KOMITE NASIONAL KESELAMATAN TRANSPORTASI
REPUBLIC OF INDONESIA

FINAL

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Aircraft Accident Investigation Report

PT. Kalstar Aviation

Embraer 190-200LR; PK-KDC

El Tari International Airport, Kupang

Republic of Indonesia

21 December 2015

2016

This Final report was produced by the Komite Nasional Keselamatan Transportasi (KNKT), Transportation Building, 3rd Floor, Jalan Medan Merdeka Timur No. 5 Jakarta 10110, Indonesia.

The report is based upon the investigation carried out by the KNKT in accordance with Annex 13 to the Convention on International Civil Aviation Organization, the Indonesian Aviation Act (UU No. 1/2009) and Government Regulation (PP No. 62/2013).

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ABBREVIATIONS AND DEFINITIONS

AC	:	Advisory Circular
AFE	:	Above Field Elevation
AGL	:	Above Ground Elevation
ARFF	:	Airport Rescue and Fire Fighting
ATIS	:	AutomaticAutomatic Terminal Information Service
ATPL	:	Air Transport Pilot License is the highest level of aircraft pilot licence
AWOS	:	Automatic Weather Observation System
BMKG	:	Badan Meterologi Klimatologi dan Geofisika (Metrological Climatology and Geophysical Agency)
°C	:	Degrees Celsius
CASR	:	Civil Aviation Safety regulation
CB	:	Cumulonimbus cloud
CG	:	Centre of Gravity
COM	:	Company Operation Manual
CRM	:	Crew Resource Management
DGCA	:	Directorate General of Civil Aviation
DME	:	Distance Measuring Equipment (DME) is defined as a navigation beacon, usually coupled with a VOR beacon, to enable aircraft to measure their position relative to that beacon
DVDR	:	Digital Voice Data Recorder
EGPWS	:	Enhanced Ground Proximity Warning System
FA	:	Flight Attendant
FL	:	Flight Level
FMS	:	Flight Management System
FSS	:	Flight Service Station
ft	:	feet
GNSS	:	Global Navigation Satellite System
IMC	:	Instrument Meteorological Condition
in Hg	:	Inch Hydrargyrum
KIAS	:	Knots Indicated Airspeed
km	:	Kilometer (s)
KNKT	:	Komite Nasional Keselamatan Transportasi / National Transportation Safety Committee

m	:	Meter (s)
MAC	:	Mean Aerodynamic Chord
mb	:	Millibars
N	:	North
Nm	:	Nautical mile (s)
PA	:	Passenger Announcement
PAPI	:	Precision Approach Path Indicator
PF	:	Pilot Flying
PIC	:	Pilot in Command
PM	:	Pilot Monitoring
QFE	:	QFE is the isobaric surface pressure at the airfield reference point
QNH	:	QNH is obtained by correcting a measured QFE to sea level using International Standard Atmosphere regardless of the temperature structure of the atmosphere.
RNAV	:	A method of navigation which permits the operation of an aircraft on any desired flight path; it allows its position to be continuously determined wherever it is rather than only along tracks between individual ground navigation aids
SIC	:	Second in Command
SMS	:	Safety Management System
SOP	:	*Standard Operating Procedures*
TAFOR	:	Terminal Area Forecast
TCAS	:	Traffic Collision Avoidance System
TWR	:	Aerodrome Control Tower
UTC	:	Universal Time Coordinate
VOR	:	VHF Omnidirectional Radio Range (VOR) is defined as Very High Frequency Omnidirectional Radio Range, an aircraft navigation system operating in the VHF band
ZFW	:	Zero Fuel Weight

INTRODUCTION

SYNOPSIS

On 21 December 2015, an ERJ 190-200 (Embraer 195) aircraft, registered PK-KDC was being operated by Kalstar Aviation on a scheduled passenger flight from H. Hasan Aroeboesman Airport (WATE) Ende to El Tari Airport (WATT) Kupang with flight number KD676. The aircraft departed at 0916 UTC, on board of this flight were two pilots, three flight attendants, and 125 passengers. The Pilot in Command (PIC) acted as pilot monitoring (PM) and the Second in Command (SIC) acted as pilot flying (PF).

The voice data did not record any checklist reading and approach briefing performed by the crew. Prior to the approach, both pilots discussed that they were going to make RNAV approach runway 07 and landing configuration with flap 5 and auto-brake low.

While flew over the initial approach point SEMAU, the aircraft was 2,000 feet above the required altitude as described on the instrument approach procedure. The approach path was shortened by deviated from published path and used higher speed.

The aircraft was on higher than the approach profile and the pilots performed non-standard configuration setting by extended landing gear down first with intention to increase drag. The voice data recorded that after the landing gear extension the flap selected to position 1 and continued to 2.

The aural warning "HIGH SPEED" alternately with EGPWS warning "CAUTION TERRAIN" and "SINK RATE" active for one minute until touchdown. The aircraft speed was about 200 knots or about 62 knots above the target speed when crossing the threshold and touched down on the middle of the runway. During the landing roll, the brake pressure was relatively low and the thrust reversers were activated.

The aircraft overrun and stopped at approximately 200 meters from the end of runway 07.

No one injured on this accident.

The investigation concluded that the contributing factors to the accident were:

- The steep authority gradient resulted in lack of synergy that contributed to least of alternation to correct the improper condition.
- Improper flight management on approach resulted to the aircraft not fully configured for landing, prolong and high speed on touchdown combined with low brake pressure application resulted in insufficient runway for deceleration

Following the accident, PT. Kalstar Aviation and PT. Angkasa Pura I branch El Tari Airport, Kupang had performed several safety actions.

Komite Nasional Keselamatan Transportasi (KNKT) considered that the safety actions were relevant to improve the safety. In addition, KNKT issued safety recommendations to PT. Kalstar Aviation, AirNav Indonesia District Office Kupang, PT. Angkasa Pura I Branch El Tari Airport, and Directorate General of Civil Aviation to address the safety issues identified in this investigation.

1 FACTUAL INFORMATION

1.1 History of the Flight

On 21 December 2015, an ERJ 190-200 (Embraer 195) aircraft, registered PK-KDC, was being operated by Kalstar Aviation on a scheduled passenger flight. The crew was scheduled to fly three sectors from I Gusti Ngurah Rai International Airport (WADD) Bali [1] – H. Hasan Aroeboesman Airport (WATE) Ende [2] – El Tari International Airport (WATT) Kupang[3] – Sultan Hasanuddin International Airport (WAAA), Makassar.

The aircraft departed Bali at 0734 UTC which was delayed for 74 minutes from the normal schedule, due to late arrival of the aircraft from the previous flight. On the flight from Bali to Ende, the Pilot in Command (PIC) acted as pilot monitoring (PM) and the Second in command (SIC) acted as pilot flying (PF). The aircraft landed in Ende at 0839 UTC.

During transit, the PIC received a short message from a flight operations officer of Kalstar Aviation in Kupang which informed him that the visibility at Kupang was 1 km. Considering the weather forecast in the Terminal Aerodrome Forecast (TAFOR) showed that the visibility at Kupang would improve at the time of arrival, the PIC decided to depart to Kupang. Another consideration was the operating hours of Ende which would be closed at 0900 UTC.

The operating hours of Ende was extended and the aircraft departed Ende at 0916 UTC, with flight number KD676. On board this flight were two pilots, three flight attendants, and 125 passengers. The PIC acted as PM and the SIC acted as PF. There was no departure briefing performed by the PF.

After takeoff, the pilot set the Flight Management System (FMS) to fly direct to KPG VOR[4] and climbed to a cruising altitude of Flight Level (FL) 175 (17,500 feet). During climbing, the PIC instructed the SIC to reduce the aircraft speed by 20 knots with the intention to wait for the weather improvement at Kupang.

During cruising, the pilots monitored communication between El Tari Tower controller with another pilot. El Tari Tower controller advised that the visibility at Kupang was 1 km while the minima for approach was 3.9 km.

At 0927 UTC, the pilot established communication with El Tari Tower controller and requested for direct to initial approach point SEMAU[5].

1 I Gusti Ngurah Rai International Airport (WADD), Bali will be named as Bali for the purpose of this report.

2 H. Hasan Aroeboesman Airport (WATE) Ende will be named as Ende for the purpose of this report.

3 El Tari Airport (WATT), Kupang will be named as Kupang for the purpose of this report.

4 VHF Omnidirectional Radio Range (VOR) is defined as Very High Frequency Omnidirectional Radio Range, an aircraft navigation system operating in the VHF band.

5 SEMAU is initial approach point located at 15 NM from KPG VOR on radial approximately 254, the approach chart required the altitude at this point should be 5,100 feet.

At 0932 UTC, the aircraft was at 62 Nm, the aircraft started to descend which was approved to 10,000 feet. When the aircraft passed FL 150, the pilot requested to turn left to fly direct to the inbound track of the VOR/DME[6] approach for runway 07 in order to avoid cloud formation which was indicated by magenta color on the aircraft weather radar.

At 0941 UTC, the El Tari Tower controller informed that the visibility on runway 07 was 4 km and issued clearance for RNAV[7] approach to runway 07 and requested that the pilot report when the runway was in sight.

Both pilots discussed the plan to make an RNAV approach to runway 07, with landing configuration with flap 5 and auto-brake set to position low[8].

At 0943 UTC, the pilot reported that the runway was in sight when passing 2,500 feet and the El Tari Tower controller informed that the wind was calm and issued a landing clearance.

During the approach, the PF noticed that all Precision Approach Path Indicator (PAPI) lights indicated a white color, which indicated that the aircraft was too high for the approach. Recognizing that the aircraft was too high, the crew performed a non-standard configuration setting by extending the landing gear down first with the intention to increase drag. The landing gear was extended at approximately 7 Nm from the runway 07 threshold and afterwards selected the flaps to 1 and 2. The published approach procedure stated that the sequence for establishing landing configuration is by selecting flap 1, flap 2, landing gear down, flap 3 and flap 5.

On final approach, the crew noticed the aural warning "HIGH SPEED HIGH SPEED". The SIC also noticed that the aircraft speed was about 200 knots. The pilots decided to continue the approach considering the runway was 2,500 meters long and would be sufficient for the aircraft to stop with the existing conditions. The pilots compared the runway condition at Kupang with the condition at Ende which had 1,650 meter length runway.

On short final approach, the aircraft was on the correct glide path and the speed was approximately 205 knots. The PF noticed the Enhanced Ground Proximity Warning System (EGPWS) warning of "TOO LOW TERRAIN" activated. The aircraft then touched down at approximately the middle of the runway. After touchdown, the PF immediately applied thrust reverser.

Realizing that the aircraft was about to overrun the end of the runway, and with the intention to avoid the approach lights on the end of the runway, the PIC turned the aircraft to the right.

The aircraft stopped approximately 200 meters from the end of runway 07.

At 0946 UTC, the El Tari Tower controller saw the aircraft overrun, then pushed the crash bell and informed the Airport Rescue and Fire Fighting (ARFF).

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6 Distance Measuring Equipment (DME) is defined as a navigation beacon, usually coupled with a VOR beacon, to enable aircraft to measure their position relative to that beacon.

7 RNAV is a method of navigation which permits the operation of an aircraft on any desired flight path; it allows its position to be continuously determined wherever it is rather than only along tracks between individual ground navigation aids.

8 Flap 5 is a setting for 20 degrees flap extension. The autobrake has four settings: low, medium, and high for landing and RTO (rejected takeoff) for takeoff.

1.2 Injuries to Persons

No one injured on this accident.

1.3 Damage to Aircraft

The aircraft was substantially damaged with the details of the damage as follows:

- Both nose wheels were minor damage. Reverted rubber marks found on both nose wheels.
- The right wing had severe damage with the details:
  - The navigation light broken,
  - The inner flap damaged,
  - The inboard slat detached from its mounting,
  - The wing leading edge behind the detached slat damaged by impact and torn (Figure 2).

Figure 1: The damaged right wing

Figure 2: The impact damage on the right wing

- The right main landing gear collapsed and the trunnions detached from the attachments. The main wheel position number 3 and 4 contacted with the right inner flap.
- The main wheel position number 3 and 4 had severe damage and found marks of reverted rubber.
- There were minor damages on the main wheel 1 and 2. No reverted rubber marks found.
- The left engine inlet cowl had some damage. The leading edges of all left engine fan blades were damaged.
- The right engine struck the ground, the lower engine cowl was significantly damaged and the inlet cowl had a minor damage. Most of the fan blades leading edges were damaged. The thrust reverser door was stuck in the open position. The reverser cowls detached and were found about 30 meters behind the aircraft final position.
- The supporting beam of the right inner wing rib was broken.

1.4 Other Damage

There was a broken runway light at the end of runway 07.

Figure 3: Broken runway light

1.5 Personnel Information

1.5.1 Pilot in Command

Gender	:	Male
Age	:	46 years
Nationality	:	Indonesian
Marital status	:	Married
Date of joining company	:	February 2014

License	:	Airline Transport Pilot License (ATPL)
Date of issue	:	27 June 1996
Aircraft type rating	:	Boeing 737-300/400/500; Embraer 190/195
Instrument rating validity	:	30 June 2016
Medical certificate	:	First Class
Last of medical	:	31 July 2015
Validity	:	31 January 2016
Medical limitation	:	Holder shall possess glasses that correct for near vision
Last line check	:	15 January 2015
Last proficiency check	:	13 December 2015

Flying experience

Total hours	:	9,800 hours
Total on type	:	598 hours
Last 90 days	:	130 hours
Last 60 days	:	80 hours
Last 24 hours	:	1 hour 55 minutes
This flight	:	40 minutes

The PIC joined the company as a qualified Boeing B737-300/400/500 pilot. The assessment prior to joining the company was considered standard. After he served in the company for about 1 year, the PIC was trained for ERJ 190-200 (Embraer 195) aircraft. The PIC was included in the first group of pilots to be trained and was planned to be a company instructor for this aircraft type rating. This assignment was based on the standard performance during the initial assessment and simulator proficiency check on Boeing 737 aircraft.

The first line training on ERJ 190-200 (Embraer 195) was conducted on 20 February 2015 and he qualified as PIC on 23 March 2015. During the training, the remarks from the instructors showed good performance.

The last recurrent training in the aircraft simulator was conducted on 28 June 2015, the remarks showed good performance.

The PIC stated that the aircraft has good performance capability for short runway with rapid deceleration. During landing on long runway airports, the PIC had attempted to stop on certain taxiway intersections and successfully met the target. Based on these personal experiences, the PIC was confident that the aircraft would be safely landed in Kupang with the existing conditions.

1.5.2 Second in Command

Gender	:	Male
Age	:	26 years
Nationality	:	Indonesian
Marital status	:	Single
Date of joining company	:	1 July 2011
License	:	Airline Transport Pilot License (ATPL)
Date of issue	:	31 October 2014
Aircraft type rating	:	ATR-42/72; Embraer 190/195
Instrument rating validity	:	31 December 2016
Medical certificate	:	First class
Last of medical	:	22 June 2015
Validity	:	22 December 2016
Medical limitation	:	None
Last line check	:	31 March 2015
Last proficiency check	:	13 December 2015
Flying experience		
Total hours	:	2,997 hours
Total on type	:	557 hours 25 minutes
Last 90 days	:	117 hours 20 minutes
Last 60 days	:	62 hours 15 minutes
Last 24 hours	:	1 hour 55 minutes
This flight	:	40 minutes

1.5.3 Flight Attendants

All flight attendants held valid licenses, rating and medical certificates.

1.6 Aircraft Information

1.6.1 General

Registration Mark	:	PK-KDC
Manufacturer	:	Embraer S.A
Country of Manufacturer	:	Brazil
Type/Model	:	190-200 LR
Serial Number	:	19000057
Year of Manufacture	:	2006
Certificate of Airworthiness		

Issued	:	20 May 2015
Validity	:	19 May 2016
Category	:	Transport
Limitations	:	None
Certificate of Registration		
Number	:	3633
Issued	:	20 May 2015
Validity	:	19 May 2016
Time Since New	:	16,862 hours 21 minutes
Cycles Since New	:	14,765 cycles
Last Major Check	:	12 February 2015 (4C)
Last Minor Check	:	-

1.6.2 Engines

Manufacturer	:	GE Engine Service
Type/Model	:	CF10-34E7
Serial Number-1 engine	:	994239
▪ Time Since New	:	15,314 hours 24 minutes
▪ Cycles Since New	:	13,831 cycles
Serial Number-2 engine	:	994240
▪ Time Since New	:	15,291 hours 24 minutes
▪ Cycles Since New	:	13,565 cycles

1.6.3 Weight and Balance

The weight and balance sheet issued by the Flight Operation Officer at Ende prior to dispatch contained the following data:

- Zero Fuel Weight 38,241 kg (maximum 42,500 kg)
- Fuel on board 5,900 kg
- Takeoff weight 44,141 kg (maximum: 44,242 kg)
- Burn fuel 1,718 kg
- Estimated Landing Weight 42,423 kg (maximum: 45,000 kg)

The weight and balance sheet showed that the total baggage on board was 650 kg with the distribution of 450 kg in compartment 1 and 200 kg in compartment 2. There was no cargo carried.

The takeoff Centre of Gravity (CG) was 19.8% of the Mean Aerodynamic Chord (MAC) and the CG of the Zero Fuel Weight (ZFW) was 22.5% of the MAC. The stab trim was 0.14 forward.

The Vref [9](speed crossing the threshold) for the estimated landing based on the Aircraft Operation Manual would be 138 KIAS.

The weight and balance sheet indicating that the aircraft was operated within the approved weight and balance envelope.

1.7 Meteorological Information

The meteorological report was provided by BMKG (*Badan Meteorologi, Klimatologi dan Geofisika* – Meteorology, Climatology and Geophysical Agency) Station, Kupang. The weather observation conducted by the Meteorology Station was supported by Automatic Weather Observation System (AWOS).

The Meteorology Station issued meteorology report at 30 minutes intervals through the Automatic Terminal Information Service (ATIS) or any significant changes.

1.7.1 Automatic Terminal Information Service (ATIS)

The meteorological reports issued by El Tari Meteorology Station on 21 December 2015 via ATIS on frequency 127.55 were as follows:

	0900 UTC	0911 UTC	0930 UTC	1000 UTC
Wind	210° / 22 knots Max 24 knots	220° / 12 knots	240° / 9 knots	Calm
Visibility	500 m	500 m	1 km	2 km
Weather	Rain	Thunder Storm Rain	Thunder Storm Rain	Rain
Cloud[10]	Few CB 1,400 ft Broken 1,300 ft	Few CB 1,400 ft Broken 1,300 ft	Few CB 1,400 ft Broken 1,300 ft	Few CB 1,400 ft Broken 1,300 ft
TT/TD	24°C / 23°C	24°C / 22°C	24°C / 22°C	24°C / 23°C
QNH	1,011 mb / 29.87 in Hg	1,011 mb / 29.87 in Hg	1,012 mb / 29.88 in Hg	1,012 mb / 29.89 in Hg
QFE	999 mb / 29.51 in Hg	999 mb / 29.51 in Hg	999 mb / 29.52 in Hg	999 mb / 29.53 in Hg
Remarks	CB over the field	CB over the field	CB over the field	CB over the field

9 Vref (reference speed) is the target speed to be reached while the aircraft passes the runway threshold at 50 feet with refer to the existing aircraft weight and landing configuration.

10 Cloud amount is assessed in total which is the estimated total apparent area of the sky covered with cloud. The international unit for reporting cloud amount for Broken (BKN) is when the clouds cover more than half (5/8 up to 7/8) area of the sky.

1.7.2 Automated Weather Observation System (AWOS)

Kupang Meteorological Station utilized Automated Weather Observation System (AWOS) with three different displays from three different sensor locations. The first sensor was located at the touchdown area of runway 07 – approximately 130 meters on the left of runway 07 centerline and approximately 400 meters from the beginning of runway 07. The second sensor was located at the touchdown area of runway 25 – approximately 98 meters on the right of runway 25 centerline and approximately 350 meters from the beginning of runway 25. The third sensor was located near the tower building named MET Garden.

The AWOS information displayed in Meteorology Station office and also in El Tari Tower station. The display showed information according to its sensor location, which were labeled 07, 25 and M (Figure 4).

Figure 4: The display of AWOS

1.7.3 Meteorological Information by Tower Set

On 1 December 2015, the AirNav Indonesia District Office Kupang as a unit providing Air Traffic Services at Kupang installed a new tower set display to provide meteorological information. The display provides information of wind, temperature, dew point, QNH and QFE (Figure 5).

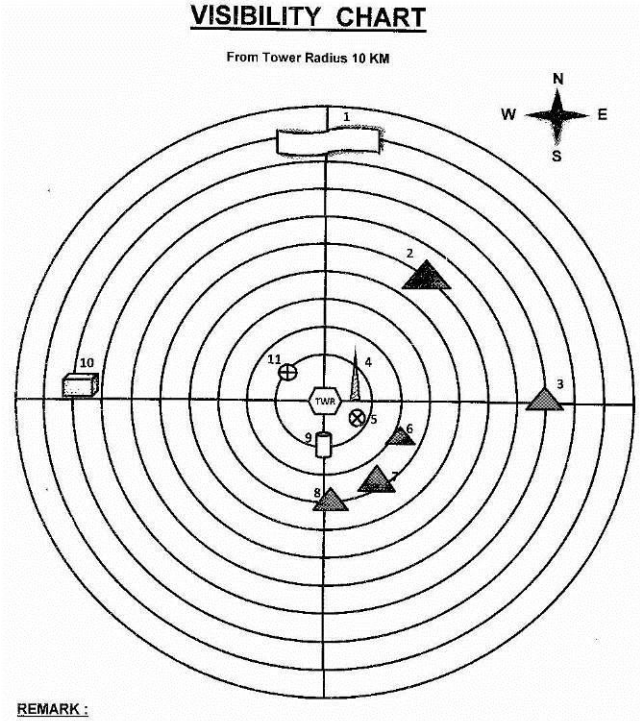
Figure 5: AWOS display (left) and Tower Set display (right).

1.7.4 Visibility Chart

The air traffic controller was provided with visibility information by the AWOS display and visibility chart that was provided in tower (Figure 6).

Based on the interview of the air traffic controller on duty, the visibility chart is used to compare the information on the AWOS display with the actual conditions based on the air traffic controller observation from tower.

There were several landmarks that were used as reference points to determine the visibility. The landmarks were selected to provide visibility information. The investigation could not find the standard operating procedure that describes the usage of the visibility chart.



REMARK :

NO.	OBSTRUCTION	BEARING	DISTANCE	HEIGHT
1	Teluk Kupang	000°	9 KM	-
2	Bukit (North East)	040°	5 KM	700 Feet
3	Bukit (East)	090°	7 KM	1800 Feet
4	"OK" NDB	076°	352 M	100 Feet
5	DVOR / ASII (South East)	135°	982 M	180 Feet
6	Bukit (South East)	135°	3 KM	1200 Feet
7	Bukit (South South East)	170°	4 KM	1805 Feet
8	Bukit (South)	190°	3 KM	1640 Feet
9	Tower Lama (Lanud)	217°	1,390 KM	50 Feet
10	Gedung Keuangan Negara	275°	8 KM	100 Feet
11	VOR / DME (Raytheon/(u/s))	287°	1 KM	200 Feet

Figure 6: El Tari visibility chart

1.7.5 Wind Information Sources

There were three different sources that provided the latest wind information to air traffic controller which were the AWOS display, the Tower Set display and a windsock. Based on the interview, the air traffic controller stated that they used the information from AWOS display of runway 07 and the windsock near the tower building as comparison before providing the latest wind condition to the pilot of the accident flight.

The investigation could not find the standard procedure to determine the wind information from the three different sources (Figure 7).

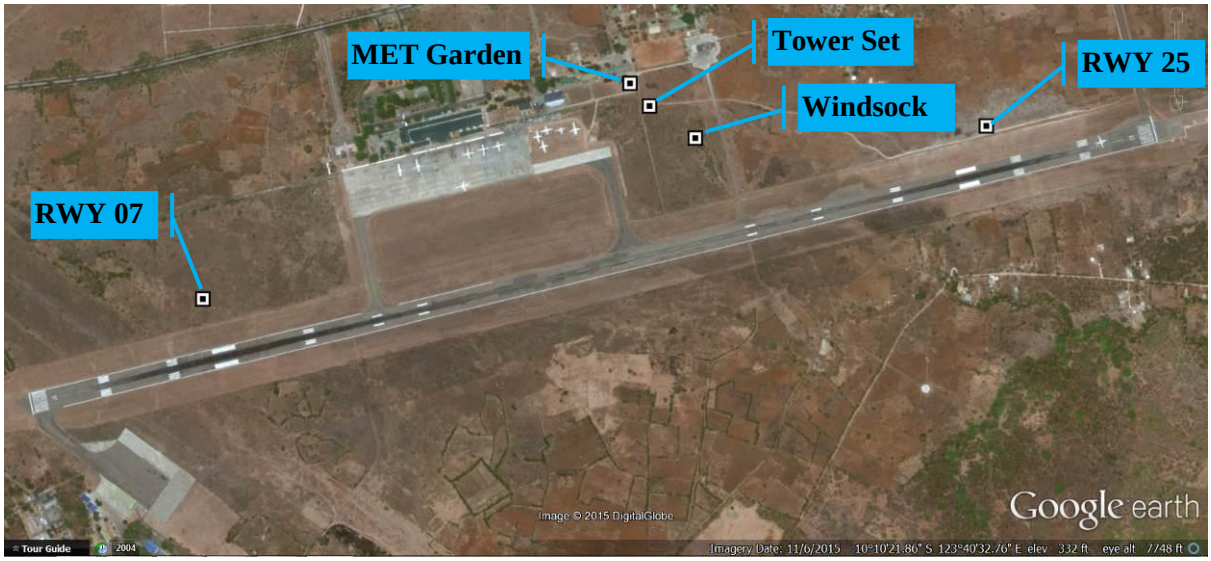


Figure 7: Meteorological sensor and windsock locations

1.8 Aids to Navigation

1.8.1 Kupang

Runway 07 Kupang was equipped with a Global Navigation Satellite System (GNSS) that can be used for RNAV Approach since 23 August 2012. The detail of RNAV Approach can be seen figure 7.

Approach guidance facilities such as Precision Approach Path Indicator (PAPI) lights and runway lights were all serviceable.

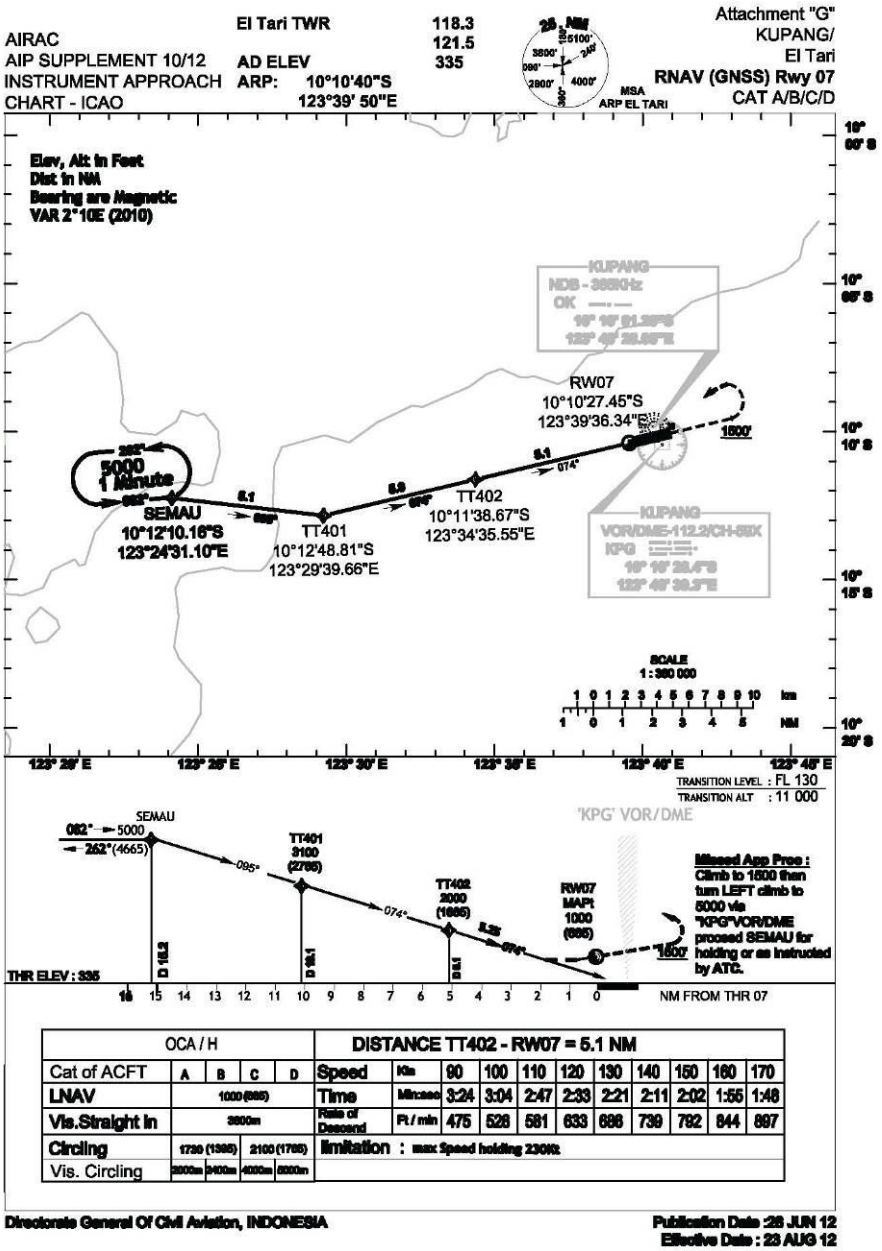


Figure 8: RNAV approach Runway 07 chart published on AIP supplement

1.8.2 The Previous Approach to Ende

The investigation found safety issues that required to be considered relating to the flight procedure and conduct of the previous approach to Ende.

The aircraft operator had developed a company procedure for the conduct of a visual approach to runway 27 at Ende. The visual approach procedure was as follows:

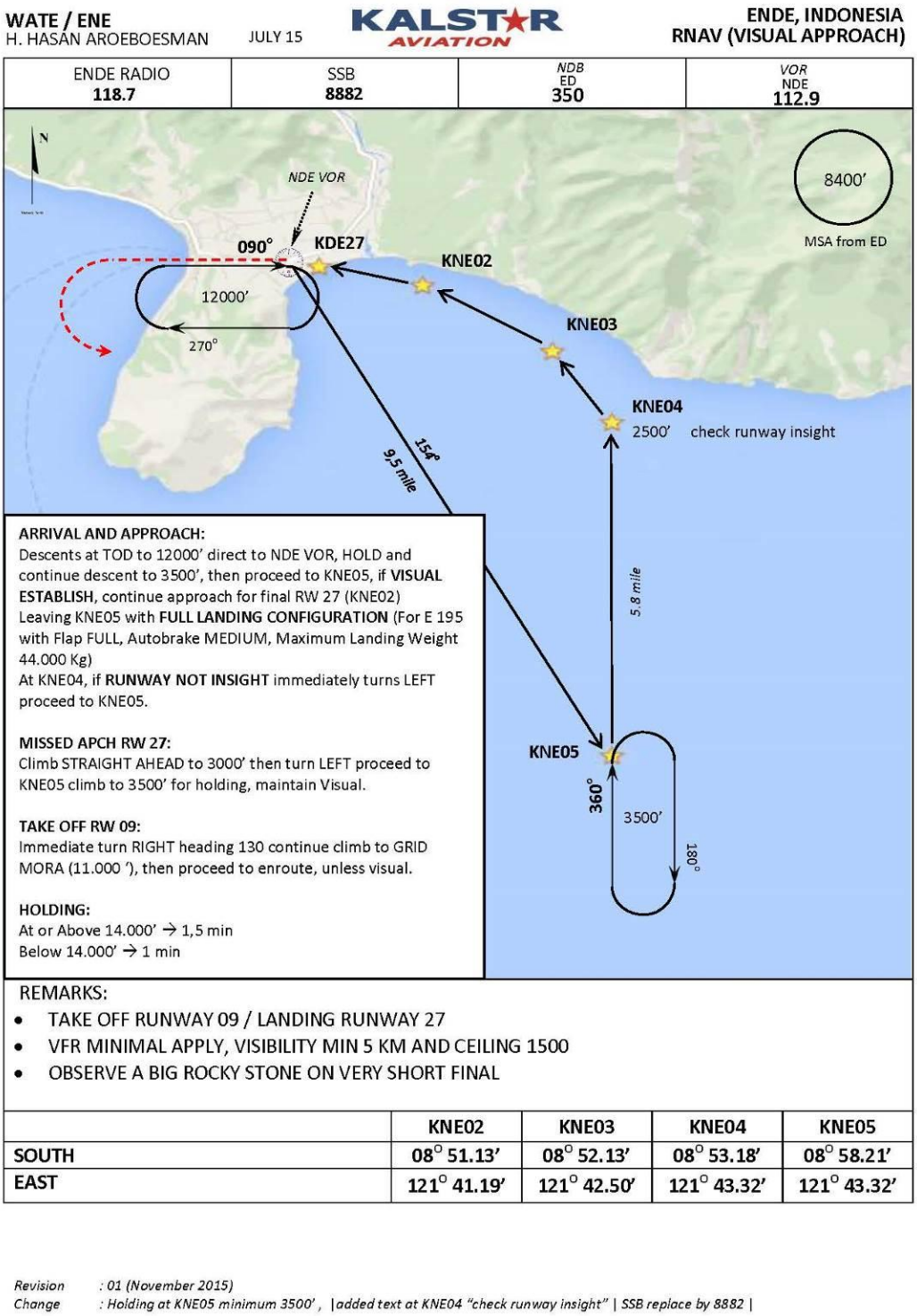


Figure 9: Aircraft operator visual approach procedure for runway 27 Ende

The examination of the air operator visual approach procedure found several issues as follows:

1. The descent path from the holding point over NDE VOR at 12,500 feet to KNE05 holding point located 9.5 Nm from NDE VOR at 3,500 feet. The gradient between these two points was approximately 10 degrees.

2. The gradient of the final approach path from KNE04 to KDE27 which was located on the threshold was 5.5 degrees and was greater than a normal approach gradient of approximately 3 degrees.
3. The approach direction from KNE02 to KDE27 was approximately 10 degrees difference.
4. The go-around from KNE04 and KDE27 were clearly specified, however no procedure for go around from KNE03 and KNE02 points.

1.9 Communications

Communications between ATS and the pilots were recorded by ground based automatic voice recording equipment and the aircraft Digital Voice and Data Recorder (DVDR). The quality of the recordings was good.

1.10 Aerodrome Information

1.10.1 H. Aroeboesman Airport

Airport Name	:	H. Hasan Aroeboesman Airport
Airport Identification	:	WATE
Airport Operator	:	Directorate General of Civil Aviation
Coordinate	:	08°50’53” S and 121°39’48” E
Elevation	:	15 feet
Runway Direction	:	09 and 27 (azimuth 089° and 267°)
Runway Length	:	1,652 m
Runway Width	:	29 m
Surface	:	Asphalt
Instrument Approach Procedure	:	None
Operating hours	:	2300 – 0900 UTC

There was an atoll on final path runway 27 located at about 1,150 meters (0.62 Nm) from beginning of runway 27 and the height of atoll was approximately 180 feet.

Figure 10: Atoll in final path runway 27

Figure 11: The atoll position seen from the apron

1.10.2 El Tari International Airport

Airport Name	:	El Tari International Airport
Airport Identification	:	WATT
Airport Operator	:	PT. Angkasa Pura I
Airport Certificate	:	020/SBU-DBU/VII/2010

Validity	:	30 July 2015
Coordinate	:	10°10’40” S and 123°39’50” E
Elevation	:	335 feet
Runway Direction	:	07 and 25 (azimuth 073° and 253°)
Runway Length	:	2,500 m
Runway Width	:	45 m
Surface	:	Asphalt

1.11 Flight Recorders

The aircraft was equipped with two DVDRs (Digital Voice and Data Recorder). Each DVDR recorded the information of both the cockpit voice and flight data. One DVDR was located at the aft side of the cabin and the other located on the electronic equipment bay on the lower front cabin.

Manufacturer : Honeywell

Part Number : 980-6025-001

Serial Number : DVDR 00660 (aft position)

DVDR 00665 (forward position)

Both DVDRs were transported to the KNKT recorder facility in Jakarta for data downloading purposes.

The DVDR data were successfully downloaded and contained 25 hours of 900 flight data parameters and two hours of cockpit voice recording which included the approach phase of the accident flight and the previous flight.

1.11.1 Flight Data

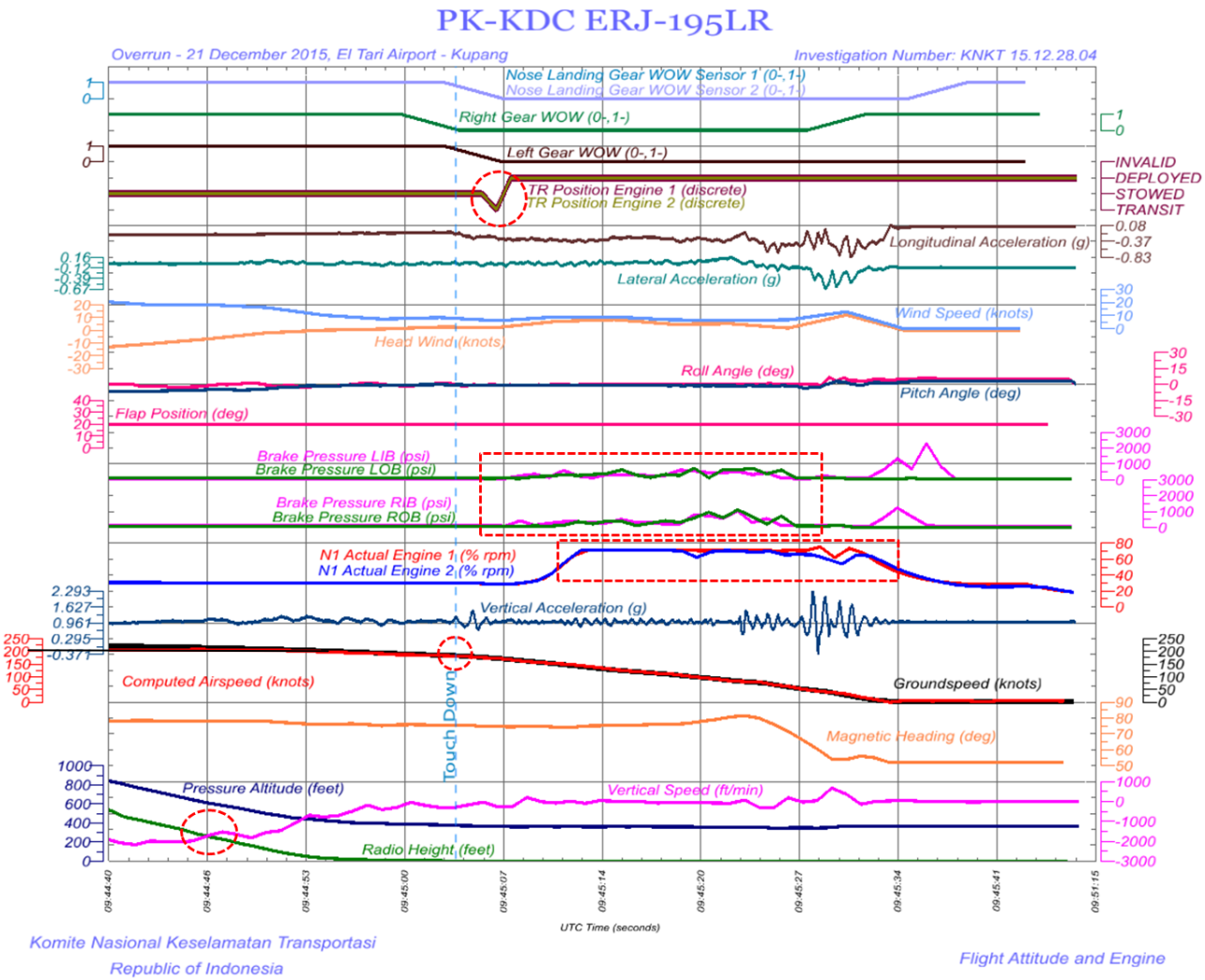


Figure 12: The graph of several flight data parameters of the accident flight

The flight data showed:

- When approach passed altitude 500 feet AGL, the rate of descend was more than 2,000 feet/minute and while passed altitude 200 feet AGL, the rate of descent was more than 1,500 feet/minute.
- Aircraft speed at 50 feet above runway was approximately 200 knots and 180 knots on touchdown.
- The thrust reversers deployed immediately after touch down.
- Brake pressures of both inboard and outboard were below 1,000 psi until the aircraft commenced to stop.
- The engine N1 rotation increased after the thrust reversers deployed.

The DVDR recorded four approach flights to Ende including the flight on 20 and 21 December 2015 prior to the accident flight. The recorded approach flight paths were as follows:

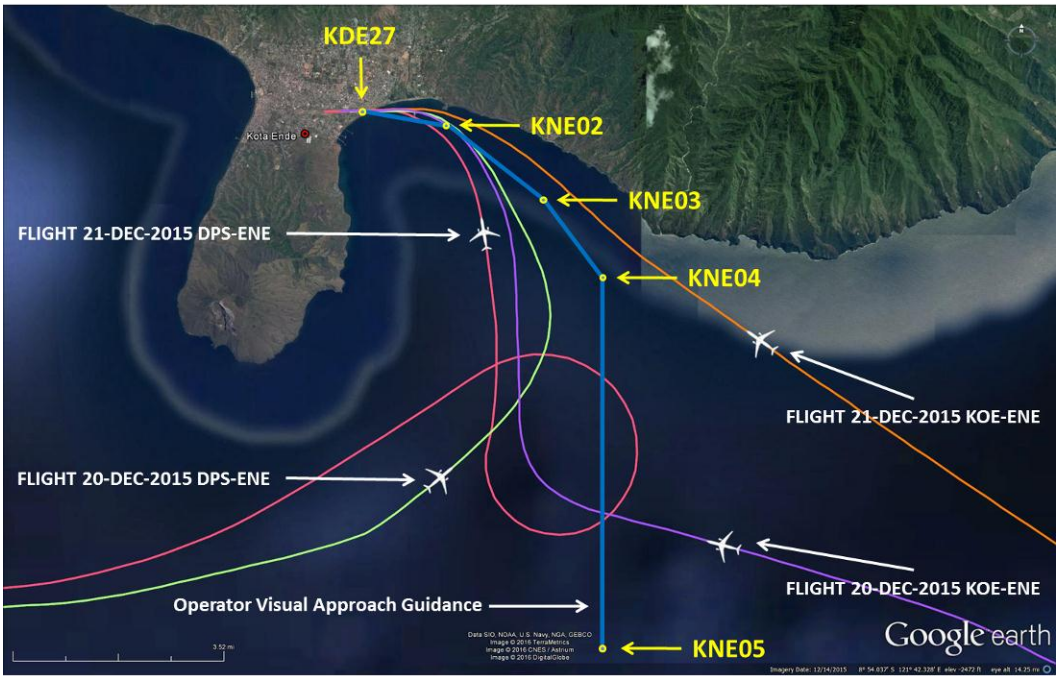


Figure 13: Flight paths of approach to Ende on 20 and 21 December 2015

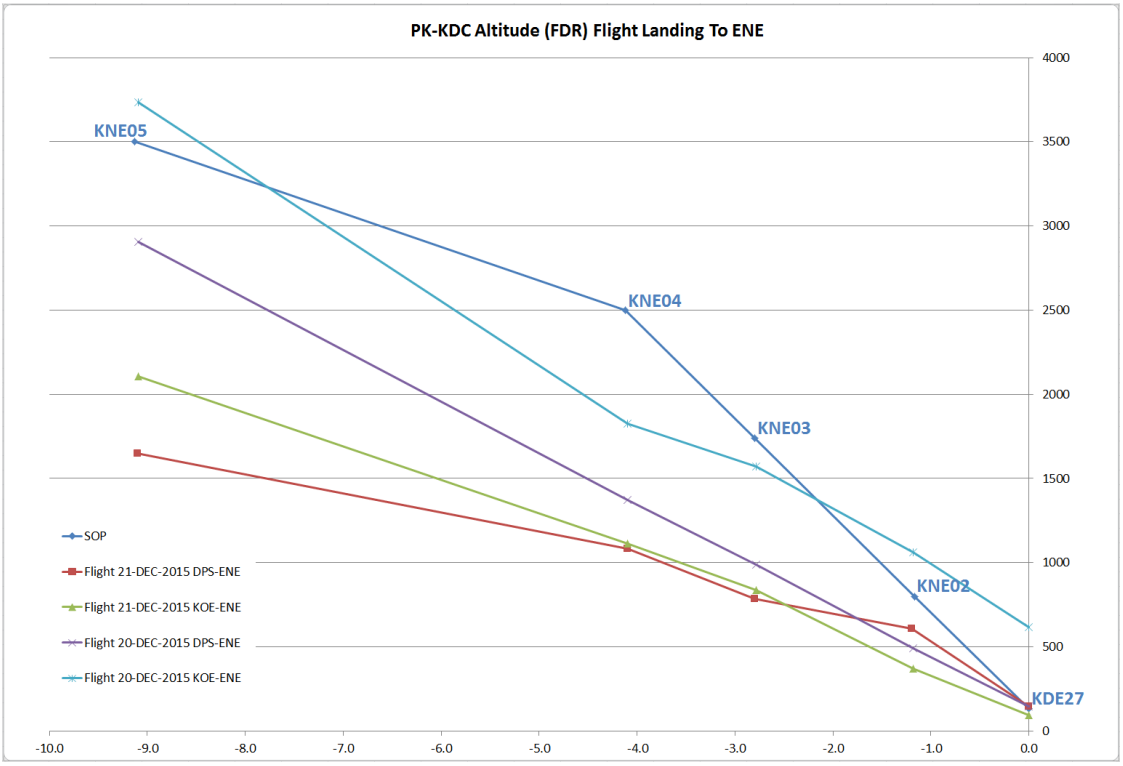


Figure 14: Altitude profile of the approach procedure and flight paths to Ende on 20 and 21 December 2015

1.11.2 Voice Data

The excerpts of the voice data during the flight to Ende on 21 Dec 2015 are as follows:

Time (UTC)	Description
08:31:02	The pilot reported the aircraft position was on five minutes out from ENDE, followed by the PIC suggested to the SIC as PF to speed up the flight by delay the speed reduction and to shortened the flight path. The PIC considered the airport operating hour that was almost close.
08:34:17	The aircraft was too high for approach and both pilots agreed to make a circle to the right to lose altitude.
08:36:16	The crew agreed to perform a visual approach, thereafter selected flap position two followed by landing gear down.
08:37:42	The crew agreed to fly manually and disengaged the autopilot.
08:38:09	The PIC reminded the SIC not to fly too high as the runway was wet.
08:38:37	EGPWS altitude callout “TWO HUNDRED”
08:38:46	EGPWS altitude callout “FIFTY”
08:38:47	EGPWS altitude callout “FORTY”
08:38:47	EGPWS warning “BANK ANGLE” repeated three times.
08:38:50	Aircraft touched down. Sound of the crew laughing.

The excerpts of the voice data during flight to Kupang are as follows:

Time (UTC)	Description
09:09:33	The pilot contacted Ende Radio, requested for start engine.
09:12:22	The pilot reported complete start engine and ready for taxi to runway 09
09:15:53	AURAL WARNING callouts “TAKEOFF OK”
09:16:17	Aircraft on takeoff
09:16:57	The flight was turned to direct to Kupang.
09:20:35	The crew set the Kupang ATIS frequency. The aircraft speed was set at 250 knots.
09:21:10	The crew discussed the EGPWS warning “BANK ANGLE” during approach at Ende that considered as un-stabilized approach and go-around should have been performed.
09:25:39	The crew monitored the communication of El Tari Tower controller with another pilot and monitored the weather report: wind 150/15 knots, visibility 1 km, present weather rain, clouds overcast, temperature 23° C and QNH 1,011 mbs.
09:27:34	The crew discussed the required fuel for diversion to alternate.
09:28:03	The pilot made first communication to El Tari Tower controller and informed that they were on cruising at altitude 17,500 feet and estimated time of arrival Kupang would be 0952 UTC.
09:28:46	The flight was approved to direct to point SEMAU and to inform when ready for descend.
09:31:50	The pilot reported position 62 Nm from Kupang and started to descend which was approved to 10,000 feet.
09:34:14	The pilot requested to turn left heading to KPG VOR to avoid clouds.
09:36:24	The pilot reported to El Tari Tower controller the position was 36 Nm was approved to continue descend to 4,500 feet and to proceed to point SEMAU.
09:39:34	The pilot reported the aircraft position was crossing radial 288 at 21 Nm from KPG VOR
09:40:25	The pilot announced to flight attendants to prepare for arrival.
09:40:30	The controller informed that the visibility was 4 km. The pilot reported position over SEMAU at altitude 7,000 feet and ready for approach which was approved to make RNAV approach runway 07.
09:40:59	The PIC suggested to increase the speed and shortened the approach.
09:41:13	The PIC suggested turning left and finding the area that clear of clouds.
09:42:24	Both pilots realized that the aircraft altitude and speed were too

Time (UTC)	Description
	high.
09:43:03	The SIC intended to select the speed brake. The PIC suggested performing non-standard configuration by selecting the landing gear down and the SIC agreed with the PIC's suggestion.
09:43:13	The SIC exclaimed that the aircraft position was 6 Nm.
09:43:21	Flaps 1 selected
09:43:41	The pilot reported passing 2,500 feet and runway was in sight.
09:43:49	Flaps 2 selected and received clearance to land.
09:43:51	The autopilot disengaged and followed by aural warning "AUTOPILOT"
09:44:02	The PIC suggested the SIC to calm down and it is OK with high speed condition.
09:44:05 to 09:44:27	The aural warning "HIGH SPEED" activated 17 times
09:44:28	The PIC suggested closing the throttle.
09:44:29 to 09:44:43	The aural warning "HIGH SPEED" (8 times) and GPWS warning "SINK RATE" (3 times) activated alternately.
09:44:45 to 09:44:56	GPWS warning "PULL UP" (2 times), "TOO LOW TERRAIN" (2 times) and aural warning "HIGH SPEED" activated alternately.
09:44:52	The PIC exclaimed "it is OK"
09:44:57.570	EGPWS altitude callout "TWENTY"
09:44:58.293	The aural warning "HIGH SPEED"
09:44:59.975	EGPWS altitude callout "TEN"
09:45:00.341	The PIC instructed to delay the touchdown
09:45:00.612	The aural warning "HIGH SPEED" activated (2 times)
09:45:05.000	Sounds of aircraft touched down
09:45:06.044	The PIC commanded for activate engine thrust reverser and brakes
09:45:08.866	Aural warning callouts "AUTOBRAKE"
09:45:30.825	Aural warning callouts "LANDING GEAR"
09:45:36.548	Both pilots executed emergency checklist and requested assistant to the El Tari Tower controller.
09:46:49.967	The PIC commanded the flight attendant to check condition and disarm the slide bars.
09:52:17	End of recording

1.12 Wreckage and Impact Information

The investigation found tire marks began at 220 meters before end of runway 07 and indicated the aircraft started to veer to the right (Figure 15).

A broken runway light was found at the end of runway 07 on the path of the aircraft movement.

Figure 15: Illustration of tire mark when the aircraft started to veer from runway centerline (white line)

The ground surface condition after stopway was down slope about 4° – 5° (Figure 14).

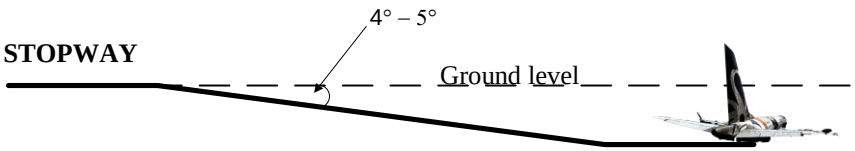


Figure 16: The illustration of ground surface (not to scale)

About 100 meters from the end of runway 07, there was a ground indentation of about 20 centimeters depth. The right main wheel marks ended before this indentation and changed to the marks from the engine cowling.

The aircraft stopped approximately 200 meters from the end of runway 07 on a heading of 060°. The relative angle of the aircraft and the ground was approximately 7° and the nose wheel was lifted about 50 centimeters from ground. The wings were tilted about 4° to the right (Figure 17).

Figure 17: The aircraft final position

The right main landing gear collapsed and contacted with the right inner flap. The flap selector was found at the Flap 5 detent (20 degrees wing flaps - Figure 18).

All wing flaps were extended to approximately 20 degrees.

The entire engine thrust reversers doors opened. The right engine thrust reverser doors detached and were found about 35 meters behind the aircraft.

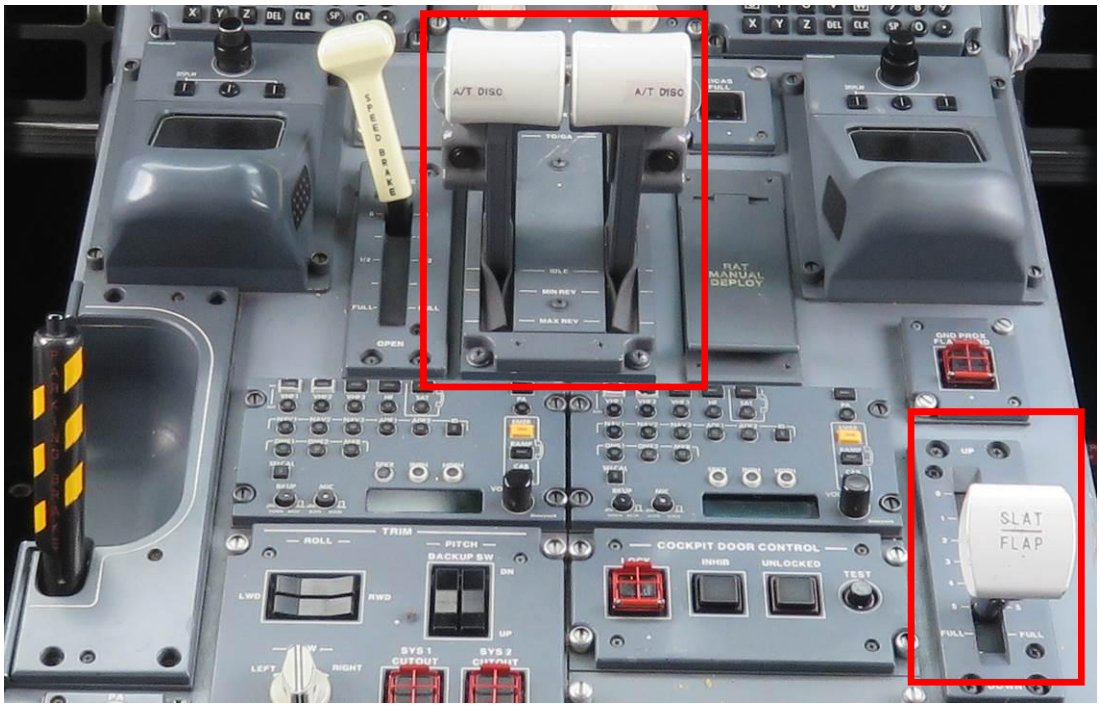


Figure 18: The thrust levers and flap selector observed after the aircraft stopped

Approximately 185 meters from end of runway 07, investigators found a collapsed palm tree. The dimension of the tree was approximately 40 cm in diameter with 5 m height. It is most likely that the right wing hit this tree damaging the leading edge of the right wing.

1.13 Medical and Pathological Information

No medical or pathological investigations were conducted as a result of this occurrence.

1.14 Fire

There was no evidence of pre or post-impact fire.

1.15 Survival Aspects

At 0946 UTC, the El Tari Tower controller noticed that the aircraft overran the runway and pushed the crash bell to inform the Aircraft Rescue and Fire Fighting (ARFF) personnel. The controller then called the ARFF personnel and informed that there was aircraft overrun from runway 07 on sector C13 of the grid map (Figure 19). The ARFF team then deployed three vehicles.

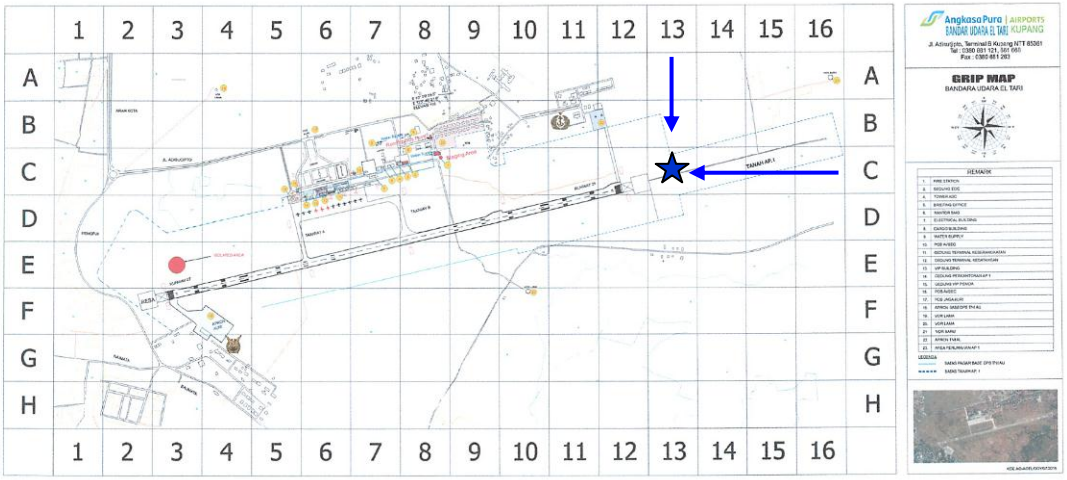


Figure 19: The aircraft location on grid map

At 0945 UTC, the ARFF personnel arrived in the accident site followed by Search and Rescue personnel and there was no indication of fire on the aircraft.

After the aircraft stopped, the PIC commanded "attention crew on station[11]" through the Passenger Announcement (PA) system. The Flight Attendant 1 (FA1) then checked inside and outside condition through a small window of forward left passenger door (L1) because the window of forward right passenger door (1R) was covered by mud. There was no luggage that had fallen out of the overhead lockers and all passengers remained in their seats. The FA1 did not see any indication of fire outside the left side of the aircraft.

The FA1 disarmed the slide then opened the L1 door to reconfirm the outside condition. When the door opened, the FA1 saw the ARFF personnel were standing by around the aircraft. The FA1 asked the ARFF personnel whether there were any stairs for passenger disembarkation and the ARFF personnel suggested using the evacuation slide because the ground condition was muddy.

11 Attention crew on station is a command that means instruction to the flight attendants to check the condition outside the aircraft in preparation for an evacuation.

The PIC then commanded "control disembarkation[12] only forward doors left side". The FA1 informed the PIC about the outside conditions that was muddy and required escape slide to disembark the passengers. The FA1 then relayed the instruction to the other flight attendant through PA system to perform control disembarkation using only left forward doors (L1). The FA1 armed the slide bar then opened the L1 door. The escape slide inflated and the SIC was the first person to disembark the aircraft using the escape slide in order to assist the evacuation process from the outside.

After about a quarter of the total passenger disembarked, the PIC instructed the FA1 to open the aft left passenger door (L3). The FA1 then relayed the instruction to the other flight attendants (FA2 and FA3) using the megaphone. The PA system was no longer functioning as no electrical power was available. The L3 door was opened by FA2 and then the passengers were directed to evacuate through this door.

At about 1000 UTC, bus and ambulance arrived to the accident site to transport the passengers to the terminal building.

After about 20 minutes, all occupants were completely evacuated. The ARFF personnel then conducted a runway inspection and there was no debris leftover on the runway.

1.16 Tests and Research

There was no test and research conducted for this investigation.

1.17 Organizational and Management Information

1.17.1 PT. Kalstar Aviation

Aircraft Owner	:	Aldus Portfolio B Limited
Address	:	Suite 4440, Atlantic Avenue, West Park Business Campus, Shannon, Co. Clare, Ireland
Aircraft Operator	:	PT. Kalstar Aviation
Address	:	Villa Melati Mas, Blok SR I, No. 14, Bumi Serpong Damai, Tangerang, Indonesia
Operator Certificate Number	:	121-037

PT. Kalstar Aviation operated 14 aircraft, consisting of three ATR 42-300, one ATR 42-500, two ATR 72-500, three ATR 72-600, one Boeing 737-300, two Boeing 737-500 and two Embraer E 190-200LR.

The operations mainly were in Kalimantan and Java Islands and, since the middle of 2015, started to operate in the Bali and Nusa Tenggara area.

12 Control disembarkation is a condition where passengers should leave the aircraft as a precautionary measure.

1.17.1.1 Company Operation Manual

The Company Operation Manual (COM) provided the following organization information.

Operation Organization Structure

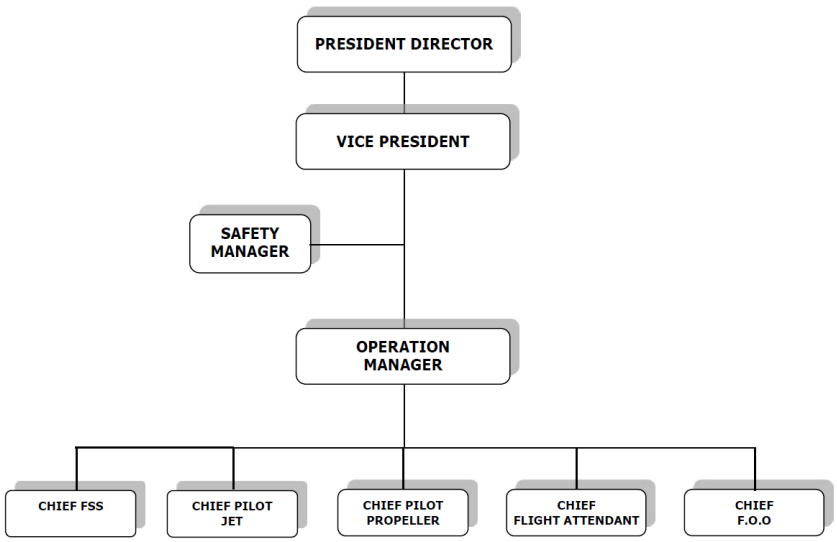


Figure 20: PT. Kalstar Aviation Operation Organization Structure

1.10.2.1 Operation Manager

Responsible to President Director

Duties and Responsibilities:

1. *To prepare and distribute aircrew rosters to cover all known and probable operational requirements. Incorporate check and training, license renewals and any other recurrence requirements in each roster.*
2. *Ensure that all CASR's requirements in relation to flight operations, roistering and flight/duty times are always adhered to. (Well knowledge of CASR & Company manuals). Maintain a current, accurate record of aircrew duty and flight times in accordance with CASR's and Company requirements;*
3. *Maintain a current, accurate record of operations and annual leave status for each aircrew member. Regularly review aircrew-staffing levels and make recommendations to the President Director for adjustments as appropriate.*
4. *Review and amend the Company Operations Manual on a regular basis. Raise and distribute amendments to the Operations Manual as required and ensure all those on the distribution list receive, acknowledge and comply with all such amendments.*
5. *Developing Standard Operating Procedures (SOP) of each aircraft.*
6. *Developing and/or implementing all required approved training program for the Company flight crews.*
7. *Prepare and issue memos to aircrew members, notifying them of any information relevant to operational or other Company matters.*
8. *Ensure that all relevant details of each contract or charter flight are*

communicated to the aircrew concerned in sufficient time and detail to enable the flights(s) to be conducted in accordance with the customer's requirements.

9. *Arrange of verify the availability of fuel, ground transport, accommodation and airport facilities for all flights, Liaison directly with customers on contractual and operational commitments and ensure the Company complies with all such commitments.*
10. *Investigate and report promptly to the Director all customer complaints relating to any aspect of the aircraft services provided by the Company. Liaisons regularly with other department heads to ensure all aircraft operations are conducted professionally and effectively.*
11. *Provide operational data as required, including tender information, to assist marketing staff in promoting the Company's services.*
12. *Make operational / air crew records and other information available to outside parties who are authorized to carry out safety/technical audits of the Company.*
13. *In liaison with the Maintenance Manager, make recommendations to the Marketing Department on the deployment of particular aircraft to various contracts or operations.*
14. *In liaison with the Maintenance Manager, take appropriate action to recover or replace unserviceable aircraft. Manage and control all Operations Department personnel.*
15. *Ensure any operations duties delegated to other employees are carried out efficiently and effectively.*
16. *Verify and approve for payment all expenses incurred by air crew members in the performance of their duties.*
17. *Liaison with Chief Pilot, Company Aviation Safety Officer (CASO) in relation to Standard Operating Procedures (SOP's) and all other operational or customer requirements that will ensure safe, efficient and professional operations.*
18. *The auctioning and distribution of accident, incident and other occurrence reports;*
19. *Assist in accident / incident investigation when required.*
20. *In his absence all responsibilities for operational duties shall be delegated to another qualified individual, except that the knowledge requirements detailed under Operation Manager qualifications may be demonstrated to the Company.*

1.10.2.3 Chief Pilot

Responsible to Operation Manager

Duties and Responsibilities:

1. *Screening new pilot applicants and forwarding recommendations to the Operation Manager.*
2. *Liaison with the Company Aviation Safety Officer and Operation Manager relative to all Company Standard Operations Procedures.*
3. *Formulate new operations procedures when required and periodically review existing ones.*
4. *Produced the training syllabus, standards of training, check procedures, etc., to insure a high degree of knowledge and proficiency within the pilot staff.*

5. *Formulate and assist in implementation of Standard Safety Procedures within the Company.*
6. *Assist in accident / incident investigations when required.*
7. *Formulate guidelines for all pilots relative to SOP'S, customer relations, crew scheduling, SAR procedures, etc.*
8. *Shall have through of the content of company operation manual, operation specifications and the DGCA regulations / CASR.*
9. *To assist the Operations Manager in whatever way required insuring efficient safe administration of the Operations Department.*
10. *Ensure all pilots comply with all DGCA regulations, Company Directives and the Operations Manual.*
11. *Coordinate and cooperate with flight instructor relative to giving check rides and implementation and monitoring of the Company training syllabus.*

The Chief Pilot and the Operation Manager were also active pilots and performed regular flights.

1.10.2.2 Safety Manager

Responsible to President Director.

Detail Duties and Responsibilities:

1. *Monitoring and advising on all company flight safety activities which may have an impact on flight operations.*
2. *Establish a reporting system which provides for a timely and free flow of flight safety related information.*
3. *Conducting safety surveys.*
4. *Soliciting and processing flight safety improvement suggestion.*
5. *Developing and maintaining a safety awareness program.*
6. *Monitoring industry flight safety concern which may have an impact on Company operations.*
7. *Maintaining close liaison with aero plane manufactures.*
8. *Maintaining close liaison with Directorate General of Civil Aviation (DGCA) and National Transport Safety Commission (NTSC).*
9. *Maintaining close liaison with industry safety association.*
10. *Developing and maintaining the Company accident response plan.*
11. *Identifying flight safety deficiencies and making suggestion for corrective action.*
12. *Investigating and reporting on incidents/accidents and making recommendation to preclude a recurrence.*
13. *Developing and maintenance a flight safety data base to monitor and analyze trend.*
14. *Monitoring the response and measuring the results of flight safety initiatives.*

Based on interview, the investigation found to conduct the duties and responsibilities the safety manager was assisted by one staff.

3.2 SAFETY STANDARDS

Personnel involved in aviation operations require high levels of skill and proficiency to perform safety. Flight operations are unforgiving of complacency. No matter how busy Company personnel shall become taking care of other matters, they shall take time to follows proper safety procedures. Safe flight operations do not tolerate carelessness or unnecessary risks.

Inattention and complacency are the contributing factors in many incidents and accidents. Employees who usually avoid these events are those employees who have discipline and deliberately develop good work habits.

The goal of PT. Kalstar Aviation is to operate with only the highest safety standards. All employees shall support this goal - safety is our first consideration on any operation. Safety is to be promoted through training, strict attention to duty and exercising good judgment in conducting the Company's affairs.

1.17.1.2 Safety Management System Manual

2.1. GENERAL

DGCA issue AC 120-92 and Aviation Act No.1 2009, for all Indonesia AOC holders are mandated to initiate the implementation of an integrated Safety Management System. Such as System should include:

1. *A safety Policy on which system based*
2. *Setting of safety objectives, goals and performance indicator*
3. *Identification of Hazards aviation safety and evaluation and management of their associated risk*
4. *Personnel training to ensure their competency to perform their duties*
5. *Documentation of all SMS components, procedures and activities including their relevant integration,*
6. *Periodic review or audit of the safety management system*
7. *Emergency respond plan*

3.2. OPERATION WORK SCOPE

The regulations will be applied to the following department / area performing activities and contract companies.

Operational area including security aspect:

a. *Operations Department.*
b. *Maintenance Department.*
c. *Finance and Administration Department*
d. *Commercial Department*

3.4. EQUIPMENT AND FACILITIES IN IMPLEMENTATION OF SMS

The intent of any Safety Management System is to produce a culture of safety awareness is a proactive approach for identifying, managing and controlling risks.

The result is a team working cooperatively and proactively to seek and detect hazards and risks, to adequately put in place adequate countermeasures to assure safety.

To achieve this goal:

- *We must establish a solid foundation for safety efforts,*
- *We must care about the safety of our customers and personnel,*
- *We must believe that every person in the organization can and has a duty to prevent accidents.*
- *We will integrate safety awareness into everyday activities.*

A Safety Management System describes an approach to managing safety and risk. It represents the most current techniques in accident prevention and recognizes that many accidents and incidents are the result of a complex but unintended interaction of multiple factors.

It is our effort in the organization to implement just culture report in the day to day activities and operations

1.17.1.3 Pilot Performance Monitoring

The investigation found that other than the training and proficiency check on simulator the aircraft operator had not established integrated system to monitor the pilot performance and pilot compliance to the company procedures especially during the daily operation.

1.17.1.4 Embraer 195 Airplane Operation Manual

Section 2: Limitation

OPERATIONAL LIMITATION (page 6)

Maximum flap extended speed (V_{FE})

Flaps 1 …… 230 KIAS

Flaps 2 …… 215 KIAS

Flaps 3 …… 200 KIAS

Flaps 4 …… 180 KIAS

Flaps 5 …… 180 KIAS

Flaps Full …… 165 KIAS

Section 14-08: Flight Controls

SLAT/FLAP SELECTOR LEVER (page 3)

Lever position	*Slat position*	*Flap position*	*Detent/Gated*
0	*0°*	*0°*	*Detent/Stop*
1	*15°*	*7°*	*Detent*
2	*15°*	*10°*	*Detent*
3	*15°*	*20°*	*Detent*
4	*25°*	*20°*	*Gated/Stop*
5	*25°*	*20°*	*Detent*
Full	*25°*	*37°*	*Detent/Stop*

Section 14-15: Warning System

AURAL WARNING (page 1 and 2)

The electronic display system has two aural warning drivers, which are responsible for generating and prioritizing aural warnings.

Aural warnings sound in a sequence, are never truncated, and are automatically canceled when the alerting situation no longer exists, or when they are reset manually by the pilot. In the event of multiple alerts, the highest priority alerts sound first.

Aural warnings are used when pilots need immediate knowledge of a condition without having to look at a visual display or indicator. Aural warnings are alert tones, bells, horns, clicks, beeps and voice messages.

AURAL WARNING PRIORITY LEVELS

There are four aural warning priority levels, from the highest to the lowest:

- *Emergency (level 3)*
- *Abnormal (level 2)*
- *Advisory (level 1)*
- *Information (level 0)*

Emergency: corresponds to a situation that requires the pilot's immediate action. The master warning annunciator is repeated with three-second intervals between alerts until the master warning reset switch is pressed.

Abnormal: corresponds to an abnormal situation such as system malfunction or failures that have no immediate impact on safety. Whenever an abnormal fault occurs, a master caution tone is presented every five seconds until the master caution reset switch is pressed.

Advisory: corresponds to the recognition of a situation such as system malfunction or failures leading to loss of redundancy or degradation of a system.

Information: corresponds to an information situation.

PRIORITY	***ALERT***	***TONE/VOICE MESSAGE***
3	*EGPWS WARNING*	*See 14-15-30*
3	*TCAS CORRECTIVE ADVISORY*	*See 14-15-40*
3	*TCAS PREVENTIVE ADVISORY*	*See 14-15-40*
3	*FIRE*	*BELL*
3	*MASTER WARNING*	*TRIPLE CHIME*
3	*OVERSPEED*	*"HIGH SPEED"*
3	*LANDING GEAR (with radar altitude valid)*	*"LANDING GEAR"*
3	*CABIN ALTITUDE*	*"CABIN"*
3	*NO TAKEOFF (slat/flap out of configuration)*	*"NO TAKEOFF FLAP"*
3	*NO TAKEOFF*	*"NO TAKEOFF TRIM"*

PRIORITY	*ALERT*	*TONE/VOICE MESSAGE*
	(pitch trim out of configuration)	
3	*NO TAKEOFF (brakes out of configuration)*	*"NO TAKEOFF BRAKES"*
3	*NO TAKEOFF (spoilers out of configuration)*	*"NO TAKEOFF SPOILERS"*
3	*AUTOPILOT (Normal or abnormal)*	
2	*MASTER CAUTION*	*SINGLE CHIME*
1	*ALTITUDE ALERT (departure)*	*C CHORD (twice) + "ALTITUDE"*
1	*ALTITUDE ALERT (capture)*	*C CHORD*
1	*AUTOTHROTTLE (normal or abnormal)*	*"THROTTLE"*
0	*TAKEOFF CONFIGURATION*	*"TAKEOFF OK"*
0	*AURAL WARNING A PIT*	*"AURAL WARNING TEST A"*
0	*AURAL WARNING B PIT*	*"AURAL WARNING TEST B"*
0	*SELECTIVE CALLING*	*"SELCAL"*
0	*TRIM MALFUNCTION*	*"TRIM" (7 seconds)*

VOICE MESSAGES

Voice messages are generated whenever a potentially dangerous condition exists, as determined by the EGPWS, TCAS, and windshear detection system.

Some voice messages may be cancelled, but others are only cancelled when the cause that activates them ceases. When a windshear, TCAS or EGPWS alert condition takes place, a special situation exists. In that case, no other voice messages are presented so that the flight crew can clearly hear the information messages. Only a stall condition takes precedence over windshear, EGPWS and TCAS alerts.

1.17.1.5 Embraer 195 Standard Operating Procedures

Chapter 3: Procedures and Techniques (page 3-138)

STABILIZED APPROACH

The airplane should be stabilized by 1000 ft AFE if in IMC conditions and no lower than 500 ft. AFE if in VMC conditions. An approach is considered stabilized when all of the following criteria are met:

- *The airplane is on the correct flight path;*
- *Only small changes in heading/pitch are required to maintain the correct flight path;*
- *The airplane approach speed is VREF + Wind Correction, not exceeding VREF +*

20 kt and not less than VREF;

- *The airplane is in the correct landing configuration;*
- *Sink rate is no greater than 1000 ft./min; if an approach requires a sink rate greater than 1000 ft./min, a special briefing should be conducted;*
- *Power setting is appropriate for the airplane configuration;*
- *All briefings and checklists have been conducted;*
- *ILS approaches should be flown within one dot of the glide slope and localizer.*

NOTE: *For EASA operators the following criteria are also applicable:*

- *Maximum Bank Angle 30°;*
- *Sink rate no greater than 1000 ft./min with a maximum deviation of +/- 300 ft/min.*

Following the stabilized approach criteria, the manual stated that at any approach, if the airplane cannot meet the stabilized approach criteria, execute a missed approach.

1.17.1.6 Embraer 190/195 Airplane Flight Manual

Section 5: Performance (page 6)

LANDING DISTANCE – LD

It is the distance necessary to land from a screen height of 50 ft above the landing surface and come to a complete stop.

The landing distance provided by CAFM for dry runway condition is the unfactored landing distance multiplied by a factor of 1.67.

The landing distance provided by CAFM for wet runway condition is the factored dry landing distance multiplied by a factor of 1.15.

1.17.2 AirNav Indonesia District Office Kupang

Air traffic services in Kupang airspace was managed by the AirNav Indonesia district office Kupang. The Kupang air traffic services consisted of Flight Service Station (FSS) that responsible to provide flight information services and Aerodrome Control Tower (TWR) that responsible to provide air traffic control services.

1.17.3 PT. Angkasa Pura I Branch El Tari International Airport, Kupang

The airport was managed by PT. Angkasa Pura I, a state owned enterprise that managed 13 airports in Indonesia including El Tari International Airport Kupang.

The aerodrome manual and standard operation procedure of El Tari Kupang International Airport did not contain a procedure associated to enable disseminate significant information of runway condition for the pilot to determine runway braking action.

1.17.4 Civil Aviation Safety Regulation Part 121

121.65 Safety Management System (SMS)

(a) From 1 January 2009, an air carrier shall develop and implement a safety management system (SMS) appropriate to the size, nature and complexity of the operations authorized to be conducted under its operations certificate and the safety hazards and risks related to the operations; acceptable to the DGCA, that, as a minimum:

(1) Identifies safety hazards and assesses and mitigates risks;

(2) Ensures that remedial action necessary to maintain an acceptable level of safety is implemented;

(3) Provides for continuous monitoring and regular assessment of the safety level achieved; and

(4) Aims to make continuous improvement to the overall level of safety.

(b) The air carrier's SMS shall clearly define lines of safety accountability throughout the operator's organization, including a direct accountability for safety on the part of senior management.

(1) An air carrier shall nominate to the DGCA for approval an Accountable Executive, meaning a single, identifiable person which might be a Chief Executive Officer, a Chairperson Board of Directors, a partner or a proprietor who has full responsibility for the organization's SMS and have full authority for human resources issues, major financial issues, direct responsibility for the conduct of the organization's affairs, final authority over operations under certificate, and final responsibility for all safety issues.

(2) An air carrier shall identify a Safety Manager to be the member of management who shall be the responsible individual and focal point for the development and maintenance of an effective SMS. The Safety Manager shall ensure that processes needed for the SMS are established, implemented and maintained; report to the Accountable Executive on the performance of the SMS and on any need for improvement; and ensure safety promotion throughout the organization.

(c) An air carrier operating an aircraft of a maximum certificated take-off mass in excess of 27.000 kg shall establish and maintain a flight data analysis program as part of its safety management system.

(1) An air carrier may contract its flight data analysis program to a third party provided it retains overall responsibility for maintenance of the program.

(2) A flight data analysis program shall be non-punitive and contain adequate safeguards to protect the source(s) of the data.

(d) An air carrier shall establish a flight safety documents system, for the use and guidance of operational personnel, as part of its safety management system.

(e) A service provider shall, as part of the SMS documentation, develop and maintain a Safety Management System Manual (SMSM), to communicate the organization's approach to safety throughout the organization.

(f) The SMSM shall document all aspects of the SMS, and its contents shall include the following:

(1) Scope of the Safety Management System;

(2) Safety policy and objectives;

(3) Safety accountabilities;

(4) Key safety personnel;

(5) Documentation control procedures;

(6) Hazard identification and risk management schemes;

(7) Safety performance monitoring;

(8) Emergency response/contingency planning;

(9) Management of change; and

(10) Safety promotion.

1.18 Additional Information

1.18.1 Authority Gradient (SKYbrary, 2016)[13]

Authority Gradient refers to the established, and/or perceived, command and decision-making power hierarchy in a Team, Crew or Group situation, and also how balanced the distribution of this power is experienced within the Team, Crew or Group. Concentration of power in one person leads to a steep gradient, while more democratic and inclusive involvement of others results in a shallow gradient.

1. Authority

Authority is not always associated with the competence to use such authority effectively, and it may be denoted by Rank, defined by Role, adopted through Ability and/or appropriated by force of character. In terms of responsibility for decision-making, authority may also be thrust reluctantly onto another person (knowingly or unknowingly) by colleagues who shirk responsibility or feel under-confident.

2. (Extreme) Steep Authority Gradient

When a team leader has an overbearing, dominant and dictatorial style of management, the team members will experience a steep authority gradient. Team members will view such leaders as overly opinionated, stubborn, and aggressive. When such conditions exist, expressing concerns, questioning decisions, or even simply clarifying instructions will require considerable determination as any comments will often be met with criticism. Team members may then perceive their input as devalued or unwelcome and cease to offer anything; and, in extreme cases, cease to participate completely.

Steep Authority gradients act as barriers to team involvement, reducing the flow of feedback, halting cooperation, and preventing creative ideas for threat analyses and problem solving. Only the most assertive, confident, and sometimes equally dominant team members will feel able to challenge authority. Authoritarian leaders are likely to consider any type of feedback as a challenge and respond aggressively; thereby reinforcing or steepening the gradient further.

13 SKYbrary. (2016). Authority Gradient. Viewed on 22 July 2016, http://www.skybrary.aero/index.php/Authority_Gradients

Authoritarian leaders are often described as "goal orientated" at the expense of "people orientation". They may themselves consider that this is the case, but by denying themselves the resources available (skills, knowledge and motivational support of other team members) their actions are self-defeating and goals are less likely to be attained.

3. (Extreme) Shallow Authority Gradient

A "paternalistic" leader who only pursues a course of action that has been democratically agreed, following equal opportunity for each and every team member to give input, will have reduced the authority gradient to zero. Decision-making will be extremely slow, and by giving equal opportunities to all, irrespective of experience levels, some of those decisions will be wrong. This in itself can undermine the leader's authority in the eyes of more experienced team members and possibly lead to their disengagement.

Such circumstances, and subsequent breakdown of communication, may also result in some team members acting independently of the leader. Responsibilities may become blurred.

1.18.2 Crew Resource Management (CRM)

The basic principle of Crew Resource Management is the application of team management concepts and the effective use of all available resources to operate a flight safely. In addition to the aircrew, it includes all other groups routinely working with the aircrew who are involved in decisions required to operate a flight. These groups include, but are not limited to, aircraft dispatchers, flight attendants, maintenance personnel, and air traffic controllers.

Throughout the CRM training, the techniques that help build good CRM habit patterns in the flight deck are discussed. For example, the situational awareness and communications are stressed. Situational awareness or the ability to accurately perceive what is going on in the flight deck and outside the aircraft, requires on going questioning, crosschecking, communication, and refinement of perception.

Situational Awareness (Endsley, 1999) [14]

Situation Awareness Definition

Situation awareness is formally defined as "the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future" (Endsley, 1988). Situation awareness therefore involves perceiving critical factors in the environment (Level 1 SA), understanding what those factors mean, particularly when integrated together in relation to the aircrew's goals (Level 2), and at the highest level, an understanding of what will happen with the system in the near future (Level 3). These higher levels of SA allow pilots to function in a timely and effective manner.

14 Endsley, MR. (1999). Situation Awareness in Aviation Systems. In: Garland DJ, Wise JA, eds. Handbook of aviation human factors. Human factors in transportation. Mahwah, NJ: Lawrence Erlbaum Associates, 1999:257–76.

Level 1 SA — Perception of The Elements in The Environment.

The first step in achieving SA is to perceive the status, attributes, and dynamics of relevant elements in the environment. A pilot needs to perceive important elements such as other aircraft, terrain, system status and warning lights along with their relevant characteristics. In the cockpit, just keeping up with all of the relevant system and flight data, other aircraft and navigational data can be quite taxing.

Level 2 SA — Comprehension of The Current Situation.

Comprehension of the situation is based on a synthesis of disjointed Level 1 elements. Level 2 SA goes beyond simply being aware of the elements that are present, to include an understanding of the significance of those elements in light of one's goals. The aircrew puts together Level 1 data to form a holistic picture of the environment, including a comprehension of the significance of objects and events.

Level 3 SA — Projection of Future Status.

It is the ability to project the future actions of the elements in the environment, at least in the very near term, that forms the third and highest level of situation awareness. This is achieved through knowledge of the status and dynamics of the elements and a comprehension of the situation (both Level 1 and Level 2 SA). Amalberti and Deblon (1992) found that a significant portion of experienced pilots' time was spent in anticipating possible future occurrences. This gives them the knowledge (and time) necessary to decide on the most favorable course of action to meet their objectives.

ERRORS IN SITUATION AWARENESS

Level 1 - Failure to Correctly Perceive the Situation.

At the most basic level, important information may not be correctly perceived. In some cases, the data may not be available to the person, due to a failure of the system design to present it or a failure in the communications process. This factor accounted for 11.6% of SA errors, most frequently occurring due to a failure of the crew to perform some necessary task (such as resetting the altimeter) to obtain the correct information. In other cases, the data is available, but is difficult to detect or perceive, accounting for another 11.6% of SA errors in this study. This included problems due to poor runway markings and lighting and problems due to noise in the cockpit.

Many times, the information is directly available, but for various reasons, is not observed or included in the scan pattern, forming the largest single causal factor for SA errors (37.2%). This is due to several factors, including simple omission — not looking at a piece of information, attentional narrowing and external distractions that prevent them from attending to important information. High task load, even momentary, is another a major factor that prevents information from being attended to.

In other cases, information is attended to, but is misperceived (8.7% of SA errors), frequently due to the influence of prior expectations. Finally, in some cases it appears that a person initially perceives some piece of information but then forgets about it (11.1% of SA errors) which negatively effects SA as it relies on keeping information about a large number of factors in memory.

Forgetting was found to be frequently associated with disruptions in normal routine, high workload and distractions.

Level 2 SA - Failure to Comprehend the Situation

In other cases, information is correctly perceived, but its significance or meaning is not comprehended. This may be due to the lack of a good mental model for combining information in association with pertinent goals. 3.5% of SA errors were attributed to the lack of a good mental model, most frequently associated with an automated system.

In other cases, the wrong mental model may be used to interpret information, leading to 6.4% of the SA errors in this study. In this case, the mental model of a similar system may be used to interpret information, leading to an incorrect diagnosis or understanding of the situation in areas where that system is different. A frequent problem is where aircrew have a model of what is expected and then interpret all perceived cues into that model, leading to a completely incorrect interpretation of the situation.

In addition, there may also be problems with over-reliance on defaults in the mental model used, as was found for 4.7% of the SA errors. These defaults can be thought of as general expectations about how parts of the system function that may be used in the absence of real-time data. In other cases, the significance of perceived information relative to operational goals is simply not comprehended or several pieces of information are not properly integrated. This may be due to working memory limitations or other unknown cognitive lapses. 2.3% of the SA errors were attributed to miscellaneous factors such as these.

Level 3 SA - Failure to Project Situation into the Future

Finally, in some cases, individuals may be fully aware of what is going on, but be unable to correctly project what that means for the future, accounting for 2.9% of the SA errors. In some cases this may be due to a poor mental model or due to over projecting current trends. In other cases, the reason for not correctly projecting the situation is less apparent. Mental projection is a very demanding task at which people are generally poor.

General

In addition to these main categories, two general categories of causal factors are included in the taxonomy. First some people have been found to be poor at maintaining multiple goals in memory, which could impact SA across all three levels. Secondly, there is evidence that people can fall into a trap of executing habitual schema, doing tasks automatically, which render them less receptive to important environmental cues. Evidence for these causal factors was not apparent in the retrospective reports analyzed in the ASRS or NTSB databases.

1.18.3 Reporting of Runway Surface Condition

ICAO Annex 14 – Aerodromes, Volume I – Aerodrome Design and Operations

2.9 Condition of the movement area and related facilities

2.9.1 Information on the condition of the movement area and the operational status of related facilities shall be provided to the appropriate aeronautical information service units, and similar information of operational significance to the air traffic services units, to enable those units to provide the necessary information to arriving and departing aircraft. The information shall be kept up to date and changes in conditions reported without delay.

1.19 Useful or Effective Investigation Techniques

The investigation was conducted in accordance with the KNKT approved policies and procedures, and in accordance with the standards and recommended practices of Annex 13 to the Chicago Convention.

2 ANALYSIS

The investigation did not find any abnormality of the aircraft systems and therefore the aircraft system was not considered to contribute to the accident.

The analysis will discuss:

- Factors contributing to the aircraft overrun;
- The Authority Gradients;
- Situational awareness;
- Management oversight.

2.1 Factors Contributing to the Aircraft Overrun

Based on the information collected, the investigation found several factors that contributed to the aircraft overrun. The factors were the approach profile, aircraft speed, approach configuration, touchdown point and deceleration forces.

Prior to reaching point SEMAU, the pilots received information that the Kupang was rain from the ATIS and communication between air traffic controller and the other pilot.

When the aircraft arrived at point SEMAU, it was about 2,000 feet higher than the required altitude. During the approach after point SEMAU, the flight crew shortened the approach path by flying direct to the final approach path and used a high speed. This method was intended to minimize the delay of the flight schedule that had been 74 minutes late at the time of the departure from Bali.

The final approach was conducted on a higher profile than the published instrument procedure. The DVDR recorded a rate of descent more than 2,000 feet/minute followed by the activation of the EGPWS warning "TOO LOW TERRAIN". The high rate of descent was required to gain the correct approach path with the consequences of corresponding high aircraft speed. The flight reached the correct glide path on short final.

The voice recorder data showed that the pilot selected flap to position 2 which was planned with flap position 5. The flaps could not be selected more than 2 since the aircraft speed was above the minima for flap 3 selection of 200 KIAS.

The high approach speed triggered the aural warning "HIGH SPEED" which was continuously active for over one minute prior to touchdown. The flight data indicated that the aircraft speed was approximately 200 knots when the aircraft at altitude 50 feet above runway, which was approximately 62 knots above the speed target.

The high approach speed and the PIC commanded to delay touchdown resulted in the aircraft touching down approximately at the middle of the runway with high speed.

A high speed touchdown and wet runway requires longer ground roll especially on wet runway as the deceleration became less effective.

The flight data revealed that during the landing roll, the thrust reversers were working properly, however the brake pressures indicated below 1,000 psi while the maximum pressure is 3,000 psi. This was due to the autobrake selected on position low and indicated that the anti-skid normal operational to maintain an optimal slip ratio based on the runway friction coefficient.

The aircraft was not fully configured for landing, delayed touchdown and high speed combined with low brake pressure application on wet runway resulting in insufficient runway for deceleration.

2.2 The Authority gradients

On the first flight to Ende, the SIC acted as pilot flying and at position about 5 minutes out, the PIC commanded to delay speed reduction and shortened the approach. This action was intended to speed up the flight, considering the Ende airport operating hours. On short final, the PIC reminded the SIC not fly too high. The voice recorder data did not record any SIC comment to those PIC commands.

On the flight to Kupang, the SIC also acted as pilot flying. During commencing the approach after left point SEMAU, the PIC suggested to increase the aircraft speed and shortened the approach path. Both pilots realized that the aircraft altitude was approximately 2,000 feet above the target altitude as described in the instrument approach procedure.

The SIC intended to select the speed brake to compensate the higher approach altitude and speed while the PIC suggested to perform non-standard configuration by selecting the landing gear down, thereafter, the SIC did not comment on the PIC suggestion and followed the PIC suggestion.

The PIC stated that a safe landing can be achieved with the existing approach condition. The SIC did not express any intention to correct the approach condition. The aircraft gained the correct approach path on short final but with speed approximately 40 knots higher than the target.

The voice recorder data indicated that during these flights, especially during approach, the PIC provided lots of suggestions and most of them were followed by the SIC. Particularly during the approach at Kupang when the PIC suggested shortening the approach and to increase the aircraft speed while the aircraft altitude and speed were above the approach profile. There was no rejection by the SIC.

The voice recorder did not record any crew briefings for approach and departure. The absence of the crew briefing might result in both pilots not having an agreed plan of the approach path and this might lead to misunderstanding each other. The misunderstanding was overcome by the PIC suggestion and commands.

Most of the instruction, coordination of the approach task implementations, indicated that the PIC was dominating the coordination in the overall time. There was no indication of the SIC challenging the PIC commands. This might be an indication of steep authority gradient, when a team leader dominant and resulted to the SIC reluctant to expressing concerns, questioning decisions, or even simply clarifying instructions.

The instructions from the PIC without rejection from the SIC, was an indication of steep authority gradients acted as barriers to team involvement, reducing the flow of feedback, halting cooperation, and preventing creative ideas for threat analyses and problem solving. These were indication of ineffective coordination (CRM implementation), and resulted to lack of synergy that might contribute to the lack of alternation to correct the improper condition.

2.3 Situational Awareness

During the approach at Ende, the CVR recorded the pilot conversation that the approach was too high and activation of EGPWS warning "BANK ANGLE" below 40 feet where the aircraft landed safely three seconds later.

The aircraft safely landed at Ende which has 1,650 meters runway length, which could be assumed that the available ground roll was 1,345 meters as normally an aircraft touch down at 1,000 feet or 305 meters from the runway threshold.

During approach at Kupang, the aircraft altitude was higher than the approach profile and the speed was approximately 40 knots higher than the target. The aural warning of "HIGH SPEED" was continuously active since one minute prior to touchdown. The pilots decided to continue the approach and considered that safe landing could be made referring to the runway was 2,500 meters and the previous experience that the aircraft required approximately 1,345 meters ground roll.

The PIC had several experiences of attempting landing with certain target to stop with success and successful landing at airports with relatively short runway including Ende. These experiences might have developed confidence to the aircraft performance and his ability to handle the aircraft.

During approach at Kupang, the aircraft altitude was higher than the approach profile and the speed was approximately 200 knots. The aural warning of "HIGH SPEED" was continuously active on the last one minute prior to touchdown. The aircraft had not been properly configured for landing. These were the Level 1 of the Situational Awareness.

The previous experiences of landing on short runway and successfully landed the aircraft on certain target had developed confidence to the aircraft performance and his ability to handle the aircraft. These were the level 2 of the Situational Awareness that might have affected the pilot judgment.

The result of the projection to the near future as level 3 of Situational Awareness deviated from the pilot prediction. This was due to the current approach condition and warnings were not correctly perceived. Information such as wet runway and aircraft configuration were not considered. The pilot success experiences were conducted on dry runway and aircraft fully configured for landing, while on the accident flight the runway was wet and the flap was selected to position 2 instead of 5.

The decision to land was based on the pilot perceived to their ability to control the aircraft and landed safely on the existing condition without proper risk assessment. The confidence developed along the time of successful landings on short runways.

2.4 Management Oversight

The operator Company Operation Manual (COM) stated that the duty and responsibility of the Operation Manager included the requirement to ensure safe, efficient and professional operation.

The Chief Pilot has a duty and responsibility to support the Operation Manager by ensuring all pilots comply with and implement company procedures. The COM also described the duty and responsibility of the Safety Manager to monitor and advise on all company flight safety activities which may have an impact on flight operations.

Other than the training and proficiency check on the simulator, the operator had not established a system to monitor the pilot performance and compliance to the company procedures especially during routine operations.

The Chief Pilot and the Operation Manager were also active pilots and performed regular flights. This activity consumed the time available to perform the tasks. The operator safety department had minimum personnel with several duties and responsibilities including monitoring, conducting safety survey and managing the company reporting system. The absence of a system to monitor daily operations was not detected by the safety department. This might be an indication that the safety department was unable to perform the assigned task with the existing number of personnel compared to the amount of task.

During the assessment prior to join the company and the proficiency checks on the simulator, the assessor noted that the PIC showed standard performance. Based on this assessment, the PIC was assigned in the first group of pilots to conduct Embraer type rating training and was planned to be one of the company instructor for this type. The Embraer training was performed with satisfactory result, as indicated by the instructor remarks that noted good performance.

The voice data did not record any checklist reading or crew briefing performed during approach to Ende and the accident flight. The accident flight revealed that some company procedures have been neglected and did not show a satisfactory standard of pilot performance.

The deviation of pilot performance was undetected by the management as a result of the absence of management oversight of the pilot’s performance. The management oversight also did not detect several approaches at Ende that did not comply with the company procedure.

2.5 Analysis Summary

This analysis determined that the aircraft was serviceable prior to the conduct of both approaches at Ende and Kupang. However, the approaches were not conducted in accordance with the published visual approach (Ende) or instrument approach (Kupang) charts. In both cases, the approaches exceeded the requirements of the company stabilized approach criteria that required the initiation of a go-around.

The crew were fully trained and qualified to conduct the flight. However, there appeared to be a steep authority gradient between the PIC and the SIC, as the PIC made numerous suggestions to the SIC, which were not challenged. Despite both crewmembers being aware of the company requirements, they both continued the un-stabilized approaches, which eventually resulted in the over-run of the runway at Kupang. In addition, the crew did not conduct the required departure and descent checklists during the flights. Checklists form a part of company standard operating procedures and are essential to the maintenance of high safety standards.

The company oversight of the pilots did not detect any anomalies in their normal operating behavior, prior to the accident.

3 CONCLUSION

3.1 Findings[15]

1. The aircraft was airworthy prior to the occurrence and was operated within the weight and balance envelope. Aircraft serviceability was considered not to contribute to the accident.
2. All crew held valid licenses and medical certificates.
3. The SIC acted as pilot flying and the PIC acted as pilot monitoring on both flights that day.
4. The voice recorder did not record any crew briefing and checklist reading.
5. The approach was intended to follow the RNAV approach runway 07. The aircraft arrived at point SEMAU at altitude about 2,000 feet above the stated altitude in the approach chart and the approach was shortened with high speed.
6. The landing configuration setting was performed with non-standard sequence by extending the landing gear down first with intention to increase drag.
7. The landing was planned with flap 5 configuration and auto-brake low. The voice data recorded that the pilot selected the flap to 2 position.
8. The aural warning "HIGH SPEED" continuously active for one minute until touchdown and on short final, the EGPWS aural warnings "SINK RATE" and "TOO LOW TERRAIN" active.
9. At altitude 50 feet above runway, the aircraft speed was 200 knots or approximately 62 knots higher than the target speed.
10. The aircraft touched down at approximately on the middle of the runway. During the landing roll, the thrust reversers were applied to maximum and the brake pressures were relatively low.
11. Improper flight management approach resulted in the aircraft not fully configured for landing, prolong and high speed on touchdown combined with low brake pressure application resulted in insufficient runway for deceleration.
12. The voice recorder data showed that the PIC provided several suggestions and commands that were followed by the SIC. Particularly during the approach at Kupang when the PIC suggested shortening the approach and to increase the aircraft speed while the aircraft altitude and speed were above the approach profile. There was no objection by the SIC.
13. The voice recorder did not record any crew briefing for approach and departure. The absence of the crew briefing might cause both pilots did not have agreed plan of the approach path and misunderstanding each other. The misunderstanding was overcome by the PIC suggestion and commands.
14. Based on the voice recorder data indicated that the PIC was dominating the

15 Findings are statements of all significant conditions, events or circumstances in the accident sequence. The findings are significant steps in the accident sequence, but they are not always causal, or indicate deficiencies. Some findings point out the conditions that pre-existed the accident sequence, but they are usually essential to the understanding of the occurrence, usually in chronological order.

coordination which might be an indication of steep authority gradient.

15. Other than the training and proficiency check on simulator, the operator had not established system to monitor the pilot performance and compliance to the company procedures especially during the daily operation.
16. There was an indication that the safety department was unable to perform the assigned task with the existing number of personnel compared to the amount of task.
17. The DVDR data showed that the approaches at Ende did not comply with the aircraft operator approach procedure.
18. The deviation of pilot performance was undetected by the management caused by the absence of management oversight to the pilot performance.
19. The investigation could not find the standard operating procedure that describes the usage the visibility chart for the air traffic controller.
20. The investigation could not find the standard operating procedure to determine the wind information from the three different sources for the air traffic controller.
21. The investigation could not find procedure associated to dissemination significant information of runway condition for the pilot to determine runway braking action.

3.2 Contributing Factors[16]

- The steep authority gradient resulted in lack of synergy that contributed to least of alternation to correct the improper condition.
- Improper flight management on approach resulted to the aircraft not fully configured for landing, prolong and high speed on touchdown combined with low brake pressure application resulted in insufficient runway for deceleration.
- The deviation of pilot performance was undetected by the management oversight system.

16 "Contributing Factors" are those events in which alone, or in combination with others, resulted in injury or damage. This can be an act, omission, conditions, or circumstances if eliminated or avoided would have prevented the occurrence or would have mitigated the resulting injuries or damages.

4 SAFETY ACTIONS

At the time of issuing this preliminary report, the Komite Nasional Keselamatan Transportasi (KNKT) has been informed safety actions taken by the PT. Kalstar Aviation and PT. Angkasa Pura I branch El Tari Airport resulting from this occurrence.

4.1 PT. Kalstar Aviation

- On 22 December 2015, issued notice to flight attendant number 028/NOFA/XII/2015 to ensure all flight attendant on duty conducting flight attendant briefing refer to Flight Attendant Manual (FAM) chapter 1.3.3 and to review the emergency procedure refer to FAM chapter 5.
- On 23 December 2015, issued safety notice to pilot number 030/KSA-CASO/XII/2015 contained that all crews of Kalstar Aviation:
  1. *Are not allowed takeoff and landing when the weather is below minimum limit either visual or instrument flight.*
  2. *All flight crews must pay attention to stabilized approach criteria, in accordance with both visual and instrument flight.*
  3. *In case of un-stabilized approach occurs or other conditions that are considered dangerous to landing, GO-AROUND procedure must be executed.*
  4. *Crew coordination and communication must be applied all phase of flight (CRM).*
  5. *Each pilot has the right to take over the control plane if the PF do things that are not appropriate safety procedures.*
  6. *All pilots have to avoid bad weather (Avoid bad weather).*
  7. *In case of entering bad weather must perform procedure of turbulence speed penetration and reduces maneuvers.*
- Enforced the recurrent training of Approach Landing Accident Reduction (ALAR) – Controlled Flight into Terrain (CFIT) for all pilot and not to assign the pilot to duty before accomplished the recurrent training.
- Enforced the CRM recurrent training for all pilot with subject of commandership and human factor issue.
- Reemphasized line check or Line Operation Safety Audit (LOSA) for all pilot.
- Briefed all pilot regarding to the procedures, crew briefing, cockpit silent policy and stabilized approach criteria.
- Included the un-stabilized approach in the proficiency syllabus.
- Restructured the Operation Department by establishing department responsible for crew training (Training Department).
- Revised the visual approach guidance of Ende.
- Developing Flight Operation Quality Assurance (FOQA) as method for crew monitoring.

Responding to KNKT safety recommendation issued on the preliminary report, PT. Kalstar Aviation performed several corrective actions as follows:

- Briefed all pilots regarding to the procedures and crew briefing for landing.
- Briefed all pilots regarding to the stabilized approach criteria.
- Briefed all pilots regarding to response to the aircraft and EGPWS warning system appropriately.

4.2 PT. Angkasa Pura I Branch Office El Tari International Airport

On 2 June 2016, the PT. Angkasa Pura I branch office El Tari International Airport conducted runway friction test using Mu-meter and the result was above the minimum friction level of 0.42.

4.3 AirNav Indonesia District Office Kupang

Responding to the KNKT safety recommendation issued on the preliminary report, the AirNav Indonesia district office Kupang updated the Standard Operating Procedure (SOP) for the air traffic controller to include the utilization of visibility chart and determination of wind information, as follows:

4.7 Avoid Bad Weather

2. *El Tari Tower give data information about wind direction and speed from AWOS display. Reading data in AWOS display accordance with current runway in used. And when controller see information from AWOS display is not correct with current condition, EI Tari Tower should make coordination with BMKG.*

4. *EI Tari Tower give information visibility to the pilot according to visibility from BMKG or AWOS Display. Reading data in AWOS display accordance with current yunway in used. If information from BMKG or AWOS Display is not correct with current condition, EI Tari Tower observe by visual reference to Visibility Chart.*

5 SAFETY RECOMMENDATIONS

As result of the investigation, Komite Nasional Keselamatan Transportasi (KNKT) identified un-achievement of effective defenses within the organization frame work. This was indicated by some of safety issues which associated to system operation oversight and flight procedurals identified prior to flight accident.

In respect to the safety, the recommendation is also refer to the findings that had or might have endangered the aircraft operation in the future.

KNKT had been notified several safety actions conducted by PT. Kalstar Aviation and PT. Angkasa Pura I branch El Tari International Airport, the KNKT considered the safety actions are relevant to improve safety. In addition, KNKT issues safety recommendations to address safety issues identified in this investigation.

5.1 PT. Kalstar Aviation

- **04.O-2016-73.2**

  To ensure pilot performs the operational procedure such as checklist reading, crew briefing properly and consistently.

- **04.O-2016-78.1**

  To develop oversight system that ensure the procedures are implemented properly and to monitor pilot performance.

- **04.O-2016-79.1**

  To ensure the comprehensive Safety Management System is implemented correctly.

5.2 PT. Angkasa Pura I Branch El Tari International Airport Kupang

- **04.B-2016-25.2**

  To develop a reporting system to enable disseminate significant information of runway condition to Air Traffic Service (ATS) unit and for those units to provide the necessary information to arriving and departing aircraft without delay as required in ICAO Annex 14 Chapter 2.9.1.

5.3 Directorate General of Civil Aviation (DGCA)

- **04.B-2016-1.3**

  To emphasize all aircraft operator to comply with stabilize approach criteria.

- **04.B-2016-81.1**

  To ensure all aircraft operators implements safety management system as required by Indonesia Civil Aviation Safety Regulation.

- **04.B-2016-25.3**

  To include in the Indonesia regulation, the procedure of reporting system from the airport operator to the ATS unit to enable disseminate significant information of runway condition to arriving and departing aircraft without delay as required in ICAO Annex 14 Chapter 2.9.1.

6 APPENDICES

6.1 Notice to Flight Attendant

KALSTAR AVIATION

NOFA

Kepada Yth	: All Flight Attendant
Dari	: Chief Flight Attendant
Hal	: Accident PK – KDC
Nomor	: 028/NOFA/XII/2015
Tanggal	: 22 Desember 2015

Dengan hormat,

Sehubungan dengan accident PK – KDC pada tanggal 21 Desember 2015, bersama ini disampaikan kepada seluruh FA on duty sebagai berikut:

1. Selalu melaksanakan Flight Attendant Briefing (refer to FAM Chapter 1.3.3)
2. Me-review kembali Emergency Procedure (refer to FAM Chapter 5)

Demikian disampaikan untuk dapat dilaksanakan. Atas perhatian dan kerjasamanya diucapkan terima kasih.

6.2 Safety Notice to Pilot

KALSTAR AVIATION	SAFETY NOTICE	STATUS
		√

Number : 030/KSA-CASO/XII/2015
Attention : All Pilot
Date : 23 Dec 2015
Subject : Runway excursion

Recently the unfavorable weather conditions at lately , urged to all crews Kalstar Aviation

1. Are not allowed takeoff and landing when the weather is below minimum limit either visual or instrument flight,
2. All flight crews must pay attention to stabilized approach criteria, in accordance with both visual and instrument flight,
3. In case of un-stabilized approach occurs or other conditions that are considered dangerous to landing, ***GO-AROUND*** procedure must be executed,
4. Crew coordination and communication must be applied all phase of flight (CRM),
5. Each pilot has the right to take over the control plane if the PF do things that are not appropriate safety procedures
6. All pilots have to avoid bad weather (Avoid bad weather) ,
7. In case of entering bad weather must perform procedure of turbulence speed penetration and reduces maneuvers.

and have save flight.

6.3 Proficiency Check Syllabus Training

KALSTAR AVIATION

RECURRENT FFS SESSION 1

PILOT NAME	LICENSE NO.	DATE of CHECK	Training For		
			CAPT	F/O	R/H QUALIFIED
Route : ZFW : FUEL : TOW : RSV :	Dawn / Day / Dusk / Night Flaps : MAC/Stab : C.I : Temp. Dev :	Wind : Vis : Present Wx : Temp / Dew : QNH :	LOCATION :		

TIME	EXCERCISES	PF			PM		
		S	SB	U	S	SB	U
4 HOURS	Flight Preparation						
	Dark Cockpit Situation / Internal Safety Inspection						
	Power Up procedure						
	Normal Start						
	Taxi Out / Pack 2 Fail MEL						
	Take Off						
	Rejected Take Off (Repositioning)/Take Off Reset						
	Take Off – Climb to 10.000 ft , while climbing TCAS performed						
	Reaching Cruise Level, Steep Turn and Clean Stall						
	DC BUS 1 Off						
	Radar Vector Back to Airport						
	ILS Approach						
	Abnormal Approach and Landing						
	Take Off Reset						
	Climb to 10.000 ft						
	Windshear, continue Windshear recovery						
	Reaching Altitude, Rudder Fail						
	Radar Vector Back to Airport						
	VOR Approach, Unstabilize approach						
	Go Around, Continue Visual Approach						
	Full stop Landing						

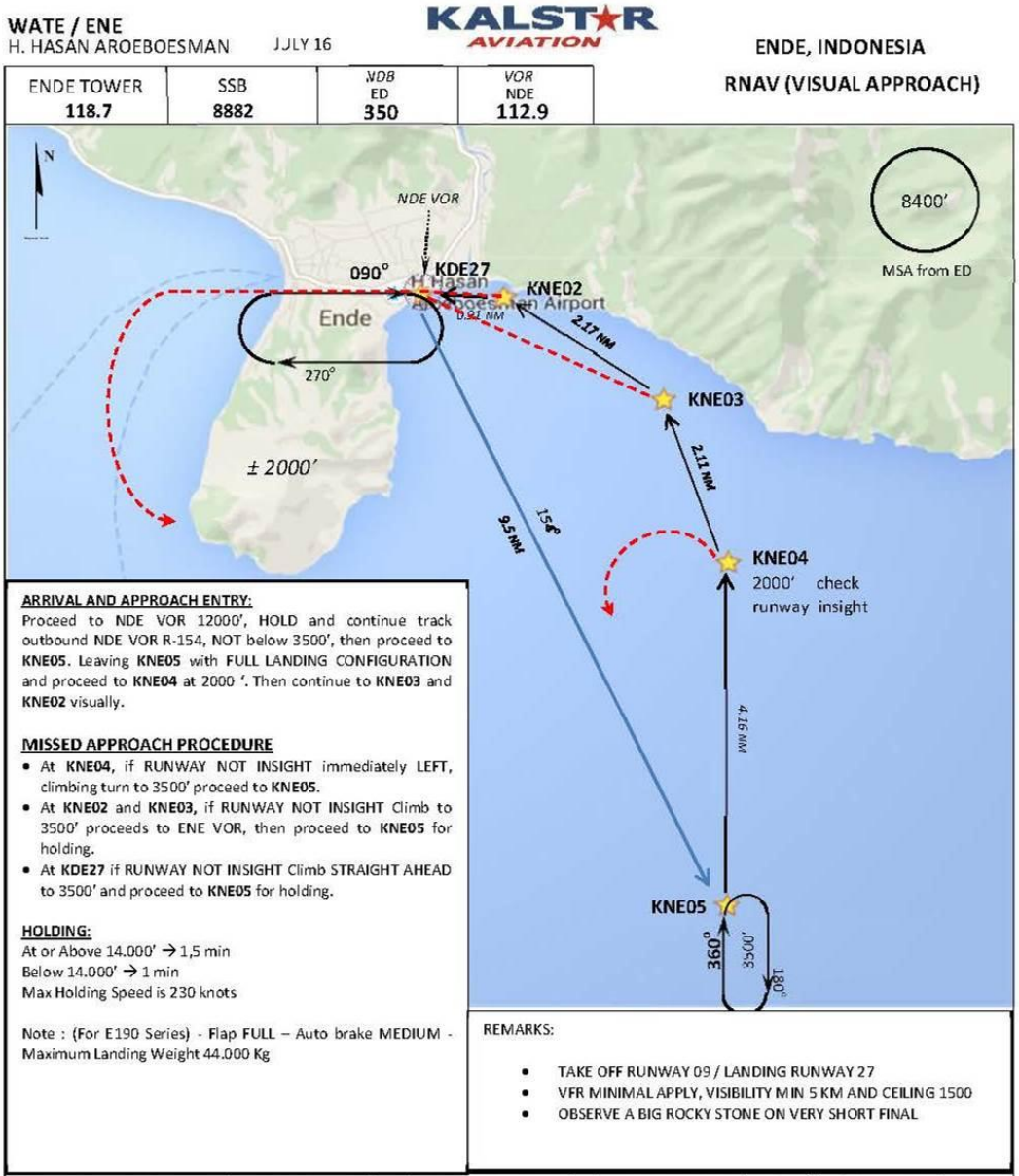
Comments :

☐ U : Unsatisfactory ☐ S : Satisfactory

PF HOURS :	PM HOURS :	TOTAL :	Accuracy : - Altitude : ± 100 feet - Speed : ± 10 kts - Heading : ± 10 degree

Trainee Name and Signature	Instructor Name and Signature
(.....)	(.....) LOA No. :

6.4 Visual Approach Guidance of Ende



Checkpoint Information	KNE02	KNE03	KNE04	KNE05
SOUTH	08° 50'59"	08° 52'13"	08° 54'12.1"	08° 58'21"
EAST	121° 41'01.7"	121° 42'50"	121° 43'33.4"	121° 43'32"

Revision : 02 (July 2016)
Change : relocation point KNE02, and KNE04 (see checkpoint information) |change text at KNE04 "2000"
|add missed approach procedure for point KNE04, KNE03 and |

WATE/ENE - ENDE, INDONESIA

KALSTAR AVIATION

D.G.C.A
H. HASAN AEROEBOESMAN
STRIP/CIVIL
JL. AHMAD YANI ENDE 86316, FLORES
NUSA TENGGARA TIMUR.
Phone: (0381) 21512, 21356, 21531
Fax: (0381) 22172:

ARP coordinate: **S 8 50.88 E 121 39.8**
(8°50'53"S 121°39'48"E)
Elevation: **7.5 ft** (2.3 m)
Temperature: 0°C (32°F)
Magnetic Var.: 2.08°
Traffic type: VFR
Dist. from city: 2 km
Time region: UTC +8
Operation hours: H/S

RWY	RUNWAY PHYSICAL CHARACTERISTICS					DECLARED DISTANCE						
	Dimension of RWY	Surface Strength	Threshold		Slope	Dimension			TORA	TODA	ASDA	LDA
			Coordinates	Elevation		SWY	CWY	RWY Strip				
09 (089°)	1650x30m (5413.37x98.42ft)	ASPHALT 25 FCXU	S 8 50.95 E 121 39.54	242ft	0°	0x0m	60x80m	1770x90m	1650m	1710m	1650m	1650m
27 (269°)			S 8 50.94 E 121 40.03	131ft	0°	0x0m	60x80m		1650m	1710m	1650m	1650m

KDE09	THRESHOLD RUNWAY 09	S 08° 50.95'	E 121° 39.54'
KDE27	THRESHOLD RUNWAY 27	S 08° 50.94'	E 121° 40.03'

REMARKS :

1. **Windshock : Available**
2. **Obstacle : High Trees & Hills on Extension RW 27**
3. **Fuel : Available**
4. **Special Info :**
   - **Observe obstacle (100°) on Final RW 27**
   - **Caution strong sea breeze occurred during dry season on short final RW 27**

Revision : 02 (July 2016)
Change : relocation point KNE02, and KNE04 (see checkpoint information) |change text at KNE04 "2000"
|add missed approach procedure for point KNE04, KNE03 and |

6.5 Runway Friction Test Result

MuMeter Run Report

ELTARI KUPANG AIRPORT

RUNWAY 07-25

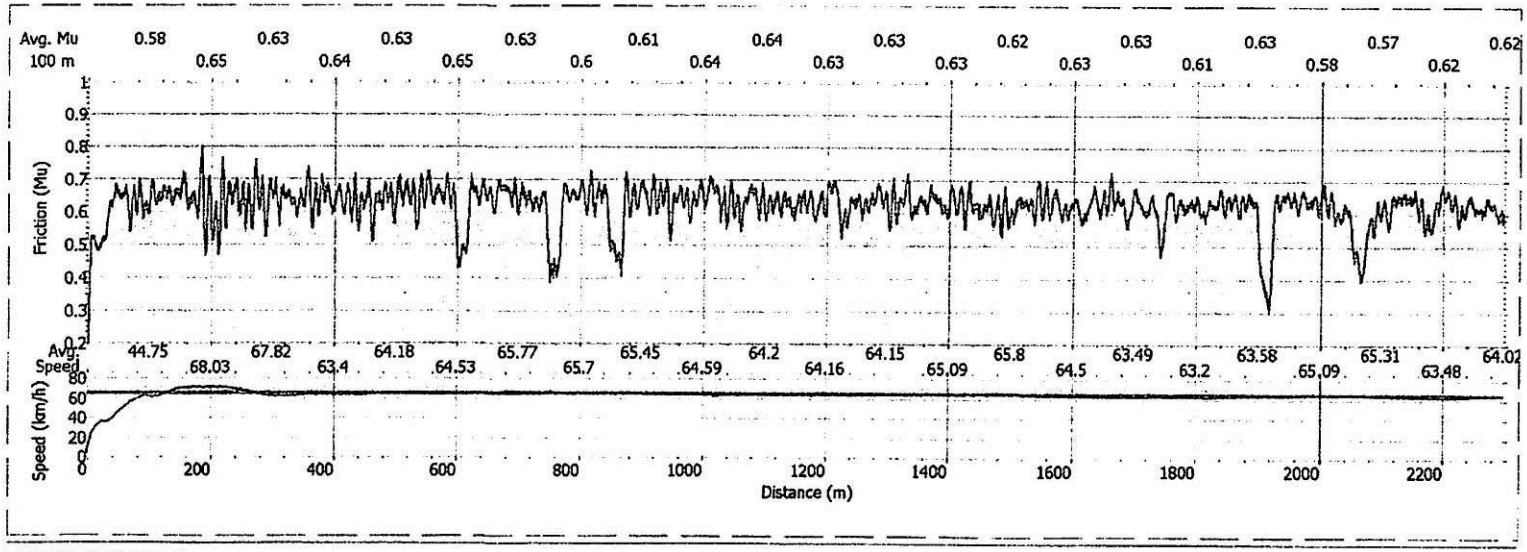
Calibration Results		
Zero Reference	18/04/2016 14:09:14	23
Distance	25/05/2010 22:05:06	406
Board Test	18/04/2016 15:01:29	8332

Average Mu	1/3	2/3	3/3	Total
07-25	0.63	0.63	0.61	0.62

Run Start:	03/06/2016 22:57:38	
Auto. End Distance	On	
Distance Travelled	2300	meters
Average Speed	63.9	km/h

Weather Condition	FINE
Air Temperature	24
Operator Notes	9 METER KANAN

Location	Event Note
m	
m	
m	



03/06/2016 23:00:13

Page 1 of 1

MuMeter Run Report

ELTARI KUPANG AIRPORT

RUNWAY 25-07

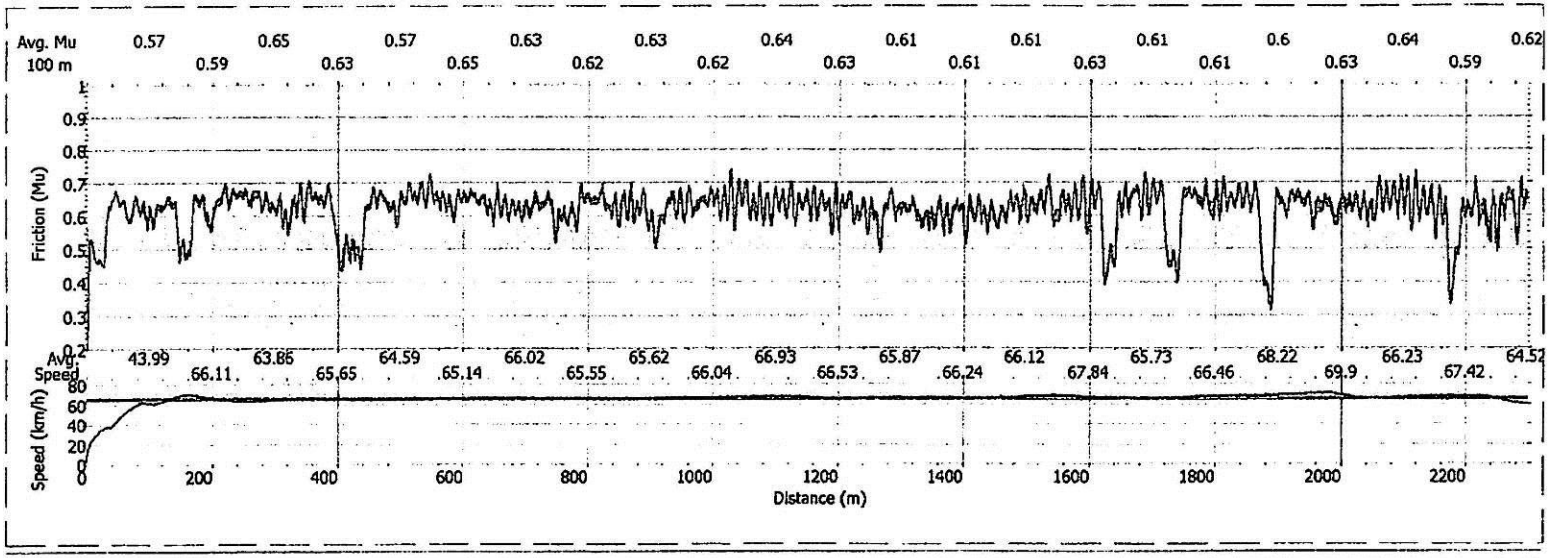
Calibration Results		
Zero Reference	18/04/2016 14:09:14	23
Distance	25/05/2010 22:05:06	406
Board Test	18/04/2016 15:01:29	8332

Average Mu	1/3	2/3	3/3	Total
25-07	0.62	0.62	0.62	0.62

Run Start:	03/06/2016 23:01:54	
Auto. End Distance	On	
Distance Travelled	2300	meters
Average Speed	65.2	km/h

Weather Condition	FINE
Air Temperature	24
Operator Notes	9 METER KIRI

Location	Event Note
m	
m	
m	



MuMeter Run Report

ELTARI KUPANG AIRPORT

RUNWAY 07-25

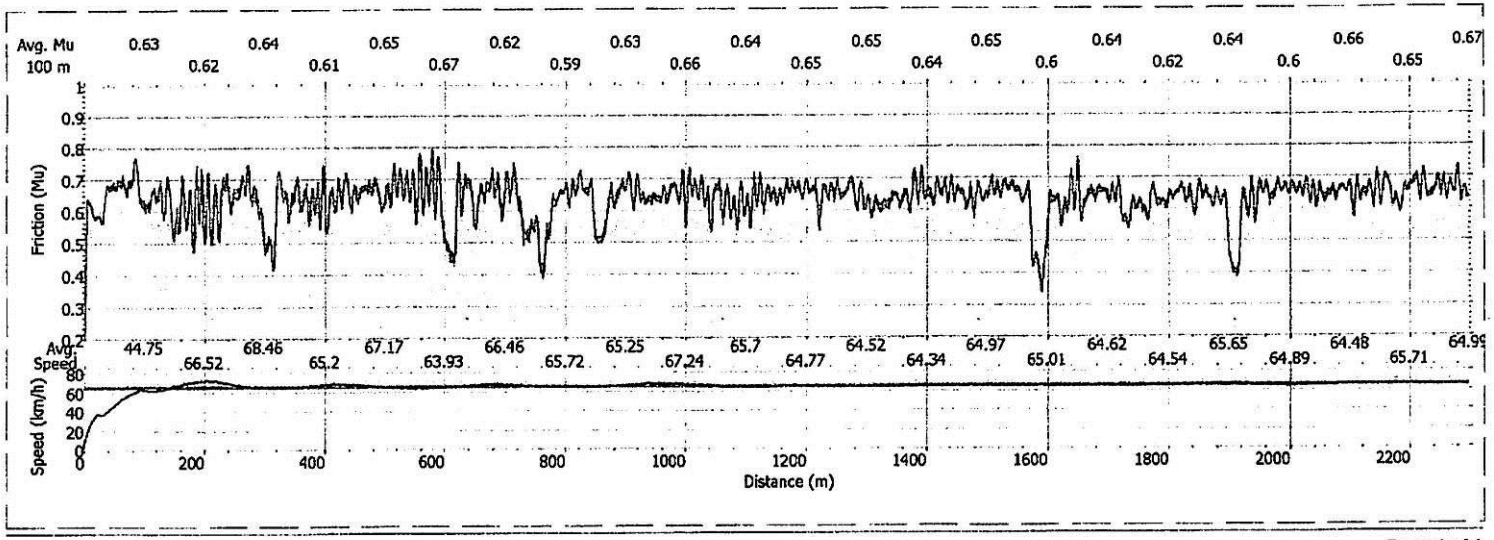
Calibration Results		
Zero Reference	18/04/2016 14:09:14	23
Distance	25/05/2010 22:05:06	406
Board Test	18/04/2016 15:01:29	8332

Average Mu	1/3	2/3	3/3	Total
07-25	0.63	0.64	0.63	0.64

Run Start:	03/06/2016 22:47:39	
Auto. End Distance	On	
Distance Travelled	2300	meters
Average Speed	64.6	km/h

Weather Condition	FINE
Air Temperature	24
Operator Notes	9 METER KIRI

Location	Event Note
m	
m	
m	



03/06/2016 22:50:37

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MuMeter Run Report

ELTARI KUPANG AIRPORT

RUNWAY 25-07

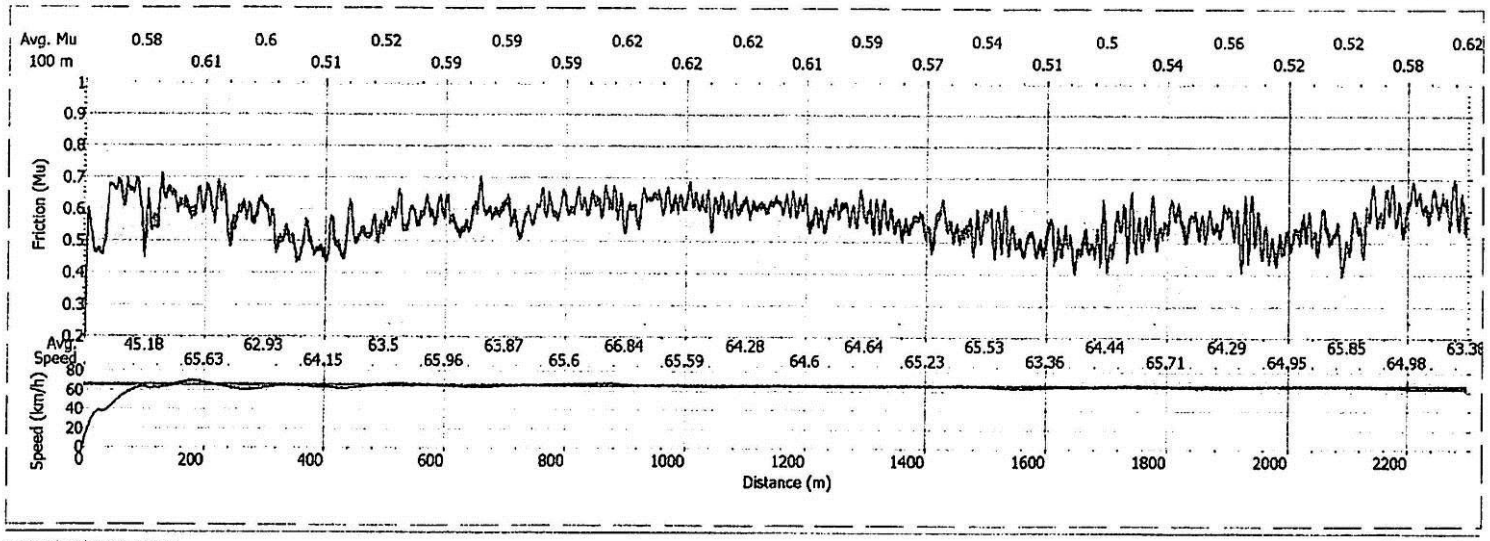
Calibration Results		
Zero Reference	18/04/2016 14:09:14	23
Distance	25/05/2010 22:05:06	406
Board Test	18/04/2016 15:01:29	8332

Average Mu	1/3	2/3	3/3	Total
25-07	0.57	0.59	0.54	0.57

Run Start:	03/06/2016 02:05:29	
Auto. End Distance	On	
Distance Travelled	2300	meters
Average Speed	63.9	km/h

Weather Condition	FINE
Air Temperature	25
Operator Notes	6 METER KANAN

Location	Event Note
m	
m	
m	



MuMeter Run Report

ELTARI KUPANG AIRPORT

RUNWAY 07-25

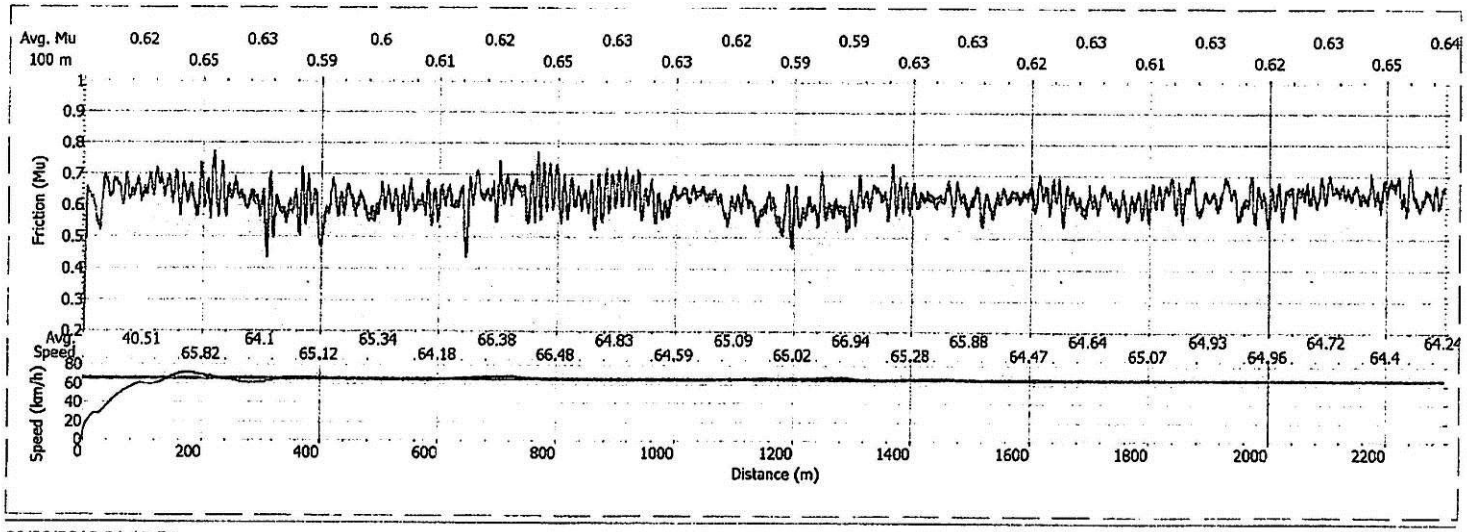
Calibration Results		
Zero Reference	18/04/2016 14:09:14	23
Distance	25/05/2010 22:05:06	406
Board Test	18/04/2016 15:01:29	8332

Average Mu	1/3	2/3	3/3	Total
07-25	0.62	0.62	0.63	0.62

Run Start:	03/06/2016 01:10:49	
Auto. End Distance	On	
Distance Travelled	2300	meters
Average Speed	64.1	km/h

Weather Condition	FINE
Air Temperature	25
Operator Notes	6 METER KANAN

Location	Event Note
m	
m	
m	



03/06/2016 01:13:58

MuMeter Run Report

ELTARI KUPANG AIRPORT

RUNWAY 25-07

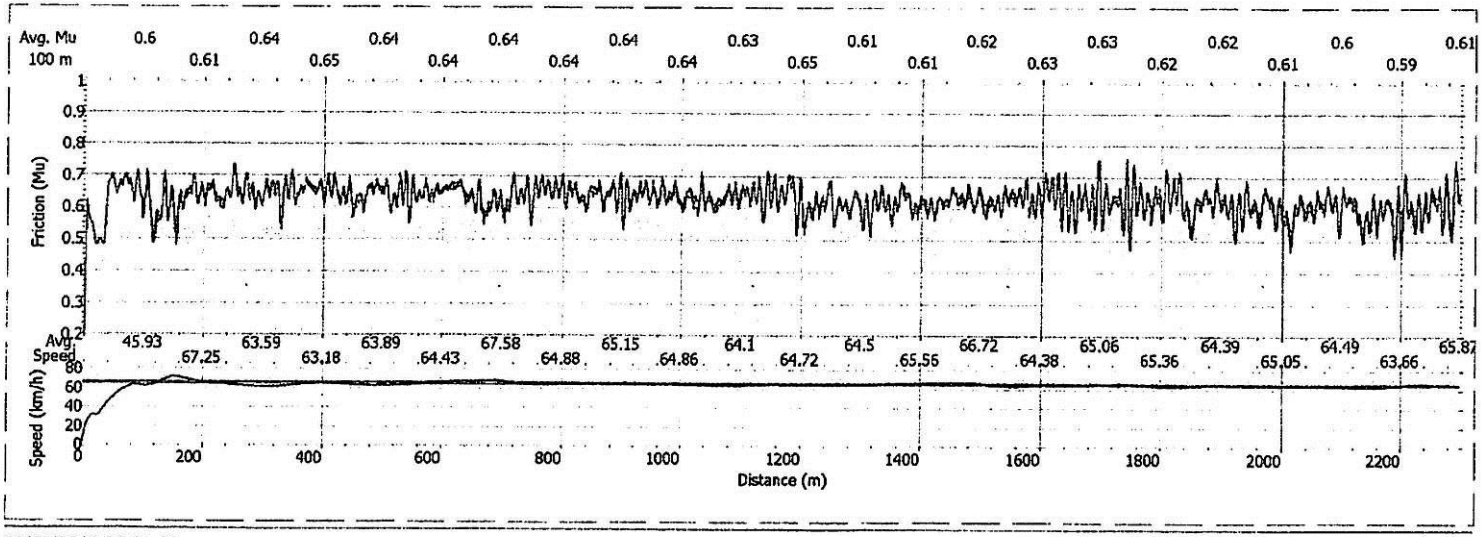
Calibration Results		
Zero Reference	18/04/2016 14:09:14	23
Distance	25/05/2010 22:05:06	406
Board Test	18/04/2016 15:01:29	8332

Average Mu	1/3	2/3	3/3	Total
25-07	0.63	0.63	0.61	0.63

Run Start:	03/06/2016 01:16:00	
Auto. End Distance	On	
Distance Travelled	2300	meters
Average Speed	64.1	km/h

Weather Condition	FINE
Air Temperature	25
Operator Notes	6 METER KIRI

Location	Event Note
m	
m	
m	



MuMeter Run Report

ELTARI KUPANG AIRPORT

RUNWAY 07-25

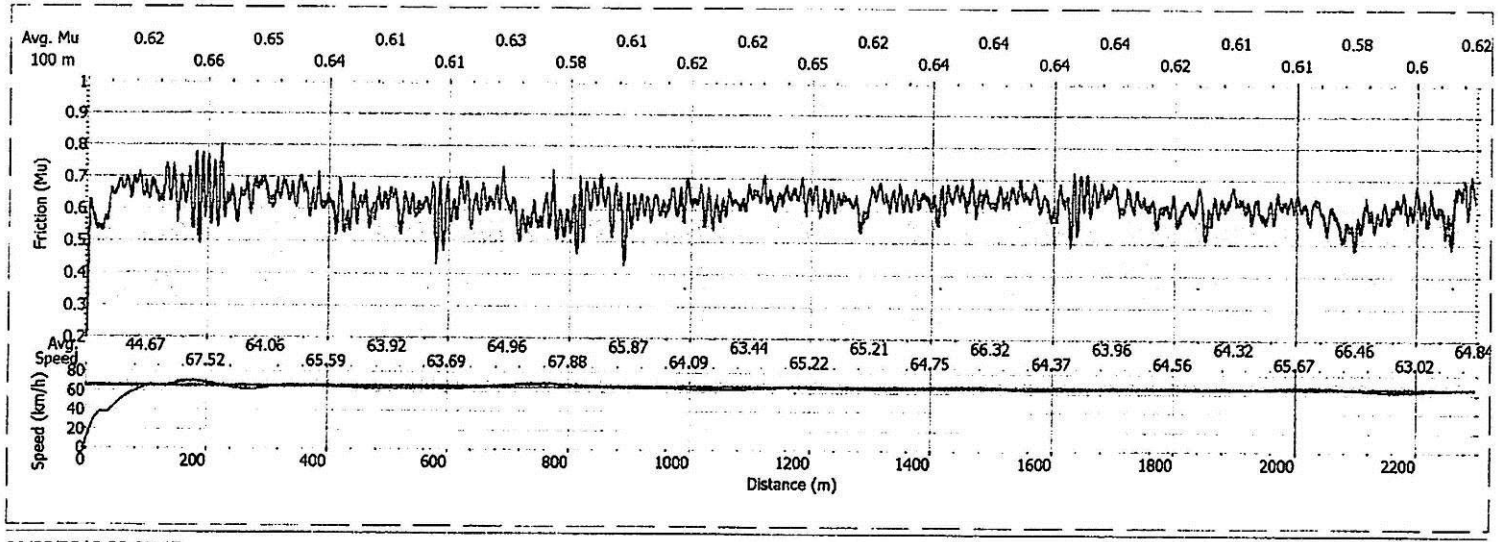
Calibration Results		
Zero Reference	18/04/2016 14:09:14	23
Distance	25/05/2010 22:05:06	406
Board Test	18/04/2016 15:01:29	8332

Average Mu	1/3	2/3	3/3	Total
07-25	0.63	0.63	0.61	0.62

Run Start:	03/06/2016 01:59:59	
Auto. End Distance	On	
Distance Travelled	2300	meters
Average Speed	64.1	km/h

Weather Condition	FINE
Air Temperature	25
Operator Notes	6 METER KIRI

Location	Event Note
m	
m	
m	



03/06/2016 02:02:47

MuMeter Run Report

ELTARI KUPANG AIRPORT

RUNWAY 25-07

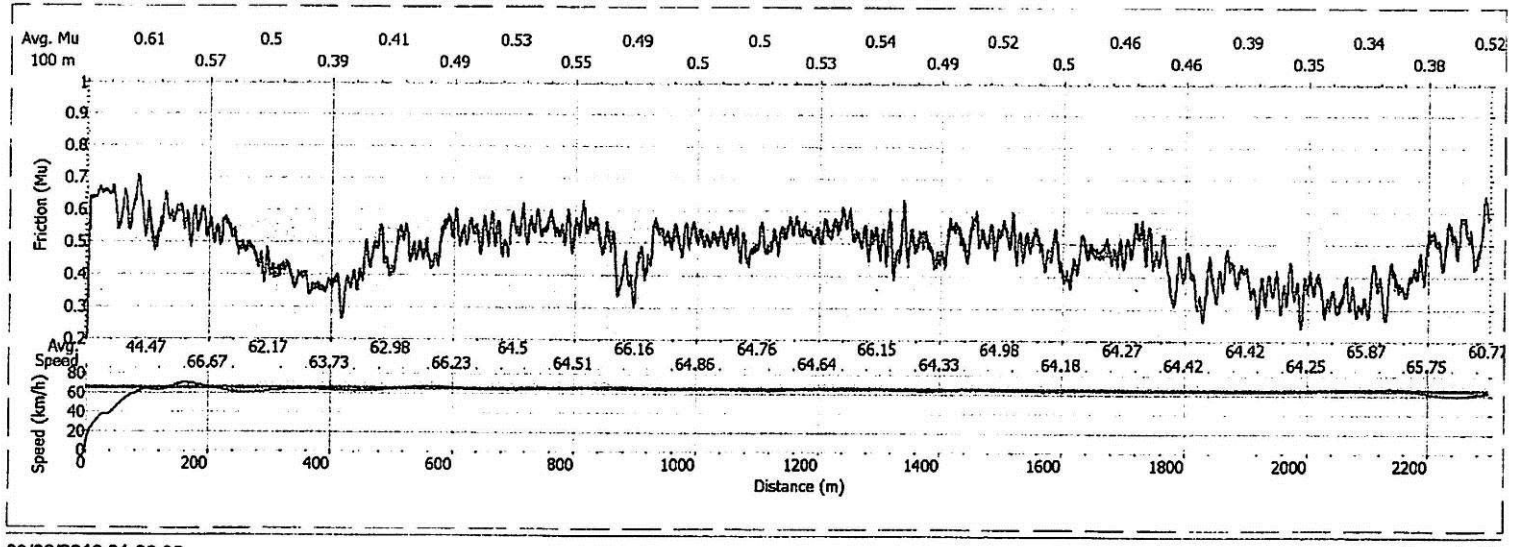
Calibration Results		
Zero Reference	18/04/2016 14:09:14	23
Distance	25/05/2010 22:05:06	406
Board Test	18/04/2016 15:01:29	8332

Average Mu	1/3	2/3	3/3	Total
25-07	0.5	0.51	0.42	0.48

Run Start:	03/06/2016 00:57:35	
Auto. End Distance	On	
Distance Travelled	2300	meters
Average Speed	63.7	km/h

Weather Condition	FINE
Air Temperature	25
Operator Notes	3 METER KANAN

Location	Event Note
m	
m	
m	



03/06/2016 01:00:36

MuMeter Run Report

ELTARI KUPANG AIRPORT

RUNWAY 07-25

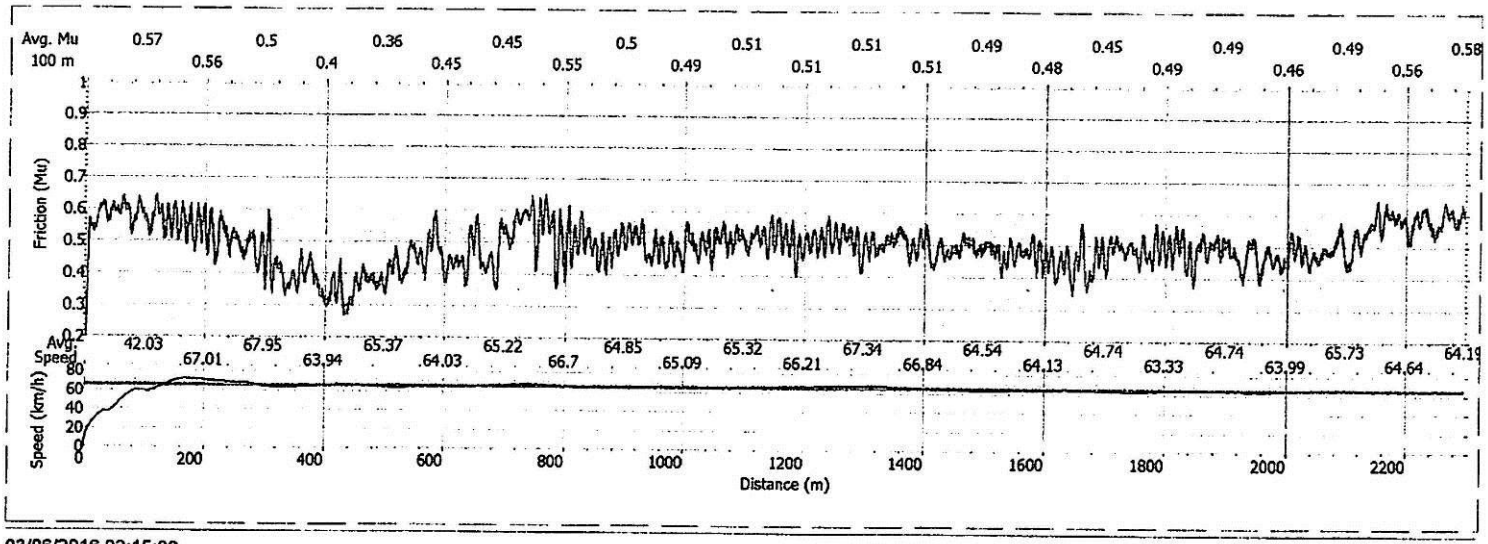
Calibration Results		
Zero Reference	18/04/2016 14:09:14	23
Distance	25/05/2010 22:05:06	406
Board Test	18/04/2016 15:01:29	8332

Average Mu	1/3	2/3	3/3	Total
07-25	0.48	0.5	0.5	0.49

Run Start:	03/06/2016 02:12:05	
Auto. End Distance	On	
Distance Travelled	2300	meters
Average Speed	64.3	km/h

Weather Condition	FINE
Air Temperature	25
Operator Notes	3 METER KANAN

Location	Event Note
m	
m	
m	



03/06/2016 02:15:00

MuMeter Run Report

ELTARI KUPANG AIRPORT

RUNWAY 25-07

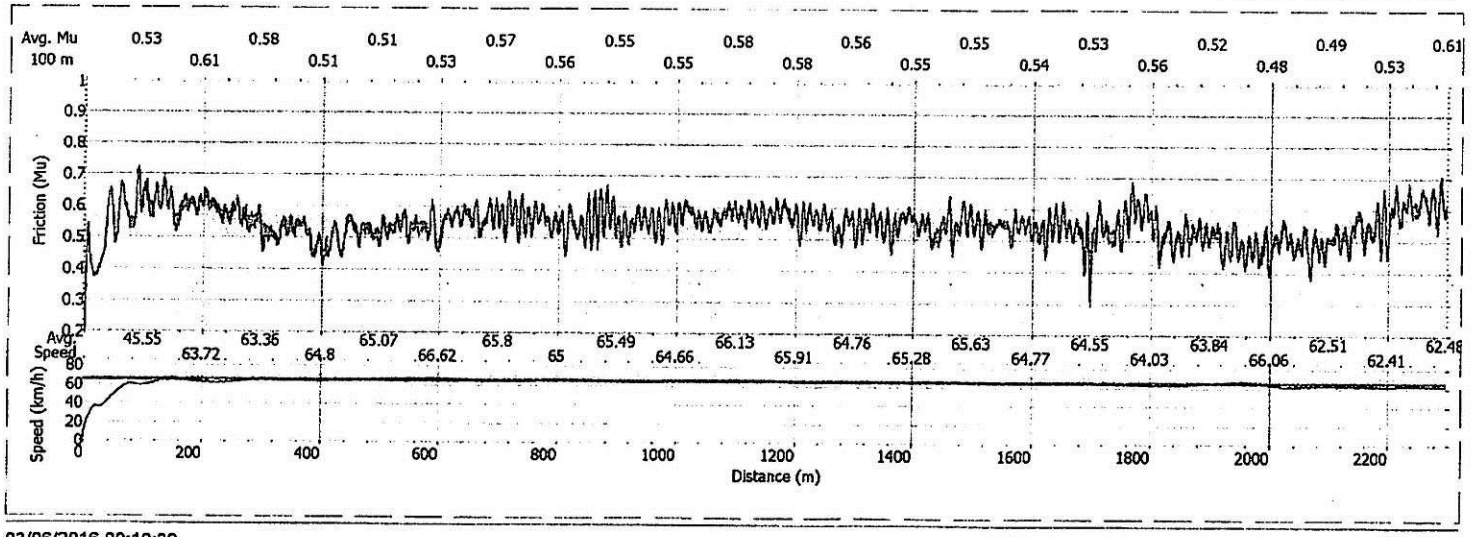
Calibration Results		
Zero Reference	18/04/2016 14:09:14	23
Distance	25/05/2010 22:05:06	406
Board Test	18/04/2016 15:01:29	8332

Average Mu	1/3	2/3	3/3	Total
25-07	0.55	0.56	0.53	0.55

Run Start:	03/06/2016 00:07:35	
Auto. End Distance	On	
Distance Travelled	2300	meters
Average Speed	63.8	km/h

Weather Condition	FINE
Air Temperature	25
Operator Notes	3 METER KIRI

Location	Event Note
m	
m	
m	



03/06/2016 00:10:39

MuMeter Run Report

ELTARI KUPANG AIRPORT

RUNWAY 07-25

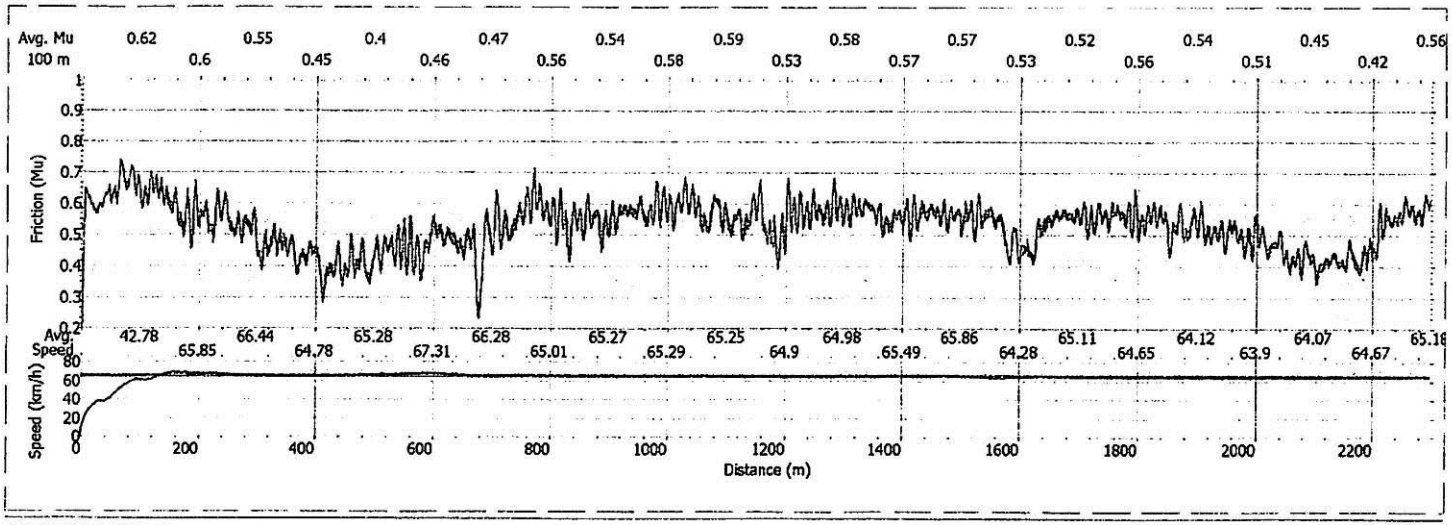
Calibration Results		
Zero Reference	18/04/2016 14:09:14	23
Distance	25/05/2010 22:05:06	406
Board Test	18/04/2016 15:01:29	8332

Average Mu	1/3	2/3	3/3	Total
07-25	0.51	0.57	0.51	0.53

Run Start:	03/06/2016 00:52:17	
Auto. End Distance	On	
Distance Travelled	2300	meters
Average Speed	64.2	km/h

Weather Condition	FINE
Air Temperature	25
Operator Notes	3 METER KIRI

Location	Event Note
m	
m	
m	



03/06/2016 00:55:21

MuMeter Run Report

ELTARI KUPANG AIRPORT

RUNWAY 25-07

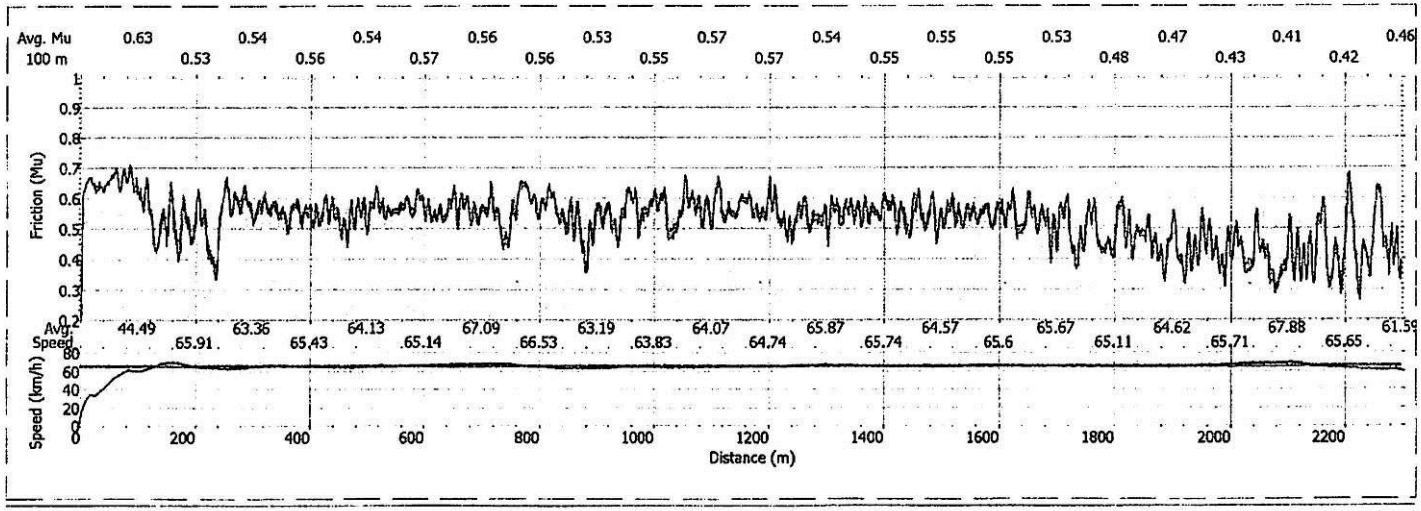
Calibration Results		
Zero Reference	18/04/2016 14:09:14	23
Distance	25/05/2010 22:05:06	406
Board Test	18/04/2016 15:01:29	8332

Average Mu	1/3	2/3	3/3	Total
25-07	0.56	0.56	0.47	0.53

Run Start:	02/06/2016 23:48:05	
Auto. End Distance	On	
Distance Travelled	2300	meters
Average Speed	64.2	km/h

Weather Condition	FINE
Air Temperature	25
Operator Notes	CENTERLINE

Location	Event Note
m	
m	
m	



02/06/2016 23:50:42

MuMeter Run Report

ELTARI KUPANG AIRPORT

RUNWAY 07-25

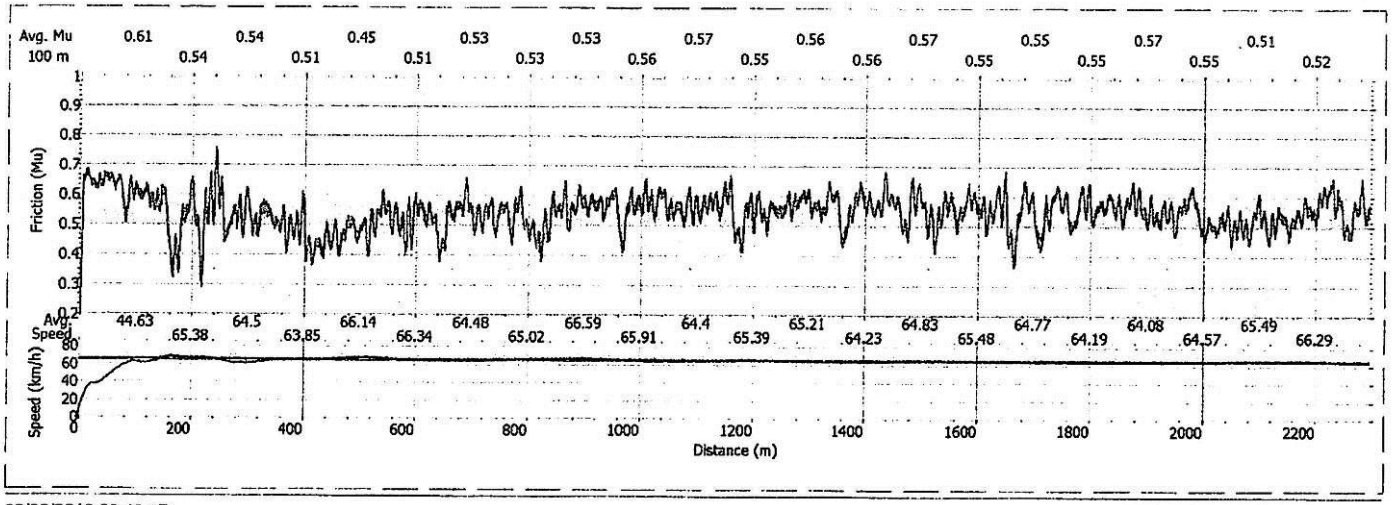
Calibration Results		
Zero Reference	18/04/2016 14:09:14	23
Distance	25/05/2010 22:05:06	406
Board Test	18/04/2016 15:01:29	8332

Average Mu	1/3	2/3	3/3	Total
07-25	0.53	0.56	0.55	0.54

Run Start:	02/06/2016 23:39:18	
Auto. End Distance	On	
Distance Travelled	2300	meters
Average Speed	64.2	km/h

Weather Condition	FINE
Air Temperature	25
Operator Notes	CENTERLINE

Location	Event Note
m	
m	
m	



02/06/2016 23:42:27

MuMeter Run Report

ELTARI KUPANG AIRPORT

RUNWAY 25-07

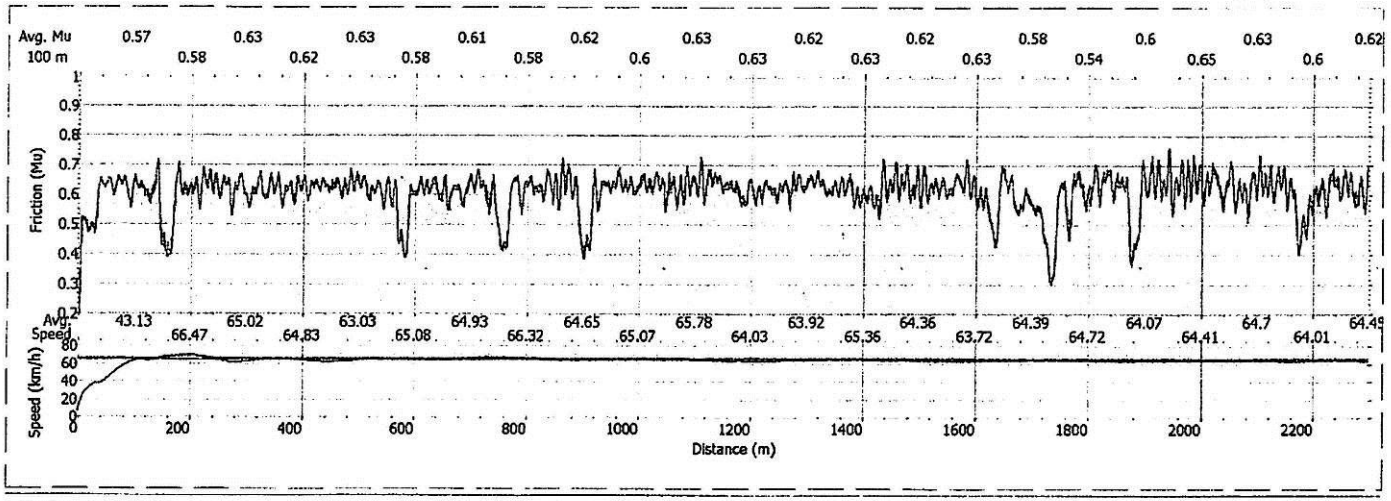
Calibration Results		
Zero Reference	18/04/2016 14:09:14	23
Distance	25/05/2010 22:05:06	406
Board Test	18/04/2016 15:01:29	8332

Average Mu	1/3	2/3	3/3	Total
25-07	0.6	0.62	0.6	0.61

Run Start:	03/06/2016 22:52:55	
Auto. End Distance	On	
Distance Travelled	2300	meters
Average Speed	63.8	km/h

Weather Condition	FINE
Air Temperature	24
Operator Notes	9 METER KANAN

Location	Event Note
m	
m	
m	



03/06/2016 22:55:34

Page 1 of 1

6.6 Direct Involve Parties Comments

6.6.1 Centro De Investigação E Prevenção De Acidentes Aeronáuticos - CENIPA (Brazil) Comments

NO	PAGE	COMMENTS	KNKT RESPONSE
1.	vii and 1	"*On 21 December 2015, an Embraer 195-200 aircraft…*" The Embraer 195 model designation is "ERJ 190-200 (Embraer 195)". **Embraer suggests the replacement of the term "Embraer 195-200" with "ERJ 190-200 (Embraer 195)".**	**Accepted**
2.	5	"[…] *After he served in the company for about 1 year, the PIC was trained for Embraer 195-200 aircraft.*" "[…] *The first line training on Embraer 195-200 was conducted on 20 February 2015 and he qualified as PIC on 23 March 2015.*" The Embraer 195 model designation is "ERJ 190-200 (Embraer 195)". **Embraer suggests the replacement of the term "Embraer 195-200" with "ERJ 190-200 (Embraer 195)".**	**Accepted**
3.	vii and 2	*"The aircraft speed was about 180 knots or about 40 knots above the target speed when crossing the threshold and touched down on the middle of the runway."* Recorded flight data indicates that the aircraft crossed the runway threshold at 50 ft AGL, at an indicated airspeed of 201 knots, or 63 knots above the reference speed. **Embraer suggests modifying the above excerpts according to the recorded flight data.**	**Accepted**
4.	42	*"During approach at Kupang, the aircraft altitude was higher than the approach profile and the speed was approximately 40 knots higher than the target."*	**Accepted**

NO	PAGE	COMMENTS	KNKT RESPONSE
		Recorded flight data indicates that the aircraft crossed the runway threshold at 50 ft AGL, at an indicated airspeed of 201 knots, or 63 knots above the reference speed. **Embraer suggests modifying the above excerpts according to the recorded flight data.**	
5.	45	*"9. On short final, the aircraft was on correct glide path and the speed was approximately at 180 knots.* *10. The aircraft speed when crossing the runway threshold was approximately 180 knots or approximately 40 knots higher than the target speed."* Recorded flight data indicates that the aircraft crossed the runway threshold at 50 ft AGL, at an indicated airspeed of 201 knots, or 63 knots above the reference speed. **Embraer suggests modifying the above excerpts according to the recorded flight data.**	**Accepted**
6.	40	*The flight data revealed that during the landing roll, the thrust reversers were working properly, however the brake pressures indicated below 1,000 psi out of 3,000 psi on maximum braking. This was due to the autobrake being set on the "low" position.* Recorded flight data confirms that the autobrake was armed and set to low before landing, and that it engaged during landing. However, it also indicates that the autobrake system was disengaged at 09:45:08 GMT, three seconds after the second and definitive touchdown, due to a manual brake application. The normal brake system of the ERJ 190-200 is equipped with an anti-skid system, which limits brake pressure to maintain an optimal slip ratio based on the runway friction coefficient. **Embraer suggests modifying the excerpt above as:** **The flight data revealed that during the landing roll, the thrust reversers were**	**Accepted**

NO	PAGE	COMMENTS	KNKT RESPONSE
		working properly, and the brake pressures indicated below 1,000 psi out of 3,000 psi on maximum braking. This range of brake pressure is an indication of the anti-skid normal operational.	
7.		*Embraer considers that the inclusion of information related to the braking performance will contribute for the completeness of the report by providing explanation for the runway overrun from a technical perspective.* *If the NTSC wishes to include a section on this matter, then the following text may be useful.* *Recorded flight data indicate that the second and definitive touchdown occurred at 09:45:05 GMT. Brake pedals application reached an intermediate level (around 40%) at 09:45:10 GMT. At this moment, the aircraft groundspeed was 152 knots and there were 855 meters of runway remaining.* *On this condition, a performance analysis showed that:* • *It would be required 1,093 meters to decelerate the aircraft to a complete stop on a wet runway;* • *It would be required 1,629 meters to decelerate the aircraft on a standing water contaminated runway.* *Both figures consider the effect of thrust reversers.* *Therefore, the remaining runway length available was not enough for the aircraft to stop within the runway limits.*	**Rejected** The suggestion was relevant, however KNKT considered that the cause of the overrun was obvious and to see more from the human factor perspective contributed to the occurrence.

6.6.2 Directorate General Civil Aviation (DGCA)

KEMENTERIAN PERHUBUNGAN
DIREKTORAT JENDERAL PERHUBUNGAN UDARA

Jalan Medan Merdeka Barat No. 8
Jakarta 10110
Telepon : 3505136 – 3505137
3811308
Fax : 3505135 – 3505139
3507144

Nomor : AU 401/2/18/DRJU.DKPPU-2016
Klasifikasi : -
Lampiran : -
Perihal : Tanggapan Draft Final Report Accident PK-KDC

Jakarta, 20 September 2016

Kepada
Yth. **KETUA**
Komite Nasional
Keselamatan Transportasi
Di –
JAKARTA

1. Sehubungan dengan surat Ketua Komite Nasional Keselamatan Transportasi no.: KTU.RH/1/16 KNKT 2016 tanggal 3 Agustus 2016 Perihal *Draft Aircraft Accident Investigation Report* KNKT.15.12.28.04 Pesawat Embraer 195-200LR registrasi PK - KDC.

2. Terkait dengan hal-hal tersebut di atas, bersama ini dengan hormat disampaikan tanggapan sebagai berikut:
   - *4 Safety Actions*
     Direktorat Jenderal Perhubungan Udara telah melakukan evaluasi terhadap kinerja *flight crew* PK-KDC *flight no.* KD676 meliputi evaluasi terhadap *internal corrective action*, *medical check*, serta *corrective training* terhadap *flight crew* yang bersangkutan (ref. surat Ditjen Perhubungan Udara no. AU.412/1/16/DRJU.DKPPU.2016 tanggal 29 Juli 2016).

   - *5 Safety Recommendations, 5.4 Directorate General of Civil Aviation, 04.B-2016-81.1*
     Terkait dengan rekomendasi agar operator penerbangan mengimplementasikan *safety management system* sebagaimana dipersyaratkan dalam *Civil Aviation Safety Regulations* serta dengan mempertimbangkan bahwa cakupan dari *safety management system* itu sendiri sangat luas, Direktorat Jenderal Perhubungan Udara menyarankan agar rekomendasi tersebut dapat difokuskan pada area dari *safety management system* yang langsung terkait dengan *contributing factors* sebagaimana yang disebutkan pada *3.2 Contributing Factors.*

3. Demikian disampaikan untuk menjadi periksa.

DIREKTUR JENDERAL PERHUBUNGAN UDARA

DIREKTORAT JENDERAL PERHUBUNGAN UDARA

SUPRASETYO
Pembina Utama Madya (IV/d)
NIP. 19580523 198703 1 001

KOMITE NASIONAL KESELAMATAN TRANSPORTASI REPUBLIK INDONESIA
Jl. Medan Merdeka Timur No.5 Jakarta 10110 INDONESIA
Phone : (021) 351 7606 / 384 7601 Fax : (021) 351 7606 Call Center : 0812 12 655 155
website 1 : http://knkt.dephub.go.id/webknkt/ website 2 : http://knkt.dephub.go.id/knkt/
email : knkt@dephub.go.id

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