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REPUBLIC OF INDONESIA**

FINAL

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Aircraft Accident Investigation Report

Batik Air Indonesia and TransNusa Aviation Mandiri

Boeing 737-800 (PK-LBS) and ATR 42-600 (PK-TNJ)

Halim Perdanakusuma International Airport, Jakarta

Republic of Indonesia

4 April 2016



2017

This final investigation report was produced by the *Komite Nasional Keselamatan Transportasi* (KNKT), 3rd Floor Ministry of Transportation, 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
AIP	:	Aeronautical Information Publication
AMC	:	Apron Movement Control
AMEL	:	Aircraft Maintenance Engineer License
AMM	:	Aircraft Maintenance Manual
AOC	:	Airline Operator Certificate
APU	:	Auxiliary Power Unit
ATIS	:	Automatic Terminal Information Service
ATPL	:	Airline Transport Pilot License
ATS	:	Air Traffic Services
ATT	:	Aircraft Towing Pushback Tractor
BMKG	:	<i>Badan Meteorologi Klimatologi Geofisika</i> / Meteorological Climatological and Geophysics Agency
BTT	:	Baggage Towing Tractor
C of A	:	Certificate of Airworthiness
C of R	:	Certificate of Registration
CASR	:	Civil Aviation Safety Regulation
CB	:	Cumulonimbus
Contributing factors	:	Contributing factors are actions, omissions, events, conditions, or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the accident or incident occurring, or mitigated the severity of the consequences of the accident or incident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil or criminal liability. (Refer to ICAO Doc 9756 Part IV)
CPL	:	Commercial Pilot License
CVR	:	Cockpit Voice Recorder
FA	:	Flight Attendant
FCTM	:	Flight Crew Training Manual
FDR	:	Flight Data Recorder

Finding(s)	: The 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. The findings should be listed in a logical sequence, usually in a chronological order. (ref to ICAO Doc 9756 Part IV)
FOQA	: Flight Operation Quality Assurance
GSE	: Ground Support Equipment
ICAO	: International Civil Aviation Organization
KNKT	: Komite Nasional Keselamatan Transportasi
LLD	: Lift Loader
LPPNPI	: <i>Lembaga Penyelenggara Pelayanan Navigasi Penerbangan Indonesia</i> (AirNav Indonesia)
LT	: Local Time
Manoeuvring area	: That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons.
MHz	: Megahertz
NOTAM	: Notice to Airmen
PALS	: Precision Approach Lighting System
PF	: Pilot Flying
PIC	: Pilot in Command
QRH	: Quick Reference Handbook
RAAS	: Runway Awareness Advisory System
RFFS	: Rescue and Fire Fighting Service
RTO	: Rejected Takeoff
SIC	: Second in Command
SOP	: Standard Operating Procedure
TOGA	: Take off / Go Around
TWR	: Tower
UTC	: Universal Coordinated Time
VHF	: Very High Frequency

SYNOPSIS

On 4 April 2016, Boeing 737-800 registration PK-LBS was being operated by Batik Air as scheduled passenger flight with flight number ID 7703 from Halim Perdanakusuma Airport with intended destination Sultan Hasanuddin International Airport, Makassar. An ATR 42-600 aircraft, registration PK-TNJ operated by TransNusa Aviation Mandiri was being repositioned from north to south apron of Halim Perdanakusuma Airport by a ground handling agent PT. Jasa Angkasa Semesta (PT. JAS). The aircraft was towed without aircraft electrical power fed to the system including the radio communication and aircraft lighting system.

At the time of occurrence, the ID 7703 pilot communicated to Halim Tower controller on frequency 118.6 MHz while the towing car driver communicated using handheld radio on frequency 152.73 KHz and was handled by assistant controller.

At 1948 LT (1248 UTC), ID 7703 pilot received taxi clearance from Halim Tower controller and after the ID 7703 taxi, the towing car driver received clearance for towing and to report when on taxiway C. Afterward the towing car driver was instructed to expedite and to follow ID 7703.

While the ID 7703 backtracking runway 24, the towed aircraft entered the runway intended to cross and to enter taxiway G. At 1256 UTC, ID 7703 pilot received takeoff clearance and initiated the takeoff while the towed aircraft was still on the runway. The towing car driver and the pilots took action to avoid the collision. The decision of the pilot and the towing car driver to move away from the centerline runway had made the aircraft collision on the centerline runway (head to head) avoided, however the wings collision was unavoidable.

At 1257 UTC, the ID 7703 collided with the towed aircraft. The ID 7703 pilot rejected the takeoff and stopped approximately 400 meters from the collision point while the towed aircraft stopped on the right of the centerline runway 24.

No one injured at this occurrence and both aircraft severely damaged.

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

- Handling of two movements in the same area with different controllers on separate frequencies without proper coordination resulted in the lack of awareness to the controllers, pilots and towing car driver.
- The communication misunderstanding of the instruction to follow ID 7703 most likely contributed the towed aircraft enter the runway.
- The lighting environments in the tower cab and turning pad area of runway 24 might have diminished the capability to the controllers and pilots to recognize the towed aircraft that was installed with insufficient lightings.

Following this occurrence, the *Komite Nasional Keselamatan Transportasi* (KNKT) had been informed several safety actions taken by related parties. The KNKT acknowledges the safety actions taken by the operators and aircraft manufacturer, there still remain safety issues that need to be considered. Therefore, the KNKT issues safety recommendations addressed to PT. Batik Air Indonesia, PT. TransNusa Aviation Mandiri, PT. Jasa Angkasa Semesta, AirNav Indonesia District Office Halim Perdanakusuma, PT. Angkasa Pura II Branch Office Halim Perdanakusuma International Airport, and Directorate General of Civil Aviation.

1 FACTUAL INFORMATION

1.1 History of the Flight

On 4 April 2016, a Boeing 737-800 aircraft, registered PK-LBS, was being operated by Batik Air Indonesia, was preparing to operate a scheduled passenger flight with flight number ID 7703¹ from Halim Perdanakusuma International Airport² with the intended destination of Sultan Hasanuddin International Airport, Makassar. On board the flight were 56 persons consisting of two pilots, five flight attendants and 49 passengers.



Figure 1: Archive photo of PK-LBS (copyright of Firstmareza Rosyidi)

On parking stand B-1, was an ATR 42-600 aircraft, registered PK-TNJ,³ operated by TransNusa Aviation Mandiri. The TransNusa Aviation Mandiri engineer was instructed by the Apron Movement Control (AMC) to move PK-TNJ from the north to the south apron.

The towing process was conducted by PT. JAS, a ground handling agent that has an agreement with TransNusa Aviation Mandiri. On board the towing car were PT. JAS personnel consisting of one towing car driver and one support personnel. The support personnel seated facing backward to communicate with engineers on board the aircraft by hand signal. On board in the cockpit of the towed aircraft were two engineers of PT. TransNusa Aviation Mandiri. The engineers were assigned to apply aircraft brake if required during the towing process and the towing car driver assigned to communicate with Halim Tower.

1 Boeing 737-800 aircraft registered PK-LBS will be named as ID 7703.

2 Halim Perdanakusuma International Airport will be named as Halim for the purpose of this report.

3 ATR 42-600 aircraft registered PK-TNJ will be named as towed aircraft.

The towed aircraft was towed without any engine running and no electrical power to the aircraft systems including the radio communication and aircraft lighting systems. Communications between the towing car driver and Halim Tower used handheld radios and battery-powered portable lights were installed on the left and right wing tips.

The air traffic control crew on duty in the Halim Tower Control unit (Halim Tower) consisted of a controller, assistant controller, supervisor and flight data officer. The lights in the tower cab⁴ were illuminated and there were several lights reflecting on the tower glass windows including the view to the direction of the beginning of Runway 24.

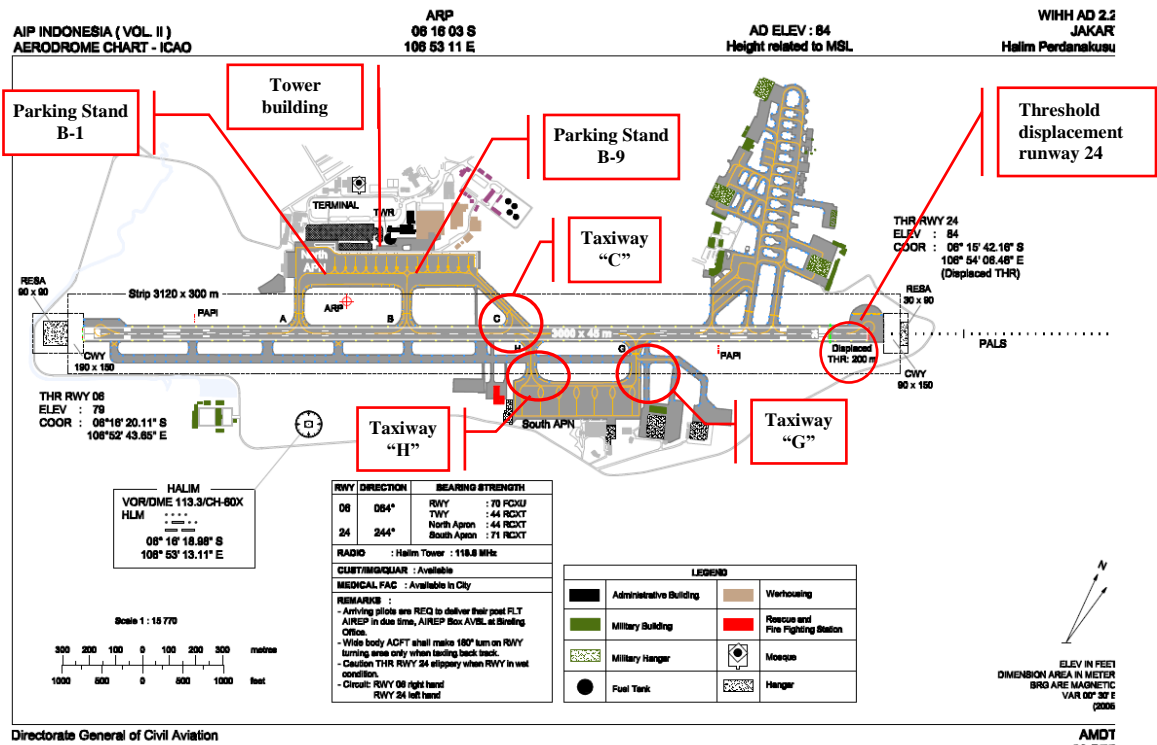


Figure 2: The Halim Perdanakusuma International Airport layout

At 1945 LT (1245 UTC⁵), the ID 7703 pilot requested pushback clearance from the Halim Tower controller on Halim Tower radio frequency of 118.6 MHz. At the time, the aircraft was parked on parking stand B-2 and was approved to push back.

After ID 7703 completed pushback, the towing car driver requested clearance to Halim Tower to reposition the aircraft from parking stand B-1 to the south apron. The towing car driver was instructed to follow ID 7703 and to report when on taxiway C. The communication between the towing car driver and Halim Tower was performed on frequency 152.73 KHz and was handled by the assistant controller.

4 Tower cab is a working room for the air traffic controller on the top of the tower building.

5 The 24-hour clock used in this report to describe the time of day as specific events occurred is in Coordinated Universal Time (UTC).

Local time that be used in this report is *Waktu Indonesia Barat* (WIB) or Indonesia Western Time Standard which is UTC +7 hours.



Figure 3: Archive photo of PK-TNJ (copyright of Adhitya Pratama)

The controller monitored the communication between the assistant controller and towing car driver, the controller recognized the position of the towed aircraft was on the parking stand B-1. The controller did not see the towed aircraft exterior lights illuminated during the movement.

At 1248 UTC, the ID 7703 pilot received taxi clearance to runway 24 via taxiway C, and two minutes later the controller instructed the ID 7703 pilot to hold on taxiway C due to arriving aircraft.

There was an arriving aircraft that would use the parking stand B-1 and the crew of that aircraft was instructed to hold to wait for the towed aircraft to pass. The assistant controller instructed the towing car driver to tow and to report when on taxiway C. The ID 7703 pilots stated that they did not know that there was a towed aircraft behind.

At 1253 UTC, the ID 7703 pilot received clearance from the controller to enter and back track runway 24.

The assistant controller noticed the last position of the towed aircraft was when the towed aircraft was in front of the tower building, thereafter the assistant controller conducted coordination with another Air Traffic Services (ATS) unit related to other departure aircraft. The assistant controller did not recall any visible light on the towed aircraft, except the lights from the towing car.

The ID 7703 aircraft lined up on the turn pad of runway 24 which was 200 meters beyond the runway threshold. During lining up, the pilots felt that the lights surrounding the turn pad was very bright and momentarily affected their forward vision.

At 12:56:05 UTC, the ID 7703 pilot reported ready for takeoff. The tower controller did not see any vehicle or object on the runway then issued clearance for takeoff to the pilot of ID 7703. There was no coordination between the controller and the assistant controller regarding traffic on the maneuvering⁶ area prior to the issuance of the takeoff clearance.

At 12:56:51 UTC, after received the takeoff clearance, the Second in Command (SIC) as pilot flying (PF) advanced the power levers and pressed the Take Off / Go Around (TOGA) button.

At that time, the towed aircraft and the towing car were on the runway, travelling east. The towing car driver saw that the ID 7703 aircraft was rolling for takeoff then asked to the Halim Tower whether the ID 7703 was taking off, and there was no reply from the Halim Tower. The towing car driver then accelerated the towing and turned to the right side of the runway in an attempt to remain clear of the aircraft taking off.

At 12:57:08 UTC, while rolling at approximately 90 knots, the SIC saw an object on the runway and called to the Pilot in Command (PIC) concerning the object. The pilots could not identify the object until later on, when the SIC realized that the object was an aircraft.

The PIC applied right rudder to move the aircraft towards the right side of the runway centerline and maintained the aircraft between the runway centerline and the runway edge. The PIC then intended to reject the takeoff, however, shortly after, the pilots felt impacts. The pilots performed the rejected takeoff and the ID 7703 stopped approximately 400 meters from the towed aircraft, which stopped on the left of the centerline runway 24 at approximately 100 meters from taxiway G.

The assistant controller saw fire on the left side of ID 7703 when the aircraft rolled between taxiway C and B. Then the assistant controller pressed the crash bell and informed the Airport Rescue and Fire Fighting (ARFF).

After ID 7703 stopped, the PIC commanded the SIC to perform ON GROUND EMERGENCY procedure, and commanded the flight attendant “Attention crew on station” twice. The PIC noticed fire on the tip of the left wing and immediately shut down both engines, activated the fire extinguishers of both engines and Auxiliary Power Unit (APU) and commanded the flight attendant to evacuate passengers from the right side.

After receiving the PIC command of “Attention crew on station”, the flight attendants checked the condition inside and outside the aircraft through the viewing windows. There was no damage inside the aircraft and they did not see any fire outside the aircraft.

The flight attendants opened all passenger and service doors and deployed the escape slides. Most of passengers evacuated from the left forward door (1L).

The pilots realized that the impacted object was a towed aircraft after they disembarked the aircraft.

⁶ Maneuvering area: part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons

The air traffic controllers realized that the towed aircraft was on the runway and collided with ID 7703 after asking the towing car driver.

1.2 Injuries to Persons

1.2.1 ID 7703

Injuries	Flight crew	Passengers	Total in Aircraft	Others
Fatal	-	-	-	-
Serious	-	-	-	-
Minor/none	7	49	56	-
TOTAL	7	49	56	-

1.2.2 Towed Aircraft

Injuries	Flight crew	Passengers	Total in Aircraft	Others (Towing Car)
Fatal	-	-	-	-
Serious	-	-	-	-
Minor/none	-	-	2	2
TOTAL	-	-	2	2

1.3 Damage to Aircraft

1.3.1 ID 7703

The ID 7703 aircraft was substantially damaged. The damage was as follows:

- The left wing was damaged approximately 575 centimeters from the wingtip. The wingtip detached including part of the aileron and the winglet.
- The wingtip was broken into three large parts.



Figure 4: The damaged on left wing

1.3.2 Towed Aircraft

The towed aircraft was substantially damaged. The damage was as follows:

- The left wing was damaged approximately 260 centimeters from the wingtip.
- The vertical stabilizer was severed from the fuselage, including the horizontal stabilizer.



Figure 5: The detached parts of wing and horizontal stabilizer

1.4 Other Damage

There was no environment and other damage reported.

1.5 Personnel Information

1.5.1 ID 7703

Pilot in Command

Gender : Male
Age : 55 years
Nationality : Indonesia
Marital status : Married
Date of joining company : 29 June 2014
License : Aircraft Transport Pilot License (ATPL)
 Date of issue : 7 May 1993
 Validity : 31 May 2016
 Aircraft type rating : Boeing 737 NG
Instrument rating validity : 30 November 2016
Medical certificate : First Class
 Last of medical : 28 October 2015
 Validity : 30 April 2016
 Medical limitation : Holder shall possess glasses that correct for near vision

Flying experience

Total hours : 18,765 hours 5 minutes
Total on type : 1,825 hours 20 minutes
Last 90 days : 290 hours 15 minutes
Last 60 days : 197 hours
Last 30 days : 103 hours
Last 24 hours : 1 hour 45 minutes
This flight : 12 minutes

Second in Command

Gender : Male
Age : 26 years
Nationality : Indonesia

Marital status : Married
Date of joining company : 5 August 2015
License : Commercial Pilot License (CPL)
 Date of issue : 7 May 2014
 Validity : 30 June 2016
 Aircraft type rating : Boeing 737 NG
Instrument rating validity : 30 June 2016
Medical certificate : First Class
 Last of medical : 26 February 2016
 Validity : 31 August 2016
 Medical limitation : None

Flying experience

Total hours : 368 hours 45 minutes
Total on type : 215 hours
Last 90 days : 114 hours 25 minutes
Last 60 days : 89 hours 50 minutes
Last 30 days : 49 hours 25 minutes
Last 24 hours : 1 hour 46 minutes
This flight : 12 minutes

1.5.2 Towed Aircraft

Engineer 1

Gender : Male
Age : 45 years
Nationality : Indonesia
Marital status : Married
Year of joining company : 2011
License : Aircraft Maintenance Engineer License (AMEL)
 Date of issue : 28 July 2004
 Type rating :
 • Fokker 50
 • Fokker 70 / 100
 • ATR 42 / 72-600
 Validity : 6 February 2017

Maintenance experience

Total experience : 25 years
Total in this operator : 5 years

Engineer 2

Gender : Male
Age : 46 years
Nationality : Indonesia
Marital status : Married
Year of joining company : 2014
License : Aircraft Maintenance Engineer License (AMEL)
Date of issue : 2 January 2007
Type rating : ATR 42 / 72-600
Validity : 13 November 2016

Maintenance experience

Total experience : 25 years
Total in this operator : 2 years

Towing Car Driver

Gender : Male
Age : 45 years
Nationality : Indonesia
Marital status : Married
Year of joining company : 2012
License : Ground Support Equipment (GSE) License
Date of issue : April 2013
Type rating :

- Lift Loader (LLD)
- Baggage Towing Tractor (BTT)
- Aircraft Towing Pushback Tractor (ATT)

Validity : April 2018

Medical examination

Last of medical : April 2013

Note: PT. JAS requires medical examination by company doctor prior to license renewal.

Ground Support experience

Total experience : 15 years

Total as ATT	:	4 years
Duty time		
Last 7 days	:	4 hours
Last 24 hours	:	about 2 hours (towed 2 aircrafts before the accident aircraft)

Note: Prior to handling the towed aircraft, the towing car driver handled another aircraft of another aircraft operator, which was towed from the north to south apron via taxiway C and G. The towing car driver towed via taxiway C and G since the taxiway H was occupied by a number of parked aircraft.

1.5.3 Air Traffic Controller Controller

Gender	:	Male
Age	:	36 years
Nationality	:	Indonesia
Marital status	:	Married
Year of joining company	:	2010
License	:	Air Traffic Controller License
Date of issue	:	1 February 2014
Type rating	:	Halim Aerodrome Control Tower Rating
Date of issue	:	June 2016
Medical certificate	:	Second Class
Last of medical	:	13 May 2015
Validity	:	13 May 2016
Medical limitation	:	None
ICAO Language Proficiency	:	Level 4
Date of issue	:	24 November 2013
Working time		
Last 7 days	:	42 hours 57 minutes
Last 24 hours	:	57 minutes
Duty time		
Last 7 days	:	2 hours 27 minutes
Last 24 hours	:	57 minutes

Assistant Controller

Gender : Male
Age : 25 years
Nationality : Indonesia
Marital status : Single
Year of joining company : 2015
License : Air Traffic Controller License
 Date of issue : 10 February 2015
 Type rating : Halim Aerodrome Control Tower Rating
 Validity : June 2016
Medical certificate : Second Class
 Last of medical : 13 May 2015
 Validity : 13 May 2016
 Medical limitation : None
ICAO Language Proficiency : Level 4
 Date of issue : 7 November 2014
Working time
 Last 7 days : 42 hours 57 minutes
 Last 24 hours : 57 minutes
Duty time
 Last 7 days : 4 hours
 Last 24 hours : 57 minutes

Supervisor

Gender : Male
Age : 52 years
Nationality : Indonesia
Marital status : Married
Year of joining company : 1994
License : Air Traffic Controller License
 Date of issue : 1 February 2014
 Type rating : Halim Aerodrome Control Tower Rating
 Validity : June 2016
Medical certificate : Third Class

Last of medical : 3 March 2016
 Validity : 3 March 2017
 Medical limitation : Holder shall possess glasses that correct for near vision
 ICAO Language Proficiency : Level 4
 Date of issue : 24 November 2013
 Working time
 Last 7 days : 29 hours 57 minutes
 Last 24 hours : 11 hours 57 minutes

Flight Data Officer

Gender : Male
 Age : 25 years
 Nationality : Indonesia
 Marital status : Single
 Year of joining company : 2013
 License : Air Traffic Control License
 Date of issue : 13 May 2015
 Type rating : Halim Aerodrome Control Tower Rating
 Validity : June 2016
 Medical certificate : Second Class
 Last of medical : 13 May 2015
 Validity : 13 May 2016
 Medical limitation : None
 ICAO Language Proficiency : Level 4
 Date of issue : 30 November 2012
 Working time
 Last 7 days : 28 hours 57 minutes
 Last 24 hours : 6 hours 57 minutes

Note: Working time is the time period when the person attends their particular working shift, while the duty time is the time period when the person performs duty to provide air traffic control service.

1.6 Aircraft Information

1.6.1 ID 7703

ID 7703 was a Boeing 737-800NG aircraft, registered PK-LBS, and was manufactured in 2014 by the Boeing Company in the United States of America with serial number 39827. The aircraft had valid Certificate of Airworthiness (C of A) and Certificate of Registration (C of R).

The aircraft total hour was 3,113 hours 18 minutes and total cycles of 1,907.

The engines were manufactured by CFM International. The type/model was CFM56-7B24 with serial number 660473 and 660493. Both engines had a total of 489 hours and 907 cycles.

The aircraft maintenance record did not show any abnormality on the aircraft systems.

1.6.2 Towed Aircraft

The towed aircraft was an ATR 42-600 aircraft, registered PK-TNJ, manufactured in September 2014 by the Avions de Transport Regional (ATR) Aircraft Company in France with serial number 1015. The aircraft had a valid Certificate of Airworthiness (C of A) and Certificate of Registration (C of R).

The aircraft total hour was 2,073 hours 28 minutes and total cycles of 1,038. The aircraft maintenance record did not show any abnormality on the aircraft systems.

The electrical power to the navigation light and anti-collision light, on the ATR 42 aircraft is supplied by DC Main Bus 1 or DC Service Bus and strobe light supplies by AC Wild power supply. The DC Buses normally supplied by the DC starter generator when engine 1 or 2 is running, and AC Wild power normally supplied by ACW generator when propeller 1 or 2 is turning.

In order to provide electrical power to navigation lights, anti-collision lights and communication system during towing requires DC starter generator, therefore it is required at least one engine to be run. The electrical power can be supplied with the right engine running without rotating the propeller by activating the Propeller Brake, this feature is called Hotel Mode⁷.

The ATR has issued SB ATR42-33-0030 applicable for ATR 42-200, -300 and -320, on 15 April 1999 that contained the modification to enable lighting up of navigation and anti-collision light on ground during towing.

The common practices in TransNusa Aviation Mandiri to prevent the battery discharge, the engineer pulls the battery circuit breaker (CB) during towing without an engine running.

⁷ Hotel Mode is a feature on all ATR turboprops replacing an APU by preventing the right propeller rotation with a 'propeller brake' while allowing the turbine, and therefore also the generator, to run, providing electrical power and bleed air.

The aircraft was towed without an engine running and no electrical power to the aircraft systems including the radio communication and aircraft lighting systems. The communication between towed aircraft and Halim Tower used handheld radios.

The substitute to the aircraft navigation lights, green and red commercial portable lights were put on each wing tip. The dimension of the lights was approximately of 8 × 3 cm. This was in accordance to the operator Engineering Instruction number ATR/EI/33/XI/2015/028 dated 04 November 2015 with subject of Installation Portable Navigation Light for Towing ATR Aircraft.

The installation of portable navigation light was accepted by PT. JAS.

1.7 Meteorological Information

The weather report for Halim was provided by *Badan Meteorologi Klimatologi Geofisika* – BMKG (Meteorological Climatological and Geophysics Agency). On 4 April 2016, between 1200 until 1400 UTC, the weather reported that cumulonimbus cloud was observed on southwest of the airport, the visibility was 5 kilometers and hazy.

1.8 Aids to Navigation

Ground-based navigation aids, on-board navigation aids and aerodrome visual ground aids were serviceable during this occurrence.

1.9 Communications

All communications between the controller and the ID 7703 pilot was conducted on frequency of 118.6 MHz. The communication was recorded on the ground based automatic voice recording equipment and the ID 7703 Cockpit Voice Recorder (CVR). The quality of the recorded transmissions was good. The detail communication between the controller and the ID 7703 pilot is described in section 1.11.2 Cockpit Voice Recorder.

The communication between the assistant controller and the towing car driver used handheld radio communication on a frequency of 152.73 KHz and was conducted in Bahasa (local language). The communication was handled by the assistant controller and was not recorded.

The investigation conducted interviews with the air traffic control crew on duty in Halim Tower and also on the towing car. The information of the communications was different between that recalled by the Halim Tower and towing car personnel.

The communications between the towing car driver and the assistant controller were described as follows:

On parking stand B-1:

The towing car driver requested to Halim Control Tower Unit (Halim Tower) for towing to reposition an aircraft from parking stand B-1 to the south apron and was replied by the Flight Data Officer to standby. After the ID7703 started to taxi, the assistant controller issued towing clearance to the towing car driver and to report when on taxiway C.

At about abeam parking stand B-9:

The assistant controller instructed the towing car driver to expedite the towing and to follow ID 7703. The instruction was acknowledged by the towing aircraft driver.

At about entering taxiway C:

The assistant controller reinstructed the towing car driver to expedite the towing and to follow ID 7703. The instruction was acknowledged by the towing aircraft driver.

Note: The air traffic control crew on duty stated that this communication did not occur.

On taxiway C:

The assistant controller reinstructed the towing car driver to expedite the towing and to follow ID 7703. The towing car driver confirmed that the taxi route was via taxiway G and affirmed by the assistant controller.

Note: The air traffic control crew on duty stated that this communication did not occur.

On the runway:

The towing car driver asked twice to the Halim Tower unit whether the ID 7703 was initiating the takeoff and there was no reply.

Note: The air traffic control crew on duty stated that this communication did not occur.

After the collision:

The assistant controller requested the towed aircraft position. The towing car driver informed that the towed aircraft was on the runway and had just collided with ID 7703.

1.10 Aerodrome Information

Airport name	:	Halim Perdanakusuma International Airport
Airport identification	:	WIHH / HLP
Airport operator	:	PT. Angkasa Pura II (Persero)
Airport certificate	:	008/SBU-DBU/VII/2010
Coordinate	:	06°17'03" S; 106°53'06" E
Elevation	:	84 feet
Runway direction	:	06 – 24
Runway slope	:	0.07% down to east
Runway length	:	3,000 meters (displaced 200 meters on the beginning runway 24)
Runway width	:	45 meters

Threshold runway 24 : 06° 15' 42.16" S, 106° 54' 06.48" E

The aerodrome layout as published in the Aeronautical Information Publication (AIP) Volume II Amendment 33 date 20 September 12, is as follows:

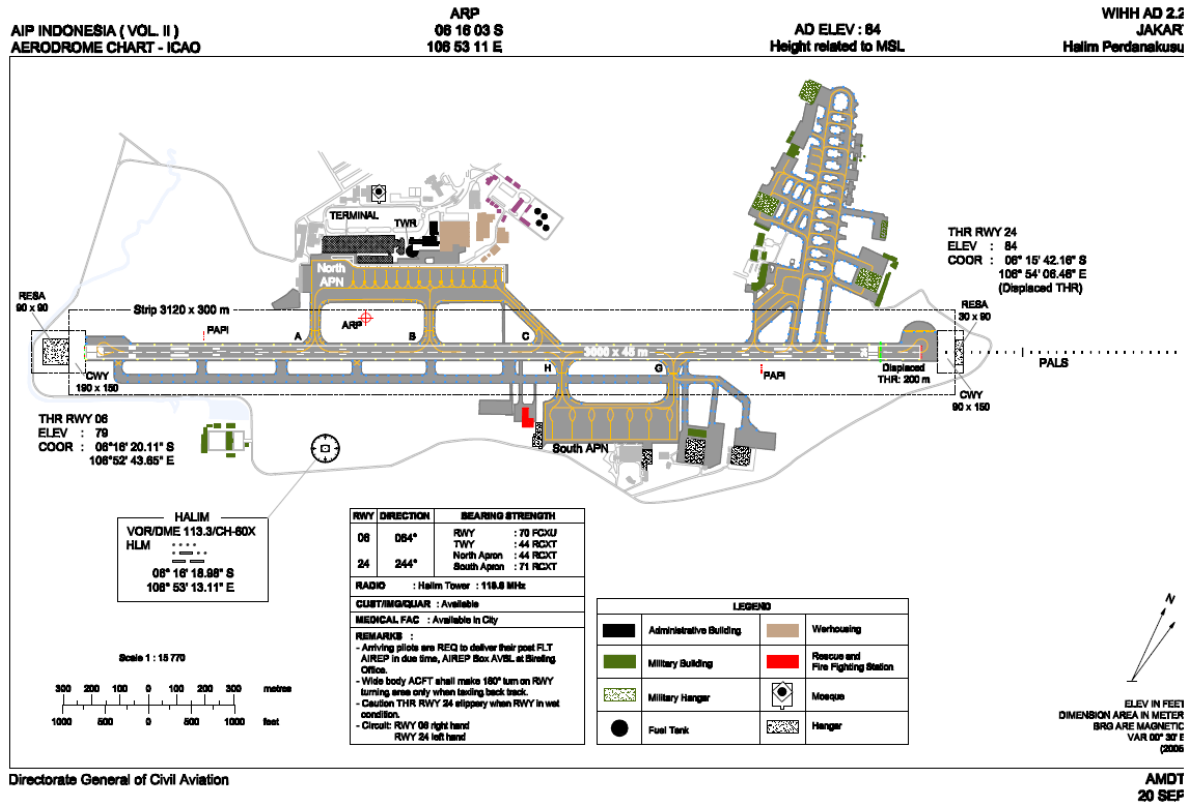


Figure 6: The Halim Perdanakusuma International Airport

Referring to the published Aeronautical Information Publication (AIP) Volume II Amendment 28, the runway at Halim was 3,000 meters long with a displaced threshold by 200 meters at the beginning of runway 24.

The threshold displacement is based on the area availability for the Precision Approach Light System (PALS) as required for the Instrument Landing System (ILS) Category 1. The PALS lights and the runway threshold lights on the pavement area were flush-mounted on the runway surface.

The investigation observed the lighting condition in Halim Tower cab after the occurrence which was similar with the condition at the time of occurrence. The lighting condition as observed is shown on the following figure.

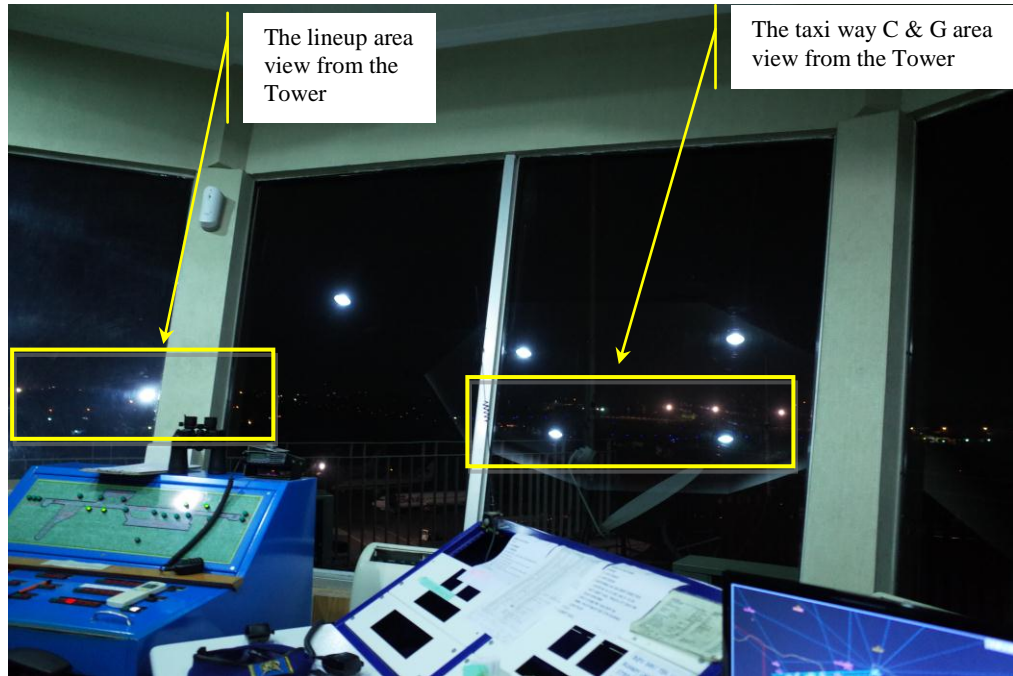


Figure 7: The lighting in Halim Tower cab and the view to the taxiways and the runway

The investigation received a photo of the lighting conditions surrounding the turn pad on Runway 24 which was taken on 20 November 2015 by a flight crew during line up (figure 7).

Based on the crew interviews, the lightings situation surrounding the turn pad of runway 24 at the time of occurrence was similar to that visualized in the photo.



Figure 8: The view from cockpit on the turning pad runway 24 area

In the preliminary report, KNKT issued recommendation to airport operator and AirNav Indonesia branch office Halim to inform aircraft operators to initiate takeoff from the threshold runway 24 of Halim. Until the issuance of this final report, it was found several aircraft initiated the takeoff before the threshold runway 24.

1.11 Flight Recorders

The towed aircraft did not have electrical power during the towing operation, therefore there was no data recorded by the FDR and CVR related to this accident.

This chapter will only discuss the flight recorder data recovered from the ID 7703 aircraft.

1.11.1 Flight Data Recorder (FDR)

The aircraft was equipped with a Honeywell solid state Flight Data Recorder (FDR) with the information as follows:

Manufacturer : Honeywell
Type/Model : HFR5-D
Part Number : 980-4750-009
Serial Number : 03277

The FDR was successfully downloaded at the KNKT facility. The downloaded data was for the time between 12:56:09 UTC until the aircraft stopped at 12:58:10 UTC.

The relevant parameter of the occurrence can be seen on figure 8 and 9.

PK-LBS Boeing 737-800GP

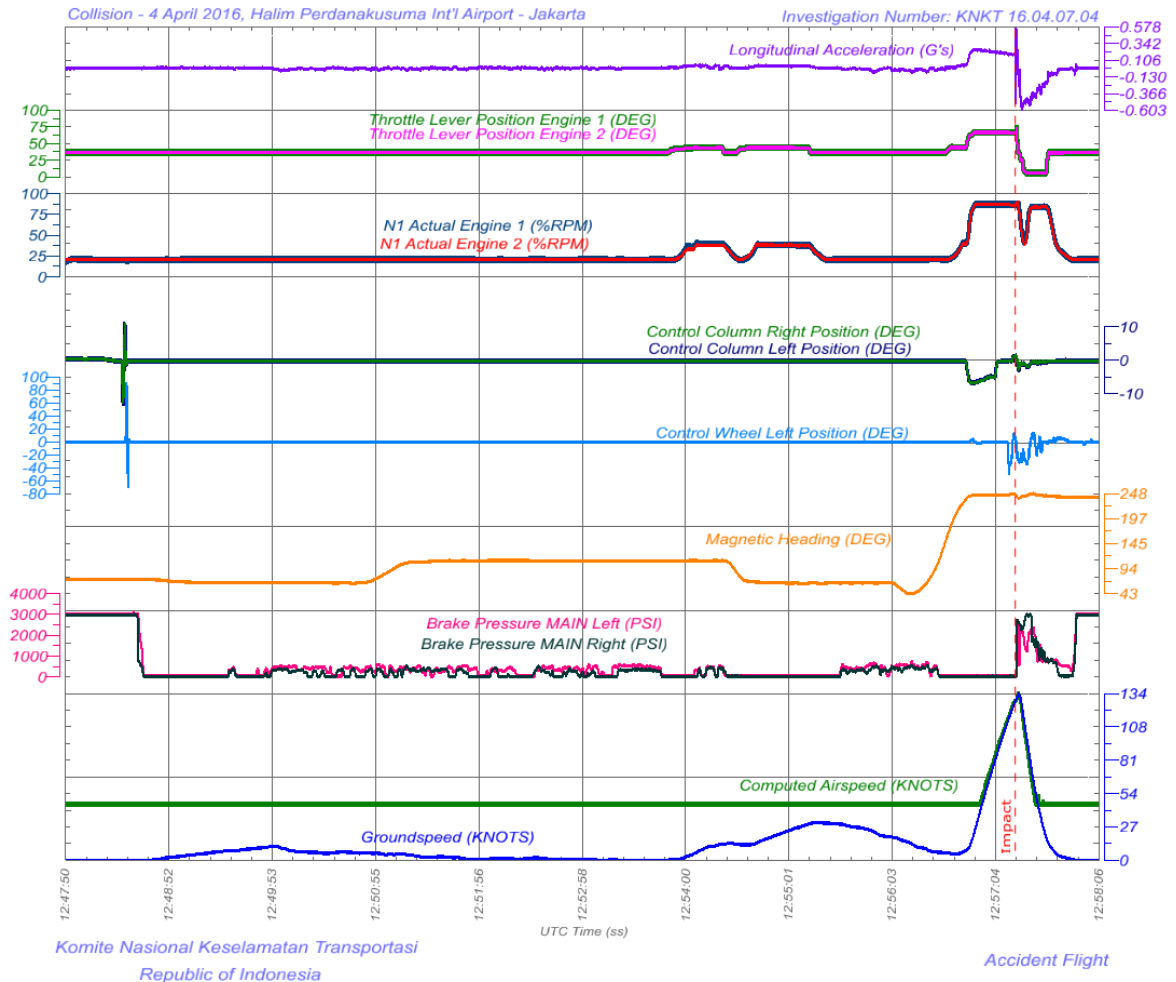


Figure 9: The graph of significant parameters recorded by the FDR from taxi until stop

The significant information of the FDR is as follows:

- 12:48:43 UTC, the ground speed started to increase, indicating that the aircraft started to taxi;
- 12:50:53 UTC, the aircraft heading started to change to heading approximately 110°;
- 12:53:08 UTC, the ground speed 0;
- 12:53:55 UTC, the engine power (N1) increased, ground speed increased
- 12:54:35 UTC, the aircraft heading changed to 065° and groundspeed increased continuously up to 30 knots;
- 12:56:03 UTC, the ground speed decreased and aircraft heading changed to the left and thereafter to the right to heading 248°;
- 12:56:55 UTC, just before reached steady heading of 248°, the throttle levers, the N1 and the aircraft speed increased.

PK-LBS Boeing 737-800GP

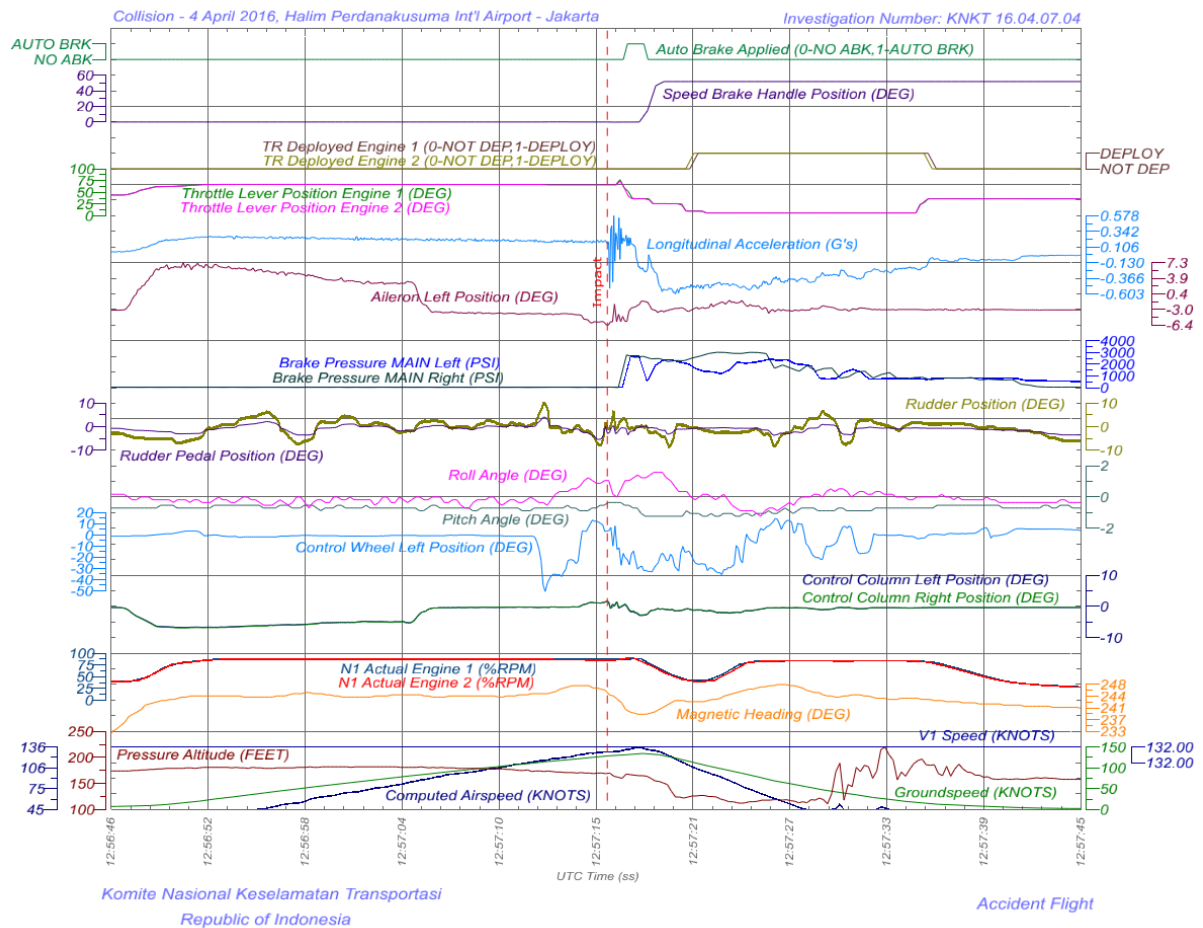


Figure 10: The graph of significant parameters recorded by the FDR on takeoff until stop

The significant information of the FDR is as follows:

- 12:56:48 UTC, the throttle levers position and the N1 started to increase to the highest recorded value. The location recorded at FDR was 6° 15' 39.618" S, 106° 54' 10.73" E or approximately 152 meters before the threshold;
- 12:56:56 UTC, the airspeed started to increase to the highest recorded value of 134 knots;
- 12:57:06 UTC, the control column changed from -5 to 0 and steady followed by the aileron changed from 9 to -3 and steady;
- 12:57:13 UTC, the ground speed was 115 knots. The rudder and the control wheel steering and the rudder pedal moved to the right for about two seconds, followed by aircraft heading changed to the right by about 2°;
- 12:57:16 UTC, the longitudinal acceleration, aileron, control wheel and control column parameters fluctuated. The FDR recorded the location was 6° 15' 53.2152" S, 106° 53' 40.4484" E or approximately 866 meters from threshold;
- 12:57:17 UTC, the throttle levers position decreased, the autobrake active and the brake pressures increased;

- 12:57:18 UTC, the speed brake handle extended, and the N1 decreased. The computed airspeed reached the highest value equal to V1⁸ value then the airspeed started to decrease;
- 12:57:19 UTC, the autobrake deactivated, the brake pressure remained on high pressure;
- 12:57:21 UTC, the thrust reversers deployed followed by N1 increased;
- 12:57:35 UTC, the thrust reversers stowed and N1 decreased;
- 12:57:45 UTC, the groundspeed showed 0. The FDR recorded the location was 6° 16' 4.9584" S, 106° 53' 16.9656" E or approximately 1,680 meters from threshold or 1,832 meters from when TO/GA was executed.



Figure 11: The ID 7703 movement based on the FDR

The ID 7703 collided with the left wing of the towed aircraft at approximately 866 meters from the threshold of runway 24.

1.11.2 Cockpit Voice Recorder (CVR)

The aircraft was equipped with Honeywell CVR with the information as follows:

Manufacturer : Honeywell
 Type/Model : SSCVR
 Part Number : 980-6022-001
 Serial Number : 16246

⁸ V1 (V one) is the take-off decision speed.

The CVR was successfully downloaded at KNKT recorder facility.

The significant excerpt of the CVR

The excerpt below was the significant communication recorded on the CVR from the time the push back initiated until the evacuation was performed.

Note:			
P1 : PIC			
P2 : SIC			
FA : flight attendant			
TWR : Halim Tower controller			
DEP 1 : departure traffic on parking stand B-5			
DEP 2 : departure traffic on parking stand B-7			
LDG 1 : the first landing traffic			
LDG 2 : the second landing traffic			
RAAS : Runway Awareness and Advisory System			
Time (UTC)	From	To	Communication
12:45:30	TWR	ID 7703	Issued pushback clearance.
12:48:11	P2	TWR	Reported ready for taxi.
12:48:14	TWR	ID 7703	Issued taxi clearance.
12:48:59	TWR	LDG 1	The landing traffic (LDG 1) was instructed to hold on taxiway A to give way the towed aircraft movement from parking stand B-1.
12:49:53	TWR	ID 7703	Issued ATC clearance.
12:50:11	TWR	ID 7703	The ID 7703 was instructed to hold on taxiway C due to another aircraft was on approach to land and the position was leaving AL NDB (LDG 2).
12:51:17	LDG 1	TWR	The pilot of the aircraft that was holding on taxiway A requested the towed aircraft position and was instructed to taxi slowly as the towed aircraft had left parking stand B-1.
12:52:23	TWR	DEP 1	A departure traffic was instructed to hold on parking stand B5 to give way the towed aircraft.
12:52:29	TWR	ID 7703	Issued clearance to backtrack runway 24 after LDG 2 landing and passed taxiway C.
12:53:46	TWR	DEP 2	Another departure traffic on parking stand B-7 (DEP 2) was instructed to hold for push back.
12:56:05	P2	TWR	Reported lining up runway 24 and ready for departure.
12:56:10	TWR	ID 7703	Issued take of clearance.
12:57:08	P2	P1	Stated to the P1 that he saw something on the runway.
12:57:16	RAAS		V1.
12:57:16			Noisy sound.

12:57:28	P2	TWR	Reported the flight was rejected.
12:57:30	TWR	ID 7703	Acknowledged the reject takeoff.
12:57:39	P1	FA	Announced “ATTENTION CREW ON STATION” twice
12:57:55	P1	FA	Instructed flight attendants to conduct passenger evacuation from the right side.
12:58:03	FA		Instructed to the passengers to expedite the evacuation.
12:58:09	P1	P2	Asked P2 concerning to the flap operation.
12:58:28	P1	P2	Confirmed whether the takeoff clearance has been issued and affirmed by P2.
12:58:53	FA		Reported to the pilots that the evacuation has completed.
12:59:11	P1	P2	Reconfirmed whether they had takeoff clearance and affirmed by P2.
12:59:24	P1	P2	Instructed to contact TWR for reporting the evacuation process.
12:59:38	P2	TWR	Informed they conducted evacuation on runway and requested assistance.
12:59:57	TWR	ID 7703	Acknowledged by replied “Ok, block runway”.

1.12 Wreckage and Impact Information

The towed aircraft stopped at the left side of the centerline runway 24, at approximately 100 meters from taxiway G with heading approximately 080°. The nose wheel and right main wheel were at the runway shoulder.

The detached left wing was found approximately 17 meters behind the towed aircraft. The horizontal stabilizer and the vertical stabilizer found approximately 30 meters behind the towed aircraft.

The ID 7703 stopped on the centerline runway 24 at approximately 400 meters from towed aircraft with heading approximately 230°.

The left wing was found damaged in three large parts. The first part was found at approximately 200 meter behind the ID 7703 near the taxiway H, while two other parts (winglet) found approximately 350 meters behind the ID 7703.

The illustration of wreckage distribution is as follows:

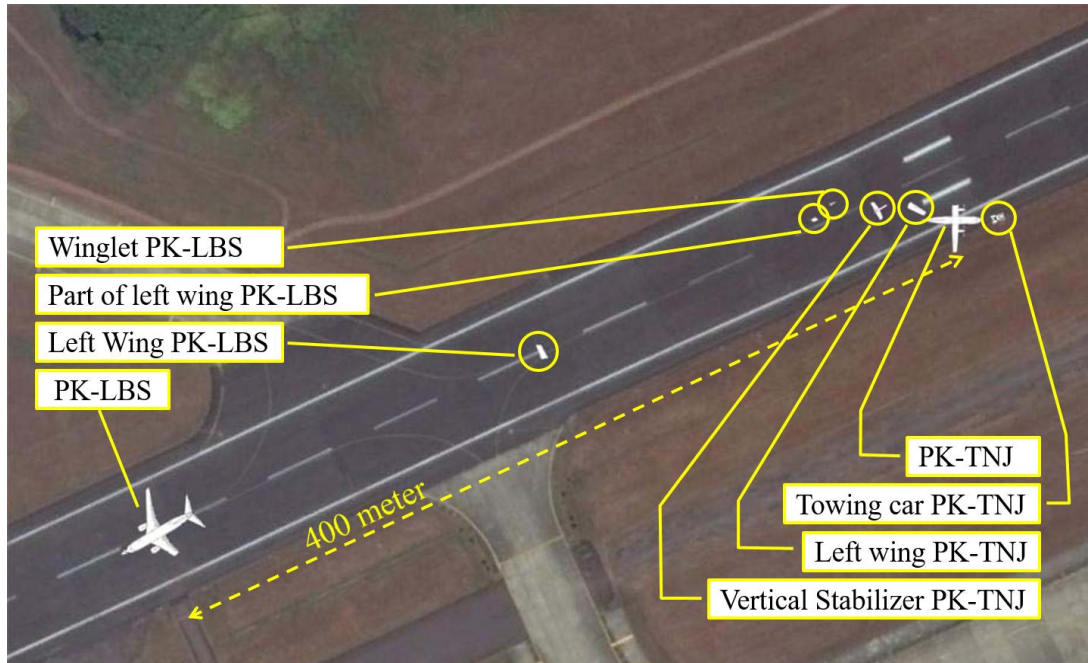
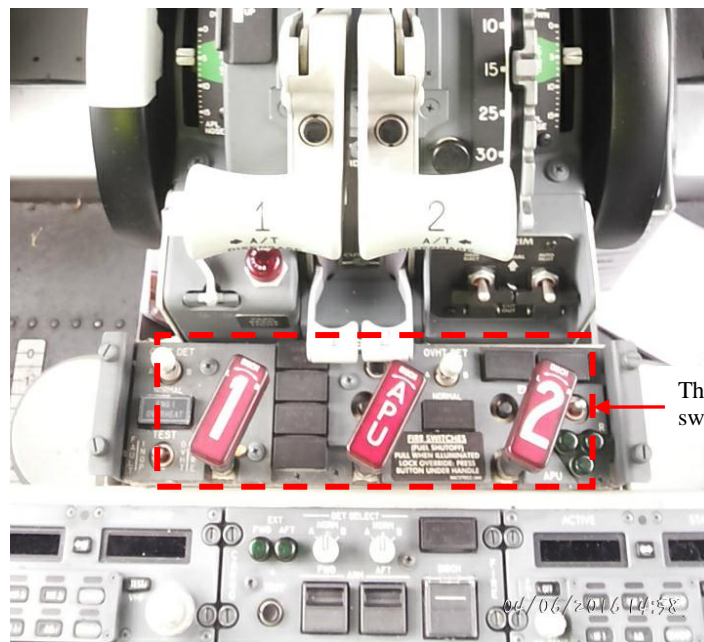


Figure 12: The illustration of the wreckage distribution superimposed to Google earth

Both Engines and the Auxiliary Power Unit (APU) fire switches were pulled and rotated to the right.



The Engines and APU Fire switches position.

Figure 13: The ID 7703 fire switches activated

1.13 Medical and Pathological Information

No medical or pathological examinations were conducted as a result of this accident.

1.14 Fire

The observation on the wreckage found there were burned parts on the left wing and the detached wingtip of the ID 7703 and the damaged stabilizer of the towed aircraft.

1.15 Survival Aspects

The Rescue and Fire Fighting Service (RFFS) arrived at the accident site within two minutes after crash bell activation and discharged the extinguisher agent foam to the left wing of ID 7703 and the other foam tender extinguished the fire on the towed aircraft.

On ID 7703 aircraft, all escape slides were deployed by the flight attendants and the passengers were evacuated through the escape slides safely. The passengers and the crew were then transported by bus to the passenger terminal.



Figure 14: The ID 7703 showing deployed escape slides

1.16 Tests and Research

There was no test and research conducted as result of this investigation.

1.17 Organizational and Management Information

1.17.1 PT. Batik Air Indonesia

The ID 7703 aircraft was operated by PT. Batik Air Indonesia (Batik Air). The operator had a valid Air Operator Certificate (AOC) number 121-050. The aircraft operator office address was Lion Office Building B 2nd floor, Lion City Telaga Bestari, Balaraja, Tangerang, Indonesia.

Batik Air operated total of 33 aircraft consisting of 13 Airbus A320, 14 Boeing 737-800 and 6 Boeing 737-900ER, which served 27 destinations and operated up to 160 flights daily.

Batik Air had several manuals that were approved by the Directorate General of Civil Aviation. The following are the relevant excerpts taken from operator manuals.

1.17.1.1 Boeing 737-800/900 Flight Crew Training Manual (FCTM)

Rejected Takeoff Decision (3.24)

The total energy that must be dissipated during an RTO is proportional to the square of the airplane velocity. At low speeds (up to approximately 80 knots), the energy level is low. Therefore, the airplane should be stopped if an event occurs that would be considered undesirable for continued takeoff roll or flight.

Examples include Master Caution, unusual vibrations or tire failure.

Note: Refer to the Rejected Takeoff NNM in the QRH for guidance concerning the decision to reject a takeoff below and above 80 knots.

As the airspeed approaches V₁ during a balanced field length takeoff, the effort required to stop can approach the airplane maximum stopping capability.

Therefore, the decision to stop must be made before V₁.

Historically, rejecting a takeoff near V₁ has often resulted in the airplane stopping beyond the end of the runway. Common causes include initiating the RTO after V₁ and failure to use maximum stopping capability (improper procedures/techniques). Effects of improper RTO execution are shown in the diagrams located in the RTO Execution Operational Margins section of this chapter. The maximum braking effort associated with an RTO is a more severe level of braking than most pilots experience in normal service.

Rejecting the takeoff after V₁ is not recommended unless the captain judges the airplane incapable of flight. Even if excess runway remains after V₁, there is no assurance that the brakes have the capacity to stop the airplane before the end of the runway.

There have been incidents where pilots have missed FMC alerting messages informing them that the takeoff speeds have been deleted or they have forgotten to set the airspeed bugs. If, during a takeoff, the crew discovers that the V speeds are not displayed and there are no other fault indications, the takeoff may be continued. The lack of displayed V speeds with no other fault indications does not fit any of the published criteria for rejecting a takeoff (refer to the Rejected Takeoff NNM in the QRH). In the absence of displayed V speeds, the PM should announce V₁ and V_R speeds to the PF at the appropriate times during the takeoff roll. The V₂ speed should be displayed on the MCP and primary airspeed indicators. If neither pilot recalls the correct rotation speed, rotate the airplane 5 to 10 knots before the displayed V₂ speed.

Rejected Takeoff Maneuver (3.25)

The RTO maneuver is initiated during the takeoff roll to expeditiously stop the airplane on the runway. The PM should closely monitor essential instruments during the takeoff roll and immediately announce abnormalities, such as “ENGINE FIRE”, “ENGINE FAILURE”, or any adverse condition significantly affecting safety of flight. The decision to reject the takeoff is the responsibility of the captain, and must be made before V1 speed. If the captain is the PM, he should initiate the RTO and announce the abnormality simultaneously.

Note: If the decision is made to reject the takeoff, the flight crew should accomplish the rejected takeoff non-normal maneuver as described in the Maneuvers Chapter of the QRH.

If the takeoff is rejected before the THR HLD annunciation, the autothrottle should be disconnected as the thrust levers are moved to idle. If the autothrottle is not disconnected, the thrust levers advance to the selected takeoff thrust position when released. After THR HLD is annunciated, the thrust levers, when retarded, remain in idle. For procedural consistency, disconnect the autothrottles for all rejected takeoffs.

If rejecting due to fire, in windy conditions, consider positioning the airplane so the fire is on the downwind side. After an RTO, comply with brake cooling requirements before attempting a subsequent takeoff.

Go/Stop Decision Near V1 (3.25)

Go/Stop Decision Near V1 It was determined when the aviation industry produced the Takeoff Safety Training Aid in 1992 that the existing definition of V1 might have caused confusion because they did not make it clear that V1 is the maximum speed at which the flight crew must take the first action to reject a takeoff. The U.S. National Transportation Safety Board (NTSB) also noted in their 1990 study of rejected takeoff accidents, that the late initiation of rejected takeoffs was the leading cause of runway overrun accidents. As a result, the FAA has changed the definition of V1 in 14 CFR Part 25 to read as follows:

- V1 means the maximum speed in the takeoff at which the pilot must take the first action (e.g., apply brakes, reduce thrust, deploy speedbrakes) to stop the airplane within the accelerate-stop distance and*
- V1 also means the minimum speed in the takeoff, following a failure of an engine at which the pilot can continue the takeoff and achieve the required height above the takeoff surface within the takeoff distance.*

Pilots know that V1 is fundamental to making the Go/Stop decision. Under runway limited conditions, if the reject procedure is initiated at V1, the airplane can be stopped before reaching the end of the runway. See RTO Execution Operational Margins diagrams for the consequences of initiating a reject after V1 and/or using improper procedures.

When the takeoff performance in the AFM is produced, it assumes an engine failure or event one-second before V1. In a runway limited situation, this means the airplane reaches a height of 35 feet over the end of the runway if the decision is to continue the takeoff.

Within reasonable limits, even if the engine failure occurs earlier than the assumed one second before V1, a decision to continue the takeoff will mean that the airplane is lower than 35 feet at the end of the runway, but it is still flying. For example, if the engine fails 2 seconds before V1 and the decision is made to go, the airplane will reach a height of 15 to 20 feet at the end of the runway.

Although training has historically centered on engine failures as the primary reason to reject, statistics show engine thrust loss was involved in approximately one quarter of the accidents, and wheel or tire problems have caused almost as many accidents and incidents as have engine events. Other reasons that rejects occurred were for configuration, indication or light, crew coordination problems, bird strikes or ATC problems.

It is important to note that the majority of past RTO accidents were not the result of an RTO initiated because of an engine failure. Full takeoff thrust from all engines was available. With normal takeoff thrust, the airplane should easily reach a height of 150 feet over the end of the runway, and the pilot has the full length of the runway to stop the airplane if an air turnback is required.

Making the Go/Stop decision starts long before V1. Early detection, good crew coordination and quick reaction are the keys to a successful takeoff or stop.

1.17.2 PT. TransNusa Aviation Mandiri

The towed aircraft was operated by PT. TransNusa Aviation Mandiri (TransNusa) that had a valid Air Operator Certificate (AOC) number 121-048. The aircraft operator office address was Jalan Palapa 7, Oebobo, Kupang, Indonesia.

TransNusa operated a total of eight aircraft consisting of five Fokker 50, one Fokker 70, one ATR 42-600 and one BAe 146-100, which served 12 destinations, mainly in the eastern region of Indonesia.

TransNusa had an agreement with PT Jasa Angkasa Semesta (PT. JAS) for ground handling at Halim airport. The agreement was stated on Standard Ground Handling Agreement No Ref.031A/JAS-TransNusa/VI/2016. The agreement did not mention the specific technical procedure for towing or pushback.

1.17.2.1 Company Standard Towing procedure

The towing procedure for ATR 42 was described in the Aircraft Maintenance Manual (AMM), chapter 09-11-00: Job Instruction Card in the instruction number TWG 10005-001. The Job Instruction Card describes the towing procedure of using the electrical system with one engine running (hotel mode). Towing by night with an engine not running was applicable only for the ATR 72 model aircraft embodied with SB ATR72-33-1016. Based on lack of customer demand, there was no aircraft manufacturer design change allowing towing without an engine running for ATR 42-500 by night.

The part of the job instruction card is as follow:



TITLE TOWING BY THE NOSE GEAR		09-11-00 TWG 10005-001			
		STS.	CHECK	PAGE 2	DATE JUL15
ITEM	TASK DESCRIPTION	MECH.	INSP.		
001	<p><u>WARNING</u></p> <p>NOTE 1: THIS JIC ALLOWS TOWING THE AIRCRAFT BY NIGHT WITH ANTI-COLL&NAV LIGHT SUPPLIED BY MEANS OF RH-ENG OPERATING IN HOTEL MODE.</p> <p>NOTE 2: ON ATR72 EMBODIED BY SB 33-1016, TOWING BY NIGHT CAN ALSO BE PERFORMED WITH ENGINE NOT RUNNING (REF JIC-091100-TWG-10000) AFTER TOWING POSITION SELECTION FOR ANTI-COLL&NAV LIGHTS.</p>				

Figure 15: Job instruction card for towing ATR 42

The operator procedure for engine running in hotel mode required personnel certified for engine run therefore towing with engine run should be accompanied by certified personnel.

When the certified personnel are not available, the operator provided the alternative anti-collision lights for the purpose of towing the aircraft at night. This procedure was described in the Engineering Instruction number ATR/EI/33/XI/2015/028 dated 4 November 2015 with subject of Installation Portable Navigation Light for Towing ATR Aircraft. The procedure required to install portable lights on the wing tips.

The investigation found red and green commercial strobe lights with dimension approximately of 8 × 3 cm (figure 15). These lights were used as alternate portable anti-collision & navigation lights installed in towed aircraft.



Figure 16: The portable light fitted on the wing tips of the towed aircraft

1.17.3 PT. Jasa Angkasa Semesta

PT. Jasa Angkasa Semesta (PT. JAS) was the ground handling service provider that performed towing for the ATR 42-600 aircraft of TransNusa. The company office address was Wisma Soewarna, Soewarna Business Park 1st Floor, Soekarno-Hatta International Airport, Tangerang, Indonesia.

PT. Jasa Angkasa Semesta established their operation in 1985 and provided ground handling services, cargo handling and warehousing services. PT Jasa Angkasa Semesta served about 42 aircraft operators in 12 airports in Indonesia.

The towing process was conducted according to PT. JAS procedures as described in the Ramp Handling Manual as follows:

RAMP Handling Manual

8.3 TOWING PROCEDURES

(a) Aircraft Towing Procedures:

(i) Prior to the commencement of any towing operation a check should be made that the communications link between the tractor operator and the aircraft flight deck crew is functional.

(ii) The aircraft flight deck crew should have full hydraulic brake system pressure prior to and for the duration of the towing operation.

(iii) In the event that the communications link between the tractor operator and the aircraft flight deck crew is broken during the tow the operation should be immediately stopped.

(e) When towing during low visibility / night conditions the aircraft should be adequately illuminated so it can be seen.

1.17.4 AirNav Indonesia District Office Halim Perdanakusuma

The AirNav Indonesia district office of Halim Perdanakusuma was air navigation provider that provided air traffic services, including aerodrome control service in Halim. The AirNav Indonesia district office of Halim Perdanakusuma address was Jalan Protokol Halim Perdanakusuma No. 1, Jakarta Timur, Indonesia.

The management explained that the aircraft and vehicle movement of cross the runway between north and south apron per day was more than 100 movements per day.

1.17.4.1 Air Traffic Services Standard Operating Procedure (SOP)

The relevant parts of the Air Traffic Services (ATS) Standard Operating Procedure (SOP) of Halim are described as follows:

- Subchapter 11.04.02 described that ATS Operation Jakarta is responsible to provide air traffic services to flights in the airspace to prevent collision between aircraft and prevent collision between aircraft with obstacle in the maneuvering area.
- Subchapter 11.07.03 described that the aerodrome control tower shall maintain a continuous watch on all flight operations on and in the vicinity of an aerodrome as well as vehicles and personnel on the maneuvering area.
- Subchapter 11.07.06 described a takeoff clearance may be issued when several requirements as follow are met:
 - Sufficient traffic separation;
 - The issued ATC clearance has been acknowledged and readback by the pilot;
 - The aircraft has been ready for takeoff and the traffic condition permitted.
- Subchapter 11.07.07 (Controlling Aircraft on Taxi), which described taxi clearance to a departure aircraft issued after the aircraft reported ready and request taxi clearance. Taxi clearance shall contain concise instruction and relevant information to assist the flight crew to follow the taxi route and to prevent collision between aircraft or minimize the aircraft to enter the active runway.
- Subchapter 11.07.12 (Ground Services Procedure), described procedure of coordination between the Air Traffic Services (ATS) unit and Apron Movement Control (AMC) for aircraft parking.

The investigation could not find the procedure of Halim airport that contained handling ground movement, other than aircraft on the maneuvering area.

1.17.4.2 The Tower Unit Set Crew Duty and Responsibility

The following are the existing SOP of the Halim Air Traffic Services on the day of the occurrence concerning to the duty and responsibility for the tower unit set crew. The original SOP written Bahasa Indonesia (left table) and the English translation were made for the purpose of this report showed on the right table.

<p><i>11.03 Administrasi dan Manajemen</i></p> <p><i>11.03.03 Uraian Tugas dan Tanggung Jawab</i></p> <p><i>b. Pengawas Teknis Operasional (PTO) / Supervisor ATC, mempunyai tanggung jawab sebagai berikut:</i></p> <ol style="list-style-type: none"> <i>1. Melakukan briefing kepada Pelaksana ATC tentang SOP, NOTAM dan semua peraturan-peraturan penerbangan yang berlaku.</i> <i>2. Memimpin anggota shift-nya.</i> <i>3. Mengatur posisi kerja anggota shift terkait.</i> <i>4. Mengatur pembagian tugas anggota shift terkait.</i> <i>5. Melakukan pemeriksaan terhadap kesiapan fasilitas kerja</i> <i>6. Mengawasi anggota shift.</i> <i>7. Mengarahkan anggota shift.</i> <i>8. Melakukan penilaian terhadap anggota shift.</i> <i>9. Melakukan tindakan awal pada kondisi dan situasi yang kritis.</i> <i>10. Melakukan koordinasi operasional dengan unit terkait.</i> <i>11. Mengisi Buku catatan Operasional kerja (logbook) pada tiap shift.</i> <i>12. Bertanggung jawab dalam pengisian e-logbook dan EFFORT⁹ pada tiap shift.</i> 	<p>11.03 Management and Administration</p> <p>11.03.03 Description of Duty and Responsibility</p> <p>b. ATC Supervisor responsible for the following:</p> <ol style="list-style-type: none"> 1. Brief the controller regarding to SOP, NOTAM and all existing regulation related to aircraft operation. 2. As a shift team leader. 3. Manage the working position of the shift member. 4. Distribute the task to the shift member. 5. Prepare the availability and serviceability of the facilities 6. Supervise the shift member. 7. Provide guidance to the shift member. 8. Assess the shift member. 9. Perform initial action during a critical situation. 10. Conduct operational coordination with the related unit. 11. Record the operation activity of each shift in the logbook. 12. Responsible to fill e-logbook and EFFORT.
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⁹ Effort is the acronym of Electronic Form for Occurrence Report which was the AirNav reporting system.

<p>13. <i>Melakukan serah terima tugas dengan PTO pengganti.</i></p> <p>14. <i>Membantu tugas-tugas lain yang diberikan atasan.</i></p>	<p>13. Handover the duty to the supervisor of the next shift.</p> <p>14. Perform other duty as assigned by the management.</p>
<p>c. <i>Pemandu Non Radar</i> adalah seseorang <i>Pemandu Lalu Lintas Penerbangan Senior yang melaksanakan pelayanan pemanduan Lalu Lintas Penerbangan pada posisi kerja menggunakan cara-cara prosedural dengan memberikan:</i></p> <ol style="list-style-type: none"> 1. <i>Separasi sesuai standar separasi non-radar.</i> 2. <i>Memberikan ketinggian yang sesuai dengan kondisi Lalu Lintas Penerbangan.</i> 3. <i>Melakukan koordinasi dengan unit ATS yang batas batas ruang udaranya berimpitan</i> 4. <i>Keputusan tentang ketinggian yang tersedia, ketinggian akhir perkiraan waktu pada titik transfer pemanduan, penyimpangan dan perubahan rute pesawat udara yang berada di dalam wilayah yang menjadi tanggung jawabnya.</i> 	<p>c. Non-radar Controller is a senior air traffic controller which perform air traffic services on the controller working position by using procedural control to provide:</p> <ol style="list-style-type: none"> 1. Separation according to non-radar separation standard. 2. Appropriate altitude in accordance with the traffic condition. 3. Coordination with the adjacent ATS units. 4. Decision of vacant altitude, estimate time of final altitude on transfer point, deviation and changing of aircraft route within responsibility jurisdiction.
<p>d. <i>Asisten Pelaksana ATC</i> adalah <i>Pemandu Non Radar yang bertugas dan bertanggung jawab membantu semua kegiatan yang dilaksanakan pelaksana ATC yaitu:</i></p> <ol style="list-style-type: none"> 1. <i>Menyiapkan data penerbangan.</i> 2. <i>Melaksanakan koordinasi dengan unit-unit Pelayanan Lalu Lintas Penerbangan.</i> 	<p>d. Assistant Controller is non-radar air traffic controller that has the duty and responsibility to assist activities performed by air traffic controller on duty, as follows:</p> <ol style="list-style-type: none"> 1. Prepare the flight data. 2. Coordinate with other Air Traffic Services units.

1.17.5 **Angkasa Pura II, branch office Halim Perdanakusuma International Airport**

The Halim Perdanakusuma airport was a combined civil and military use airport. The civil airport was operated by Angkasa Pura II branch office Halim Perdanakusuma International Airport. The airport operator address was Halim Perdanakusuma International Airport, Jakarta 13610.

1.17.6 Indonesia Regulations

The related regulations concerning of controlling vehicles at aerodrome, and aircraft lightings are described as follows.

1.17.6.1 CASR 25: Airworthiness Standards: Transport Category Airplanes

25.1385: Position Light System Installation

(a) *General. Each part of each position light system must meet the applicable requirements of this section and each system as a whole must meet the requirements of Secs. 25.1387 through 25.1397.*

(b) *Forward position lights. Forward position lights must consist of a red and a green light spaced laterally as far apart as practicable and installed forward on the airplane so that, with the airplane in the normal flying position, the red light is on the left side and the green light is on the right side. Each light must be approved.*

25.1387: Position Light System Dihedral Angle

(b) *Dihedral angle L (left) is formed by two intersecting vertical planes, the first parallel to the longitudinal axis of the airplane, and the other at 110 degrees to the left of the first, as viewed when looking forward along the longitudinal axis.*

(c) *Dihedral angle R (right) is formed by two intersecting vertical planes, the first parallel to the longitudinal axis of the airplane, and the other at 110 degrees to the right of the first, as viewed when looking forward along the longitudinal axis.*

25.1391 Minimum Intensities in the Horizontal Plane of Forward and Rear Position Lights

Each position light intensity must equal or exceed the applicable values in the following table:

Dihedral angle (light included)	Angle from right or left of longitudinal axis, measured from dead ahead	Intensity
L and R (forward red and green)	0° to 10°	40
	10° to 20°	30
	20° to 110°	5
A (rear white)	110° to 180°	20

25.1401: Anticollision Light System

(a) *General. The airplane must have an anticollision light system that—*

(1) *Consists of one or more approved anticollision lights located so that their light will not impair the crew's vision or detract from the conspicuity of the position lights; and*

(2) *Meets the requirements of paragraphs (b) through (f) of this section.*

(b) *Field of coverage.* The system must consist of enough lights to illuminate the vital areas around the airplane considering the physical configuration and flight characteristics of the airplane. The field of coverage must extend in each direction within at least 75 degrees above and 75 degrees below the horizontal plane of the airplane, except that a solid angle or angles of obstructed visibility totaling not more than 0.03 steradians is allowable within a solid angle equal to 0.15 steradians centered about the longitudinal axis in the rearward direction.

(c) *Flashing characteristics.* The arrangement of the system, that is, the number of light sources, beam width, speed of rotation, and other characteristics, must give an effective flash frequency of not less than 40, nor more than 100 cycles per minute. The effective flash frequency is the frequency at which the airplane's complete anticollision light system is observed from a distance, and applies to each sector of light including any overlaps that exist when the system consists of more than one light source. In overlaps, flash frequencies may exceed 100, but not 180 cycles per minute.

(d) *Color.* Each anticollision light must be either aviation red or aviation white and must meet the applicable requirements of Sec. 25.1397.

(e) *Light intensity.* The minimum light intensities in all vertical planes, measured with the red filter (if used) and expressed in terms of "effective" intensities, must meet the requirements of paragraph (f) of this section. The following relation must be assumed:

$$I_e = \frac{\int_{t_1}^{t_2} i(t) dt}{0.2 + (t_2 - t_1)}$$

where:

I_e = effective intensity (candles).

$I(t)$ = instantaneous intensity as a function of time.

$t_2 - t_1$ = flash time interval (seconds).

Normally, the maximum value of effective intensity is obtained when t_2 and t_1 are chosen so that the effective intensity is equal to the instantaneous intensity at t_2 and t_1 .

(f) *Minimum effective intensities for anticollision lights.* Each anticollision light effective intensity must equal or exceed the applicable values in the following table.

Angle above or below the horizontal plane	Effective intensity (candles)
0° to 5°	400
5° to 10°	240
10° to 20°	80
20° to 30°	40
30° to 75°	20

1.17.6.2 CASR 91: General Operating and Flight Rules

91.209 Aircraft Lights

No person may, during the period from sunset to sunrise

- (b) Park or move an aircraft in, or in dangerous proximity to, a night flight operations area of an airport unless the aircraft:*
 - (1) Is clearly illuminated;*
 - (2) Has lighted position lights; or*
 - (3) Is in an area which is marked by obstruction lights.*

1.17.6.3 CASR 170: Air Traffic Rules

170.039 Control of persons and vehicles at aerodromes

- 1) The movement of persons or vehicles including towed aircraft on the maneuvering area of an aerodrome shall be controlled by the aerodrome control tower as necessary to avoid hazard to them or to aircraft landing, taxiing or taking off;*
- 4) Subject to the provisions in 3.8.3, vehicles on the manoeuvring area shall be required to comply with the following rules:*
 - a) vehicles and vehicles towing aircraft shall give way to aircraft which are landing, taking off or taxiing;*
 - b) vehicles shall give way to other vehicles towing aircraft;*
 - c) vehicles shall give way to other vehicles in accordance with ATS unit instructions;*
 - d) Notwithstanding the provisions of a), b) and c), vehicles and vehicle towing aircraft shall comply with instructions issued by the aerodrome control tower.*

170.052 Aeronautical fixed service (ground-ground communication)

- 3) Surface movement control service*
 - a) Communications for the control of vehicles other than aircraft on maneuvering areas at controlled aerodromes*
 - (i) Two-way radiotelephony communication facilities shall be provided for aerodrome control service for the control of vehicles on the maneuvering area, except where communication by a system of visual signals is deemed to be adequate.*
 - (ii) Where conditions warrant, separate communication channels shall be provided for the control of vehicles on the maneuvering area. Automatic recording facilities shall be provided on all such channels.*
 - (iii) Recordings of communications as required in paragraph (ii) shall be retained for a period of at least thirty days. See also ICAO Annex 10, Volume II, 3.5.1.5.*

1.17.6.4 Advisory Circular (AC) CASR 170-02: Manual of Air Traffic Services Operational Procedures

7.5.3 Traffic on the manoeuvring area

7.5.3.1 CONTROL OF TAXIING AIRCRAFT

7.5.3.1.1 TAXI CLEARANCE

7.5.3.1.1.1 Prior to issuing a taxi clearance, the controller shall determine where the aircraft concerned is parked. Taxi clearances shall contain concise instructions and adequate information so as to assist the flight crew to follow the correct taxi routes, to avoid collision with other aircraft or objects and to minimize the potential for the aircraft inadvertently entering an active runway.

7.5.3.1.1.2 When a taxi clearance contains a taxi limit beyond a runway, it shall contain an explicit clearance to cross or an instruction to hold short of that runway.

7.5.3.1.2 TAXIING ON A RUNWAY-IN-USE

7.5.3.1.2.1 For the purpose of expediting air traffic, aircraft may be permitted to taxi on the runway-in-use, provided no delay or risk to other aircraft will result. Where control of taxiing aircraft is provided by a ground controller and the control of runway operations by an aerodrome controller, the use of a runway by taxiing aircraft shall be coordinated with and approved by the aerodrome controller. Communication with the aircraft concerned should be transferred from the ground controller to the aerodrome controller prior to the aircraft entering the runway.

7.5.3.1.2.2 If the control tower is unable to determine, either visually or by radar, that a vacating or crossing aircraft has cleared the runway, the aircraft shall be requested to report when it has vacated the runway. The report shall be made when the entire aircraft is beyond the relevant runway-holding position.

7.5.3.2 Control of Other Than Aircraft Traffic

7.5.3.2.1 Entry to The Manoeuvring Area

The movement of pedestrians or vehicles on the manoeuvring area shall be subject to authorization by the aerodrome control tower. Persons, including drivers of all vehicles, shall be required to obtain authorization from the aerodrome control tower before entry to the manoeuvring area. Notwithstanding such an authorization, entry to a runway or runway strip or change in the operation authorized shall be subject to a further specific authorization by the aerodrome control tower.

7.5.3.2.3 Communication Requirements and Visual Signals

7.5.3.2.3.1 At controlled aerodromes all vehicles employed on the manoeuvring area shall be capable of maintaining two-way radio communication with the aerodrome control tower, except when the vehicle is only occasionally used on the manoeuvring area and is:

- a) accompanied by a vehicle with the required communications capability, or*
- b) employed in accordance with a pre-arranged plan established with the aerodrome control tower.*

12.2 General

12.2.1 Most phraseologies contained in Section 12.3 of this Chapter show the text of a complete message without call signs. They are not intended to be exhaustive, and when circumstances differ, pilots, ATS personnel and other ground personnel will be expected to use plain language, which should be as clear and concise as possible, to the level specified in the ICAO language proficiency requirements contained in Annex 1 — Personnel Licensing, in order to avoid possible confusion by those persons using a language other than one of their national languages.

12.2.6 Phraseologies for the movement of vehicles, other than tow-tractors, on the manoeuvring area shall be the same as those used for the movement of aircraft, with the exception of taxi instructions, in which case the word “PROCEED” shall be substituted for the word “TAXI” when communicating with vehicles.

12.3.4.5 TOWING PROCEDURES

...ATC response

†a) *REQUEST TOW* [company name] (aircraft type) *FROM* (location) *TO* (location);

b) *TOW APPROVED VIA* (specific routing to be followed);

c) *HOLD POSITION*;

d) *STAND BY*.

†: Denotes transmission from aircraft/tow vehicle combination.

1.17.6.5 Manual of Standard CASR – Part 139 Volume I Aerodromes

<p>10.10.3. Pengemudi Kendaraan Sisi Udara</p> <p>10.10.3.1. Pengemudi yang mengoperasikan kendaraan di sisi udara harus terlatih dan kompeten dalam melaksanakan tugasnya.</p> <p>10.10.3.2. Setiap orang yang mengoperasikan kendaraan dan peralatan darat, harus:</p> <ul style="list-style-type: none"> a) memiliki PAS bandar Udara; b) memiliki Tanda Izin Mengemudi; c) memiliki lisensi yang sesuai; d) mengetahui terminologi (runway, taxiway, apron, services road), dan e) mengenal dengan baik area sisi udara; f) mengerti makna dari rambu dan marka bandar udara; dan 	<p>10.10.3. Operator of vehicle on the airside</p> <p>10.10.3.1. Operator of vehicle on the airside shall be properly trained and capable to perform the duty.</p> <p>10.10.3.2 Operator of vehicle and ground support, shall:</p> <ul style="list-style-type: none"> a) hold valid airport ID; b) hold airport driving license; c) hold proper license; d) understand the terminology (runway, taxiway, apron, service road), and e) well know the air side area; f) understand the meaning of the airport sign and marking;
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g) jika memungkinkan, kompeten dalam menggunakan alat komunikasi radio dan mengerti instruksi-instruksi yang disampaikan melalui radio.	g) if possible, able to use radio communication and understand the instructions.
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1.17.6.6 Advisory Circular CASR PART 139-14, Competency Standard for Aerodrome Personnel

6. Competency Standard for Ground Support Equipment Personnel

6.1. Competence for the personnel have the rating of Aircraft Towing Pushback Tractor – Narrow or wide, the standard competence is able to operate Aircraft Towing Pushback Tractor - Narrow or wide.

6.2. Competence Standard

Rating Aircraft Towing Pushback Tractor – Narrow or wide.

- a. Have adequate knowledge to the related regulations.*
- b. Have adequate knowledge the general equipment of the Ground Support Equipment (GSE).*
- c. Have adequate knowledge the daily maintenance of the Ground Support Equipment (GSE).*
- d. Have adequate knowledge the procedures of the Ground Support Equipment (GSE).*
- e. Have adequate knowledge the emergency procedure of the Ground Support Equipment (GSE).*

1.17.7 ICAO Standard and Recommended Practices

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

Attachment A. Guidance material supplementary to Annex 14, Volume I

19. Operators of vehicles

19.1 The authorities responsible for the operation of vehicles on the movement area should ensure that the operators are properly qualified. This may include, as appropriate to the driver's function, knowledge of:

- a) the geography of the aerodrome;*
- b) aerodrome signs, markings and lights;*
- c) radiotelephone operating procedures*
- d) terms and phrases used in aerodrome control including the ICAO spelling alphabet;*
- e) rules of air traffic services as they relate to ground operations;*
- f) airport rules and procedures; and*
- g) specialist functions as required, for example, in rescue and fire fighting.*

19.2 *The operator should be able to demonstrate competency, as appropriate, in:*

- a) the operation or use of vehicle transmit/receive equipment;*
- b) understanding and complying with air traffic control and local procedures;*
- c) vehicle navigation on the aerodrome; and*
- d) special skills required for the particular function.*

In addition, as required for any specialist function, the operator should be the holder of a State driver's license, a State radio operator's license or other licenses.

19.3 *The above should be applied as is appropriate to the function to be performed by the operator, and it is not necessary that all operators be trained to the same level, for example, operators whose functions are restricted to the apron.*

19.4 *If special procedures apply for operations in low visibility conditions, it is desirable to verify an operator's knowledge of the procedures through periodic checks.*

ICAO Document 9426: Air Traffic Services Planning Manual

2.1 Operational Requirements

2.1.4 *Vertical supports for the cab roof should be kept to the smallest feasible diameter so as to minimize their obstruction of the controller's view. The supports should also be as few as possible commensurate with minimizing reflections. In this respect, it should be noted that the less vertical supports, the fewer window panes are required. However, with fewer panes there will also be more reflections. The height of the window sills, which support the windows in the cab, should be as low as practicable since they affect the controller's ability to scan the surface area extending from the base of the tower. For the same reason, tower consoles should be designed so as not to exceed the height of the window sill. The depth of consoles has similar effects on sight limitations. Generally, the higher the window sill and/or the deeper the consoles the larger the surface area extending from the base of the tower which cannot be seen by the controller. Suitable minimum glare or non-glare lighting must be provided to allow the controller to read and write. It must also be arranged so that at night it does not diminish his ability to survey the aerodrome and its vicinity.*

2.2 Structural Requirements

2.2.1.5 *Tower cab lighting of variable intensity should generally be recessed in the ceiling and directionally adjustable. Operational lighting required to illuminate a specific working position should be placed and painted so as to minimize glare and reflections. Floor lighting and stair lighting should be recessed and shielded.*

1.18 Additional Information

1.18.1 Towing Car

The towing car used for towing aircraft was an F59 model which having 4x4 drive system capable to tow ATR 42 up to MD 80 aircraft and had towing speed capability of between 10 to 20 km/Hr depending on the aircraft weight and environmental conditions.

The towing car was fitted with head lights and a rotating beacon located above the driver compartment, which were illuminated during the towing process.

The towing car have a valid certificate of operation worthiness of airport equipment and utility number DBU-GSE/HLP/0002/II/2015 issued on 23 February 2015 from Directorate of Airport and valid until February 2017.

The figures below show the towing car and performance capability.



Figure 17: Archive photo of the Towing Car




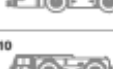



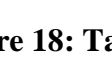
		Aircraft weight									
		50t	100t	150t	200t	250t	300t	350t	400t	45t	
Boeing		B717	B727		B757	B767	B767		B777	B747-400	
Airbus		A318	A319	A320	A310	A300	A350	A330	A340	A340-600	
MDOuglas			MD80				DC10		MD11		
others		F28	AV10	Bas	F100		IL76	L1011	IL96		AN124
• Tow Hitch	Drive system	Tractor weight									
	4x4	5/7 to									
	4x4	8/11 to									
	4x4	10/18 to									
	4x4	18/25 to									
	4x4	22/32 to									
	4x4	28/43 to									
	4x4	48/70 to									
	Hydro-static drive	4.3 to									

Figure 18: Table of F59 tow performance capability (red shadow)

1.18.2 Night Vision

The introduction to the night vision refers to the United States Air Force School of Airspace Medicine Brook AFB Texas, 4th Edition, July 1995¹⁰. The article described: *there are two types of sensory receptors in the retina--rods and cones. According to the widely accepted duplicity theory of vision, the rods are responsible for vision under very dim levels of illumination (scotopic vision), and the cones function at higher illumination levels (photopic vision). The cones alone are responsible for color vision. This receptor system allows the human eye to function over an impressively large range of ambient light levels (Fig. 8-16). There is a common misconception (misconstruction), however, that the rods are used only at night and the cones only during the day. Actually, both rods and cones function over a wide range of light intensity levels and, at intermediate levels of illumination, they function simultaneously.*

¹⁰ More detail of this literature is attached in the Appendix 6.6 of this final report.

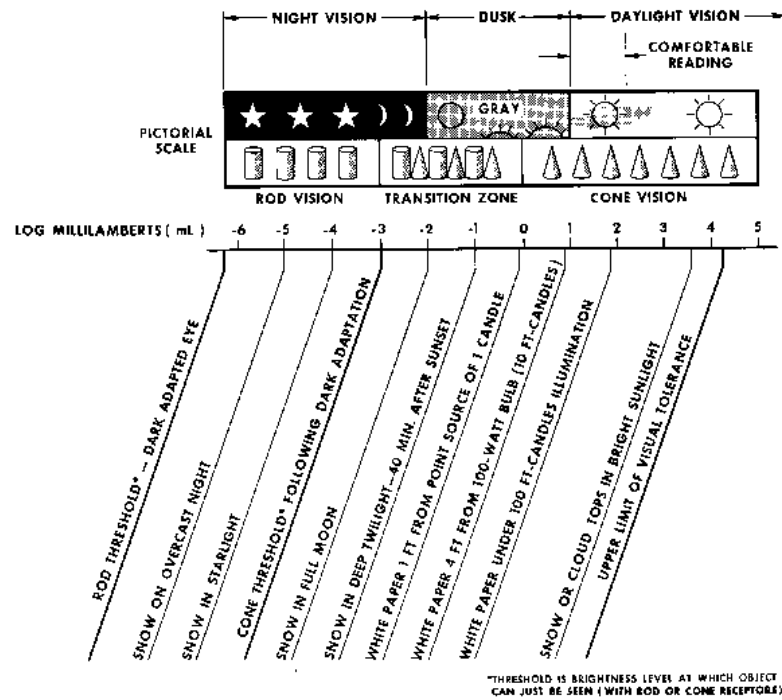


Figure 8-16. Range of ambient light levels, in millilamberts of luminance, over which the human eye can function. Ranges of photopic (cone) vision and scotopic (rod) vision are shown, along with the transition zone of mesopic vision.

Dark Adaptation, both the rods and cones contain photopigments which, on exposure to light, undergo a chemical change that initiates visual impulses in the retina. A reversal of this process occurs during dark adaptation, where there is regeneration of the photopigments. Intense light will transform the photoreceptor pigments fairly rapidly and completely; this reduces retinal sensitivity to dim light. In the fully dark-adapted eye, photopigment regeneration is complete and retinal sensitivity is at its maximal level. The rods and cones differ in their rate of dark adaptation. Rods require 20 to 30 minutes, or longer, in absolute darkness to attain their maximum sensitivity after exposure to bright light. Cones attain maximum sensitivity in about 5 to 7 minutes.

Operational Aspects of Night Vision, Contrast Discrimination: Visual acuity is reduced at night under low illumination conditions, and 20/20 vision cannot be sustained below a level of about one millilambert, the low photopic or upper mesopic range. Accordingly, objects are seen at night because they are either lighter or darker than their backgrounds, i.e. can be discriminated by a difference in contrast. These contrast differences may be reduced by light reflected from the following: windshields, visors or spectacles; fog or haze; scratched or dirty windshields, visors or spectacles.

Because visual acuity is a function of small differences in the luminance contrast between objects and their backgrounds, any transparent medium through which the flyer must look should be spotlessly clean for night operations. Also, knowledge of the importance of contrast at night may be used by pilots to detect enemy planes, as well as to hide their own. Pilots should fly below the enemy, when flying over dark areas, such as land. They should fly above the enemy, when flying over white clouds, desert, moonlit water, or snow.

1.18.3 Similar Event at Halim Perdanakusuma Airport

On 22 June 2016, the Indonesian Air Force aircraft with flight number LD0114 was being prepared for flight with intended destination Adisutjipto International Airport, Yogyakarta. The PK-EJR aircraft was on preparation for reposition from south to north apron.

When PK-EJR aircraft position on taxiway H, the towing car driver was instructed to cross the runway and enter taxiway C. Shortly after, takeoff clearance was issued to LD0114. The takeoff clearance was cancelled and LD0114 was instructed to hold position. The Halim Tower Controller also instructed PK-EJR towing car driver to move the aircraft backward.

The pilot of LD0114 already initiated take off roll, decided to continue take off. PK-EJR aircraft moved backward behind the holding position marking.

LD0114 lifted off before the intersection with taxiway H and a collision was avoided.

This incident was not investigated by KNKT as it did not meet the criteria of serious incident as described in the Manual on the Prevention of Runway Incursion (ICAO Doc. 9870).

1.18.4 Batik Air Simulation on Rejected Take off

Batik Air conducted a simulation of the accident in a training simulator based on the aircraft condition, the weather and the Flight Operation Quality Assurance (FOQA) data that processed using AirFASE® system. The simulation was performed by Batik Air check and training pilots. The objective of the simulation was to determine whether the collision was avoided if the rejected takeoff carried out after the pilot identified the object on the runway.

The FOQA data that have been processed using the AirFASE® system is as follows:

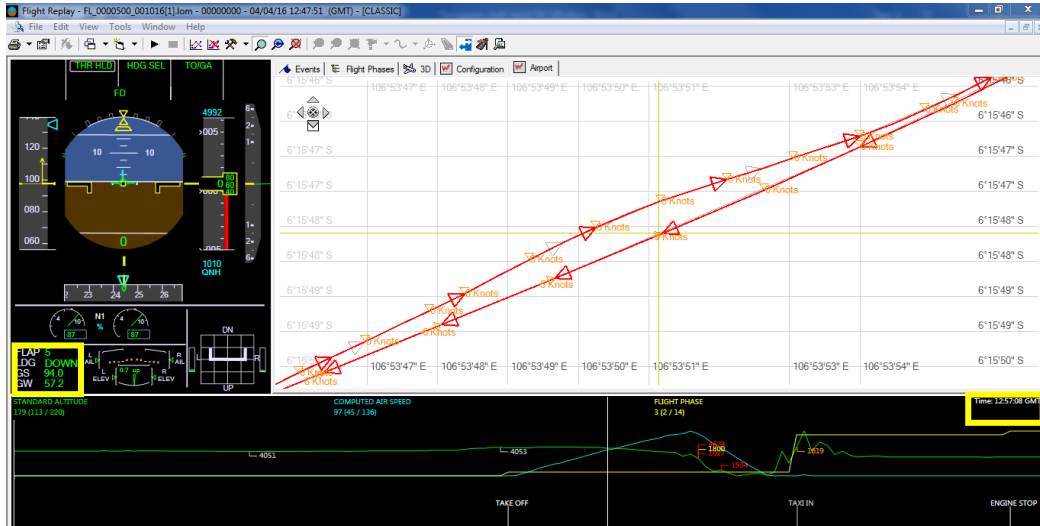


Figure 19: The FOQA data processed using the AirFASE® system

The simulation base on the data as follow:

- The TO/GA was initiated at 12:56:48 UTC and, based on the data of latitude and longitude, Batik Air calculated the position was approximately 70 meters before the threshold;
- The SIC stated that he saw something at 12:57:08 UTC and the Ground Speed (GS) was 94 Knots;
- The impact position was 916 meters from the runway threshold.

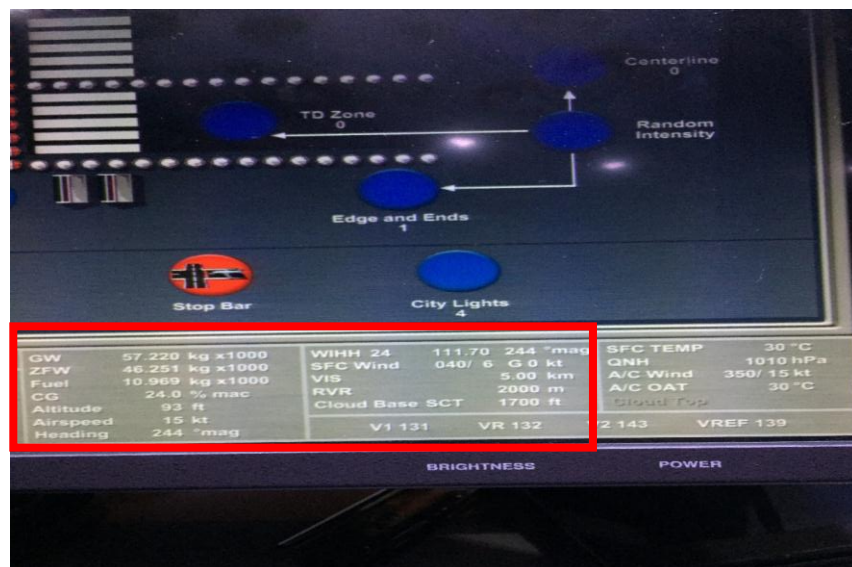


Figure 20: The simulator panel setting during the simulation

Based on these data, the simulation was carried out by performed TO/GA at 70 meters before the runway threshold and the rejected takeoff was initiated when the aircraft was accelerating at a ground speed of 94 knots. The rejected takeoff was performed by immediate action of closing the power levers, full thrust reversers, immediate spoiler deployment, autobrake at RTO (rejected takeoff) at speed above 60 knots and overrode by maximum manual braking at speed below 60 knots.

The simulation found that the required distance to stop since the TO/GA activated was 1,125 meters. Considering that the impact position was 916 meters from the threshold, the aircraft would only be able to stop 139 meters after impact. Based on the results of the simulation, Batik Air concluded that the collision would be unavoidable.

The other consideration referring to the simulation was that the pilot would focus on the rejected takeoff execution. Therefore, avoidance action by deviation from the runway centerline might have been difficult to perform. Lower speeds during the rejected takeoff might also reduce the rudder effectiveness. Should the rejected takeoff initiated immediately, the impact might have occurred to the ID 7703 left engine or fuselage, resulting in considerably more damage to both aircraft.

Based on the simulation, Batik Air concluded that the pilot action during the accident had reduced the consequence of the accident.

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 ID7703 aircraft that was rolling for take-off collided with an aircraft being towed that was also on runway 24. Aircraft serviceability was not an issue in this accident. Therefore, this analysis will discuss the relevant issues associated with:

1. Aircraft Movement
2. Movement Control in the Maneuvering Area
3. Lightings and Environment
4. Pilot Decision Making
5. Procedures for Vehicles on the Maneuvering area

2.1 Aircraft Movement

The aircraft movement analysis was based on the CVR and FDR data, interviews and assumed towing speed average of 10 km/hour or 154 meters/minute.

The communication between the air traffic controller and the towing car driver was not recorded and the investigation received two different statements relating to the communications. The investigation could not determine the communications that were actually occurred, therefore the investigation only considered the communications that were recalled by both sides to be analyzed.

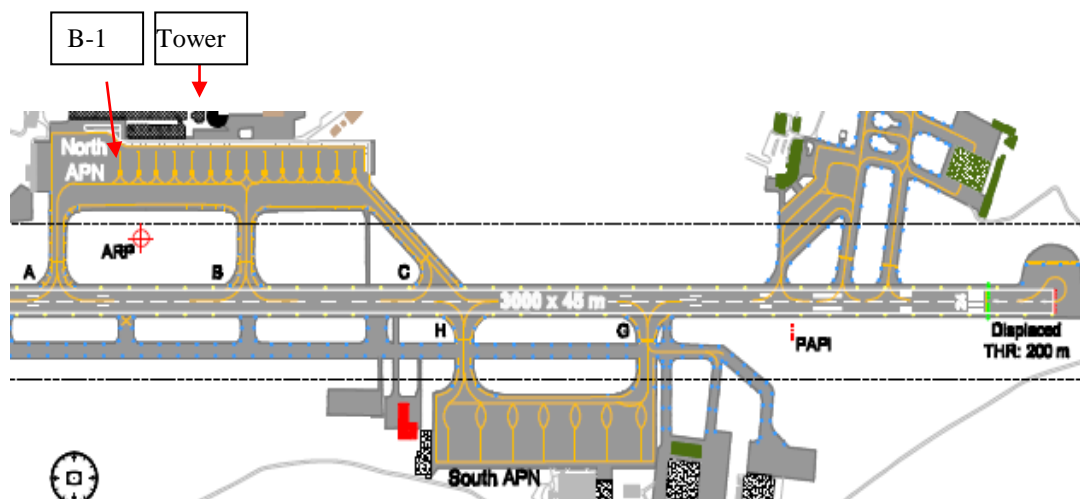


Figure 21: Airport layout including position of parking stand B-1 and tower building

At 12:48:43 UTC, after the ID 7703 started taxi, the towed aircraft received clearance to initiate towing and was instructed to report when on taxiway C.

At 12:48:59 UTC an aircraft that had just landed that was later on parked on stand B-1, instructed to hold on taxiway A to give way to the towed aircraft.

At 12:50:11 UTC, ID 7703 pilot instructed to hold on taxiway C due to another aircraft was on approach to land and the position was leaving AL NDB.

At 12:51:17 UTC, the pilot of the aircraft that was holding on taxiway A requested the towed aircraft position and was instructed to taxi slowly as the towed aircraft had left parking stand B-1.

It can be assumed that the towed aircraft started to move at 12:51 UTC.

The distance between taxiway A to parking stand B-1 was about 240 meters, however the pilot could not identify the towed aircraft. This indicated that the towed aircraft was not clearly visible, especially from the rear.

At 12:52:23 UTC, the pilot of an aircraft which parked on stand B-5 requested for pushback and was instructed to hold to give way to the towed aircraft to pass. This means that towed aircraft had not passed parking stand B-5.

The distance between parking stand B-1 to B-5 was approximately 206 meters. Assumed the towing speed was 154 meters/minute and the towing initiated at 1251 UTC, the towed aircraft position at this time was just about passed parking stand B-4 and had not passed parking stand B-5.

At 12:52:29 UTC, the ID 7703 pilot was instructed to enter the runway after an aircraft on final landing. The FDR data recorded that the ID 7703 completely stop on taxiway C at 12:53:03 UTC.

The distance between parking stand B-1 to B-9 was approximately 330 meters, it can be assumed that the towed aircraft was abeam parking stand B-9 was at about 1253 UTC.

At about 1253 UTC or while towed aircraft position abeam parking stand B-9, the towing car driver was instructed to expedite the towing and to follow ID 7703. The instruction was acknowledged by towing car driver.

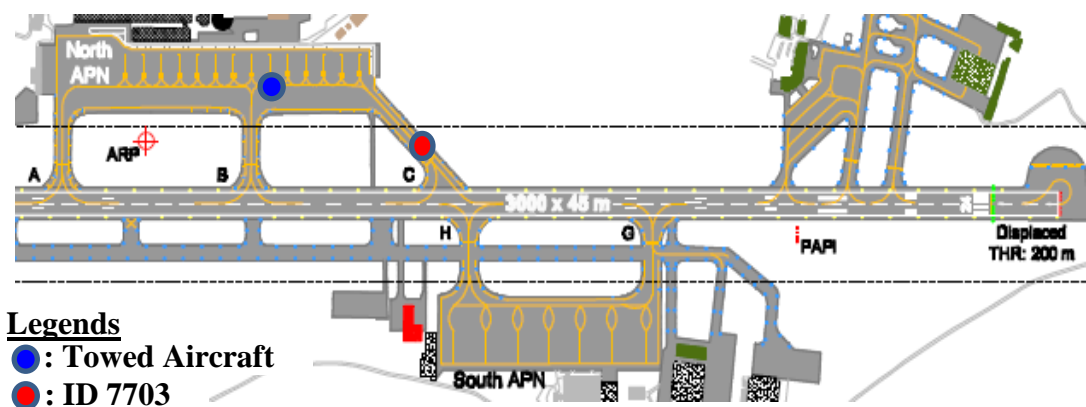


Figure 22: Illustration of the aircraft position at 1253 UTC

At 12:53:54 UTC, the ID 7703 started to taxi to enter and backtrack runway 24.

The distance between parking stand B-1 to the beginning taxiway C was about 530 meters, it can be assumed that at about 1254 UTC, the towed aircraft was about to enter taxiway C.

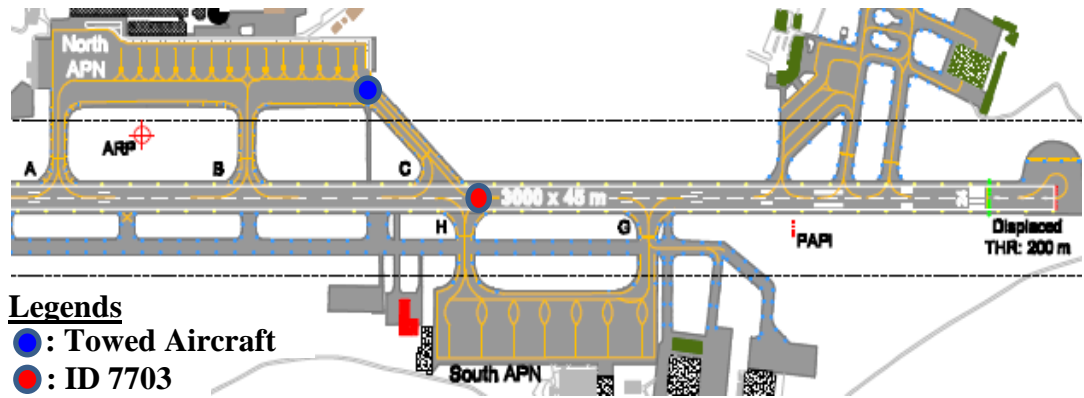


Figure 23: Illustration of the aircraft position at 1254 UTC

At 12:54:35 UTC, the ID 7703 was on runway centerline and backtracking runway 24.

The length of taxiway C was about 210 meters, it can be assumed that at about 1255 UTC, the towed aircraft was on the middle of taxiway C.

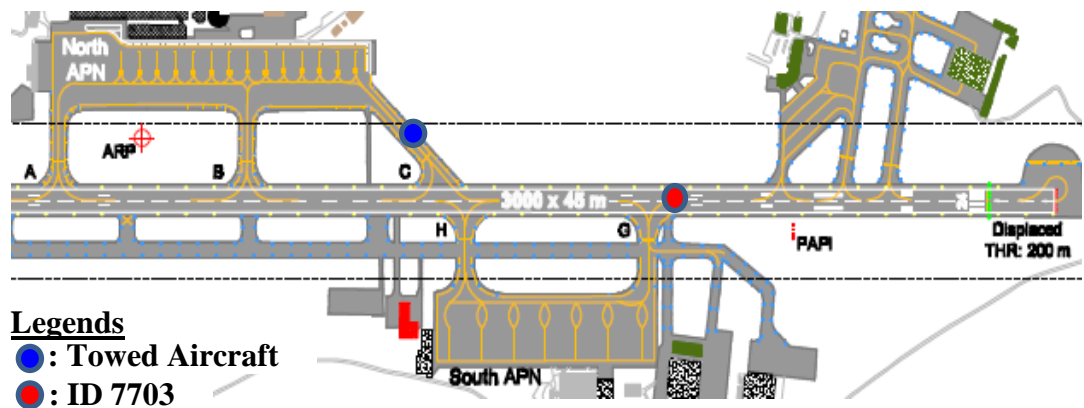


Figure 24: Illustration of the aircraft position at 1255 UTC

At 12:56:49 UTC, the ID 7703 started the takeoff roll. The towing car driver noticed that the ID 7703 on the takeoff and started to turn to the right.

The distance of the middle taxiway C to the runway centerline was approximately 190 meters. Assumed that the towed aircraft on taxiway C at 1255 UTC, therefore when the ID 7703 was initiating the takeoff, the towed aircraft was on the runway center line.

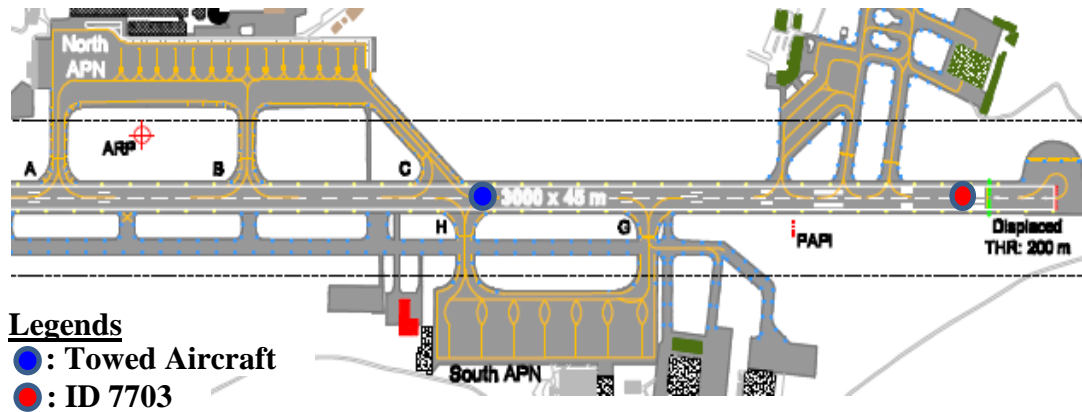


Figure 25: Illustration of the aircraft position at 1256 UTC

At 12:57:16 UTC, impact of both aircraft on runway.

The distance between intersection taxiway C to the impact point was approximately 210 meters. Refer to the previous assumption that the towed aircraft on the runway centerline at 1256 UTC, therefore, at 12:57:16 UTC, the towed aircraft had reached the impact point.

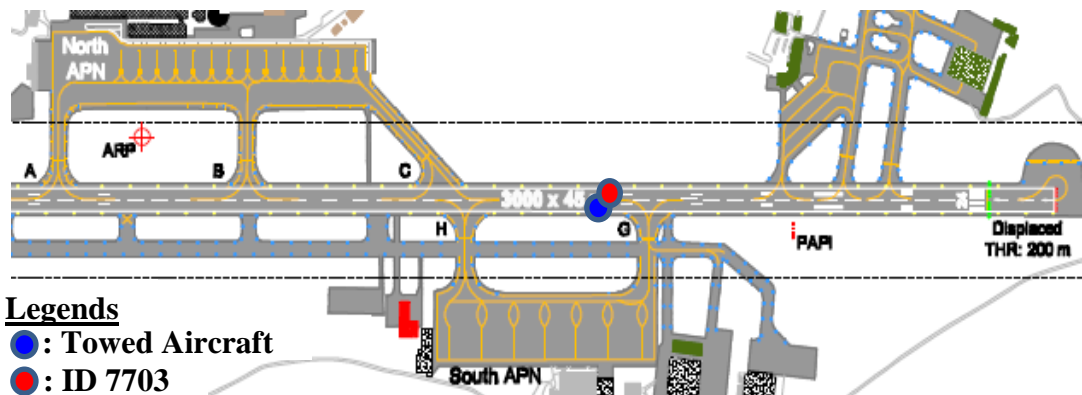


Figure 26: Illustration of the aircraft impact position at 1257 UTC

The towing clearance provided to the towing car driver consisted of a clearance to commence towing and to report when on taxiway C. The towing route to reach the south apron includes enter and cross the runway. The clearance was given without a specific route to be followed and explicit clearance to cross or to hold short of the runway as required in the AC 170.

The instruction to report on taxiway C was issued as a precaution for the assistant controller if the towed aircraft was about to enter the runway and to determine further decision to give clearance to cross or to hold short of runway considering the traffic situation.

While the towed aircraft position was at about parking bay B9, the assistant controller issued instructions to the towing car driver to expedite and to follow ID 7703. The assistant controller might have expected that the towing car driver would report when position on taxiway C as instructed on the first contact.

The instruction to follow the ID 7703 that was issued when the ID 7703 about to enter the runway, might have been interpreted that the towed aircraft approved to enter the runway and the takeoff clearance for ID 7703 would be issued after the towed aircraft entered the south apron. The instruction to follow the ID 7703 might also be interpreted that the position report on taxiway C has no longer required.

The last position that the assistant controller monitored the movement of the towed aircraft was when the position in front of the tower building or abeam parking stand B-5. Thereafter, the assistant controller made coordination with another air traffic services unit related to other departure aircraft. It was likely that the assistant controller did not monitor the towed aircraft position which was abeam parking stand B-9 while issuing the clearance.

The instruction to follow the ID 7703 was given when the assistant controller did not maintain the continuous watch to the towed aircraft position and expected that the towing car driver would report when position on taxiway C. Meanwhile the towing car driver might interpret that the towed aircraft approved to enter the runway and considered the position report on taxiway C was no longer required. This communication misunderstanding most likely contributed the towed aircraft enter the runway.

2.2 Movement Control in the Maneuvering Area

The Air Traffic Services (ATS) Standard Operating Procedure (SOP) Chapter 11.07.03 stated that the controller shall maintain continuous watch on all flight operations in the vicinity of an aerodrome, and vehicles and personnel movement in the maneuvering area. The controller assisted by an assistant controller to provide traffic data and coordinate with the other Air Traffic Services unit as stated in the chapter 11.03 of the SOP.

The CASR 170.052, stated that separation communication channels to control vehicles on the maneuvering area is allowed where the conditions warrant and all communication shall be automatically recorded and retained for at least 30 days.

Prior to the accident, it was revealed that the communication of controlling aircraft and vehicle movement were separated. The aircraft movement was handled by the controller and communication was conducted on a frequency of 118.6 MHz. The vehicle movement was handled by the assistant controller and the communication was conducted on frequency 152.73 KHz. The communication on this frequency was not recorded.

The controller monitored the communication between the assistant controller and the towing car driver, and recognized the position of the towed aircraft was on the parking stand B-1. There was no evidence that the controller and assistant controller had discussed the roles they would play to control the towed aircraft.

The procedure related to control vehicle movement in maneuvering area has not been included in the ATS SOP, the detail analysis of the procedure is discussed in the chapter 2.5 of this report.

Handling two movements in the same area with different controllers on separate frequencies without proper coordination resulted in the lack of awareness to the controllers, pilots and towing car driver. The controllers and the pilot did not realize that the towed aircraft was on the runway.

It was supported by the evidence that the pilots realized that the impacted object was an aircraft being towed after they disembarked the aircraft. The air traffic controller set crew realized that the towed aircraft was on the runway and collided with ID 7703 after asking the towing car driver.

2.3 Lighting and Environment

Tower Cab Lighting

The investigation observed the lighting conditions inside the tower cab and the ability for the controllers to observe the outside conditions from the tower. Most of the lights in tower cab were illuminated during the event and reflected on the glass window surrounding the tower cab. The reflection on the glass window reduced contrast differences to external objects to be observed by the controllers.

The glare on the glass window on the tower cab increased the difficulty for the controllers to observe any vehicle or object prior to issue the takeoff clearance to ID 7703.

The Lighting on the Turn Pad Area of Runway 24

During lining up on the turn pad of runway 24, which was 200 meters beyond the runway threshold, the pilot felt that the lights surrounding the turn pad were very bright and momentarily affected their forward vision.

Human eyes are capable of dark adaptation by the function of the rods and cones which, on exposure to light, undergo a chemical change that initiates visual impulses in the retina. Rods require 20 to 30 minutes, or longer, in absolute darkness to attain their maximum sensitivity after exposure to bright light.

At 12:56:05 UTC, the pilot reported lining up and ready for departure and the pilots sensed that the environment lighting was “*very bright*”. At 12:56:47 UTC, the pilot initiated the takeoff which was about 42 seconds from exposure to the bright light.

The investigation could not determine the pilots capability of dark adaptation, after exposure to bright lights only 42 seconds before being exposed to a dark environment condition.

The lighting conditions on Runway 24 was not absolute darkness, however it would require time for the eyes to adapt from very bright to dark conditions. The time available was less than the time required for the eyes to attain their maximum sensitivity after exposure to bright light and this might have contributed to the pilots ability to identify objects on the runway ahead early.

Portable Lights Fitted on Towed Aircraft

The towing was performed without any engine running and no electrical power supplied to the aircraft systems, including position (navigation) lights. The CASR Part 91.209 required that to move an aircraft in, or in dangerous proximity to a night flight operations area of an airport unless the aircraft is illuminated and lighted position lights.

As an alternative, portable red and green lights, which were commercial flashing lights with dimension approximately of 8×3 cm, were fitted on each wingtip. The installation of the portable lights was in accordance with the company Engineering Instruction (EI) number ATR/EI/33/XI/2015/028 dated 04 November 2015.

Position and anti-collision lights as required by CASR Part 25 stated the requirement of field coverage, flashing characteristic, color and intensity. However, the EI did not describe any technical specifications for the portable lights.

The pilots of the aircraft that was held on taxiway A were unable to see the towed aircraft that was approximately 240 meters away. The controller did not monitor the aircraft position after it passed in front of tower building. These indicated that the towed aircraft was not clearly visible, especially from the rear.

The fitted portable lights did not meet the CASR Part 25 requirements and might have contributed to the inability of the controllers and the pilots of ID 7703 to observe the towed aircraft.

Summary

The lighting environment in the tower cab created glare on the window glass which increased the difficulty for the controllers to observe the towed aircraft that was not clearly visible, especially from the rear.

The transition of very bright to dark conditions within a short time available for adaptation might have made the pilots unable to observe the towed aircraft earlier in the take-off roll.

2.4 Decision Making

2.4.1 Aborted Takeoff Decision

During the takeoff roll, the SIC saw something on the runway and mentioned it to the PIC, and the takeoff was continued. A few seconds later, the aircraft slightly turned to the right and thereafter the RAAS callout V1 followed by impact sounds were recorded by the CVR. Following the impact, the takeoff was rejected.

The analysis on the movement control in the maneuvering area described the separated communications and, as a result, the pilots of ID 7703 did not realize that there was an aircraft being towed or that it may have been on the runway. Furthermore, the analysis on lighting and environmental conditions made it very difficult for the pilots to identify the towed aircraft in dark conditions with inadequate lighting fitted.

The aborted takeoff was initiated after V1 and following the collision, most likely influenced by the pilots not realizing earlier about the towed aircraft being on the runway due to separated communications, inadequate time for adaptation and inadequate lighting.

According to the Boeing 737-800/900 FCTM, the decision to reject the takeoff is the responsibility of the captain, and normally made before V1. Rejected takeoff after V1 is allowed if the captain judges that the aircraft is incapable of flight. If the captain is the PM, he should initiate the RTO and announce the abnormality simultaneously.

The ID 7703 left wing was damaged approximately 575 centimeters from the wingtip. The damaged wingtip detached including part of the left aileron and the winglet. This damaged condition made the aircraft incapable of flight due to unbalanced lift on both wings and would have rendered the aircraft difficult to control due to the missing aileron section.

2.4.2 Avoidance Decision

During the takeoff roll, after the ID 7703 pilots noticed an object on the runway. At a speed of approximately 115 knots, the rudder and steering was deflected and the aircraft heading changed approximately 2 degrees to the right for about 2 seconds. This was the pilot's action to deviate and maintain the aircraft position between the runway centerline and the runway edge. The pilot tried to avoid collision with the object and to stay on the runway. This action made the aircraft deviate approximately 6 meters to the right from the runway centerline.

The towing car driver saw that the ID 7703 was on the takeoff roll, then accelerated the towing and turned to the right side of the runway. The investigation found that the towing car was on the grass after the impact and the aircraft was on a heading of approximately 080 degrees (figure 24).

Both aircraft had moved away from the runway centerline, however the ID 7703 left wing collided with the left wing and the vertical stabilizer of the towed aircraft. The illustration of the impact is depicted in the figure below.

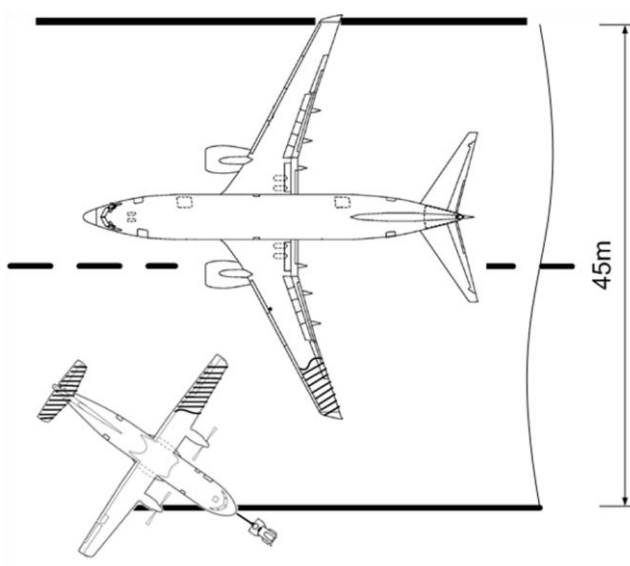


Figure 27: Illustration of the impact

The decision of both the pilot and the towing car driver to move away from the runway centerline avoided a centerline (head to head) collision however the wing collision was unavoidable. The wing collision was less severe compared to an aircraft collision on the runway centerline.

2.5 Procedure of Vehicle on the Maneuvering Area

ICAO Annex 14, Attachment A, required for the operator of a vehicle on the movement area should properly qualified and has adequate knowledge of several items including the geography of the aerodrome; aerodrome signs, markings, lights and radiotelephone operating procedures. The operator of vehicle should hold a driver's license, radio operator license or other licenses.

The Indonesian regulation for the operator of vehicles are described in the Manual of Standard (MOS) CASR – Part 139 Volume I Aerodromes, chapter 10.10.3. Operator of vehicle on the airside stated that the requirement for radiotelephone was not mandatory.

Advisory Circular (AC) CASR - Part 139-14, Competency Standard for Aerodrome Personnel requirements did not include requirements for the towing car personnel to understand the geography of the aerodrome; aerodrome signs, markings and lights; and radiotelephone operating procedures.

The Indonesian regulation related to vehicle movement on the maneuvering area is described in the Advisory Circular (AC) 170.039: Control of persons and vehicles at aerodromes which stated that: *The movement of persons or vehicles including towed aircraft on the maneuvering area of an aerodrome shall be controlled by the aerodrome control tower as necessary to avoid hazard to them or to aircraft landing, taxiing or taking off.*

The Advisory Circular (AC) 170 Manual of Air Traffic Services Operational Procedures, chapter 7.5.3.2.1 entry to the maneuvering area for any person or vehicle shall obtain authorization from the aerodrome control tower before entry to the maneuvering area, and further specific authorization is required to enter a runway or runway strip.

The ATS SOP chapter 11.04.01: Function and responsibility described that one of the objectives of the air traffic services is to prevent collision between aircraft. However, the investigation could not find the procedure for control movement on the maneuvering area for other than aircraft. The chapter of ground services procedure contained the procedure of coordination between the ATS unit and AMC for aircraft parking.

The current Indonesia regulation related to the personnel qualification for aerodrome personnel had not included several items as required by the ICAO standard.

The ATS SOP had not included the procedure to control ground movement other than aircraft on the maneuvering area as required by AC 170.

3 CONCLUSIONS

3.1 Findings¹¹

1. The ID 7703 aircraft had valid airworthiness certificate prior to the occurrence.
2. The ID 7703 crew member, the air traffic control set crew and tow car driver had valid licenses and medical certificates.
3. The towed aircraft was being reposition from north to south apron which was planned via taxiway C and G.
4. Prior to handling the PK-TNJ, the towing car driver had towed another aircraft of another aircraft operator from north to south apron via taxiway C and G.
5. The towing was performed without any engine running and no electrical power supplied to the aircraft systems, including position (navigation) lights. The CASR Part 91.209 required that to move an aircraft in dangerous proximity to a night flight operations area of an airport unless the aircraft is illuminated and lighted position lights.
6. The position light was substituted with portable lights with dimension approximately of 8×3 cm placed on each wing tip. The installation of the substitute lights was described in the operator Engineering Instruction however the Engineering Instruction did not describe specification of the portable lights.
7. The PT. JAS towing procedure required the aircraft should be adequately illuminated during towing in low visibility or night conditions. The fitted portable lights during towing process did not meet the CASR 25 requirements.
8. The towing car was fitted with anti-collision light above the driver compartment and head lights, which were illuminated during the towing process.
9. The lights in the tower cab were illuminated and there were several light reflections on the tower glass windows including the view to the direction of the beginning runway 24. The light reflections on the tower glass window had reduced contrast differences to the object to be observed by the controller.
10. The controller communicated with ID 7703 pilot on frequency 118.6 MHz while the assistant controller communicated with the towing car driver using handheld radio on frequency 152.73 KHz. This separated communication resulted in the ID 7703 pilots did not know that there was a towing aircraft behind.
11. The communication on frequency 152.73 KHz was not recorded. The CASR 170.052 requires communication of controlling vehicles on the maneuvering area shall be provided with automatic recording facilities.
12. The communication between the assistant controller and the towing car was conducted in Bahasa (local language) and the AC 170-02 required communication of pilots, ATS personnel and other ground personnel to use plain

¹¹ 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.

English, which should be as clear and concise as possible, in order to avoid possible confusion by those persons using a language other than one of their national languages.

13. There was no evidence that the controller and assistant controller had discussed the coordination to control vehicle movement on the maneuvering area.
14. The assistance controller might have expected that the towing car driver would report when position on taxiway C as instructed on the first contact. The towing car driver might consider that the report position when on taxiway C was no longer required after received clearance to follow ID 7703.
15. The last position of the assistant controller monitored the movement of the towed aircraft was when the position in front of the tower building. Afterward, the assistance controller made coordination with another air traffic services unit related to other departure aircraft. It was likely that the assistant controller did not monitor the towed aircraft position which was abeam parking stand B-9 while issuing the clearance.
16. The instruction to follow the ID 7703 was given when the assistant controller did not maintain the continuous watch to the towed aircraft position and expected that the towing car driver would report when position on taxiway C. Meanwhile the towing car driver might interpret that the towed aircraft approved to enter the runway and considered the position report on taxiway C was no longer required.
17. The ID 7703 pilot stated that during line up, the lights surrounding the turn pad were very bright and affected forward vision for a short time.
18. The towing car driver saw that the ID 7703 was on rolling takeoff, then accelerated the towing and turned to the right side of the runway.
19. During the takeoff roll, the SIC stated that he saw something on the runway and the takeoff was continued. Few seconds later, the aircraft deviated and maintained position between the runway centerline and the runway edge.
20. The decision of the pilot and the towing car driver to move away from the centerline runway had made the aircraft collision on the centerline runway (head to head) avoided, however the wings collision was unavoidable.
21. After the impact, the takeoff was rejected. The rejected takeoff was made after V1, most likely influenced by the pilots did not realize early to the towed aircraft due to separate communication, inadequate time for eyes adaptation and lightings condition on the towed aircraft.
22. According to the Boeing 737-800/900 FCTM, the rejected takeoff after V1 is allowed if captain judges the aircraft incapable of flight. The damaged condition on the ID 7703 made the aircraft incapable to fly due to unbalance lift on both wings and difficulty to control due to the missing aileron part.
23. After aircraft stopped the PIC commanded evacuation from the right side. The flight attendants opened all passengers and service doors, after observation through the viewing windows did not see any fire.
24. The Rescue and Fire Fighting Service (RFFS) arrived in the occurrence site within two minutes after crash bell activation and discharged extinguishing agent

foam to the left wing of ID 7703 and the other foam tender extinguished the fire on the towed aircraft.

25. The pilots realized that the impacted object was an aircraft being towed after disembarked the aircraft. The air traffic controller set crew realized that the towed aircraft was on the runway and collided with ID 7703 after asked to the towing car driver.
26. The Air Traffic Services Standard Operation Procedure had not included the procedures to control ground movement other than aircraft on the maneuvering area as required by the AC 170.
27. The current regulation related to the personnel qualification for aerodrome personnel had not included several items as required by the ICAO standard, including requirement for radio telephony
28. The published Aeronautical Information Publication (AIP) Volume I Amendment 28, Halim has runway length of 3,000 meters and was displaced 200 meters.
29. The CASR 170 Air Traffic Rules subpart 170.039 point (4) mentions the statement “*subject to the provisions in 3.8.3*” that referred to chapter of ICAO Annex 11.
30. In the preliminary report, KNKT issued recommendation to Halim operator and AirNav Indonesia branch office Halim to inform aircraft operators to initiate takeoff from the threshold runway 24 of Halim. Until the issuance of this final report, it was found several aircraft initiated the takeoff before the threshold runway 24.
31. On 22 June 2016, there was similar occurrence of runway incursion in Halim, between a towed aircraft and takeoff aircraft. This incident was not investigated by KNKT as it was not meet the criteria of serious incident as described in the Manual on the Prevention of Runway Incursion (ICAO Doc. 9870).

3.2 Contributing Factors¹²

- Handling of two movements in the same area with different controllers on separate frequencies without proper coordination resulted in the lack of awareness to the controllers, pilots and towing car driver.
- The communication misunderstanding of the instruction to follow ID 7703 most likely contributed the towed aircraft enter the runway.
- The lighting environments in the tower cab and turning pad area of runway 24 might have diminished the capability to the controllers and pilots to recognize the towed aircraft that was installed with insufficient lightings.

¹² Contributing factors is defined as actions, omissions, events, conditions, or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the accident or incident occurring, or mitigated the severity of the consequences of the accident or incident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil or criminal liability. (Refer to ICAO Doc 9756 Part IV).

4 SAFETY ACTION

At the time of issuing this final report, the Komite Nasional Keselamatan Transportasi (KNKT) had been informed by the operators, several corrective actions responding to the KNKT safety recommendations issued in the preliminary report and safety actions, resulting from this occurrence.

4.1 PT. Batik Air Indonesia

The safety actions conducted by PT. Batik Air Indonesia related to runway incursion mitigation, ground movement precaution and black out vision recovery.

The summaries of the safety action are as follows:

On 7 April 2016, issued notice to pilot number 009/IV/2016 described:

Runway Incursion Mitigation Review

According to incursion event PK-LBS Batik Air on April 4th, 2016 here we remind you to review RUNWAY INCURSION refers to Batik Operation Manual Part A Rev: 02 Issued: 02 date March 14th, 2016 Chapter 8.3.1.8 point A, B, C, D, E. Specially point C to mitigate risk as attached on this notice, otherwise to follow company email from Chief Pilot on April 5th, 2016 about "Requesting Information Ground Traffic" to ATC Halim during before taxiing specially night operation.

On 10 April 2016, issued safety circular number 06/SSQ/SC/IV/2016 described:

Based on PK-LBS serious incident, SSQ Directorate emphasis all operation staff to always implement all tasks in accordance with Standard Operating Procedure (SOP). Besides, SSQ give safety precaution in ground movement as follows:

- a. Pilot:*

 - i. Ensure ground traffic before and during taxi*
 - ii. Performed visual check of runway and traffic condition before enter to the active runway*
 - iii. To ensure the runway was clear before takeoff*
 - iv. In any doubt of traffic, contact the ATC controller before continue movement*

- b. Ground Handling*
 - i. Coordinate with the pilot to ensure the traffic status before push back*
 - ii. Always communicate with the same frequency with ATC controller in any towing aircraft*
 - iii. Ensure that clearance had been approved by ATC controller before push back or towing the aircraft*
 - iv. Use the same frequency with ATC controller in any movement of towing car in the maneuvering area*
- c. FOO*
 - i. To monitor the aircraft and traffic movement in the ground and air.*
 - ii. In any problem regarding the traffic or movement, contact the Aircraft Movement Control (AMC) or related department to find problem solving.*

On 18 April 2016, issued notice to pilot number 010/IV/2016 described:

Delay for Takeoff for due to Black out Vision Recovery

In regard the condition of night take off on runway 24 and to avoid black out in vision caused by high intensity of approach light in dark environment during turning in to position on runway 24 Halim Perdanakusuma, pilot required to delay the take off until the eyes back to normal adaptive environment before call ready for departure.

4.2 PT. TransNusa Aviation Mandiri

On 14 April 2016, PT. TransNusa Aviation Mandiri informed to the Komite Nasional Keselamatan Transportasi related to safety action taken as follows:

1. Issued Safety Notice number SN/001-IV/2016 dated 7 April 2016 described:
 - a. Improve the situational awareness for all pilots especially during takeoff and landing at Halim Perdanakusuma and other airports.
 - b. To use the same active frequency during movement in the maneuvering area.
 - c. Engineer requires using VHF hand held radio as a back-up communication during towing.
 - d. To conduct the towing procedure refreshing course for all engineers.
 - e. To include the towing procedure from Aircraft Maintenance Manual (AMM) in the TransNusa Aviation Mandiri procedure.
 - f. To conduct any task in according with approved procedures.
2. Issued notice to pilot number 002/OPS/TAM/IV/2016 dated 7 April 2016, described:
 - a. To ensure the runway is clear from any traffic, animal or foreign object after receiving takeoff clearance from air traffic controller.
 - b. Improve the awareness of any obstacle during taxi.
 - c. To follow the air traffic controller instruction and recheck prior to executing any instruction.
3. Issued Quality Notice number QN-TAM/018/IV/2016 dated 11 April 2016, described:
 - a. *During pushback and towing, engineer must refer to Aircraft Maintenance Manual (AMM) Chapter 9 on each aircraft type, especially to switch "ON" the Navigation and Anti Collision Light (by night only).*
 - b. *If towing is performed with the unavoidable deviation from the AMM due to the specific reason, engineer must refer to the approved internal documents issued by Quality or Technical Service such as Quality Instruction or Engineering Instruction.*

- c. *ATC permission to tow must be obtained by engineer in charge who sit in the cockpit using VHF Comm which installed on the aircraft with normal ATC frequency. In case on the certain airport, the communication is required only between ground handling and ATC using the specific frequency, engineer should monitor in the normal ATC frequency by the VHF Com on the aircraft or GH operator.*
- d. *Engineer should refuse to start towing when any other aircraft is still on the runway. If AMC force the aircraft to enter the runway and coincide with the other aircraft, engineer should request 'follow-me' car to guide the aircraft passing clear of the runway.*

4.3 AirNav Indonesia

Responding to KNKT safety recommendation, on 7 April 2016, the AirNav Indonesia issued safety notice addressed to all air traffic control units as follows:

- a. Required all towing aircraft to switch on the navigation lights.
- b. Required all towing aircraft to communicate in published tower frequency.
- c. Required all vehicle without radio communication entering maneuvering area shall be guided by "follow me car".
- d. Required air traffic controller to record towing movement on the flight progress strip.
- e. Required to reduce the lights intensity in the tower cab while providing air traffic services at night.

On 28 April 2016, issued NOTAM number A1268/16 for all departure aircraft that using runway 24 to initiate the acceleration for takeoff at threshold runway 24.

On 1 November 2016, issued NOTAM number A3291/16, informed that the Halim Ground Control services was operated for trial on frequency 118.6 Mhz until 4 January 2017. On 3 January 2017, the Halim Ground Control services trial was extended until 3 April 2017 and on 24 March 2017, the trial re-extended until 9 June 2017.

4.4 Halim Perdanakusuma International Airport

Responding to KNKT safety recommendation, the airport operator has been conducted several corrective actions as follows:

- On 17 May 2016, issued safety notice letter to aircraft operator, ground handling service and fuel supplier service to ensure all movement activities on the maneuvering area using lights that could be seen by Halim Tower unit and other traffic movement, and this requirement shall be inserted on the Standard Operating Procedure of each related parties.
- On 9 July 2016, issued letter to all aircraft operator operates in Halim to use the runway perimeter access route and prohibit all vehicles movement between north and south apron to cross the runway, except for fuel vehicle and towing aircraft.

- On 20 September 2016, issued letter to all aircraft operator to remind that there was displaced threshold on runway 24 and the detail information have been published on the Indonesian AIP.

4.5 Avions de Transport Regional (ATR)

The manufacturer has developed a design change number MOD 07626 for ATR42 and for ATR72 SB ATR72-33-1046 issued 12 January 2017, that enable to supply anti-collision light and navigation lights with batteries. The new design change will be added to the aircraft configurations for which the Job Instruction Card (JIC) towing by night without engine running. The design change is applicable to all customers who request it.

5 SAFETY RECOMMENDATIONS

While the KNKT acknowledges the safety actions taken by the operators and aircraft manufacturer, there still remain safety issues that need to be considered. Therefore, the KNKT issues the following safety recommendations addressed to:

5.1 PT. Batik Air Indonesia

The PIC did not announce the reason to reject the takeoff, however the action to reject the take-off was according to the operator policy but the time and distance were not sufficient to avoid the collision.

- **04.O-2017-7.1**

It is recommended that the operator enhances the FCTM chapter 3.24 Rejected Takeoff Decision which is the PIC should announce the abnormality simultaneously.

The PIC commanded to evacuate from right side, the flight attendants opened all passengers and service doors, after observation through the viewing windows did not see any fire.

- **04.O-2017-7.2**

It is recommended that the operator to review the evacuation procedure and consider the area can be observed through the viewing windows.

5.2 PT. TransNusa Aviation Mandiri

The towing was conducted without electrical supplied to the aircraft system including aircraft radio and lightings. The substitute of the anti-collision lights was portable anti-collision lights placed on each wing tip in according with operator engineering instruction. The engineering instruction did not describe any technical specification of the portable lights.

According to these findings, therefore KNKT recommends to:

- **04.O-2017-7.3**

Ensure the aircraft adequately lighted during night operation in accordance with CASR 91.209.

- **04.O-2017-7.4**

Consider risk assessment, compliance to the regulation and specification required prior to issue the Engineering Instruction.

5.3 PT. Jasa Angkasa Semesta

The communication between the assistant controller and the towing car was conducted in Bahasa (local language) and the AC 170-02 required communication of pilots, ATS personnel and other ground personnel to use plain English, which should be as clear and concise as possible, in order to avoid possible confusion by those persons using a language other than one of their national languages.

- **04.L-2017-7.5**

It is recommended to review the requirement of personnel licensing for towing car driver as required by the regulation standard, including the language requirement.

The PT. JAS towing procedure required the aircraft should be adequately illuminated during towing in low visibility or night conditions. The fitted portable lights during towing process did not meet the CASR 25 requirements.

- **04.L-2017-7.6**

It is recommended to ensure the SOP of towing procedure is well implemented.

5.4 AirNav Indonesia District Office Halim Perdanakusuma

There was no evidence that the controller and assistant controller had discussed the role play in controlling aircraft and vehicle movement on the maneuvering area.

- **04.A-2017-7.7**

It is recommended updating the SOP to accommodate controller coordination to warrant the safe operation of aircraft and vehicle movement on maneuvering area.

The instruction to follow did not include clearance limit and might have been interpreted that the towed aircraft was approved to follow the ID 7703 to enter the runway.

- **04.A-2017-7.8**

It is recommended to ensure the taxi or towing clearance issued contains explicit limit to cross or to hold short of runway as required by AC 170.

5.5 AirNav Indonesia District Office Halim Perdanakusuma and Angkasa Pura II Brach Office Halim Perdanakusuma

The pilot felt that during line up, the lights surround the turn pad were very bright and affected his forward vision for a short time.

In the preliminary report, KNKT issued recommendation to Halim operator and AirNav Indonesia branch office Halim to inform aircraft operators to initiate takeoff from the threshold runway 24 of Halim (recommendation number 04.B-2016-57.1). Until the issuance of this final report, it was found several aircraft initiated the takeoff before the threshold runway 24.

- **04.B-2017-7.9**

It is recommended to reinforce the implementation of the KNKT recommendation (04.B-2016-57.1).

5.6 Directorate General of Civil Aviation

The towing was performed without any engine running and no electrical power supplied to the aircraft systems, including position (navigation) lights. The CASR Part 91.209 required that to move an aircraft in dangerous proximity to a night flight operations area of an airport unless the aircraft is illuminated and lighted position lights.

- **04.R-2017-7.10**

It is recommended to review the procedure of aircraft movement on maneuvering area for airport operator and air navigation provider to accommodate the requirement of CASR 91.209.

The current Indonesia regulation related to the personnel qualification for aerodrome personnel had not included several items as required by the ICAO standard.

- **04.R-2017-7.11**

It is recommended to review the requirement of personnel licensing for towing car driver as required by the ICAO standard.

The CASR 170 Air Traffic Rules subpart 170.039 point (4) mentions the statement “*subject to the provisions in 3.8.3*” that referred to chapter of ICAO Annex 11.

- **04.R-2017-7.12**

It is recommended to review the contain of CASR to ensure its clarity.

Halim has runway length of 3,000 meters and was displaced 200 meters. However, the published Aeronautical Information Publication (AIP) Volume I Amendment 28, did not contain information that the total runway length is reduced to 2,800 meters.

- **04.R-2017-7.13**

It is recommended to update the current published AIP.

6 APPENDICES

6.1 Notice to Pilot Number: 009/IV/2016



NOTICE TO PILOT

Cat : *Compulsory*
No : *009/IV/2016*

RUNWAY INCURSION MITIGATION REVIEW


Applicability : All Pilots
Effective Date : April 7th, 2016
Expired Date : Permanent
Distribution List : Crewnet, Notice Book, and Display Board

Dear All Pilots,

According to incursion event PK-LBS Batik Air on April 4th, 2016 here we remind you to review **RUNWAY INCURSION** refers to **Batik Operation Manual Part A** Rev: 02 Issued: 02 date March 14th, 2016 **Chapter 8.3.1.8 point A, B, C, D, E. Specially point C to mitigate risk** as attached on this notice, otherwise to follow company email from Chief Pilot on April 5th, 2016 about "Requesting Information Ground Traffic" to ATC Halim during before taxing specially night operation.

Thank you for your attention.

6.2 Safety Circular Number: 06/SSQ/SC/IV/2016

 <i>Safety, Security, and Quality</i>	SAFETY, SECURITY AND QUALITY DIRECTORATE	06/SSQ/SC/IV/2016
	SAFETY CIRCULAR	10 04 2016
		Page 1/2

Date of effectiveness	: April 10 th , 2016
Distribution list	: DZ,DO,DA,OF,OS,GO
Applicability	: Pilots, Ground Handling, FOO
Prepared by	:
Approved by	:
Subject	: Safety Precaution in Ground Movement



All Related Departments/Units,

On April 4th 2016, Batik Air Boeing B737-800, registration PK-LBS route HLP – UPG with flight number BTK 7703 experienced runway incursion at HLP. During take-off roll, the aircraft collided with Transnusa ATR 42-600, that was being towed on the runway. The Pilot immediately aborted the take-off and the aircraft came to a stop at 1633 meter from threshold of runway 24. All 49 passengers and 7 crews were evacuated safely. No fatality in this incident but Batik Air L/H wing was burned and broken.

Based on PK-LBS serious incident, SSQ Directorate emphasis all operational staff to always implement all tasks in accordance with Standard Operating Procedure (SOP). Besides, SSQ give safety precaution in ground movement as follows:

- a. Pilot :
 1. To ensure ground traffic position before and during taxi.
 2. To visually check runway condition and traffic before entering active runway.
 3. To ensure the runway is clear before initiating the takeoff roll.
 4. If traffic is in doubt, please confirm to ATC before continuing the movement.
- b. Ground Handling
 1. To always coordinate with pilot for ensuring the traffic position before commencing the push back.
 2. To always use the same radio frequency with tower frequency in towing aircraft.
 3. Traffic information and clearance must be received before commencing the towing.
 4. Individual towing car movement in crossing active runway, must use the same radio frequency with tower.
- c. FOO
 1. To always monitor aircraft movement and the traffic in the ground or in the air.
 2. If problem existed, to be proactive in coordinating with AMC (Aircraft Movement Control) or other respective department to solve the problem.

6.3 Notice to Pilot Number: 010/IV/2016



NOTICE TO PILOT

Cat : *Compulsory*

No : *010/IV/2016*

Delay For Take Off for due to Black Out Vision Recovery

Applicability : All Pilots

Effective Date : April 18th, 2016

Expired Date : Permanent

Distribution List : Crewnet, Notice Book, Display Board, and E-mail

Dear All Pilot,

In regard the condition of night take off on runway 24 and to avoid black out in vision caused by high intensity of approach light in dark environment during turning in to position on runway 24 Halim Perdana Kusuma, pilot required to delay the take off until the eyes back to normal adaptive environment before call ready for departure.

Thank you for your attention.

6.4 Safety Notice Number: SN/001 – IV/2016



SAFETY DEPARTMENT

SAFETY NOTICE

No : SN/001 – IV/2016
Attn to : Pilot, Engineer, Flight Operation, Ramp Personnel, Ground Handling Agent
Date : 07 April 2016
Status : High
Effective Date : 07 April 2016
Cc : BOD
Subject : Kewaspadaan pada saat proses towing (pemindahan pesawat)

Terkait kejadian accident tertabraknya pesawat ATR TransNusa PK-TNJ oleh pesawat Batik Air pada hari Senin, pada saat towing sekitar pukul 19:56 di Bandara Halim Perdanakusuma, dengan ini Departemen Safety mengeluarkan Safety Notice terkait kejadian tersebut sebagai berikut:

1. Seluruh Pilot pada saat on duty agar meningkatkan situational awareness terutama pada saat take off dan landing di HLP khususnya dan bandara-bandara lain yang diterbangi PT. TransNusa Aviation Mandiri.
2. Pada saat aircraft towing agar mempergunakan radio frequency yang dipergunakan oleh seluruh pihak yang terlibat pada area pergerakan bandara, sehingga bisa saling memonitor.
3. Pihak Engineer TransNusa Aviation Mandiri agar ikut menggunakan VHF Handy Talky untuk membackup komunikasi pada saat proses towing (tidak hanya mengandalkan ke pihak Operator Ground Handling).
4. Seluruh Engineer/ EOB agar segera melaksanakan Refreshing Course terkait dengan aircraft towing procedure sesuai dengan AMM TransNusa Aviation Mandiri.
5. Memasukkan prosedur towing kedalam prosedur TAM sesuai AMM.
6. Melaksanakan tugas sesuai prosedur yang telah ditetapkan.

Think Safety, Fly safely.

6.5 Safety Notice Number: EDR.13.01/00/LPPNPI/04/2016/001



AirNav Indonesia

Kantor Pusat
Perum LPPNPI
Gedung AirNav Indonesia
Jalan Ir. H. Juanda Tangerang 151.
Banten - Indonesia
Telp : 021-55915000
Fax : 021-55915100
www.airnavindonesia.co.id

SURAT EDARAN

NOMOR : EDR.13.01/00/LPPNPI/04/2016/001

TENTANG

PENINGKATAN KESELAMATAN PENERBANGAN DI AREA MANOUEVERING

1. Untuk meningkatkan keselamatan penerbangan di area manouvering diperlukan kewaspadaan tentang pergerakan pesawat di Apron, Runway, Taxiway dan Data Pergerakan Pesawat.
2. Terkait butir 1 (satu) diatas, disampaikan kepada seluruh Pimpinan KPNP untuk melakukan hal-hal sebagai berikut :
 - a. Mengevaluasi SOP untuk mengeliminasi hazard;
 - b. Mewajibkan semua pesawat yang towing untuk menghidupkan Navigation Light;
 - c. Mewajibkan semua pesawat yang towing untuk melakukan komunikasi melalui radio komunikasi resmi (tower frequency);
 - d. Mewajibkan semua kendaraan yang masuk area manouvering dan tidak memiliki radio komunikasi agar mengikuti "follow me car";
 - e. Mewajibkan petugas ATC mencatat pergerakan Towing Car di Strip Marking mulai dari awal hingga akhir selesai beroperasi;
 - f. Selama memberikan Pelayanan Lalu Lintas Penerbangan di malam hari, lampu di dalam tower cabin harus diredupkan.
3. Demikian Surat Edaran ini dibuat untuk dapat dilaksanakan dengan sungguh-sungguh.

6.6 Flight Surgeon's Guide

United State Air Force School of Aerospace Medicine, Brook Air Force Base, Texas, 4th Edition, July 1995, Major David O'Brien.

Night Vision

Introduction

There are two types of sensory receptors in the retina--rods and cones. According to the widely accepted duplicity theory of vision, the rods are responsible for vision under very dim levels of illumination (scotopic vision), and the cones function at higher illumination levels (photopic vision). The cones alone are responsible for color vision. This receptor system allows the human eye to function over an impressively large range of ambient light levels (Fig. 8-16). There is a common misconception, however, that the rods are used only at night and the cones only during the day. Actually, both rods and cones function over a wide range of light intensity levels and, at intermediate levels of illumination, they function simultaneously.

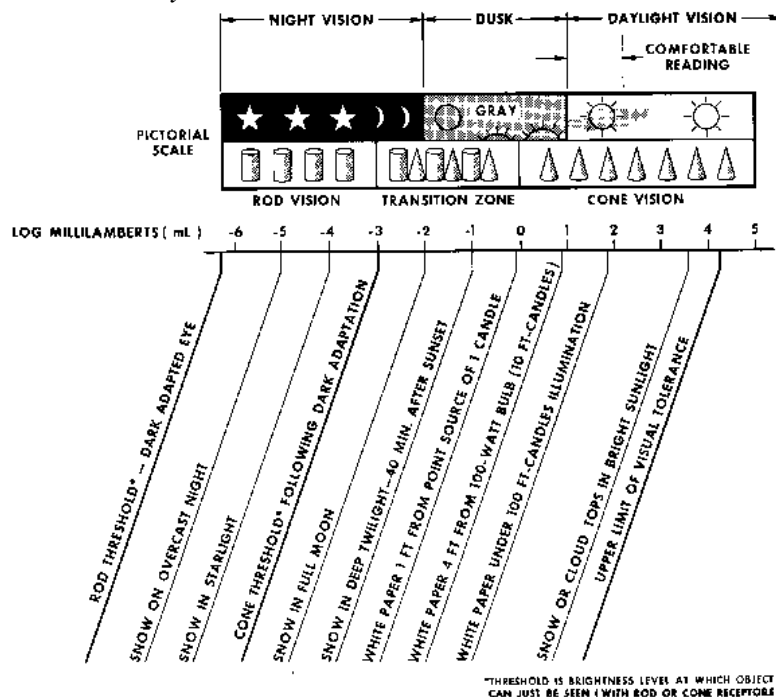


Figure 8-16. Range of ambient light levels, in millilamberts of luminance, over which the human eye can function. Ranges of photopic (cone) vision and scotopic (rod) vision are shown, along with the transition zone of mesopic vision.

Mesopic Vision

There is a transition zone between photopic and scotopic vision where the level of illumination ranges from about 1 to 10-3 millilamberts. Both the rods and cones are active in this range of light, and the perception experienced is called mesopic vision. Although neither the rods nor the cones operate at peak efficiency in this range, mesopic vision may be of great importance to the military aviator, because some low level of light is usually present during night operations. Below the intensity of

moonlight (10-3 millilamberts), the cones cease to function and the rods alone are responsible for vision, i.e. scotopic vision. Scotopic vision is characterized by poor acuity resolution and a lack of color discrimination, but greatly enhanced sensitivity to light.

Brightness Thresholds

The dimmest light in which the rods can function is about 10-6 millilamberts, which is the rod threshold. This is equivalent to an overcast night with no moonlight. The dimmest light in which the cones can function is about 10-3 millilamberts, the cone threshold, which is roughly equivalent to a night with 50% moonlight. Thus, a white light which can just barely be seen by the rods must be increased in brightness 1,000 times before it becomes visible to the cones.

Central Blind Spot at Night

That portion of the retina responsible for the keenest visual acuity is the fovea, which corresponds to the center of the visual field. The fovea is used constantly to fixate objects. The fovea is devoid of rods and is composed entirely of cones. Therefore, at luminance levels below 10-3 millilamberts, a blind spot develops in the center of the visual field, because the ambient light is below cone threshold. (see figure 8-17).

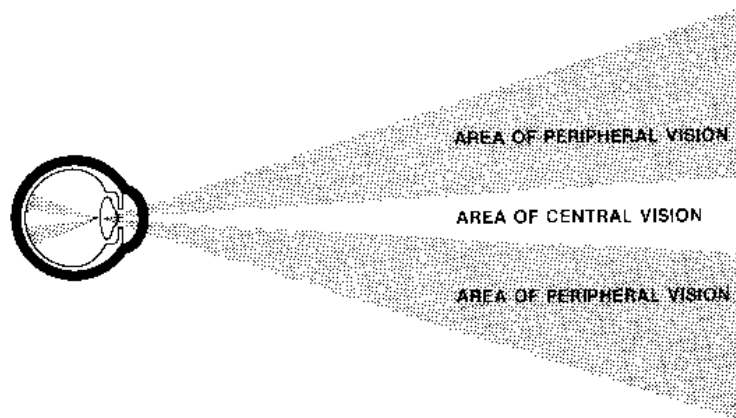


Figure 8-17. Area of the central blind spot under scotopic conditions. Because central vision cannot function in diminished illumination, any object an individual fixates directly, in dim illumination, will not be seen.

Rods are present outside the foveal area and gradually increase in number, finally reaching a maximum concentration at a point some 17-20o from the fovea. Since the rods have a lower threshold than the cones, they are much more sensitive to light. Thus, a person attempting to see, in illumination dimmer than moonlight, has to depend entirely on rods. To best utilize the rods under such circumstances, the individual must look 17- 20o to one side, above, or below any object to see it. This is known as eccentrically fixating. Proper education and training is, therefore, essential for maximum use of vision at night. Individuals should be taught to fixate slightly above, below, or to either side of a night target and to employ a scanning technique. (see figures 8-18 and 8-19).

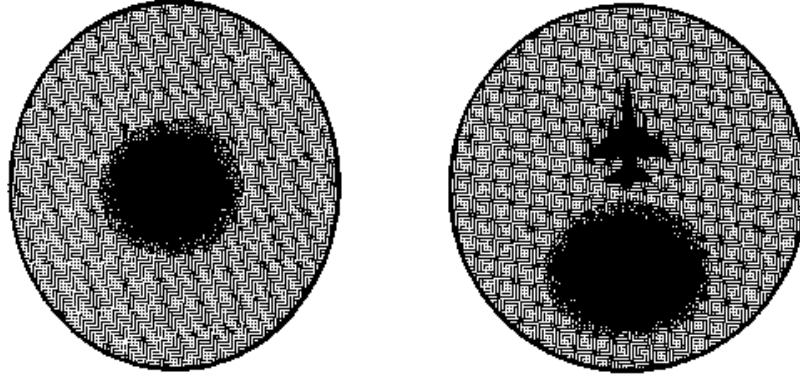


Figure 8-18. Eccentrically fixating.

Left - The central blind spot present in very dim light makes it impossible to see an aircraft, if it is fixated directly.

Right - The aircraft can be seen in the same amount of light by looking below 17-20o, so that it is not obscured by the central blind area.

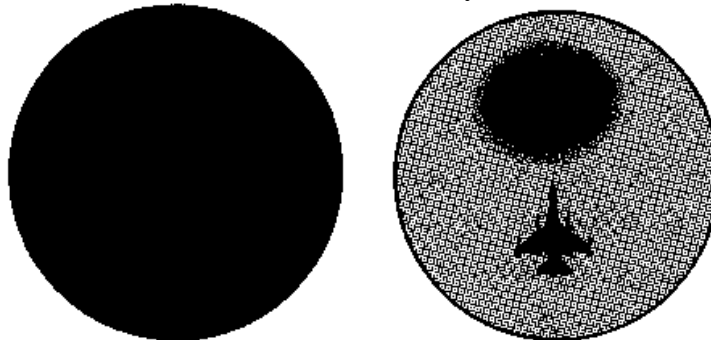


Figure 8-19. Dark adaptation.

Left - View seen by a person who is not dark-adapted.

Right - The same view seen by a dark-adapted person who is looking at a point above the aircraft.

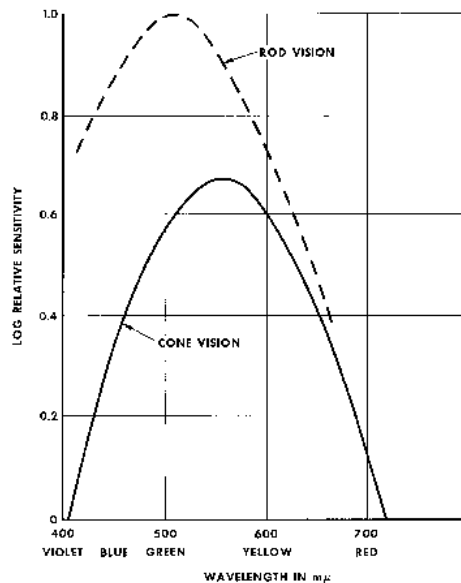
Dark Adaptation

Both the rods and cones contain photopigments which, on exposure to light, undergo a chemical change that initiates visual impulses in the retina. A reversal of this process occurs during dark adaptation, where there is regeneration of the photopigments. Intense light will transform the photoreceptor pigments fairly rapidly and completely; this reduces retinal sensitivity to dim light. In the fully dark-adapted eye, photopigment regeneration is complete and retinal sensitivity is at its maximal level. The rods and cones differ in their rate of dark adaptation. Rods require 20 to 30 minutes, or longer, in absolute darkness to attain their maximum sensitivity after exposure to bright light. Cones attain maximum sensitivity in about 5 to 7 minutes.

Photochromatic Interval

Rods are not sensitive to wavelengths of light greater than about 650 nanometers, i.e., the red portion of the visible spectrum. However, rod insensitivity to red light is not present in the cones. This fact is easily demonstrated by slowly decreasing the intensity of a colored light, until the cone threshold is reached. This is the point at which the color will disappear, but not the sensation of light. When this procedure is performed with any color except red, for example blue light, the color will disappear at the cone threshold, but the light will still be perceived by the rods as dim gray.

If the intensity is further decreased, until the rod threshold is reached, the light will disappear entirely. With red light, the color and sensation of light disappear at the same time. The difference between the level of illumination at which the color of a light disappears (the cone threshold) and that at which the light itself disappears (the rod threshold) is known as the photochromatic interval. There is a photochromatic interval for every color of the spectrum, except the longer wavelengths of red (see figure 8- 20).



Operational Aspects of Night Vision

Contrast Discrimination: *Visual acuity is reduced at night under low illumination conditions, and 20/20 vision cannot be sustained below a level of about one millilambert, the low photopic or upper mesopic range. Accordingly, objects are seen at night because they are either lighter or darker than their backgrounds, i.e. can be discriminated by a difference in contrast. These contrast differences may be reduced by light reflected from the following: windshields, visors or spectacles; fog or haze; scratched or dirty windshields, visors or spectacles.*

Because visual acuity is a function of small differences in the luminance contrast between objects and their backgrounds, any transparent medium through which the flyer must look should be spotlessly clean for night operations. Also, knowledge of the importance of contrast at night may be used by pilots to detect enemy planes, as

well as to hide their own. Pilots should fly below the enemy, when flying over dark areas, such as land. They should fly above the enemy, when flying over white clouds, desert, moonlit water, or snow.

Under conditions of low illumination, following other aircraft, either from above or below, rather than from directly behind will enlarge their the retinal images and lessen the likelihood of losing them in the darkness.

Night Myopia: A person who does not normally wear spectacles (emmetropia) may have a shift toward low myopia under conditions of extremely reduced illumination. The exact cause of this night myopia, although controversial, suggests two components, ocular spherical aberration produced by the widely dilated pupils and slight involuntary accommodation. These components apparently vary in their importance with different people, but some people will have about 0.75 diopters of night myopia. This can occur in spectacle wearers corrected to emmetropia with spectacles, also. Night myopia is usually of relatively minor importance, as no visually resolvable target is visible, when it occurs. When a target does become visible, the eye rapidly readjusts. Problems may occur, however, in the initial detection of targets.

Enhancing and Maintaining Dark Adaptation: For maximum utilization of scotopic vision, 20 to 30 minutes are required, in total darkness, to attain satisfactory dark-adaptation. A more practical alternative is to have the aircrew members wear red goggles to facilitate dark adaptation. Red goggles can be worn in normal illumination and do not interfere significantly with the ability to read maps, charts, manuals, etc. They block all light except red light, and red light does not stimulate the rods, as we have seen.

To understand why red filters can be used to achieve dark adaptation, it is necessary to examine the relative positions of the photopic and scotopic sensitivity curves in Figure 8-20. If a red filter with a cutoff at about 650 nanometers is worn, essentially no light is transmitted to the eye that can stimulate the rods. However, the cones are sensitive to the red light, and, thus, adequate visual acuity is permitted. By wearing red goggles for 30 minutes, the rods are almost fully dark adapted. Although the cones are not dark adapted, it only takes about 5 to 7 minutes, after a pilot steps into the dark, for the cones to adapt. Cone adaptation is relatively unimportant, since they are incapable of functioning in starlight illumination. There are, however, some drawbacks to wearing red goggles. For example, when reading maps, all markings in red ink on a white background may be invisible. In addition, red light creates or worsens near point blur in the pre-presbyopic or presbyopic pilot, as red light comes to a focus behind the retina and requires more accommodation to bring it into focus.

Dark adaptation of the rods develops rather slowly over a period of 20 to 30 minutes, but it can be lost in a second or two upon exposure to bright lights. The night flyer must, therefore, be taught to avoid bright lights. Also, the instrument panel must be kept illuminated at the lowest level consistent with safe operation, and the flyer must avoid looking at flares, after-burner flames, or gun flashes. If light must be used, it should be as dim as possible and used for the shortest possible period.

Dark adaptation is an independent process in each eye. Even though a bright light may shine in one eye, the other will retain its dark adaptation, if it is protected from

the light. This is a useful bit of information, because a flyer can preserve dark adaptation in one eye by simply closing it.

Cockpit Illumination: The use of red light (wavelength greater than 650 nanometers) for illumination of the cockpit is desirable, because it, like red goggles, does not affect dark adaptation. Red cockpit lighting has been traditional since World War II. The intent was to maintain the greatest rod sensitivity possible, while still providing some illumination for central foveal vision. However, red cockpit lighting did create some near vision problems for the pre-presbyopic and presbyopic aviators. With the increased use of electronic and electro-optical devices for navigation, target detection, and night vision, the importance of the pilot's visual efficiency within the cockpit has increased and new problems have been created. Low intensity, white cockpit lighting is presently used to solve those problems. It affords a more natural visual environment within the aircraft, without degrading the color of objects. Blue-green cockpit lighting is used in aircraft in which night-vision devices are used because, unlike the human eye, these devices are not sensitive to light at that end of the visual spectrum. In addition, blue-green light is the easiest for accommodative focus and is seen by the rods more readily than any other color. It is not seen as blue-green, however, but only as light. However, the enemy can easily see a blue-green light, under scotopic conditions, in any position of his peripheral field, whereas a low intensity red light would be invisible unless viewed directly.

Drugs: The use of systemic drugs to improve normal night vision has been uniformly unsuccessful. Vitamin A has improved night vision only when there has been a chronic insufficiency of the vitamin and the stores in the liver are depleted.

Smoking Tobacco: The effects on night vision of smoking tobacco products are somewhat controversial. Early studies showed a significant decrease in scotopic dark adaptation with smoking, which was attributed to the hypoxic effects of carbon monoxide. Later studies found that smoking actually improved night visual performance on some psychophysical tests. This was presumed to be a result of the stimulant effect of nicotine. More recent studies have reported that smokers have reduced mesopic vision when compared with non-smokers.

Smoking should be discouraged. There is evidence that it degrades mesopic and/or night vision. The hypoxic effect of carbon monoxide is additive with high altitude hypoxia. Secondary smoke is a significant irritant for contact lens wearers, and many flyers could be wearing contact lenses. Smoke forms filmy deposits on windscreens, visors, and spectacles that can degrade contrast at night. The chronic, long-term effects of smoking are hazardous to one's overall health. A recent USAF directive prohibits smoking during night missions and three hours before.

Hypoxia: The effect on night vision, of hypoxia at altitude, is primarily one of an elevation of the rod and cone threshold. The rise in foveal cone threshold, at 4,000 feet, is less than 0.05 log units and, at 8,000 feet, it is less than 0.1 log units. Since the pilot uses cone (central) vision for reading instruments, the actual decrement in central acuity from hypoxia is minimal. However, scotopic function, at altitude, can be significantly affected. It is reported that night vision capability is decreased by 5% at 1100 meters, 18% at 2800 meters, and 35% at 4000 meters without the use of supplemental oxygen. Thus, the use of oxygen, even at low pressure altitudes becomes very important at night.

Further information on night vision and night vision devices can be found in AL-SR-1992-0002, "Night Vision Manual for the Flight Surgeon" and its revisions.

Currently, several electro-optical NVD are available to improve flyers' vision at night. These include night vision goggles (NVG) and forward looking infrared systems (FLIR).

Night vision goggles are like binoculars and are helmet-mounted in front of the eyes. They employ image intensifier tubes that are sensitive to some visible and short wavelength infrared (IR) radiation. NVG greatly enhance night vision over unaided scotopic vision, however, they do have significant limitations. These include a maximum best visual acuity of 20/40 to 20/50, a field of view of only 40 degrees or less, degraded depth perception/stereopsis, and a different sensitivity to light than the human eye. Thus, training and experience with NVG are critically important for flying safety.

A FLIR device consists of a cockpit-mounted video monitor and external infrared sensor that is usually slaved to the nose of the plane. The sensor is sensitive to the long wavelength infrared (IR) wavelengths of light and provides excellent resolution. However, FLIR devices have a smaller field of view than NVG and no capability to look from side to side.

6.7 Direct Involves Party Comments

6.7.1 AirNav Indonesia Branch Office Halim Perdanakusuma

No	Reference Chapter, Page, Paragraph	Proposed Amendment	Reason For Proposed Change	Remarks
1.	Introduction - Synopsis (page 9)	At the time of occurrence, the ID 7703 pilot communicated to Halim Tower controller on frequency 118.6 MHz while the towing car driver communicated using handheld radio on frequency 152.730 KHz MHz and was handled by assistant controller	Correction of frequency	Accepted
2.	Introduction - Synopsis (page 9)	The assistant controller instructed the towing car driver to expedite the towing and to follow ID 7703 three times. The last instruction was given when the towed aircraft on taxiway C. (deleted) The towing car driver confirmed the taxi route was via taxiway G and affirmed by the assistant controller	Internal AirNav Investigation that Assistant Controller stated only instructed the towing car driver to expedite two times.	Accepted
3.	Introduction - Synopsis (page 9)	Therefore, the KNKT issues safety recommendations addressed to AirNav Indonesia District Office Halim Perdanakusuma, PT. Angkasa Pura II Branch Office Halim Perdanakusuma International Airport, PT. Batik Air Indonesia, <u>PT. TransNusa Aviation Mandiri</u> and Directorate General of Civil Aviation	Consider if Safety Recommendations will be provided to PT. TransNusa Aviation Mandiri.	Accepted
4.	Chapter 1. Factual Information	1.1 History of the Flight After the ID 7703 completed pushback, the towing car	Correction of frequency	Accepted

No	Reference Chapter, Page, Paragraph	Proposed Amendment	Reason For Proposed Change	Remarks
	(page 11)	driver requested clearance to Halim Tower for reposition aircraft from parking stand B-1 to south apron. The towing car driver was instructed to follow ID 7703 and to report when on taxiway C. The communication between the towing car driver and Halim Tower was performed on frequency 152.730 <u>152.730 KHz</u> MHz and was handled by the assistant controller		
5.	Chapter 1. Factual Information (page 12)	<p>1.1 History if the Flight</p> <p>When about entering taxiway C, the assistant controller reinstructed to expedite the towing and to follow ID 7703 and was acknowledged by the towing car driver.</p> <p>When the towed aircraft on taxiway C, the assistant controller reinstructed to expedite the towing and to follow ID 7703, and was acknowledged by towing car driver. Thereafter, the towing car driver clarified that the taxi route was via taxiway G and was affirmed by the assistant controller. Meanwhile, the ID 7703 was still on back track runway 24. (deleted)</p>		Accepted
6.	Chapter 1. Factual Information (page 12)	<p>1.1. History of the Flight</p> <p>The towing car driver saw the ID 7703 was rolling for takeoff then asked to the Halim Tower whether the ID 7703 was taking off, and there was no reply from the Halim Tower. (deleted) The towing car driver then</p>		Accepted

No	Reference Chapter, Page, Paragraph	Proposed Amendment	Reason For Proposed Change	Remarks
		accelerated the towing and turned to the right side of the runway to anticipate the ID 7703 taking off		
7.	Chapter 1. Factual Information (page 23)	<p>1.9. Communications</p> <p>At about abeam parking stand B-9:</p> <p>Assistant controller instructed towing car driver to expedite the towing and to follow ID 7703. The instruction was acknowledged by the towing aircraft driver.</p> <p>At about entering taxiway C:</p> <p>The assistant controller reinstructed the towing car driver to expedite the towing and to follow ID 7703. The instruction was acknowledged by the towing aircraft driver.</p> <p>On taxiway C:</p> <p>The assistant controller reinstructed the towing car driver to expedite the towing and to follow ID 7703. The towing car driver confirmed that the taxi route was via taxiway G and affirmed by the assistant controller.</p> <p>On the runway:</p> <p>The towing car driver asked twice to the Halim Tower</p>		Accepted

No	Reference Chapter, Page, Paragraph	Proposed Amendment	Reason For Proposed Change	Remarks
		unit whether the ID 7703 was initiating the takeoff and there was no reply.		
8.	Chapter 1. Factual Information (page 51)	<p>1.18.3 Similar Event at Halim Perdanakusuma Airport</p> <p>The pilot of LD0114 already initiated take off roll, decided to continue take off. PK-EJR aircraft moved backward <u>to yellow line</u> as instructed.</p>		Accepted
9.	Chapter 4. Safety Action (page 67)	<p>4.3. AirNav Indonesia</p> <p>On 1 November 2016, issued NOTAM number A3291/16, informed that the Halim Ground Control services was opened for trial on frequency 118.6 Mhz until 4 January 2017.</p> <p><u>On 3 January 2017, issued NOTAM number A0028/17, informed that the Halim Ground Control services was operated for trial on frequency 118.6 Mhz until 3 April 2017.</u></p> <p><u>On 24 March 2017, issued NOTAM number A0996/17, informed that the Halim Ground Control services was operated on frequency 118.6 Mhz with operating hours from 2200 - 1700 UTC until 9 June 2017.</u></p>	Update information	Accepted

6.7.2 PT. Batik Air Indonesia

No	Reference Chapter, Page, Paragraph	Proposed Amendment	Reason For Proposed Change	Remarks
1.	Chapter 2. Analysis (page 59)	<p>2.4. Decision Making 2.4.1. Aborted Takeoff Decision During takeoff roll <u>At 12:58:07, when the airspeed already passing 80 KIAS and the ground speed at that time was 94 knots</u>, the SIC saw something on the runway and mentioned to the PIC, and the takeoff was continued. A few seconds later the aircraft slightly turned to the right and thereafter the RAAS callout V1 followed by impact sounds recorded by the CVR. After the impact, the takeoff was rejected.</p>	1) Batik Air has conduct a simulation regarding this issue.	Accepted
2.	Chapter 2. Analysis (page 59)	<p>2.4. Decision Making 2.4.1. Aborted Takeoff Decision According to the Boeing 737-800/900 FCTM, the decision to reject the takeoff is the responsibility of the captain, and normally made before V1. Rejected takeoff after V1 is allowed if captain judges the aircraft incapable of flight. If the captain is the PM, he should initiate the RTO and announce the abnormality simultaneously. <u>If the pilots prioritized aborted takeoff instead of avoidance maneuver, the rudder become less effective while the speed was decreasing and the use of nose wheel steering is considered dangerous. PIC action to</u></p>	1) Batik Air has conduct a simulation regarding this issue. Moreover, if the pilots prioritized the aborted takeoff, the aircraft will still collide with the towed aircraft.	Accepted The simulation information inserted in the subchapter 1.18.4.

No	Reference Chapter, Page, Paragraph	Proposed Amendment	Reason For Proposed Change	Remarks
		<p><u><i>conduct maneuver to the right while the rudder was still more effective successfully avoids more severe collision. Moreover, if the pilots prioritized the aborted takeoff, considering the distance needed by the aircraft to stop, the aircraft will still collide with the towed aircraft.</i></u></p> <p>The ID 7703 left wing damaged approximately 575 centimeters from the wingtip. The damaged wingtip detached including the part of aileron and the winglet. This damaged condition made the aircraft incapable to fly due to unbalance lift on both wings and difficulty to control due to the missing aileron part.</p>		

6.7.3 PT. TransNusa Aviation Mandiri

No	Reference Chapter, Page, Paragraph	Proposed Amendment	Reason For Proposed Change	Remarks
1.	Introduction - Synopsis (page 9)	An ATR 42-600 aircraft, registration PK-TNJ operated by TransNusa Aviation Mandiri was being reposition from north to south apron. The aircraft was towed without aircraft electrical power fed to the system includes the radio communication and aircraft light system. <u><i>The aircraft was towed by the ground handlers PT. Jasa Angkasa Semesta (PT. JAS)</i></u>	1) Clarify PT. JAS handled the towing of the TransNusa ATR42-600 aircraft 2) PT. JAS is a separate company from TransNusa	Accepted
2.	Introduction - Synopsis (page 9)	At the time of occurrence, the ID 7703 pilot communicated to Halim Tower controller on frequency 118.6 MHz while the <u><i>PT. JAS</i></u> towing car driver communicated using handheld radio on frequency 152.73 KHz and was handled by assistant controller. The procedure for using two different frequencies is a common procedure in Halim Perdanakusuma Airport.	1) PT. JAS is a separate company from TransNusa 2) The PT. JAS towing car driver handled the ground communication on frequency 152.7 with the assistant controller. 3) The two different frequencies procedure is accepted and applies to all operators in HLP.	Accepted
3.	Chapter 1.1. History of the Flight (page 10)	The engineer on duty did not qualify for engine starting and run-up. (deleted)	1) The accepted procedure at Halim was to tow the ATR aircraft without engine start up. 2) Accordingly even if the engineer on duty had engine start qualification, they would not have started the engine. 3) TransNusa had an internal procedure to install portable lights on the wing tips. 4) The engineers on duty did not require	Accepted

No	Reference Chapter, Page, Paragraph	Proposed Amendment	Reason For Proposed Change	Remarks
			qualification for engine starting, their duty was to activate the brakes if required.	
4.	Chapter 1.1. History of the Flight (page 10)	The towed aircraft would be moved using a towing car operated by <u>PT. JAS</u> without engine run and no electrical power fed to the aircraft system includes the radio communication and aircraft light system. The communication between the <u>PT. JAS</u> towing car driver and Halim Tower used handheld radio communication and battery-powered portable lights installed on the left and right wing tips.	1) Clarify PT. JAS handled the towing of the TransNusa ATR42-600 aircraft 2) PT. JAS is a separate company from TransNusa	Accepted
5.	Chapter 1.1. History of the Flight (page 11)	On board the towing car were one driver and one supporting personnel <u>from PT. JAS</u> , and on board in the cockpit of the towed aircraft were two engineers <u>from TransNusa</u> . The engineers' <u>duty was to</u> apply aircraft brake during the towing process if required and the towing car driver assigned to make communication with Halim Tower.	1) Clarify PT. JAS handled the towing of the TransNusa ATR42-600 aircraft 2) PT. JAS is a separate company from TransNusa 3) Clarify the role to be performed by the TransNusa engineers	Accepted
6.	Chapter 1.5. Personnel Information (page 17 - 18)	1.5.2 Towed Aircraft Engineer 1 Note: The engineer did not have authorization for engine run-up. (deleted) Engineer 2 Note: The engineer did not have authorization for engine run-up. (deleted)	1) The accepted procedure at Halim was to tow the ATR aircraft without engine start up. 2) Accordingly even if the engineer on duty had engine start qualification, they would not have started the engine. 3) TransNusa had an internal procedure to install portable lights on the wing tips.	Accepted

No	Reference Chapter, Page, Paragraph	Proposed Amendment	Reason For Proposed Change	Remarks
			4) The engineers on duty did not require qualification for engine starting, their duty was to activate the brakes if required.	
7.	Chapter 1.5. Personnel Information (page 18)	1.5.2 Towed Aircraft Towing Car Driver <u>of PT. JAS</u> Note: Prior to handle the towed aircraft, the towing car driver has handled another aircraft <u>for another operator</u> , which was towed from north to south apron via taxiway C and G.	1) Clarify that the “towing Car driver” was employed by PT. JAS, not TransNusa. 2) Clarify that PT JAS performed ground handling for multiple operators at HLP	Accepted
8.	Chapter 1.6. Aircraft Information (page 22)	1.6.2 Towed Aircraft Engineering Instruction number ATR/EI/33/XI/2015/028 dated 04 November 2015 with subject of Installation Portable Navigation Light for Towing ATR Aircraft. <u>PT. JAS was aware and had no objections for the portable lights to be installed.</u>	Clarify PT JAS was aware of the Engineering Instruction number ATR/EI/33/XI/2015/028 and had no objections for the lights to be installed for towing	Accepted
9.	Chapter 1.6. Aircraft Information (page 22)	1.6.2 Towed Aircraft The common practice <u>with all ATR operators</u> to prevent the battery discharge, the engineer pulls the battery circuit breaker (CB) during towing without engine run.	This practice to pull the CB is common with all ATR operators	Rejected KNKT has no evidence of other ATR operator common practice.
10.	Chapter 1.6. Aircraft Information (page 22)	1.6.2 Towed Aircraft The engineers on duty during the towing did not have, <u>nor were they required to have</u> authorization for engine run <u>as they were only required to activate the brakes</u> . The aircraft was towed without engine run and no electrical power fed to the aircraft system included to the radio communication and aircraft lighting system.	1) The accepted procedure at Halim was to tow the ATR aircraft without engine start up. 2) Accordingly even if the engineer on duty had engine start qualification, they would not have started the engine. 3) TransNusa had an internal procedure to	Rejected The function of engineer on duty has been described in subchapter 1.1.

No	Reference Chapter, Page, Paragraph	Proposed Amendment	Reason For Proposed Change	Remarks
		<u><i>The normal practice in Halim</i></u> for aircraft towing would require the communication between towed aircraft and Halim Tower used handheld radio communication that is handled by PT. JAS	install portable lights on	
11.	Chapter 1.17 Organizational and Management Information (page 36)	1.17.2 PT. TransNusa Aviation Mandiri The TransNusa had an agreement with PT Jasa Angkasa Semesta (PT. JAS) for ground handling at Halim. The agreement was stated on Standard Ground Handling Agreement No Ref.031A/JAS-TransNusa /VI/2016. The agreement did not specifically mention the towing or pushback procedure, <u><i>however PT JAS followed their own procedures for pushback and towing.</i></u>	1) Clarify PT. JAS operated in accordance with their own towing procedures for operations at Halim in accordance with their policy. 2) See attachment 7 for PT JAS RAMP HANDLING MANUAL Section B 8.3 - Towing procedure	Rejected Not relevant
12.	Chapter 1.17 Organizational and Management Information (page 38)	1.17.3 PT. Jasa Angkasa Semesta The towing <u><i>of the TAM</i></u> aircraft was performed following PT. JAS' procedures.	1) See attachment 7 for PT JAS RAMP HANDLING MANUAL Section B 8.3 - Towing procedure	Rejected Other subchapters have been clearly described.
13.	Chapter 1.17 Organizational and Management Information (page 39)	1.17.4.1 Air Traffic Services Standard Operating Procedure (SOP) The investigation could not find the procedure of Halim that contain of handling ground movement other than aircraft on the maneuvering area. <u><i>The procedure at HLP differs from other airports in Indonesia as they operate Military Training flights in addition to the Scheduled, Chartered and VVIP flights.</i></u> (added)	1) To clarify that HLP procedures are different from those at other airports. - See attachment 4 for Surat Edaran Air navigation - See attachment 6 for Surat Edaran Angkasa Pura II	Rejected

No	Reference Chapter, Page, Paragraph	Proposed Amendment	Reason For Proposed Change	Remarks
14.	Chapter 1.18 Additional Information (page 48)	1.18.1 Towing Car The towing car used for towing aircraft was F59 model which having 4x4 drive system capable to tow ATR 42 up to MD 80 aircraft and had towing speed capability between 10 to 20 km depends on the aircraft weight and environmental condition. Towing Car <u>belonging to and operated by PT. JAS</u>	Clarify that the towing car belongs to and is operated by PT JAS's personnel	Rejected
15.	Chapter 1.18 Additional Information (page 48)	1.18.1 Towing Car Figure 16: Archive photo of the Towing Car <i>Add sentences :</i> <u>the vehicle lighting of towing car comply with airside requirement and specifically if the anticollision light on the towing car was illuminated during the towing process.</u>	There is no mention in the report if the towing car lighting (headlights and anti-collision light) meets the requirements of vehicles operating or towing aircraft at Halim Airport, this aspect would be considered relevant to the incident. See attachment 8 for Towing CAR PT. JAS (Picture)	Accepted Added to subchapter 1.18.1 <i>The towing car was fitted with head lights and a rotating beacon located above the driver compartment, which were illuminated during the towing process.</i>

6.7.4 Bureau d'Enquêtes et d'Analyses (BEA)

No	Reference Chapter, Page, Paragraph	Proposed Amendment	Reason For Proposed Change	Remarks
1.	Chapter 1.6. Aircraft Information (page 22)	1.6.2 Towed Aircraft The electrical power to the navigation light <u>and anti-collision light</u> , on the ATR 42 aircraft, supplies by DC <u>Main Bus 1 or DC Service Bus</u> and strobe light supplies by AC Wild power supply. The DC Buses normally supplied by the <u>DC starter generator when engine 1 or 2 is running</u> , AC generator or battery and AC Wild power normally supplied by ACW generator <u>when propeller 1 or 2 is turning</u> .	Technical correction of electrical system supplying power to the anti-collision lights, navigation lights and strobe light	Accepted
2.	Chapter 1.6. Aircraft Information (page 22)	1.6.2 Towed Aircraft In order to provide electrical power to <u>navigation lights</u> , anti-collision lights and communication system during towing requires engine <u>DC starter</u> generator therefore it is required <u>at least one</u> engine to be run. The electrical power can be supplied with right engine running without rotating the propeller by activating Propeller Brake, this features call Hotel Mode.	Technical correction of electrical system supplying power to the anti-collision lights, navigation lights and strobe light	Refer to the Indonesia CASR, the navigation light is named as position light.
3.	Chapter 1.6. Aircraft Information (page 22)	1.6.2 Towed Aircraft The battery is able to supply electrical power to navigation light when the battery toggle selects to ON which also automatically supply electrical power to Ground Handling Bus. Operation of battery for normal towing period will cause the battery discharge and the remaining battery power would not be sufficient for engine start. (deleted)	This description refers to a configuration which was not the one fitted on PK-TNJ.	Accepted

No	Reference Chapter, Page, Paragraph	Proposed Amendment	Reason For Proposed Change	Remarks
4.	Chapter 1.6. Aircraft Information (page 22)	1.6.2 Towed Aircraft The substitute to the aircraft navigation anti-collision lights, green and red commercial portable lights was put on each wing tip. The dimension of the lights was approximately of 8 × 3 cm. This was accordance to the operator Engineering Instruction number ATR/EI/33/XI/2015/028 dated 04 November 2015 with subject of Installation Portable Navigation Light for Towing ATR Aircraft	Correction : - Green and Red light put on each wing tip should refer to the Navigation Lights and not to the Anti-collision Light. - Anti-collision "flashing" Lights are all Red or all White color.	Refer to the Indonesia CASR, the navigation light is named as position light.
5.	Chapter 1.6. Aircraft Information (page 22)	Footnote 7 : Hotel Mode is a feature on <u>all</u> ATR 42 turboprops replacing an APU by <u>preventing</u> locking the right <u>propeller rotation</u> engine with a 'propeller brake' while allowing the turbine, and therefore also the generator, to run, providing electrical power and bleed air	Technical correction	Accepted
6.	Chapter 1.17.2. PT. TransNusa Aviation Mandiri (page 36)	1.17.2.1 Company standard towing procedure Towing by night with engine not running was applicable only for the ATR 72 embodied with SB <u>ATR72-33-1016</u> . <u>Based on lack of customer demand</u> , there was no aircraft manufacturer <u>design change allowing</u> document described the applicability of towing without engine running for ATR 42- <u>500 by night</u> .	Corrections. A design change exist for ATR 42-200, -300 and -320 (SB ATR42-33-0030)	Accepted
7.	Chapter 2. Analysis (page 57)	2.3. Lighting and environment Portable Anti-collision Lights Fitted on Towed Aircraft The towing was performed without engine running and no electrical power supplied to the aircraft system including <u>navigation</u> anti-collision lights. As	Correction: - Green and Red light put on each wing tip should refer to the Navigation Lights and not to the Anti-collision Light. - Anti-collision "flashing" Lights are all	Refer to the Indonesia CASR, the navigation light is named as position light.

No	Reference Chapter, Page, Paragraph	Proposed Amendment	Reason For Proposed Change	Remarks
		alternative, portable red and green lights which were commercial flashing lights with dimension approximately of 8 × 3 cm fitted on each wingtip.	Red or all White color.	
8.	Chapter 3.1. Findings (Page 64)	27. <u><i>There was no design change developed by the manufacturer allowing navigation lights and anti-collision light being power supplied for towing by night without engine running for ATR 42-500 has not been included in the manufacture document.</i></u>	More accurate information. A design change exist for ATR 42-200, -300 and -320 (SB ATR42-33-0030).	The finding was deleted
9.	Chapter 5. Safety Recommendations (page 69)	<p>Proposed to deleted this sentences</p> <p>5.6 Avions de Transport Regional (ATR) The towing without engine running for ATR 42 has not been included in the manufacture document.</p> <p>• It is recommended to the aircraft manufacturer to review possibility of the procedure towing without engine run available for ATR 72 aircraft to be implement for ATR 42.</p> <p>Proposed to added this sentences</p> <p><u><i>Chapter 4. Safety Actions</i></u></p> <p><u><i>4.5 Avions de Transport Regional (ATR)</i></u></p> <p><u><i>The manufacturer has developed a design change that enable to supply anti-collision light and navigation lights with batteries. The new design change will be added to the aircraft configurations for which the JIC towing by night without engine running is applicable.</i></u></p>	<p>A design change enabling the anti-collision and navigation lights to be connected to batteries has been developed by ATR. This design is certified and available to all customers who request it.</p> <p>This action undertaken by is in line with the objective of the safety recommendation. Therefore we propose to replace the safety recommendation (5.6) by a safety action (4.5).</p>	Accepted as safety action

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