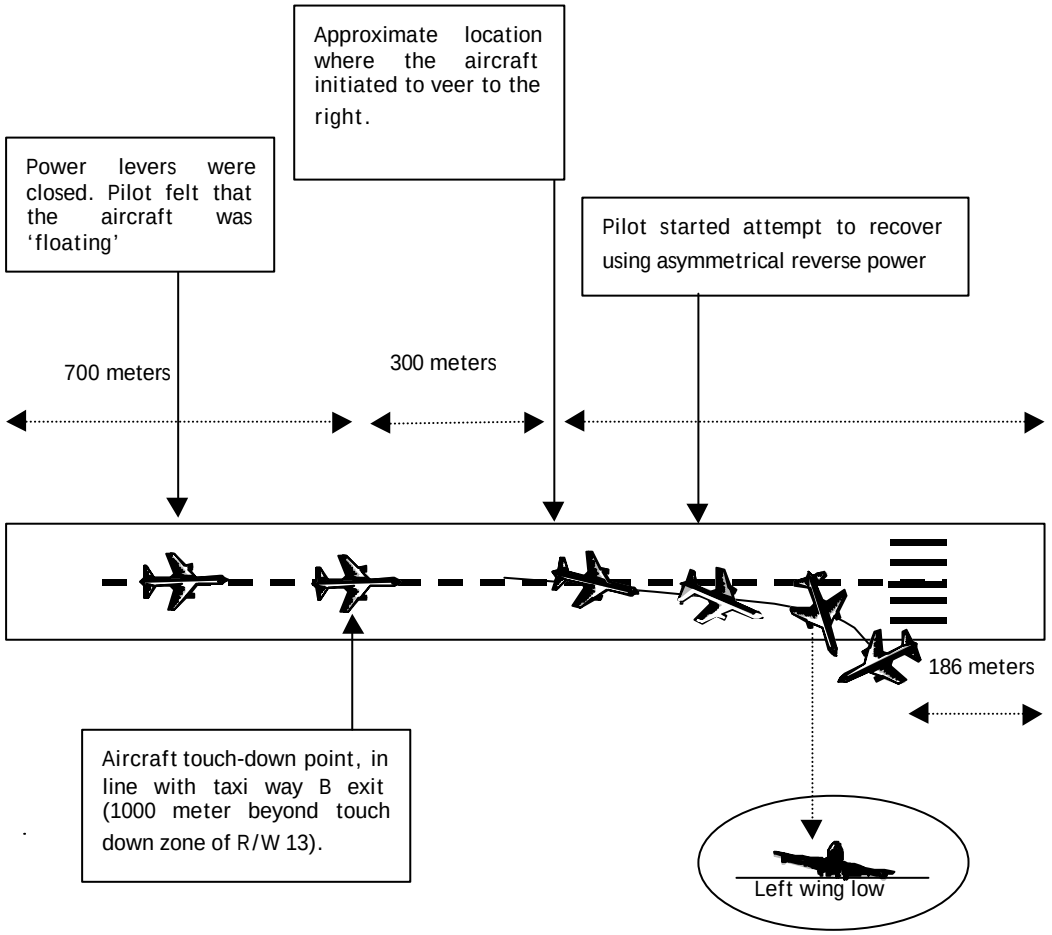


Figure 2. Aircraft ground roll trajectory (sketch)

2.1 Aircraft systems

1) **Flight controls**. Reported good by both pilots and no complaints or repairs were reported prior to the occurrence.

2) **Hydraulics**. Reported good by both pilots and no complaints or repairs were reported prior to the occurrence.

3) **Brakes**. Maintenance records showed that the auto brake has been inoperative but not replaced prior to the flight.

4) **Speed brakes**. The speed brakes were reported to be in good condition.

5) **Power plants/engines**. The engines were reported to be in good conditions by both pilots, and no repairs were done in weeks prior to the occurrence.

6) **Landing gear**. All landing gear tires showed worn out spots. The worst damage was found on the landing gear #1 tire, linearly diminishing in size, the worst or the largest worn out areas were found on landing gear tire #1 gradually diminishing in size on tires #2, #3 and #4. The worn out spot sizes were approximately 20x30 sq cm and less. The #1 landing gear damage is most likely due to high loading during the high speed right turn of the aircraft, which was also evidenced by the separation of the #1 engine.

Figure 3. The tire damage on the main wheel surfaces (worn spots on each main wheel) – front view

2.2 Pilot training/proficiency check program

Interviews with the cockpit crew and the management of the operator revealed that the pilots may not have the appropriate knowledge, training or experience to handle adverse weather situations (i.e. adverse weather landing roll technique), post-accident emergency situations, or to implement CRM.

2.3 Human Performance

Physical health

Both pilots were found in physically fit conditions, during the interviews in Ujungpandang, several hours after the accident and during follow-up interviews on 15th April 1999 in Jakarta. Both pilots were reported looking fit prior to accident.

Psychological aspects

During the interviews the PIC seemed to be a bit uneasy or nervous. It was also felt that the Co-pilot was a bit more nervous than the PIC. These nervousnesses may be attributed to possible post-accident trauma factors, as well as some apprehensions facing the interviewers.

Environment situation awareness

Both pilots did not recognize that the weather over the airfield had changed from cloudy (cumulonimbus formation) at 06:30 LT to heavy rain within minutes, at 06:37 LT. These cloud formations could and should be recognized from radar displays.

According to ATC records, the wind directions changed very quickly in the very short period of the landing, indicating that clouds and rains must have been positioned over or in the vicinity of the airfield.

Situational awareness

Both pilots showed a lack of situational awareness during the high work load period of the landing procedure. The cockpit crew apparently did not rely on flight instruments readings, but seem to trust visual observations of the environmental and weather conditions. The weather information from the ATC (ATIS) was also not acknowledged, which may be an indication of the possibility of an unawareness of the weather conditions.

Decision making process

The PIC, who was also the pilot flying, was quick in his decision making, which apparently made and implemented without consulting the Co-pilot. The Co-pilot seemed not to be assertive enough to challenge or to comment on the PIC's decision making and or handling of the aircraft.

There was ample time to have discussed plans and procedures between the ATC instruction to fly VFR for R/W 31 and the decision to make an ILS approach for R/W 13.

The PIC used 30° flap setting during landing, which is not in compliance to the company's AOM (Chapter on landing on wet runways). The AOM procedures recommended full flap settings for landing on wet runways, although the AOM also mentioned that less flaps setting results in better pilot visibility during the final moments of the landing procedure.

2.4 Air Traffic Service

The Ujungpandang Air Traffic Service is shared between the Hasanuddin Tower, Ujungpandang Approach, Ujungpandang Control and Ujungpandang Information of air zones, as mentioned in the aerodrome and route chart information. Each unit has its own specific responsibility, communication frequency and control area.

There is no instrument approach procedure for R/W 31, and the only published procedures are the ILS and VOR approaches for R/W 13. Considering the weather

phenomena at the time of the occurrence, i.e. rainy conditions and a westerly wind gusting with speeds of up to 20 kts, where the aircraft might have encountered changing tail wind velocities or speeds, it seems very prudent and mandatory for the air traffic controller to provide the aircrew with current and quick local weather information in real-time mode.

The local airport procedures mentioned that the Ujungpandang Approach will control and communicate with incoming aircraft, until the runway is in sight, at which point the Tower Control will take over until aircraft touchdown. However, it was found that the Approach Control controlled the landing sequence until aircraft touchdown.

Approach Control is located in a confined space, where the controller on duty sits in front of a radar display. From his position the controller could not see the runway or the runway conditions during the final approach and landing of the aircraft. This is a critical weakness of the landing control if the controller, as he cannot see the conditions of, or on the runway, while the cockpit crew may need an immediate update on the weather conditions, especially below 500 ft height. An additional weakness is that Approach Control has to ask the Control Tower for these critical information if needed.

The need for the latest accurate and real-time weather conditions information updates is critical during the landing phase, especially at heights of less than 200 ft. It is a very critical part of the landing procedure and maneuver. This, however could not be provided by the Ujungpandang ATC.

2.5 Meteorological conditions

The Hasanuddin Airport altitude is 47 ft MSL, located at 119:33E - 05:04 N, surrounded by mountainous area of between 3,000 and 4,000 feet to the east of the airport, and the South Sulawesi seas to the west. In general, wind condition at midmorning (09:00 LT) is a north-westerly sea breeze with wind velocities of approximately 8 knots. Thunderstorms are formed producing down and up drafts within a distance of approximately 2.5 to 5 nm, resulting in head and tailwinds within that distance.

The weather conditions (wind velocities and directions) at the Hasanuddin Airport at the time of occurrence were analyzed for possible discrepancies between values provided by various sources, such as the meteorological office, the tower, and from the onboard instruments of aircraft into Hasanuddin Airport. The result of the analysis showed that the minimum value of the velocity differences was 10 to 13 knots, and the maximum value of the direction changes or differences was found to be 50 degrees. These values indicate the uncertainty of accuracy of the weather information the pilot may acquire from the several sources he has at hand, which may be contributing to ineffective or wrong flight handling of the aircraft, leading towards the inevitability of the occurrence.

Note that these weather data may well point to wind changes that has the characteristics of wind bursts in the Hasanuddin Airport surrounding areas, resulting the aircraft touching down at approximately 3,000 ft beyond the target touchdown point.

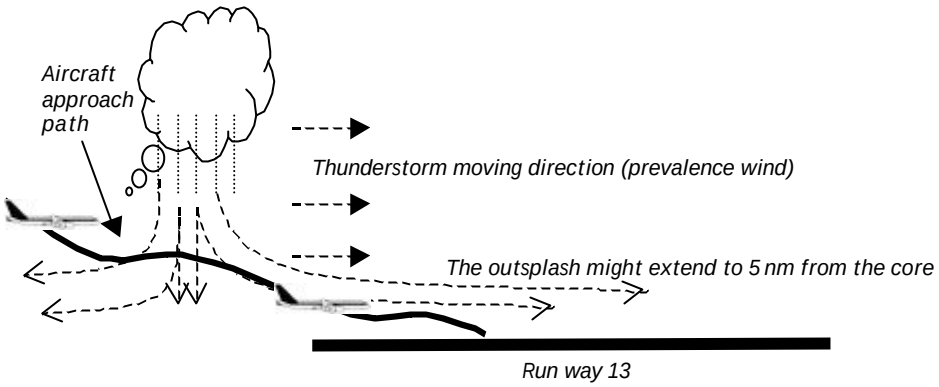


Figure 4. The aircraft approach path illustration

3 CONCLUSIONS

Findings:

- There was no evidence or indication of aircraft systems anomalies or malfunctions contributing to the occurrence. The PIC decided to use 30 degrees flap setting during the landing, which was applied during adverse weather. The wind velocity and direction was unstable, changing rapidly from a northerly 360/04 to 270/17 kts/hour in 8 minutes.
- The aircraft was floating and the touch down was approximately 1000 meters beyond the target touch-down point. The cockpit crew apparently did not rely on the flight instrument readings, but seemed to trust visual observations of the environmental and weather conditions.
- The damage to the tire surfaces indicates that the #1 tire experienced the highest loads during the landing maneuver, evidenced also by the separation of the #1 engine during the landing. The existing airport infrastructure was not sufficient to make instrument approaches on R/W 31. The only approach procedures published are ILS and VOR approaches for R/W 13 only. Note that at the time of the occurrence it was raining and the wind velocities and direction were northerly with gusts of up to 20 kts, while the aircraft operation manual procedures stated a tailwind limit of 20 kts during landings. It is noted that the weather monitoring system equipment is located near the tower at about 50 meters distance from the runway. During the landing maneuver, the approach control communicated with, and controlled the aircraft until touch-down.
- The interviews with the flight crew seem to indicate that the cockpit crew were not aware of, or not well versed in, or did not apply good 1) adverse weather landing roll techniques, 2) CRM culture practices, and 3) post accident evacuation procedures as needed. The airline did not conduct flight crew recurrent emergency evacuation training, and the PIC did not have any training since the Lufthansa conducted training in 1994.
- The airline did not have a Crisis Manual to be used as a guidance in an emergency or crisis condition during the operation.

4 RECOMMENDATIONS

Operators will take note that a series of approach and landing incidents, specifically overruns on wet runways during shifting wind speeds and directions which has occurred recently and in the past at the Hasanuddin airport has shown similar characteristics. These incidents indicate a serious deficiency either in the airport facilities, approach and landing procedures, or the pilots airmanship during approach and landings under adverse weather condition.

Referring to the analysis and findings, NTSC outlined three institutions that linked and contributed significantly to the occurrence. The recommendations, therefore, are addressed to these institutions.

4.1 To All Airline Operators

1. REC/99.06.04.02/I/01 (ref. Preliminary recommendation no. R.01/AAIC/99) - Taking into consideration a series of repetitive incidents occurring during the approach and landing phases into the Hasanuddin International and Domestic Airport, in adverse weather conditions, the NTSC recommends an immediate review of the existing Air Operators Manuals procedures to recover from the effects of adverse weather conditions.
2. REC/99.06.04.02/I/02 (ref. Preliminary recommendation no. R.02/AAIC/99) - Operators are strongly recommended to strengthen the enforcement of their crews to comply and adhere to the Operator's Aircraft Operation Manuals on Approach and Landing Procedures in adverse weather conditions, specifically on wet runways, and tailwind conditions.
3. REC/99.06.04.02/I/03 (ref. Preliminary recommendation no. R.03/AAIC/99) - Operators are recommended to review their crew training programs for correction techniques to recover from unusual situations during approach and landing procedures, such as aircraft cornering techniques due the effect of cross wind and or asymmetry power in adverse weather conditions, specifically during wet runways, tail wind and or cross wind conditions.
4. REC/99.06.04.02/I/04 (ref. Preliminary recommendation no. R.04/AAIC/99) - All pilots have to request wind velocity and speed data or information updates when they have to land on Hasanuddin R/W 13, at least at 500 ft on the final landing track.

4.2 To Mandala Airlines

1. REC/99.06.04.02/I/05 (ref. Preliminary recommendation no. R.05/mdl/99) - It is strongly recommended to provide the flight crews with additional training for approach and landings on wet runways combined with unstable wind conditions.
2. REC/99.06.04.02/I/06 (ref. Preliminary recommendation no. R.06/mdl/99) - PT. Mandala Airlines should provide wind shear class room training followed by a flight simulator training as required by, and in compliance with the CASR Part 12.404.

3. REC/99.06.04.02/I/07 (ref. Preliminary recommendation no. R.07/mdl/99) - In particular it is strongly recommended that PT. Mandala provides Crew Resource Management (CRM) training.
4. REC/99.06.04.02/I/08 (ref. Preliminary recommendation no. R08/mdl/99) - It is recommended that PT. Mandala revises their maximum tail wind component issued in the aircraft manual from 15 kts to 10 kts, and advice their pilots as soon as practicable.
5. REC/99.06.04.02/I/09 (ref. Preliminary recommendation no. R.09/mdl/99) - PT. Mandala Airlines has to provide a Company Emergency Response Plan or Procedure, and establish an independent flight safety department or unit within their organization responsible for, and reporting to the president director on the company's flight safety oversight.

4.3 Hasanuddin Airport Management (UPAM), Directorate of Aviation Safety

1. REC/99.06.04.02/I/10 (ref. Preliminary recommendation no. R.10/AAIC/99) - It is strongly recommended that Ujungpandang ATS enforce the compliance to, and the implementation of the ATS published procedures for the Hasanuddin Airport.
2. REC/99.06.04.02/I/11 (ref. Preliminary recommendation no. R.11/AAIC/99) - It is recommended that Hasanuddin Tower control area responsibility is increased to 1500 ft or higher, to avoid an interruption of communications from Ujungpandang Approach during the final landing phase of the flight.
3. REC/99.06.04.02/I/12 (ref. Preliminary recommendation no. R.12/AAIC/99) - The Hasanuddin tower should have the capability to provide current and accurate wind velocity and speed updates, and the latter shall be based on calibrated sources and approved indicators.
4. REC/99.06.04.02/I/13 (ref. Preliminary recommendation no. R.13/AAIC/99) - The Hasanuddin Airport ATS should be able to anticipate, and submit current weather condition updates to all arriving aircraft, and if requested, but at least once every thirty minutes, in case of quick and significant weather changes.
5. REC/99.06.04.02/I/14 (ref. Preliminary recommendation no. R.14/AAIC/99) - The rubber deposit at both ends of the runway must be removed before the rainy season.
6. REC/99.06.04.02/I/15 (ref. Preliminary recommendation no. R.15/AAIC/99) - An alternative and safe landing system and procedure for RWY 31 landings in adverse weather conditions must be made available as soon as possible. The landing system and procedures for RWY 31 landings must be in operation as soon as possible but not later than the start of the rainy season in Ujungpandang.

APPENDICES

APPENDIX A – FDR READOUT AND ANALYSIS (BASI REPORT)

BASI
Bureau of Air Safety Investigation

Readout and Analysis of Recorded Flight Data
From PK-RIL Boeing 737-230

5 April 1999 Ujung Pandang

COMMONWEALTH DEPARTMENT OF
TRANSPORT AND REGIONAL SERVICES

BUREAU OF AIR SAFETY INVESTIGATION - AUSTRALIA
FLIGHT RECORDER SERVICES SECTION
SPECIALIST REPORT

Job No: **FDR199900024** Registration No: **PK-RIL**

Job Category:	**Investigation**
Job Description:	**Runway Excursion**
Job Comment:	
Date Recorded:	**05 April 1999**
Order Number:	
Action Officer:	**Neil Campbell**

Aircraft Details

Aircraft Manufacturer:	**Boeing Co**
Aircraft Model:	**737-230**
Aircraft Type:	**Aeroplane**
Maintenance Org:	**Mandala Airlines**

DFDR Details

Manufacturer:	**Sundstrand Data Control Inc**
Model:	**UFDR**
Part Number:	**980-4100-FWUS**
Serial No:	**2488**
Mod. Status:	
FDAU Serial No:	
Copy Rec. Details:	**BASI**

Readout Results

Faulty Recorder System:	**No**
Reason for Loss of Data:	
Synchronisation:	

Parameters

Mandatory:	**Appear to be serviceable.**
Non-Mandatory:	**Appear to be serviceable.**

Report Comments:

1. INTRODUCTION

On 05 April 1999, B737-230 PK-RIL was landing at Ujung Pandang, Sulawesi, Indonesia. During the landing roll on runway 13, in rain, the aircraft was reported to have overrun the runway.

2. INVESTIGATION PROCEDURE

This aircraft was equipped with an Allied Signal (Sundstrand) Digital Flight Data Recorder (DFDR) P/N 980-4100-FWUS, S/N 2488.

The DFDR was sent to the Bureau and was received on 20 April 1999. The DFDR was copied in the Bureau's Flight Data Recorder Laboratory in Canberra and data from the copy tape was analysed.

The most recently recorded flight was examined and it was observed that the aircraft had cruised in a South-Easterly direction for approximately 30 minutes before landing on a runway with an orientation of 129 degrees magnetic. This landing was identified as the incident landing.

3. DFDR SYSTEM

The DFDR installation on this aircraft records 5 parameters versus time. The recorded parameters are:

Engineering Parameter:	Mnemonic:	Sampling Rate (samples per second):
1. Pressure Altitude	ALT	1
2. Indicated Airspeed	IAS	1
3. Magnetic Heading	MAG	1
4. Vertical Acceleration	VERG1,VERG2 & VERG3	12

Discrete Parameter:	Mnemonic:	Sampling Rate (samples per second):
5. Microphone Keying	RADIO	1

This model of DFDR records elapsed time starting from the time the DFDR was powered-up prior to taxiing. This elapsed time counter increments every second and is converted to elapsed hours and minutes by the readout software and is shown in the third column of the data listing as RTIME. The modulo 60 seconds count of this elapsed time counter is shown in the listing as SECS.

In addition to these parameters this model DFDR also records three internally derived parameters ie. CHECK, TYPE and TEMP.

CHECK is the result of a DFDR BITE check and a recorded value of '48' indicates that no DFDR faults were detected.

TYPE indicates the pressure transducer package P/N installed in the DFDR. The pressure transducer package uses pitot/static pressures to generate pressure altitude and indicated airspeed data. For this recorder pressure transducer type '0' was fitted ie. P/N 300-0424-002-D. Data reduction and plotting software customised for this transducer type were used for this readout.

TEMP is the internal recorded temperature of the DFDR pressure transducer package and is used for temperature corrections to the recorded pressure altitude data. NB. TEMP is not an aircraft parameter and is not the same as Outside Air Temperature (OAT) or Total Air Temperature (TAT).

4. RESULTS

A data listing containing all parameters for the 6 minute period from 2,500 ft on approach to the recorder being powered-down after landing was produced.

Three plots were also produced:

Plot 1: Covers a 30 minute period from top of descent to the end of recording.

Plot 2: Covers a 2 minute period from final approach to the end of recording.

Plot 3: Covers a 40 second period from shortly before touchdown to the end of recording.

DFDR data is recorded in 4 second frames which comprise 4 subframes each of 1 second duration.

4.1 Altitude

Recorded Pressure Altitude data is referenced to 1013.2 hPa. The average rate of descent between frames 511 (894 ft) and 526 (120 ft) was 770 fpm and no significant fluctuations in the rate of descent were observed.

4.2 Indicated Airspeed (IAS)

Examination of the recorded Indicated Airspeed data (refer to Plot 2) shows a steady decrease in IAS until approximately 20 seconds before touchdown when the IAS stabilised at approximately 145 knots. The IAS at touchdown was 140 knots. During the landing roll the IAS decreased steadily at approximately 5 knots per second.

4.3 Magnetic Heading

The aircraft began turning onto runway heading while it was levelled-out at 1,500 ft. The turn was completed as the aircraft was leaving 1,500 ft on descent.

The aircraft touched down with a recorded magnetic heading of 128 degrees (runway heading is 129 degrees). During the landing roll (refer to Plot 3) the aircraft heading has initially turned to the right by 4 degrees before turning to the left by 8 degrees. From 11 seconds after touchdown, the aircraft heading has continuously increased (right turn) until the end of recording. The final recorded value was 238 degrees.

4.4 Vertical Acceleration

Changes in recorded Vertical Acceleration data during the approach were consistent with normal aircraft manoeuvring.

Touchdown is indicated by a spike in the recorded Vertical Acceleration data and occurred during subframe 3 of frame 527. The maximum value recorded at touchdown was 2.76 g which is larger than for a typical touchdown. Although the recorded IAS was 0 knots at the end of recording, scatter in the Vertical Acceleration data indicates that the aircraft was still moving (slowly) when the DFDR stopped recording.

4.5 Microphone Keying

Recorded Microphone Keying data shows that two radio transmissions were made in the one minute period before touchdown.

5. ACCURACIES

The accuracy for altitude values, assuming the transducer within the recorder is functioning correctly, is +- 100 ft (low altitude) to +- 700 ft (high altitude).

The accuracy for airspeed values, assuming that the transducer within the recorder is functioning correctly, is +- 10 knots when the airspeed is greater than 50 knots and +- 20 knots when the airspeed is less than 50 knots.

The accuracy for magnetic heading values is +- 2 degrees.

6. CONCLUSIONS

DFDR data from Mandala B737-230 PK-RIL recorded during the approach to Ujung Pandang on 5 April 1999 has been examined.

Examination of the recorded data revealed that 5 parameters (Pressure Altitude, Indicated Airspeed, Magnetic Heading, Vertical Acceleration and Microphone Keying) were recorded.

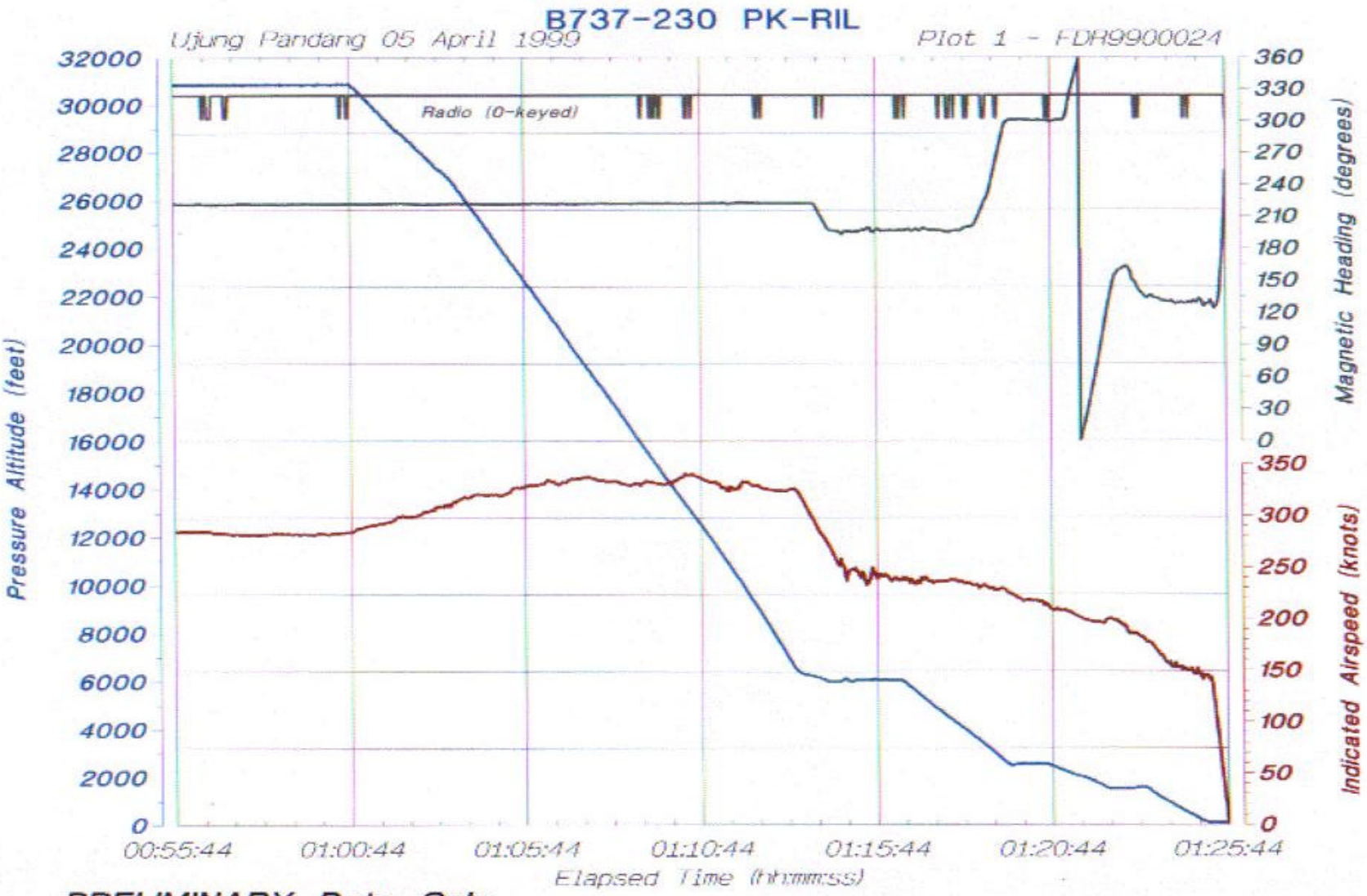
The aircraft had a steady rate of descent of 770 fpm during the one minute period before touchdown. The IAS stabilised at 147 knots approximately 20 seconds before touchdown.

The maximum Vertical Acceleration value recorded on touchdown (2.76 g) was higher than for a typical landing.

From 11 seconds after touchdown, the aircraft heading has continuously increased (right turn) until the end of recording.

Neil Campbell

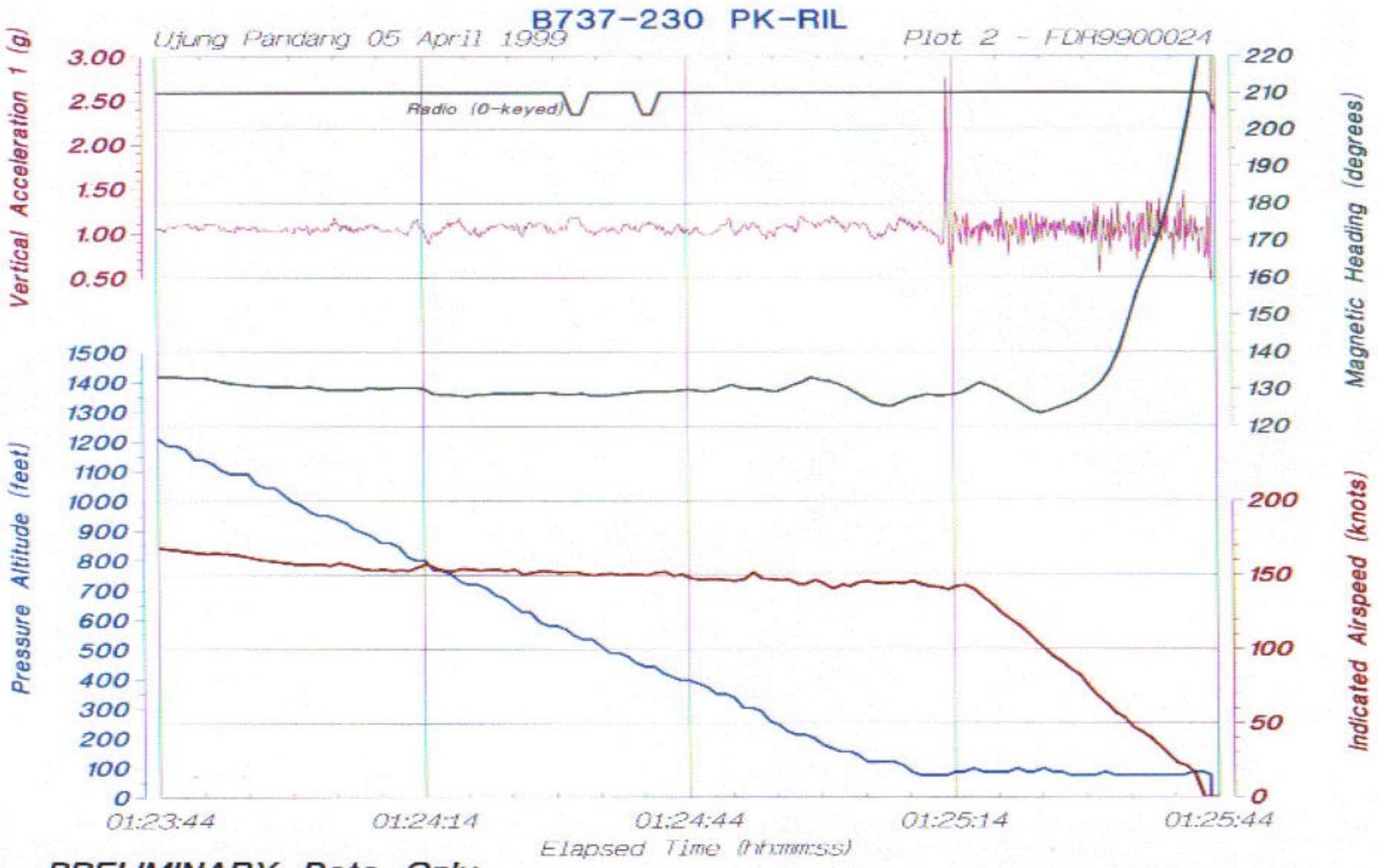
24 June 1999



PRELIMINARY Data Only

Revised: June 21, 1999

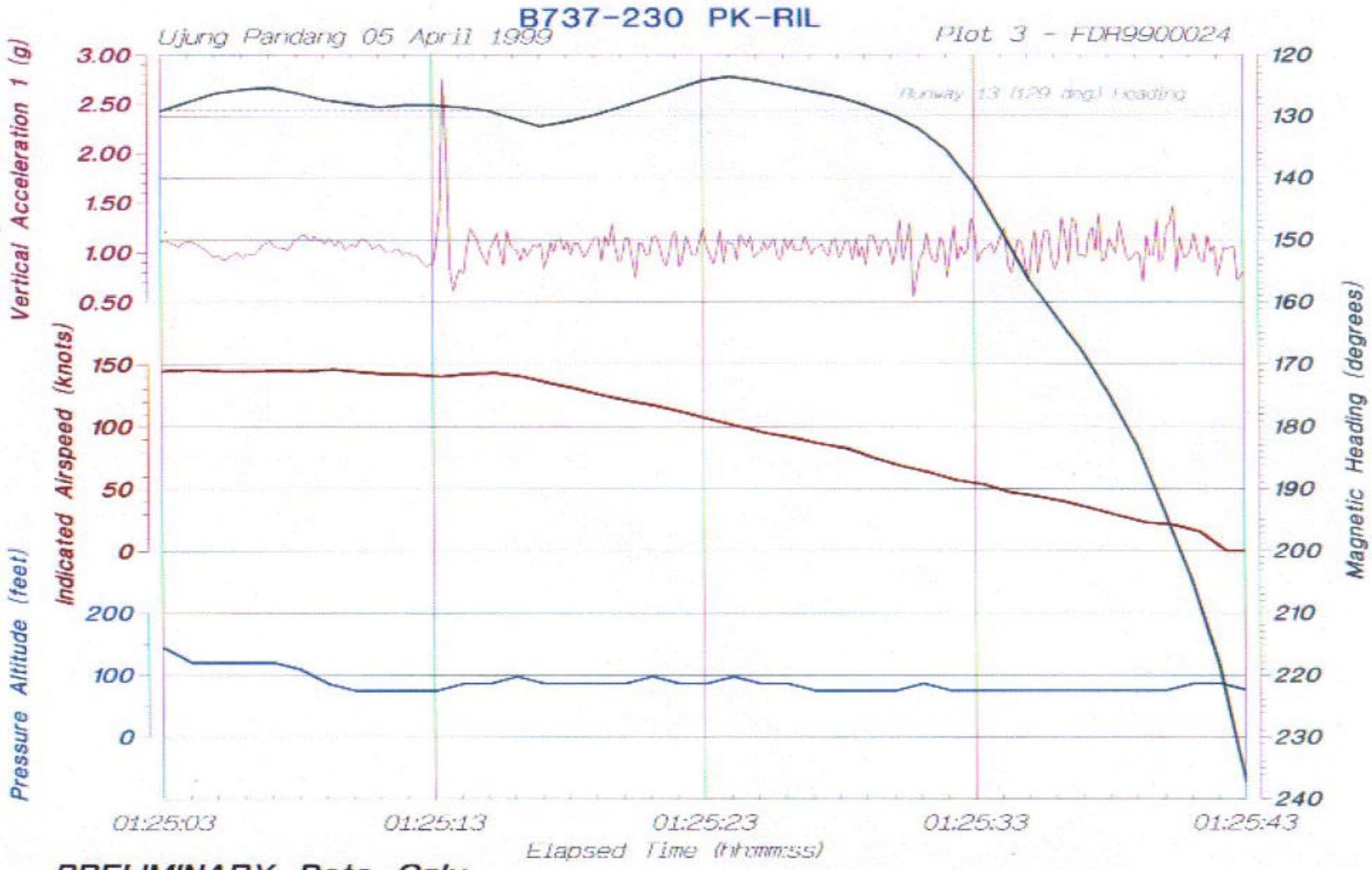
Bureau of Air Safety Investigation - BASI



PRELIMINARY Data Only

Created: June 21, 1999

Bureau of Air Safety Investigation - BASI



PRELIMINARY Data Only

Revised: June 21, 1999

Bureau of Air Safety Investigation - BASI

APPENDIX B – ATC TRANSCRIPT

06.20	MDL493	:	Ujungpandang Approach MDL493
	APP	:	Descend to 8000 report reaching, expect runway 31
	MDL493	:	Descend to 8000 report reaching runway 31, MDL493
06.21	MDL493	:	Approach MDL493 passing FL-130 visual
	APP	:	MDL493 report reaching 8000
	MDL493	:	Call reaching 8000, MDL493
06.22	MDL493	:	Approach MDL493 reaching 8000 feet visual
	APP	:	MDL493 descend 4000 report reaching
	MDL493	:	4000 feet, call reaching MDL493
06.24	MDL493	:	MDL493 request heading to MKS
	APP	:	MDL493 heading to MKS …
	MDL493	:	MDL493
06.25	APP	:	MDL493 continue descend to 2500 feet, proceed to right hand down wind runway 31
	MDL493	:	Descend to 2500 feet, proceed right down wind runway 31, MDL493
06.26	MDL493	:	MDL493 request to VOR
	APP	:	A roger MDL493 proceed to VOR approved, descend to 2500
	MDL493	:	MDL493
	APP	:	MDL493, 493 wind info indicate 270 and 15 knots are you able runway 13 for landing
	MDL493	:	Go ahead err.. standby sir
06.27	MDL493	:	Err.. approach MDL493 request proceed to joining left down wind
	APP	:	Left down wind approved, continue descend report airport in sight
	MDL493	:	MDL493 wilco
			Err.. confirm aerodrome is rain sir
	APP	:	Slight rain

06.30	MDL493	:	Approach MDL493 cancelled visual, err.. we are like turn request runway 13
	APP	:	MDL493 heading out, check heading three ..30 ..300 for maintain 2500
	MDL493	:	Roger maintain 2500, MDL493
06.31	APP	:	MDL493 for you info wind is 270 up to 17 knots
	MDL493	:	Confirm call mandala
	APP	:	Affirm, MDL493 continue 1500 feet report localizer
	MDL493	:	1500 feet, report localizer, MDL493
06.33	MDL493	:	MDL493 reaching 1500 feet established localizer
	APP	:	MDL493 position 6 nm from touch down, confirm runway in sight
	MDL493	:	Err.. negative yet
06.37	MDL493	:	MDL493 runway in sight
	APP	:	MDL493 cleared to land, after landed contact tower 118.1
	MDL493	:	Cleared to land, contact tower 118.1, MDL493
06.38	APP	:	MDL493 landed
06.39	APP	:	Monitor 118.1 (APP heard MDL493 contacted Tower and requested assistance)