KOMITE NASIONAL KESELAMATAN TRANSPORTASI
REPUBLIC OF INDONESIA

FINAL

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Aircraft Accident Investigation Report

PT. Batik Air Indonesia

Airbus A320; PK-LZJ

Sultan Hasanuddin International Airport

Republic of Indonesia

25 May 2019

2020

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

The report was 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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Jakarta, 24 August 2020
KOMITE NASIONAL
KESELAMATAN TRANSPORTASI
CHAIRMAN

SOERJANTO TJAHJONO

TABLE OF CONTENTS

TABLE OF FIGURES

ABBREVIATIONS AND DEFINITIONS

AAS	:	Angkasa Aviasi Servis
AMC	:	Apron Movement Control
AOC	:	Air Operator Certificate
ATS	:	Air Traffic Services
ATT	:	Aircraft Towing Tractor
CASR	:	Civil Aviation Safety Regulation
CB	:	Circuit Breaker
CVR	:	Cockpit Voice Recorder
DGCA	:	Directorate General of Civil Aviation
ERM	:	Eergency Response Manual
EWIS	:	Electrical Wiring Interconnection System
FDR	:	Flight Data Recorder
ICAO	:	International Civil Aviation Organization
KNKT	:	*Komite Nasional Keselamatan Transportasi*/National Transportation Safety Committee
LMPM	:	Line Maintenance Procedure Manual
LT	:	Local Time
MATSC	:	Makassar Air Traffic Services Center
MEL	:	Minimum Equipment List
OCC	:	Operational Control Center
OM-part A	:	Operation Manual Part A
PIC	:	Pilot in Command
SIC	:	Second in Command
SSQ	:	Batik Air Safety, Security and Quality
UTC	:	Universal Time Coordinated
WI	:	Working Instruction

SYNOPSIS

On 25 May 2019, an Airbus A320 aircraft registered PK-LZJ was being operated on a scheduled passenger flight from Sultan Hasanuddin International Airport (WAAA), Makassar to Mopah International Airport (WAKK), Merauke. On board the aircraft was two pilots, five flight attendants and 82 passengers.

At 1842 UTC (0242 LT), on night time, the aircraft commenced pushback from stand B1. The push back operation used towing tractor with the three crews consisted of towing tractor driver, a wing-man and a headset-man who performed by an aircraft mechanic. There was no briefing among the crew related to the pushback activity including the push back maneuver. The towing tractor driver and wing-man used high visibility vest while the headset-man used company uniform without any fluorescence strip or high visibility vest.

The push back maneuver did not follow the guideline and the headset-man walked behind the nose wheel while observing the engine start process. During a turn, the aircraft nose wheel passed over the right foot of the headset-man. The towing tractor driver felt a bump and noticed that the headset-man laid on the ground. The headset-man evacuated to the nearest hospital for medical treatment and found sustaining fracture on his right tarsometatarsal.

The investigation determined that the aircraft and towing tractor airworthiness serviceability, and communication transmission were not an issue on this occurrence. Therefore, the analysis discussed the pushback operation and personnel awareness. The investigation concluded the contributing factors of the occurrence as follows:

The different assumption of pushback maneuver between headset-man and the push back tractor driver, and both were fixated to their own duties while working on a reduced alertness condition, resulted in the towing tractor driver did not aware of the headset-man position and the headset-man did not aware of the nose wheel position. These conditions led to the nose wheel passed over the headset-man foot.

The KNKT had been informed of safety actions taken by the involved parties resulting from this occurrence. However, there still remain safety issues that need to be considered. Therefore, the KNKT issues the following safety recommendations addressed to the Angkasa Aviasi Servis.

1 FACTUAL INFORMATION

1.1 History of the Flight

On 25 May 2019, an Airbus A320 aircraft registered PK-LZJ was being operated on a scheduled passenger flight from Sultan Hasanuddin International Airport (WAAA), Makassar to Mopah International Airport (WAKK), Merauke. On board the aircraft were two pilots, five flight attendants and 82 passengers. The Pilot in Command (PIC) acted as Pilot Flying and the Second in Command (SIC) acted as Pilot Monitoring.

After the passenger boarding completed, the aircraft was ready for push back. The SIC then requested push back clearance to the Makassar Tower controller.

At 1841 UTC (0241 LT[1]) on early morning (night) time, the Makassar Tower controller issued pushback clearance to the pilot to maneuver aircraft heading south and to expect takeoff on runway 03. This heading south clearance was a simplify term to communicate since the actual heading south clearance would be south west. The SIC readback the clearance and the PIC relayed the instruction to the headset-man using intercom. The headset-man then advised the towing tractor driver using hand signal that the clearance was push back to heading south. Prior this pushback operation, there was no briefing conducted to discuss the pushback maneuver between the ground personnel.

At 0242 LT, the aircraft commenced pushback from stand B1 and the aircraft was on heading north-westerly. The push back operation used towing tractor with the crew consisted of towing tractor driver, a wing-man and a headset-man who performed by a mechanic. During the pushback, the towing tractor head lights and rotating beacon light located above the driver compartment and the aircraft anti-collision lights were illuminated. The towing tractor driver and wing-man used high visibility vest while the headset-man used company uniform without any fluorescence strip or high visibility vest.

The towing tractor driver maneuvered the towing tractor straight along the yellow line (straight lead-in line) with the wing-man was on the left side and the headset-man was on the right side of the towing tractor driver. The towing tractor was left-hand drive (the steering wheel on the left side).

A few meters after following the straight lead-in line, the towing tractor driver maneuvered the towing tractor to the left and made the aircraft facing north. This maneuver made the aircraft out of the straight lead-in line provided, with intention to provide sufficient space when maneuvering aircraft to face south west (see figure 2 for the detail apron layout and figure 4 for the aircraft maneuver illustration).

1 The 24-hours clock in Local Time (LT) is used in this report to describe the time as specific events occured. Local time is Universal Time Coordinated (UTC) +8 hours.

During maneuvering, when the aircraft was facing north, the wing-man moved to the right side of the towing tractor to observe the left wing and the tail of the aircraft to ensure safe separation with an aircraft that was parked on parking stand 37. The headset-man was on the right side of the towing tractor (on the left side of the aircraft), and walking faced to the aircraft to observe the aircraft left engine starting process after the right engine had been started without any abnormality.

After the aircraft faced to the north, the towing tractor driver continued by straight maneuver then turned right with intention to make the aircraft facing south west. During the turning maneuver to face south west, the towing tractor driver was focusing on the aircraft movement as it was not a straight maneuver, and did not recall the headset-man position. The aircraft nose wheel then rolled behind the headset-man and passed over the right foot of the headset-man. The towing tractor driver felt a bump and noticed that the headset-man laid on the ground. The towing tractor driver stopped the towing tractor when the aircraft was facing west and the aircraft nose wheel was facing north.

When the aircraft stopped, the PIC attempted to call the headset-man via intercom and no answer. The wing-man which also noticed that the headset-man laid on the ground, then ran to the ground handling service provider office to report the occurrence and asked for medical assistance for the headset-man.

The engineer group leader on duty arrived to the occurrence site and took over the duty of headset-man. The engineer group leader advised the PIC of the occurrence and to shut down the right engine. The pilot then set the aircraft parking brakes and shut down the engine. Thereafter, the PIC advised the engineer group leader to check the aircraft condition.

The visual observation to the right foot of headset-man indicated that there was possibility of bone fracture. The headset-man evacuated to the nearest hospital for medical treatment using Batik Air operational car.

At 0244 LT, the SIC requested to the Makassar Tower controller to hold on present position and advised that there was problem with the towing tractor, the request was approved. After performed aircraft visual check and no damage found on the aircraft, the engineer group leader suggested the PIC to continue the flight and was agreed. The engineer group leader considered the occurrence was not mandatory occurrence to be reported as there was no defect on the aircraft, and the pilots were not aware that the occurrence was classified as accident.

The pilots restarted the engines, and at 0249 LT, the SIC advised to the Makassar Tower controller that the aircraft was ready to continue the pushback and it was approved. The towing tractor driver and wing-man continued the duty while the role of the headset-man was replaced by the engineer group leader. The towing tractor driver continued to maneuver by pushing further the aircraft until reach the taxiway guideline.

At 0253 LT, after pushback completed, the SIC requested taxi clearance to the Makassar Tower controller and was instructed to taxi to runway 03. The aircraft taxied and departed using runway 03 at 0301 LT. The aircraft continued to fly and arrived at the destination aerodrome uneventfully. After landed the PIC filed occurrence report to the Batik Air Operation Department and the Safety, Security and Quality (SSQ) Department. The Komite Nasional Keselamatan Transportasi (KNKT) was notified of the occurrence by the Batik Air SSQ Department after the PK-LZJ aircraft had departed from Makassar.

1.2 Injuries to Persons

Injuries	Flight crew	Passengers	Total in Aircraft	Others
Fatal	-	-	-	-
Serious	-	-	-	1
Minor	-	-	-	Not applicable
None	7	82	89	Not applicable
TOTAL	7	82	89	1

The headset-man is Indonesian, sustained fracture on his right tarsometatarsal[2]. After the accident, the headset-man evacuated to hospital and was hospitalized until 29 May 2019.

1.3 Damage to Aircraft

The aircraft was undamaged.

1.4 Other Damage

No other damage to property and/or the environment in this accident.

1.5 Personnel Information

1.5.1 Pilot

Both pilots are Indonesian and held valid license with qualification as Airbus A320 aircraft pilot. The PIC had valid first-class medical certificate with limitation to wear lenses that correct for distant vision and possess glasses that correct for near vision. The SIC had valid first-class medical certificate without any limitation.

The total flying hours of the PIC on Airbus A320 was 2,588 hours while the SIC was 3,840 hours.

1.5.2 Air Traffic Controller

The air traffic controller had valid license and rating to perform aerodrome control service in Makassar Tower unit. The controller also had valid third-class medical certificate without any limitation.

2 Tarsometatarsal is a joint composed of three arthrodial joints, the bones of which articulate with the bases of the metatarsal bones.

1.5.3 Apron Movement Control Officer

The Apron Movement Control (AMC) officer is Indonesian, 33 years old, had valid AMC license and 11 years of experience as AMC officer.

Prior the accident, the AMC officer never noticed any incident during pushback maneuver nor pushback maneuver that did not follow the available guidance lines in the parking stand B1.

1.5.4 Towing Tractor Driver

The towing tractor driver is Indonesian, 43 years old, had valid Ground Support Equipment license and rating to drive Aircraft Towing Tractor (ATT). The towing tractor driver had 7 years of experience as ATT driver.

One day before the accident, the towing tractor driver was on noon shift from 1500 to 2300 LT. At the day of the accident, the towing tractor driver arrived in the airport about 2215 LT for night shift from 2300 to 0730 LT. Prior to the accident, the towing tractor driver had performed duty for pushback two aircraft from parking stand other than B1.

Based on the daily activity record, in the last one month, the towing tractor driver had pushed back 15 aircraft from parking stand B1 to face south west direction, without following the available lead-in lines. The towing tractor driver considered that if the offset lead-in line was followed, the aircraft maneuver would be too close to the service road and he had reported this issue to his supervisor. The towing tractor driver also did not consider to follow the straight lead-in line, considering this maneuver required longer time for the aircraft to reach the taxiway line on a position ready for taxi following the taxi guide line.

All the pushbacks were conducted successfully without any complaint from his supervisor, engineer nor AMC officer. Three aircraft including the accident aircraft was pushed back at night time condition.

The towing tractor driver did not recall ever paired with the injured headset-man. Based on the daily activity record, in the last one month, the day of the accident was the first time for the towing tractor driver paired with the injured head-set man.

1.5.5 Towing Tractor Driver Supervisor

The supervisor is Indonesian, 46 years old and had 14 years of experience as towing tractor driver. The supervisor described that the pushback maneuver from the parking stand B1 for facing aircraft to south-west direction was often conducted similar with the accident aircraft maneuver. The supervisor did not consider the maneuver without following the available guidance lines as hazard since there was no incident ever happened prior to this accident. Moreover, the supervisor did not recall any requirement to follow available guidance lines during pushback on the Ground Support Equipment Standard Operation Procedure (SOP).

1.5.6 Wing-man

The wing-man is Indonesian, 25 years old and had 7 months of experience as wing-man. At the day of the accident, the wing-man was on night shift from 2300 to 0730 LT and the pushback of the accident aircraft was his first duty assignment of the day.

1.5.7 Headset-man

The headset-man is Indonesian, 27 years old which qualified as aircraft mechanic. The headset-man had 4 years of experience as aircraft mechanic. The duty as aircraft mechanic is to check the aircraft serviceability and usually follows by duty as headset-man.

On the last two days, the headset-man was on night shift from 1930 to 0730 LT. On the accident day, at 2300 LT the headset-man performed daily check for the PK-LZJ aircraft which then followed by pushback operation.

The headset-man had conducted several pushback operations to maneuver aircraft facing south west from parking stand B1, and recalled that all of the pushback conducted by following the straight lead-in line.

Based on the daily job assignment record, in the last one month, the headset-man recorded twice conducting pushback operation from parking stand B1, including the accident aircraft. The previous pushback from the parking stand B1 was conducted at night by following the straight lead-in line and the towing car driver was not the same person with the day of the accident. During the accident, the headset-man assumed that the push back would be conducted following the straight lead-in line.

1.6 Aircraft Information

The PK-LZJ aircraft had valid Certificate of Airworthiness and Certificate of Registration. There was no report or record of aircraft system malfunction during the occurrence. The aircraft was operated within the weight and balance envelope.

The headset jack (connector) for headset-man to plug his headset was located in the nose area of the aircraft (see figure 1).

Figure 1: The common push back activity and the location of headset jack on typical Airbus A320

1.7 Meteorological Information

The meteorological information was not issue in this accident. The time of the accident was night time.

1.8 Aids to Navigation

The aids to navigation were not issue in this accident.

1.9 Communications

The communication between Makassar Tower controller and the pilot was recorded by ground based automatic voice recording equipment. The audio record on the CVR had overwritten as the aircraft continued the flight. The audio transmission recorded in the ground based automatic voice recording was in good quality. The significant excerpt of audio communication was as follows:

Time (LT)	Communication
02:41:27	The Makassar Tower controller issued engine start and pushback clearance heading south to the pilot and it was readback.
02:44:21	The pilot requested to the Makassar Tower controller to hold on present position and advised that there was problem with the towing tractor, the request was approved.
02:49:44	The pilot advised to the Makassar Tower controller that the aircraft was ready to continue the pushback and it was approved.
02:53:03	The pilot requested taxi clearance to the Makassar Tower controller and was instructed to taxi to runway 03.
02:53:16	The Makassar Tower controller provided departure route clearance to the pilot, included the Secondary Surveillance Radar (SSR) code[3] for the flight.
02:58:29	The Makassar Tower controller instructed the pilot to continue lining up runway 03.
03:00:00	The Makassar Tower controller issued takeoff clearance using runway 03 for the pilot.

1.10 Aerodrome Information

The Sultan Hasanuddin International Airport (WAAA) is operated by PT. Angkasa Pura I (Angkasa Pura I) which had valid aerodrome certificate. The airport located in Makassar, Indonesia on coordinate 05°03’39.00” S; 119°33’16.00” E.

The airport had two runways (03-21 and 13-31), 13 taxiways, three aprons (new, old and cargo), and 37 parking stands. The airport layout can be seen on figure 2.

3 The Secondary Surveillance Radar (SSR) code is the number assigned to a particular multiple pulse reply signal transmitted by a transponder which make the aircraft can be displayed in radar display.

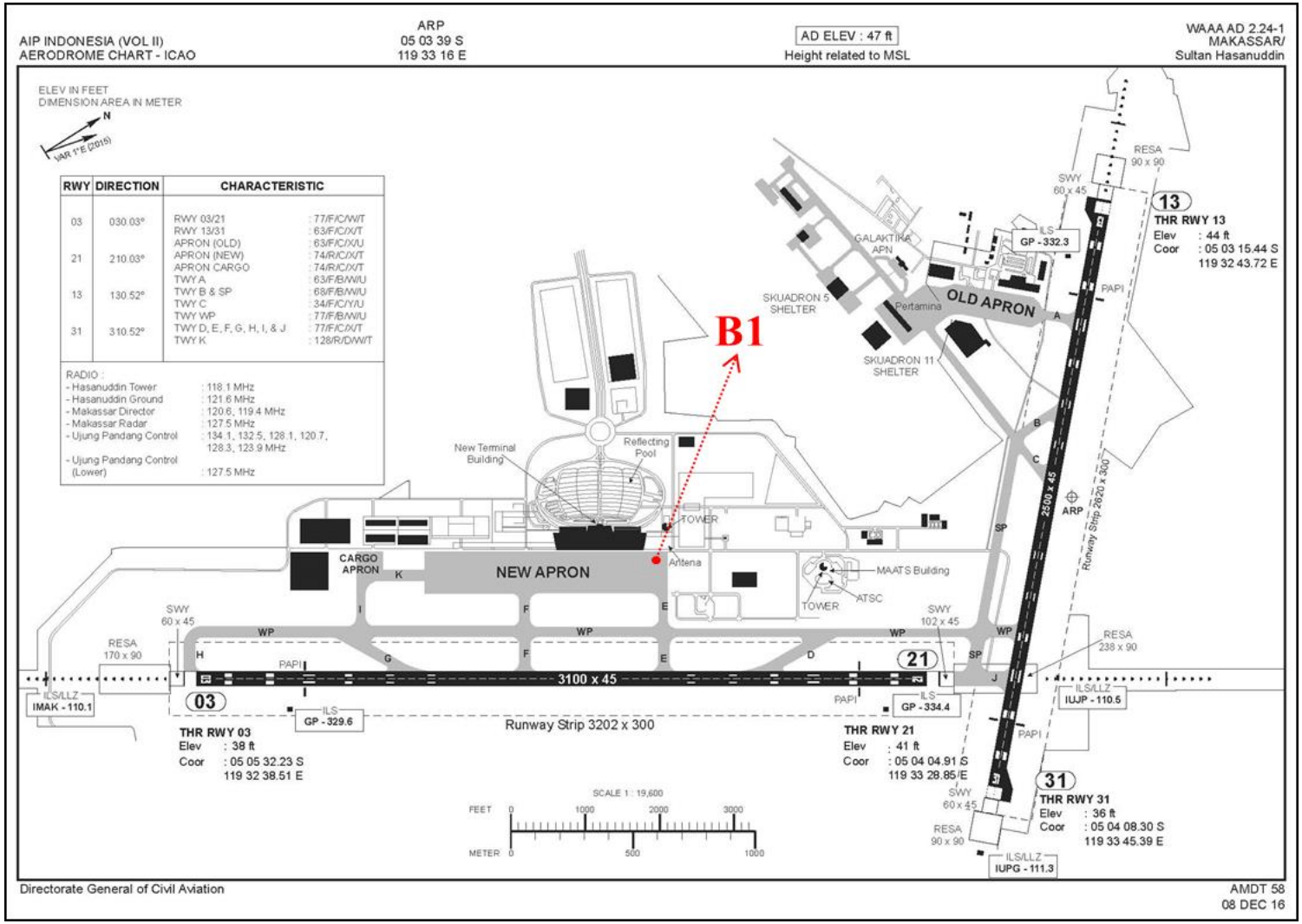

Figure 2: The apron layout

1.10.1 Parking Stand B1

The parking stand B1 located on the most north-east side of the new apron in conjunction of taxiway ECHO, at coordinate 05°04’31.66” S 119°32’54.51” E. The parking stand B1 is nose-in aircraft parking stand which can be used for narrow body aircraft including Airbus A320 aircraft. The aircraft parked on the parking stand B1 would face on heading 300° (north-west direction).

The parking stand B1 has two offset lead-in lines and one straight lead-in line. The lead-in lines use for guidance during taxi in and also during pushback maneuver. The left and right offset lead-in line mentions in this investigation report refers to the position looking outside from the parking bay or the view of pushback tractor driver.

The right offset lead-in line could not be used for taxi in guidance, as there was no taxi route from north east direction. The left offset lead-in line is used for aircraft which taxi from taxiway FOXTROT (south-west direction). The straight lead-in line is used for aircraft which taxied from taxiway ECHO (south-east direction). Therefore, the designated number of parking stand B1 only painted on the left offset nose-wheel lead-in line and straight lead-in line.

The left offset lead-in line can be used as pushback guidance for aircraft facing north east, while the right offset lead-in line and straight lead-in line were provided as pushback guidance for aircraft to face south-west direction. If the right offset lead-in line would be used for pushback guidance, the aircraft maneuver will be too close to the service road, and if the straight lead-in line would be used, the aircraft have to be pushed straight back close to taxiway ECHO until the nose wheel can taxi following the apron taxiway centerline marking.

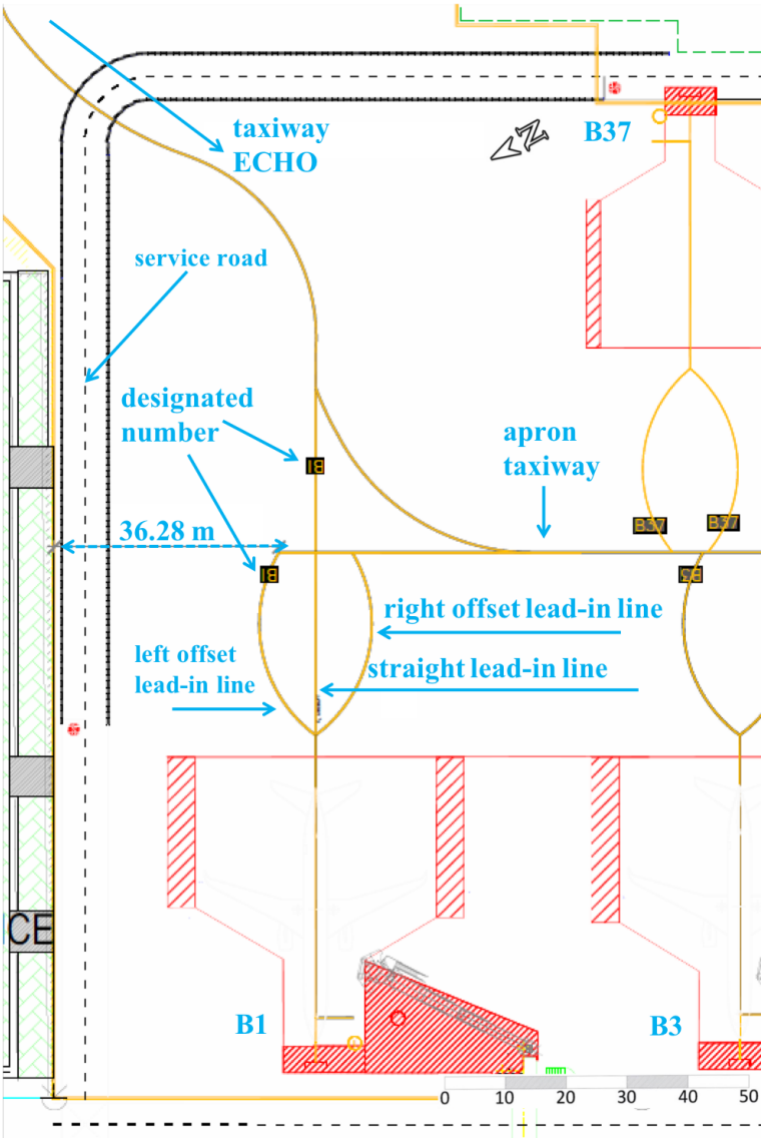

Figure 3: Parking stand B1 layout

1.10.2 Closed-Circuit Television

The airport operator utilized Closed-Circuit Television (CCTV) system to support the airport operation service. Other than security purposes, several CCTV cameras that were located on the apron can be utilized by the Apron Movement Control (AMC) unit to monitor the aircraft movement.

The CCTV camera located on the parking stand B1 was unable to provide clear view of the pushback maneuver as the view was blocked by the passenger boarding bridge (figure 4).

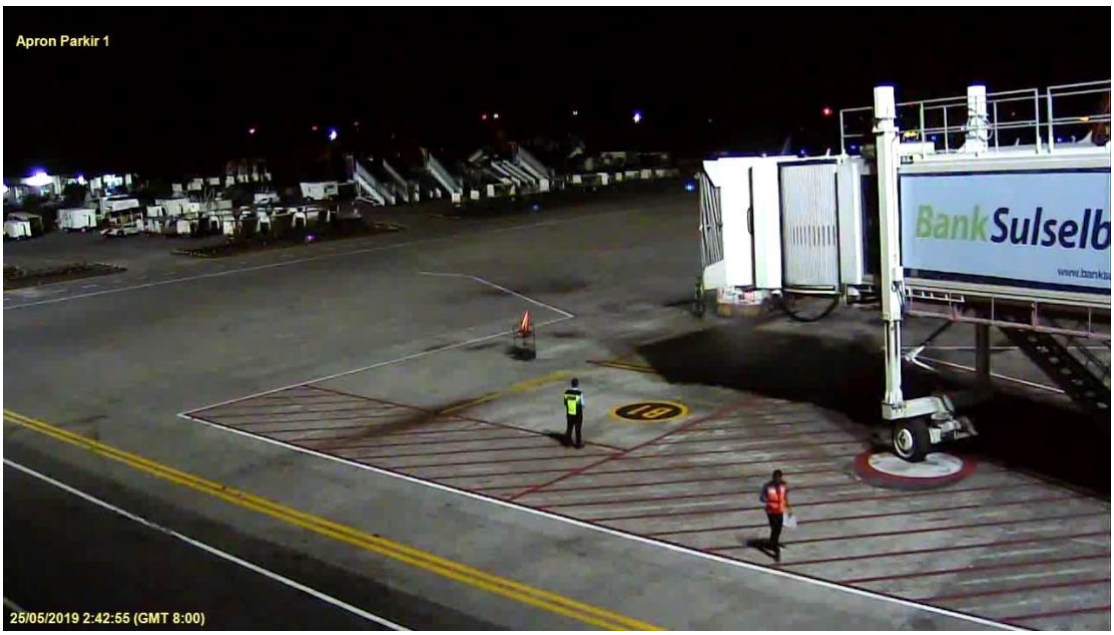

Figure 4: The blocked view of parking stand B1 CCTV

The Air Traffic Services (ATS) provider also utilized CCTV system for security purposes. One of the CCTV cameras located outside the tower building facing to the apron recorded the push back maneuver. Based on the CCTV record, throughout the pushback maneuver, the headset-man position as such that the nose wheels were behind him (figure 6).

The CCTV from the airport operator or ATS provider indicated that the apron was provided with sufficient light.

Figure 5: The aircraft as recorded by the ATS provider CCTV system

Figure 6: The zoomed-in view of the ATS provider CCTV display showed the headset-man position during pushback

1.11 Flight Recorders

The aircraft was equipped with a Cockpit Voice Recorder (CVR) and a Flight Data Recorder (FDR). The recorded voice on the CVR had overwritten.

The FDR of the aircraft was L-3 FDR model with part number 2100-4245-00 and serial number 001303540. The FDR was downloaded in the KNKT facility and contained data of 1,064 parameters with approximately 95 hours of aircraft operation, which was containing 40 flights including the accident flight.

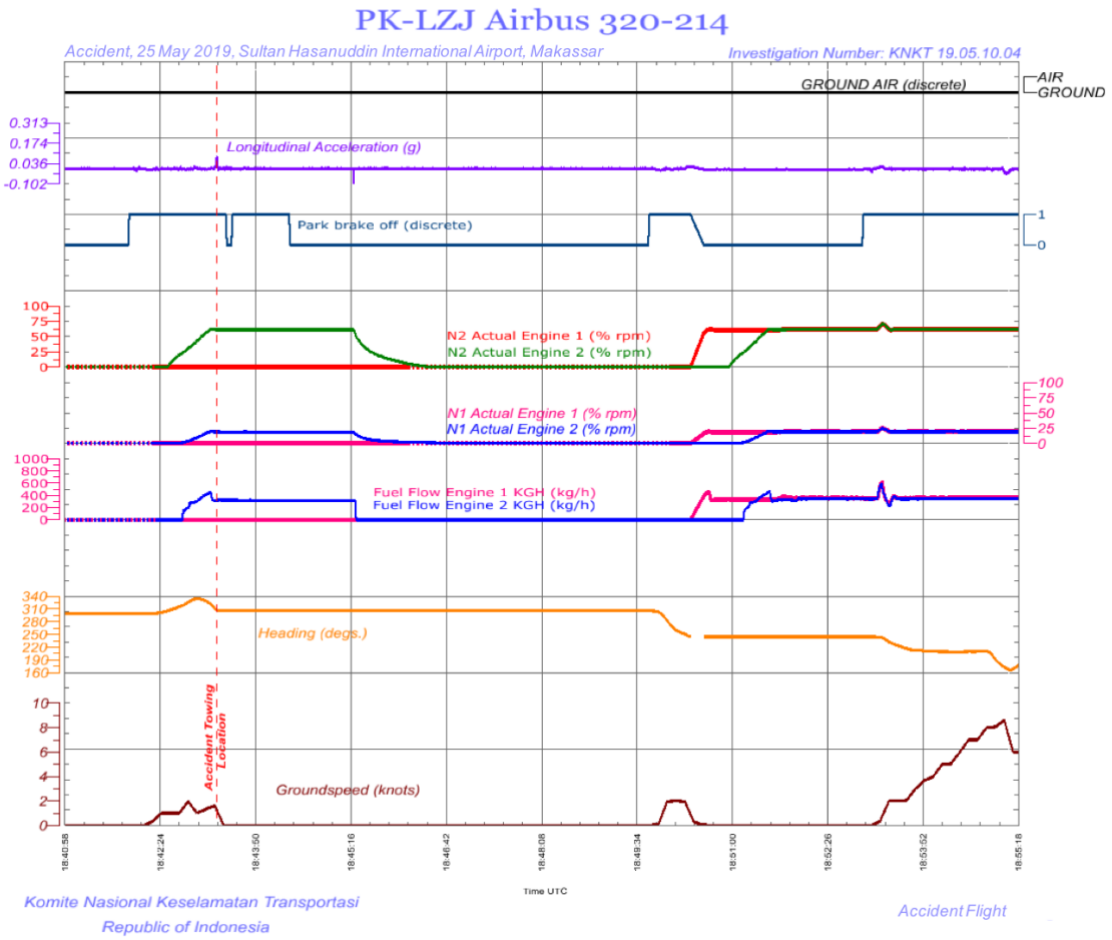

Figure 7: The relevant parameters of the FDR

The significant parameters of the FDR were as follows:

1. 18:42:18 UTC (02:42:18 LT), the aircraft heading was 300°, the ground speed increased from 0 (the aircraft started to move) and maintained to 1 knot for 30 seconds.
2. 02:42:22 LT, the aircraft heading increased from 300° to 301° and continuously increased (aircraft was turning to the right) until 02:42:56 LT, the ground speed maintained at 1 knot.
3. 02:42:43 LT, the aircraft heading increased from 316° to 317° (aircraft was turning to the right), the ground speed maintained at 1 knot, the N1 Engine number 2 (right engine) increased from 0 to 1 % and continuously increased.
4. 02:42:48 LT, the aircraft heading increased from 322° to 324° (aircraft was turning to the right), the ground speed increased from 1 knot to 2 knots and maintained for seven seconds, the N1 Engine number 2 increased from 3.1 % to 3.6 %.
5. 02:42:55 LT, the aircraft heading increased from 332° to 333° (aircraft was turning to the right), the ground speed reduced from 2 knots to 1 knot and maintained for 11 seconds, the N1 Engine number 2 increased from 7 % to 8 %.
6. 02:42:56 LT, the aircraft heading reached the highest value of 334° and maintained for four seconds, the ground speed maintained at 1 knot, the N1 Engine number 2 increased from 8 to 9 %.

7. 02:43:00 LT, the aircraft heading reduced from 334° to 333° and continuously reduced (aircraft was turning to the left), the ground speed maintained at 1 knot, the N1 Engine number 2 increased from 11 to 12 %.
8. 02:43:06 LT, the aircraft heading reduced from 329° to 328° (aircraft was turning to the left), the ground speed increased from 1 knot to 2 knots and maintained for eight seconds, the N1 Engine number 2 increased from 16 to 18%.
9. 02:43:08 LT, the aircraft heading reduced from 326° to 324° (aircraft was turning to the left), the ground speed maintained at 2 knots, the N1 Engine number 2 increased from 18% to 19% and maintained.
10. 02:43:14 LT, the aircraft heading reduced from 311° to 309° (aircraft was turning to the left), the ground speed reduced from 2 to 1 knot, the N1 Engine number 2 maintained at 19%.
11. 02:43:15 LT, the aircraft heading reduced from 307° and maintained to 306°, the ground speed reduced from 1 to 0 knots (the aircraft stopped), and the N1 number 2 (right engine) maintained at 19%.
12. 02:43:21 LT, the aircraft heading maintained at 306°, the ground speed remained 0 knots, the N1 number 2 remained 19%, and the brake pedals angle indicated an increasing value.
13. 02:43:24 LT, the parking brake indicated ON until 02:43:28 LT.
14. 02:43:29 LT, the parking brake indicated OFF until 02:44:20 LT.
15. 02:44:21 LT, the parking brake indicated ON.
16. 02:45:18 LT, the N1 Engine number 2 reduced from 19% to 17% and continuously reduced until 0% at 02:46:33 LT.
17. 02:49:45 LT, the parking brake indicated OFF.
18. 02:49:48 LT, the aircraft heading reduced from 306° to 305° (aircraft was turning to the left) and continuously reduced.
19. 02:49:55 LT, the ground speed increased from 0 and to 1 knot (the aircraft started to move), the aircraft heading reduced from 302° to 300° (aircraft was turning to the left).

1.12 Wreckage and Impact Information

During turning the aircraft from facing north east to south east, the nose wheel of the aircraft passed over the headset-man right foot. The towing tractor driver felt a bump and noticed that the headset-man laid on the ground.

After the bump, the towing tractor driver stopped the towing tractor and the aircraft stopped by facing south east. The aircraft was undamaged.

The location of the blood spills on coordinate 5°4'32.86"S; 119°32'55.67"E, about 50 meters from the beginning of parking stand B1, was considered as the location when the nose wheel passed over the headset-man right foot.

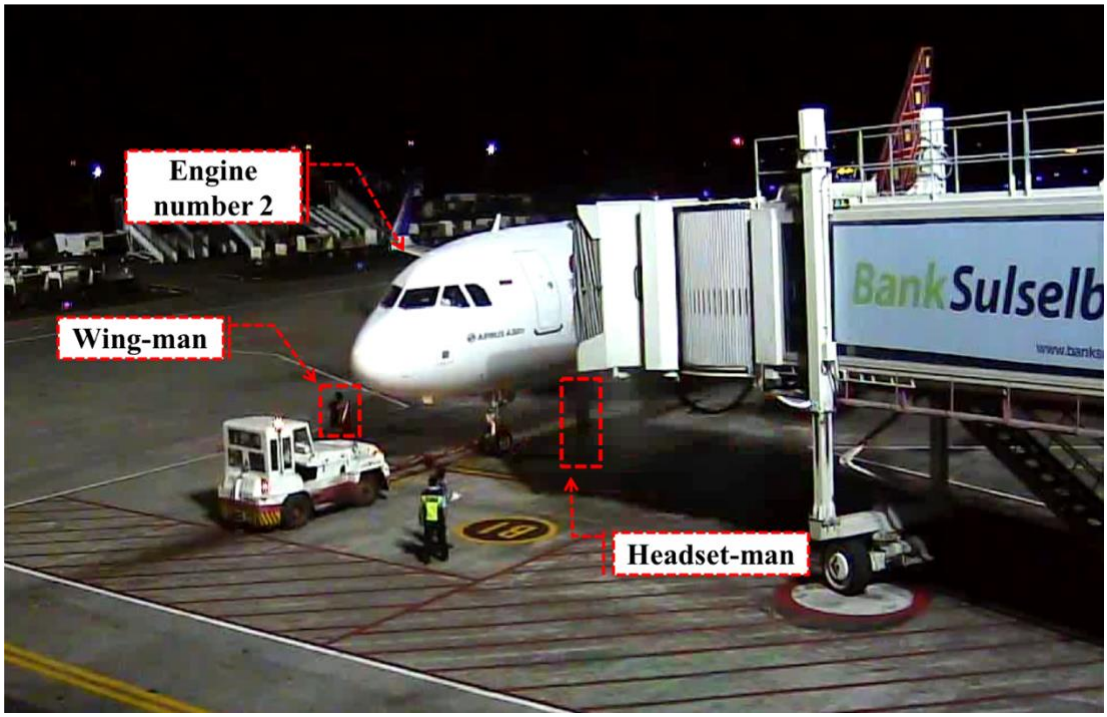

Figure 8: The view from CCTV, 4 seconds after the aircraft moved

Figure 9: The position of the towing tractor and when the aircraft stopped after the accident

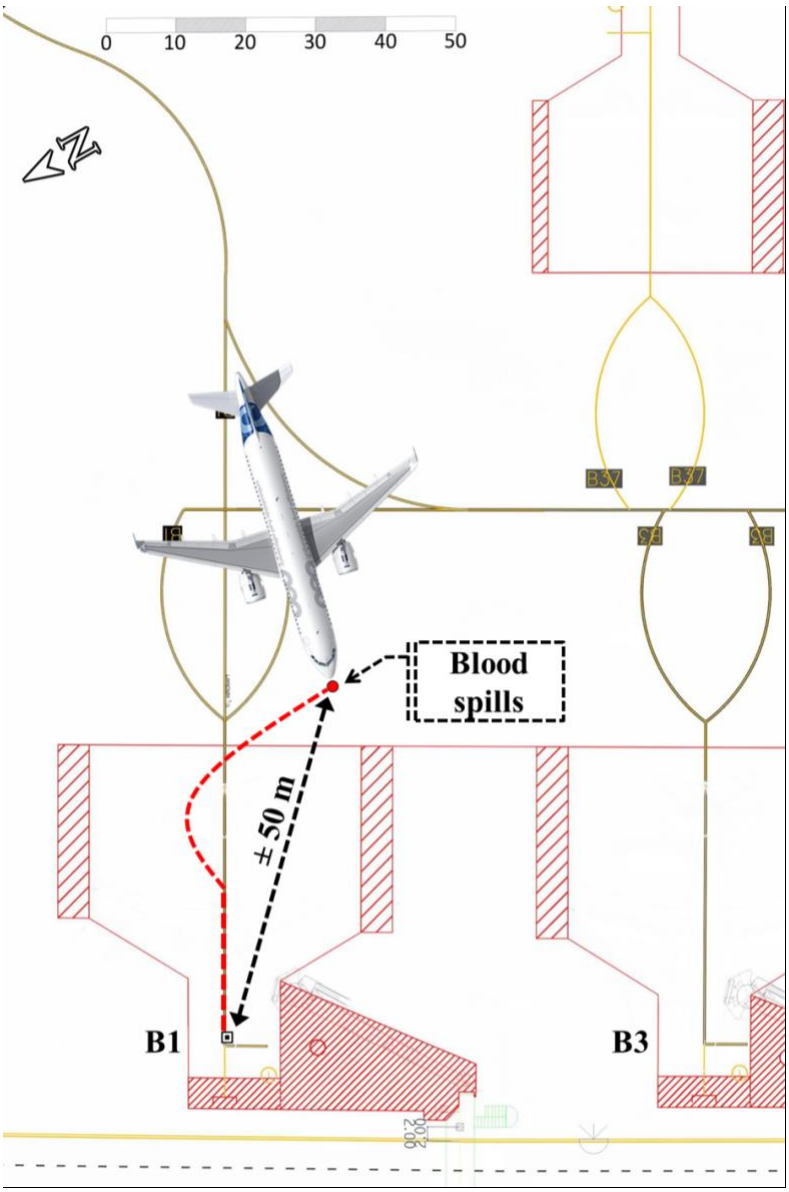

Figure 10: The illustration of the nosewheels movement during pushback maneuverer (red dot line)

1.13 Medical and Pathological Information

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

1.14 Fire

No evidence of fire during the accident.

1.15 Survival Aspects

The towing tractor driver stopped the maneuver after felt a bump and noticed that the headset-man laid on the ground. The wing-man then ran to the ground handling service provider office to report the occurrence and asked medical treatment for the headset-man. About four minutes later, the headset-man evacuated to the nearest hospital for medical treatment using Batik Air operational car.

1.16 Tests and Research

No test and research are performed in relation to this investigation.

1.17 Organizational and Management Information

1.17.1 Aircraft Operator

The PK-LZJ aircraft is owned by SMBC Aviation Capital Limited, Ireland and operated by PT. Batik Air Indonesia (Batik Air) that had valid Air Operator Certificate (AOC) number 121-050. The Batik Air was operating several aircraft types consisted of 43 Airbus A320-200, eight Boeing 737-800 and six Boeing 737-900ER aircraft.

The Batik Air has Operation Manual Part A (OM-part A) which contains policy and procedure approved by the Directorate General of Civil Aviation. The relevant subchapter to the investigation was described as follows:

11.1.1 ACCIDENT

An accident is an occurrence associated with the operation of an aircraft which:

- *the aircraft sustains damage or structural failure which:*
  - *adversely affects the structural strength, performance or flight characteristics of the aircraft; and*
  - *would normally require major repair or replacement of the affected component,*
- *except for engine failure or damage, when the damage is limited to the engine, its cowlings or accessories; or for damage limited to propellers, wing tips, antennas, tyres, brakes, fairings, small dents or puncture holes in the aircraft skin: or*
- *person is fatally or seriously injured as a result of:*
  - *being in the aircraft;*
  - *direct contact with any part of the aircraft, including parts which have become detached from the aircraft; or,*
  - *direct exposure to jet blast,*

  Except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew.
- *The aircraft is missing or is completely inaccessible.*

11.1.4 SERIOUS INJURIES

A serious injury is an injury which is sustained by a person in an accident and which:

- *Requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received; or*
- *Results in a fracture of any bone (except simple fractures of fingers, toes or nose); or*
- *Involves lacerations which cause severe hemorrhage, nerve, muscle or tendon damage; or*
- *Involves injury to any internal organ; or*

- *Involves second or third degree burns, or any burns affecting more than 5 per cent of the body surface; or*
- *Involves verified exposure to infectious substances or injurious radiation.*

11.3 PROCEDURES IN CASE OF ACCIDENT, SERIOUS INCIDENT OR OVERDUE AIRCRAFT REPORT

11.3.1 INITIAL / IMMEDIATE NOTIFICATION TO THE COMPANY

In the event of an accident or a serious incident, either airborne or on the ground, the Pilot in Command or a crew member, if physically able, or any other person will advise OCC by the quickest available means, that will in turn advise SSQ Directorate.

In the case the OCC is aware of a BATIK AIR aircraft accident or a serious incident or, has reasons to believe a BATIK AIR aircraft has been involved in an accident, or in the case of an overdue aircraft report, the OCC will immediately advise BATIK AIR SSQ Directorate by the quickest available means.

As soon as it is advised of the situation, SSQ Directorate will declare the corresponding emergency phase and manage the situation in accordance with procedures detailed in the BATIK AIR Emergency Response Manual (ERM).

11.3.3 PRESERVATION, PRODUCTION AND USE OF FDR AND CVR

Following an accident or a serious incident, the Company must attempt to preserve all FDR and CVR data and make it available to the investigating authority. In addition, BATIK AIR will ensure all operational manuals and documents in force at the time of the accident / serious incident are collected and preserved.

PIC shall secure the CVR after experiencing serious incidents or accidents by pulling the CVR CB(s) on the ground after engine shutdown procedures completed and in coordination with maintenance personnel.

Events required pilot to secure the CVR CB(s)

I. ACCIDENTS

Weather occurrences causing serious injury or fatality for person onboard the aircraft.

II. SERIOUS INCIDENTS

a. Collisions not classified as accidents.

b. Events requiring the emergency use of oxygen by the flight crew

c. Aircraft structural failures or engine disintegrations, including uncontained turbine engine failures, not classified as an accident.

d. Multiple malfunctions of one or more aircraft systems seriously affecting the operation of the aircraft.

e. Flight crew incapacitation in flight

f. Fuel quantity level or distribution situations requiring the declaration of an emergency by the pilot, such as insufficient fuel, fuel exhaustion, fuel starvation, or inability to use all useable fuel on board

g. Runway incursion in which a collision is narrowly avoided.

11.4 REPORTABLE EVENTS

11.4.1 NOTIFICATION AND REPORTING OF ACCIDENTS AND SERIOUS INCIDENTS

As soon as it is advised of an accident or serious incident (refer to paragraph §11.3.1 "INITIAL NOTIFICATION" of this Chapter, the Company (SSQ Directorate) must, in turn, immediately, and by the most suitable and quickest means available, report to the Indonesian National Transportation Safety Committee (NTSC) and the DGCA, as well as to the Authority of the State of occurrence.

This immediate occurrence report must in all cases, be submitted within 24 hours following the accident or serious incident.

1.17.2 Ground Handling Service Provider

The ground handling services for Batik Air flight operations were provided by PT. Angkasa Aviasi Servis (AAS).

The AAS issued Ground Support Equipment Operational Standard Operation Procedure (SOP) as guidance for AAS personnel, including procedure for towing tractor driver and wing-man during pushback. The subchapter 5.1.1 of the SOP, described the procedure for conducting pushback operation for aircraft, the procedure did not contain requirement to follow available guidance lines nor any requirement to conduct briefing or have discussion with headset-man regarding the planning maneuver that will be conducted. The briefing is only required when performing aircraft towing.

1.17.3 Aircraft Maintenance Provider

The aircraft maintenance service for Batik Air flight operations in Makassar are provided by PT. Batam Aero Technic (BAT). The BAT is an approved maintenance organization under Civil Aviation Safety Regulation (CASR) part 145 which had valid approval number 145D-914. The capability list approved by the Directorate General of Civil Aviation (DGCA) included the maintenance activities for all Batik Air aircraft in the base maintenance and line maintenance activities.

The line maintenance activities included aircraft daily check and departure handling. The aircraft departure handling includes pushback activity.

The BAT has Line Maintenance Procedure Manual (LMPM) which defines procedure in compliance with the aviation authority requirements, company policies, procedures and technical manuals to perform Line Maintenance activities to the customers under the company Fleet Management Programs.

1.17.3.1 Engine Start Procedure

The BAT LMPM subchapter 5.3.2 described aircraft dispatch procedure which include the engine start procedure as follows:

5.3.2.5 START THE ENGINES.

Engineer or mechanic shall:

1. *Check that all anti-collision lights are working to warn the personnel that engine starting is about to taking placed.*
2. *Ensure the fire extinguisher is available and at the right location & position to the engine about to start.*

3. *Keep close contact with PIC during the starting up procedures.*

CAUTION:

1. *Personnel, tools and equipment are not allowed in the engine intake and blast areas during the starting procedure or while engines are running.*
2. *All personnel present during the engine starting should wear their protective earring aid.*

1.17.3.2 Pushback Procedure

The BAT LMPM subchapter 5.6.2.2 described procedures as follows:

5.6.2.2 DURING PUSH-BACK

1. *Pushback speed during the whole operation shall not exceed 5 (five) km/hrs.*
2. *Engineer or mechanic shall communicate with flight crew by interphone or visual signal and tractor driver/helper by visual signals and or verbal instruction refer to LMPM 4.1 Ground Cockpit Communication.*
3. *Certifying/Engineer and tractor driver shall ensure that the center line of an aircraft fuselage (not only nose wheels) is aligned with the guideline.*
4. *Complete the check of the surrounding area, the Engineer or mechanic shall give all clear signals to the flight crew. The engineer or mechanic ensures that the fire extinguisher is always available at stand during engine starting.*

The Batik Air Aircraft Maintenance Manual (AMM) for Airbus A318/A319/A320/A321 task 09-10-00-584-002-A described towing procedure by nose landing gear from the front with a towbar. Those tasks include warning as follows:

WARNING: *OBEY THESE SAFETY PRECAUTIONS DURING MOVEMENT OF THE AIRCRAFT (TOWING, PUSHBACK OR TAXIING). MAKE SURE THAT:*

- *THE PATH OF THE AIRCRAFT IS CLEAR OF PERSONS, EQUIPMENT AND OTHER OBSTACLES.*
- *NO PERSONS GO NEAR THE TOW TRACTOR, TOWBAR, LANDING GEARS, ENGINE NACELLES OR BELOW THE AIRCRAFT FUSELAGE.*
- *ONLY QUALIFIED PERSONS ARE ON THE TRACTOR AND NO PERSONS SIT OR STAND ON THE TOWBAR.*
- *NO PERSONS GO NEAR THE AIRCRAFT BEFORE IT IS FULLY STOPPED.*
- *THERE IS A RISK OF INJURY OR DEATH IF YOU DO NOT OBEY THESE INSTRUCTIONS.*

The towing procedure on subtask 09-10-00-584-064-A described that during the towing operations, while the aircraft moves, all persons must be at a minimum distance of 3 meters or 10 feet from the wheels and the tractor. The hazard area during towing operations were illustrated on the following figure:

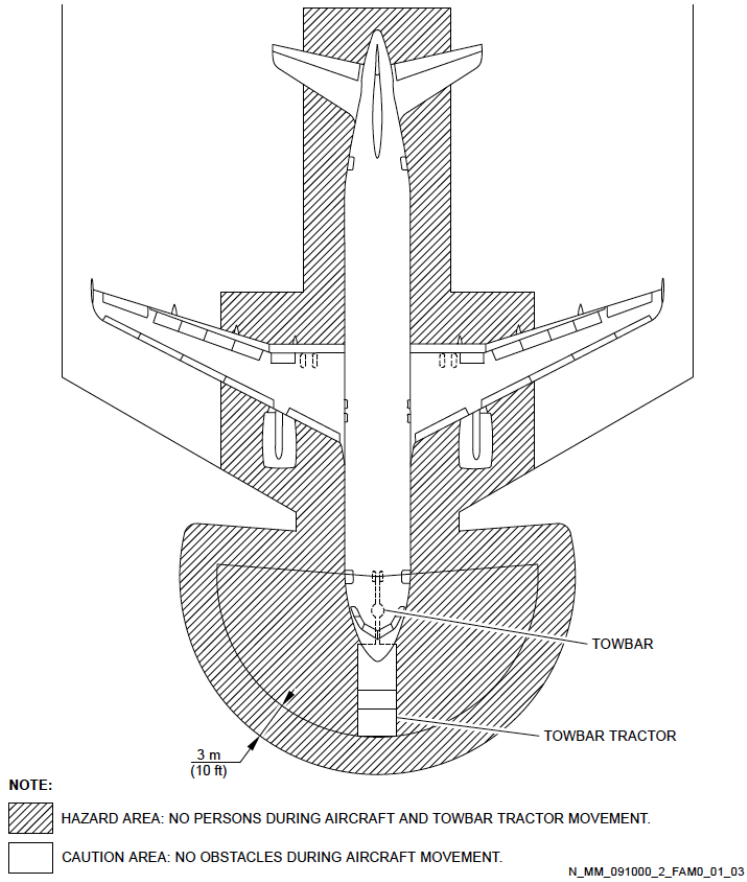

Figure 11: The hazard area during towing operation as describes in the Batik Air AMM for Airbus A318/A319/A320/A321

1.17.3.3 Reporting Accident Procedure

The BAT LMPM subchapter 7.2 described accident/incident report requirement as follow:

7.2 ACCIDENT/INCIDENT REPORT

7.2.1 PURPOSE

This procedure is guidance for line maintenance personnel to report of any incident / accident occurs in Batam Aero Technic customer fleet under the contracted maintenance.

7.2.2 CRITERIA OF TECHNICAL INCIDENT OR REPORTABLE DEFECT

Generally in the conditions to be reported are those identified by individuals that has resulted or may result in an unsafe condition that hazards seriously the flight safety. Examples of occurrences considered as Technical Incidents / Reportable Defects are listed below:

- *Serious structural damage (for example: cracks, permanent deformation, delamination, debonding, burning, excessive wear, or corrosion) found during maintenance of the aircraft or component.*
- *Serious leakage or contamination of fluids (for example: hydraulic, fuel, oil, gas or other fluids).*
- *Failure or malfunction of any part of an engine or power plant and/or transmission resulting in any one or more of the following:*
- *Non-containment of components/debris;*
- *Failures of the engine mount structure.*
- *Significant malfunction of a safety-critical system or equipment including emergency system or equipment during maintenance testing or failure to activate these systems after maintenance.*
- *Incorrect assembly or installation of components of the aircraft found during an inspection or test procedure not intended for that specific purpose.*
- *Wrong assessment of a serious defect, or serious non-compliance with MEL and*
- *Technical logbook procedures.*
- *Serious damage to Electrical Wiring Interconnection System (EWIS).*
- *Any defect in a life-controlled critical part causing retirement before completion of its full life.*
- *The use of products, components or materials, from unknown, suspect origin, or unserviceable critical components.*
- *Misleading, incorrect or insufficient applicable maintenance data or procedures that could lead to significant maintenance errors, including language issue.*
- *Incorrect control or application of aircraft maintenance limitations or scheduled maintenance.*
- *Releasing an aircraft to service from maintenance in case of any non-compliance which endangers the flight safety.*
- *Serious damage caused to an aircraft during maintenance activities due to incorrect maintenance or use of inappropriate or unserviceable ground support equipment that requires additional maintenance actions.*
- *Identified burning, melting, smoke, arcing, overheating or fire occurrences.*
- *Any occurrence where the human performance, including fatigue of personnel, has directly contributed to or could have contributed to an accident or a serious incident.*

- *Significant malfunction, reliability issue, or recurrent recording quality issue affecting a flight recorder system (such as a flight data recorder system, a data link recording system or a cockpit voice recorder system) or lack of information needed to ensure the serviceability of a flight recorder system.*

After the line maintenance personnel identified accident or incident had occurred, the procedure to be followed was as follows:

7.2.3 PROCEDURE

1. *Safety action: do not move the aircraft and wreckage from the place of accident/ incident unless:*
   - *It is already permitted by DGCA or local authority,*
   - *It is helping people in serious injury or trap,*
   - *It avoids aircraft to break down / create more damage,*
   - *It is avoiding or reducing danger to people,*
   - *It prevents from other accident/incident (air navigation, etc.).*

   Before moving the aircraft and wreckage, pictures shall be made or a sketch hand marking shall be made around the aircraft on the land. The part that cannot be taken a picture shall be noted. Be careful while moving the aircraft break downs and care from adding trouble.
2. *The engineer who handles the aircraft shall be responsible for reporting immediately using Internal Occurrence report form (BT-QMF-042).*
3. *The report is to be acknowledged by the leader to MCC Duty Manager or Line Maintenance Manager (or Deputy) and can be handed-over or sent by e-mail.*
4. *Chief Line Station or Engineer in charge shall keep the copy of report in file.*
5. *The report shall be either written or type written in block letters and in English only.*
6. *Every incident / accident must be reported within 24 hours to Quality Assurance Department and Safety & Security (SMS) Department, with copy to Line Maintenance General Manager by MCC Duty Manager.*
7. *As necessary Quality Department and Safety Department may request additional details.*
8. *Any further investigation shall be done under SMS Department authority.*

NOTE: The aircraft records must be saved and do not change the record.

1.17.4 Airport Operator

The Sultan Hasanuddin International Airport is operated by PT. Angkasa Pura I (Angkasa Pura I) which also operates 12 other airports in Indonesia. The Angkasa Pura I had valid aerodrome certificate to operate airport services in Sultan Hasanuddin International Airport.

The airport service provided by the airport operator included the apron movement control, which conducted by Apron Movement Control (AMC) unit in coordination with the Makassar Tower control unit.

The AMC unit is responsible to monitor person and vehicle movement in the apron while the clearance for aircraft movement is provided by the Makassar Tower unit.

The airport operator had Working Instruction (WI) number IK/UPG-OP/PU-01-07 which contained instruction to be followed by the AMC unit during monitoring of pushback and start engine operation. The instruction number 6.8 described that during pushback operation, the towing tractor driver must be accompanied by wing-man and the aircraft must be pushed back following the guidance line until reach the taxiway centerline.

The AMC unit utilized radio communication to monitor the communication between pilot and tower controller, and several Closed-Circuit Television (CCTV) displays to monitor the pushback operation.

During the pushback of PK-LZJ, the AMC officer did not maintain continuously watch the pushback maneuver from the CCTV. The AMC officer was aware of the problem related to the pushback process when he heard the communication between pilot and the tower controller. The blocked view of the passenger boarding bridge prevented the AMC officer to see clearly the current situation. About five minutes later, the AMC officer heard the communication of the pilot requesting to continue the pushback to the tower controller. Based on this communication, the AMC officer assumed that the problem was daily technical reason that did not require assistance from the AMC unit.

About 0530 LT, the AMC officer received the accident report from the airport security.

1.17.5 Air Traffic Services Provider

The *Perusahaan Umum Lembaga Penyelenggara Pelayanan Navigasi Penerbangan Indonesia* (AirNav Indonesia) is the Air Traffic Services (ATS) provider within Indonesia. The ATS in Makassar is provided by AirNav Indonesia branch office Makassar Air Traffic Services Center (MATSC) which held a valid Air Traffic Services provider certificate.

The ATS provided by the MATSC were aerodrome control service; approach control service; aeronautical communication service; and flight information services. The aerodrome control service is provided by the Makassar Tower control unit which includes providing taxi clearance to parking stand and pushback clearance from parking stand. The Makassar Tower unit must coordinate with AMC unit for assignment of the parking stand number.

1.17.6 Aerodrome Design Standards and Recommended Practices

International Civil Aviation Organization (ICAO) Document 9157 Part 4, provides guidance for proper design and installation of visual aids used at airports. On the subchapter 2.3.5 lead-in line as follows:

Lead-in lines

2.3.5 These lines provide guidance from apron taxiways into specific aircraft stands…For nose-in stands, the lead-in lines will mark the stand centre line to the aircraft stopping position. There will be no lead-out lines, and the tractor drivers will use the lead-in lines for guidance during the push-back manoeuvre.

1.17.7 Accident within Indonesia Territory

According to the Aviation Law Number 1 of 2009 and Government Decree Number 62 of 2013 described that KNKT have responsibility to conduct investigation on accident of civil aircraft occurred within the territory of Republic of Indonesia.

The CASR part 830 subpart 830.2 defines:

Accident*. An occurrence associated with the operation of an aircraft in which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time as it comes to rest at the end of the flight and the primary propulsion system is shut down, in which:*

a. person is fatally or seriously injured as a result of:

1) being in the aircraft, or

2) direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or

3) direct exposure to jet blast,

except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or.

b. the aircraft sustains damage or structural failure which:

1) adversely affects the structural strength, performance or flight characteristics of the aircraft, and

2) would normally require major repair or replacement of the affected component,

except for engine failure or damage, when the damage is limited to a single engine (including its cowlings or accessories), to propellers, wing tips, antennas, probes, vanes, tires, brakes, wheels, fairings, panels, landing gear doors, windshield, the aircraft skin (such as small dents or puncture holes), or for minor damages to main rotor blades, tail rotor blades, landing gear, and those resulting from hail or bird strike (including holes in the radome);

c. or the aircraft is missing or is completely inaccessible.

Serious injury*. An injury which is sustained by a person in an accident and which:*

a. requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received; or

b. results in a fracture of any bone (except simple fractures of fingers, toes or nose); or

c. involves lacerations which cause severe haemorrhage, nerve, muscle or tendon damage; or

d. involves injury to any internal organ; or

e. involves second- or third-degree burns, or any burns affecting more than 5 per cent of the body surface; or

f. *involves verified exposure to infectious substances or injurious radiation.*

Any accident or serious incident of civil aircraft occurred within Indonesia territory, the CASR 830 subpart 830.06 requires person, organization or enterprise engaged in or offering to engage in an aircraft operation, with minimum delay and by the most suitable and quickest means available, must report to the *Komite Nasional Keselamatan Transportasi* (KNKT).

1.18 Additional Information

1.18.1 Towing Tractor Information

The towing tractor manufactured by PT. United Tractors Pandu Engineering (PATRiA), Indonesia and the model PTD 50 is capable to tow Airbus A320. According to the product specification, the maximum speed for PTD 50 with forward-1 clutch is 12 km/hour and forward-2 clutch is 32 km/hour. The steering wheel of the PTD 50 is left hand drive which the steering wheel is on the left side.

Prior to the accident, there was no report or record of towing tractor system malfunction.

Figure 12: The towing tractor

1.18.2 Headset Tools

The headset-man utilized wired headset manufactured by David Clark Company with product code of ML0715-28. During the accident the headset cable was rolled up and headset-man held the rolled-up cable. The total length the headset on rolled-up condition was 6 meters, from the headset to rolled-up cable was about 1.5 meters while from rolled-up to headset jack was about 4.5 meters. Prior to and during the accident, there was no record or report of headset malfunction.

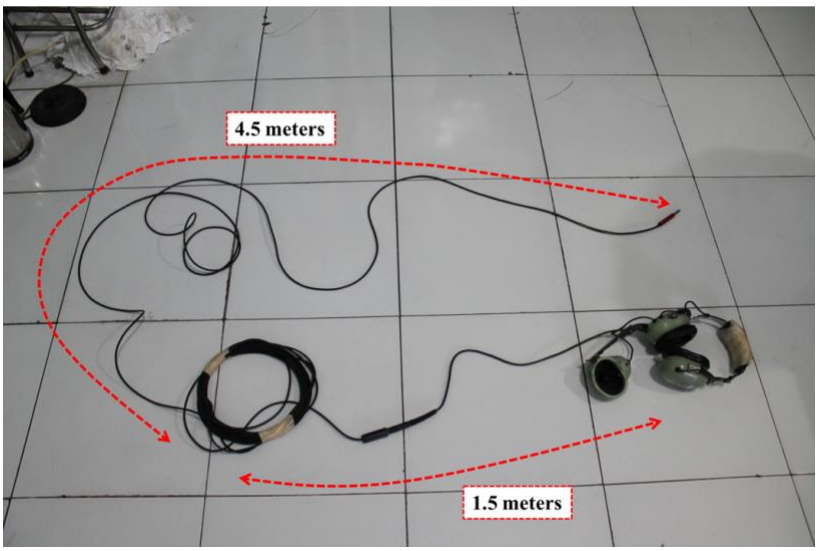

Figure 13: The headset used by the headset-man during the accident

1.18.3 Human Performance

Human normally need 8 hours of sleep in a 24-hour period which losing as little as 2 hours of sleep will result in acute sleep loss, which will induce fatigue and degrade subsequent waking performance and alertness (Dinges et al., 1996)[4].

Human brain has a clock which regulates 24-hour pattern of body function which controls the human sleep and wakefulness time[5]. According to FAA aeromedical safety brochure[6], circadian rhythm is described as described as an internal biological clock that regulates our body functions, based on our wake/sleep. A circadian cycle disruption can lead to acute sleep deficits, cumulative sleep loss, decreases in performance and alertness, and various health problems.

According to the Dinges et al., (1996), on 24-hour cycle, between 0200 and 0600 is estimation for window of circadian low, when human biological functions and performance efficiency are at their lowest level. Maintaining wakefulness during the window of circadian low has a higher potential for fatigue and increased requirement for recovery.

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.

4 Dinges et al. (1996). Principles and guidelines for duty and rest scheduling in commercial aviation. The article can be found in https://ntrs.nasa.gov/search.jsp?R=19990063635.

5 National Sleep Foundation, (2018). The article can be found in https://sleepfoundation.org/sleep-topics/what-circadian-rhythm.

6 FAA (2009). Circadian Rhythm Disruption and Flying. The article can be found in https://www.faa.gov/pilots/safety/pilotsafetybrochures/.

2 ANALYSIS

Prior to the pushback, there was no record or report of the towing tractor and aircraft system malfunction. The pilots and the headset-man described that during the occurrence, there was no indication of a communication transmission problem. The investigation determined that the aircraft and towing tractor airworthiness serviceability, and communication transmission were not an issue on this occurrence. Therefore, the analysis would discuss the relevant issues as follows:

- pushback operation; and
- personnel awareness.

2.1 Pushback Operation

The parking stand B1 was nose-in parking stand that had two offset lead-in lines and one straight lead-in line. According to the International Civil Aviation Organization (ICAO) Document 9157 Part 4, nose-in parking stand would not have lead-out lines and the towing tractor driver would use the lead-in lines for guidance during the push-back maneuver. Therefore, the parking stand B1 had the right offset lead-in line and the straight lead-in line that can be used as pushback guidance for making aircraft to face south-west direction.

The BAT LMPM required the certifying personnel or engineer, and tractor driver must ensure that the centerline of nose wheels and aircraft fuselage is aligned with the guideline. The airport operator Working Instruction also required the AMC unit to ensure the aircraft was pushback following the guidance line until reach the taxiway centerline. Those procedures indicated that the pushback must be conducted following the available guidance lines.

The towing tractor driver did not consider to follow the available lines when pushed back aircraft from parking stand B1 to face south west direction. He considered if the straight lead-in line was followed, the maneuver would take a longer time as the aircraft must be pushed back until the nose wheel could taxi following the apron taxiway centerline marking, and if the right offset lead-in line was followed, the aircraft maneuver would be too close to the service road.

In the last one month, the towing tractor driver had pushed back 15 aircraft from parking stand B1 to face south west direction, without following the available lead-in lines. All the pushbacks were conducted successfully without any complaint from his supervisor, engineer nor AMC officer.

The towing tractor driver supervisor had been aware of the deviated maneuver. As there was no incident ever happened prior to the accident nor requirement to follow the available guidance lines in the GSE SOP, the supervisor did not consider the deviated maneuver as a hazard. Similar with the supervisor, the successful pushback, might have made the previous engineer paired with the towing tractor driver did not consider the deviated maneuver as a hazard.

The view to the parking stand B1 on the CCTV system that was blocked by the passenger boarding bridge resulted in the pushback maneuver did not completely visible by the AMC officer. This condition might have made the AMC officer never noticed pushback maneuvers on the parking stand B1 that were not follow the available guidance lines. Without any incident, the pushback maneuvers on the parking stand B1 that were conducted deviating from the guideline was unnoticed.

The unnoticed AMC officer of the actual pushback maneuver and the successful pushback experienced without any complaint from engineer nor towing tractor driver supervisor resulted in the pushback of the accident aircraft had been conducted using deviated pushback maneuver.

2.2 Personnel Awareness

The towing tractor driver had successfully pushed back 15 aircraft from parking stand B1 without following the available straight lead-in line. During the accident, the towing tractor driver intended to make the same maneuver. Meanwhile, the headset-man had conducted several pushback operations to maneuver the aircraft facing south west direction from parking stand B1 and all maneuvers followed the available straight lead-in line. The headset-man assumed that the push back would be conducted following the straight lead-in line.

The Ground Support Equipment Standard Operation Procedure (GSE SOP) did not require towing tractor driver to conduct briefing related to the pushback maneuver, among the personnel involved in the pushback activity. The briefing among the crew including the push back maneuver was not performed prior to pushback commenced. The absence of the briefing and different experiences resulted in difference assumption of the pushback maneuver between the headset-man and the towing tractor driver.

After the pushback initiated, the towing tractor driver initially turned the tractor to the left, and made the aircraft turned to heading approximately 334°. This maneuver made the aircraft deviated from the lead-in straight line. The towing tractor driver then turned the tractor to the right. During this turning maneuver, the tractor driver focused on the aircraft maneuver as it was not a straight maneuver, and assumed that the headset-man would know the deviated maneuver. The towing tractor driver did not recall the headset-man position until the headset-man laid on the ground.

During the pushback, the headset-man was wearing company uniform without fluorescence strip uniform or high visibility vest. Those condition might reduce the headset-man for being visible by the towing tractor driver.

The pushback operation was conducted during window of circadian low on night time condition with sufficient light. Maintaining wakefulness during window of circadian low might create fatigue that decreases human alertness and increase requirement for recovery.

The different assumption of pushback maneuver, fixated to the aircraft maneuver, decreasing visual to the headset-man on a reduced alertness condition, resulted in the towing tractor driver did not aware of the headset-man position and continued the maneuver until the accident happened.

Throughout the pushback maneuver, the headset-man position as such that the nose wheels were behind him. This position made the headset-man did not have visual to the nose wheel position and movement. The headset-man might have visual cues when the aircraft fuselage deviated from the guide line or by referring the distance between fuselage to headset-man that became closer, as the apron was provided with sufficient light.

One day before the accident, the headset-man had worked on night shift, which might have created fatigue and increased requirement for recovery. On the day of the accident, the headset-man performed another night shift which might have created higher potential for fatigue that reduce the alertness. This decreasing alertness might affect the ability of headset-man to perform his duty during pushback including to assess the visual cues to predict the actual pushback maneuver.

The Batik Air Aircraft Maintenance Manual (AMM) for Airbus A318/A319/A320/A321 described hazard area during towing operation, which required all person must be at a minimum distance of 3 meters from the wheels and the tractor when the aircraft moved.

The headset cable was rolled with remaining length of about 4.5 meters from headset-man to the headset jack. This created limited distance and movement between the headset-man to the nose wheel as the headset jack was located in the nose area of the aircraft.

The FDR data recorded that after 25 seconds the aircraft moved, the aircraft right engine was started. The headset-man who walked on the right side of the towing tractor (on the left side of the aircraft), faced to the left toward the right engine to observe the engine starting process. This might make the headset-man walked too close to the aircraft fuselage, and entering the hazard area in order to get better view of the right engine. After the right engine starting process completed, the aircraft stopped. This indicated that the accident happened during the transition of aircraft right to left engine starting process while the headset-man was focusing to observe the process.

The assumption that the pushback would follow the straight lead-in line, unable to monitor the wheel position, limited distance to nose wheel, and fixated on observing the aircraft engine starting process resulted in the headset-man did not aware the position which entered the hazardous area. The decreasing awareness of the headset-man that affected the ability to perform his duty during pushback including to assess the visual cues to predict the actual pushback maneuver.

The different assumption of pushback maneuver, fixated to their own duties on a reduced alertness condition, resulted in the towing tractor driver did not aware of the headset-man position and the headset-man did not aware of the nose wheel position. These conditions led to the nose wheel passed over the headset-man foot.

3 CONCLUSIONS

3.1 Findings

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.

In this occurrence, the KNKT identified several findings as follows:

1. The pilots had valid licenses which qualified as Airbus A320 pilot and valid first-class medical certificates.
2. The air traffic controller had valid license and rating to perform aerodrome control service in Makassar Tower unit. The controller also had valid third-class medical certificate.
3. The Apron Movement Control (AMC) officer had valid AMC license and 11 years of experience as AMC officer. Prior the accident, the AMC officer never noticed any incident during pushback maneuver nor pushback maneuver that did not follow the available guidance lines in the parking stand B1.
4. The towing tractor driver had valid Ground Support Equipment license and rating to drive Aircraft Towing Tractor. The towing tractor driver had 7 years of experience as Aircraft Towing Tractor driver.
5. The towing tractor driver supervisor had 14 years of experience as towing tractor driver. The supervisor did not consider the maneuver without following the available guidance lines as hazard since there was no incident ever happened prior to the accident.
6. The headset-man has qualification as aircraft mechanic and had 4 years experienced. The duty as aircraft mechanic usually follows by duty as headset-man.
7. Prior to the pushback, there was no record or report of the towing tractor and aircraft system malfunction. The pilots and the headset-man described that during the occurrence, there was no indication of a communication transmission problem. The investigation determined that the aircraft and towing tractor airworthiness serviceability, and communication transmission were not an issue on this occurrence.
8. According to the International Civil Aviation Organization (ICAO) Document 9157 Part 4, nose-in parking stand would not have lead-out lines and the towing tractor driver would use the lead-in lines for guidance during the push-back maneuver.
9. The parking stand B1 was nose-in parking stand that had two offset lead-in lines and one straight lead-in line. Therefore, the parking stand B1 had the right offset lead-in line and the straight lead-in line that can be used as pushback guidance for making aircraft to face south-west direction.

10. The BAT LMPM required the certifying personnel or engineer, and tractor driver must ensure that the centerline of nose wheels and aircraft fuselage is aligned with the guideline. The airport operator Working Instruction also required the AMC unit to ensure the aircraft was pushback following the guidance line until reach the taxiway centerline. Those procedures indicated that the pushback must be conducted following the available guidance lines.
11. Based on the daily activity record, in the last one month, the towing tractor driver had pushed back 15 aircraft from parking stand B1 to face south west direction, without following the available lead-in lines. All the pushbacks were conducted successfully without any complaint from his supervisor, engineer nor AMC officer.
12. The towing tractor driver considered if the straight lead-in line was followed, the towing tractor would take a longer time, and if the offset lead-in line was followed, the aircraft maneuver would be too close to the service road.
13. The towing tractor driver supervisor had been aware of the deviated maneuver. As there was no incident ever happened prior to the accident nor requirement to follow the available guidance lines in the GSE SOP, the supervisor did not consider the deviated maneuver as a hazard. Similar with the supervisor, the successful pushback, might have made the previous engineer paired with the towing tractor driver did not consider the deviated maneuver as a hazard.
14. The view to the parking stand B1 on the CCTV system that was blocked by the passenger boarding bridge resulted in the pushback maneuver did not completely visible by the AMC officer. This condition might have made the AMC officer never noticed pushback maneuvers on the parking stand B1 that were not follow the available guidance lines. Without any incident, the pushback maneuvers on the parking stand B1 that were conducted deviating from the guideline was unnoticed.
15. The unnoticed AMC officer of the actual pushback maneuver and the successful pushback experienced without any complaint from engineer nor towing tractor driver supervisor resulted in the pushback of the accident aircraft had been conducted using deviated pushback maneuver.
16. During the accident, the towing tractor driver intended to make the deviated maneuver. Meanwhile, the headset-man had conducted several pushback operations to maneuver the aircraft facing south west direction from parking stand B1 and all maneuvers followed the available straight lead-in line. The headset-man assumed that the push back would be conducted following the straight lead-in line.
17. The Ground Support Equipment Standard Operation Procedure (GSE SOP) did not require towing tractor driver to conduct briefing related to the pushback maneuver, among the personnel involved in the pushback activity. The briefing among the crew including the push back maneuver was not performed prior to pushback commenced. The absence of the briefing and different experiences resulted in difference assumption of the pushback maneuver between the headset-man and the towing tractor driver.

18. The towing tractor driver maneuvered the towing tractor to follow the straight lead-in line, and a few meters later made maneuver to the left in order to turn the aircraft facing north. This maneuver deviated the aircraft from the available straight lead-in line with intention to maneuver aircraft to face south west.
19. During this turning maneuver, the tractor driver focused on the aircraft maneuver as it was not a straight maneuver, and assumed that the headset-man would know the deviated maneuver. The towing tractor driver did not recall the headset-man position until the headset-man laid on the ground.
20. During the pushback, the headset-man was wearing company uniform without fluorescence strip uniform or high visibility vest. Those condition might reduce the headset-man for being visible by the towing tractor driver.
21. The pushback operation was conducted during window of circadian low on night time condition with sufficient light. Maintaining wakefulness during window of circadian low might create fatigue that decreases human alertness and increase requirement for recovery.
22. The different assumption of pushback maneuver, fixated to the aircraft maneuver, decreasing visual to the headset-man on a reduced alertness condition, resulted in the towing tractor driver did not aware of the headset-man position and continued the maneuver until the accident happened.
23. Throughout the pushback maneuver, the headset-man position as such that the nose wheels were behind him. This position made the headset-man did not have visual to the nose wheel position and movement.
24. The headset-man might have visual cues when the aircraft fuselage deviated from the guide line or by referring the distance between fuselage to headset-man that became closer, as the apron was provided with sufficient light.
25. One day before the accident, the headset-man had worked on night shift, and on the day of the accident, the headset-man performed another night shift which might have created higher potential for fatigue that reduce the alertness. This decreasing alertness might affect the ability of headset-man to perform his duty during pushback including to assess the visual cues to predict the actual pushback maneuver.
26. The Batik Air Aircraft Maintenance Manual (AMM) for Airbus A318/A319/A320/A321 described hazard area during towing operation, which required all person must be at a minimum distance of 3 meters from the wheels and the tractor when the aircraft moved.
27. The headset cable was rolled with remaining length of about 4.5 meters from headset-man to the headset jack. This created limited distance and movement between the headset-man to the nose wheel as the headset jack was located in the nose area of the aircraft.
28. The headset-man who walked on the right side of the towing tractor (on the left side of the aircraft), faced to the left toward the right engine to observe the engine starting process. This might make the headset-man walked too close to the aircraft fuselage, and entering the hazard area in order to get better view of the right engine.

29. After the right engine starting process completed, the aircraft stopped. This indicated that the accident happened during the transition of aircraft right to left engine starting process while the headset-man was focusing to observe the process.

30. The location of the blood spills on coordinate 5°4'32.86"S; 119°32'55.67"E, about 50 meters from the beginning of parking stand B1 was considered as the location when the nose wheel passed over the right headset-man foot.

31. The assumption that the pushback would follow the straight lead-in line, unable to monitor the wheel position, limited distance to nose wheel, and fixated on observing the aircraft engine starting process resulted in the headset-man did not aware the position which entered the hazardous area.

32. The decreasing awareness of the headset-man that affected the ability to perform his duty during pushback including to assess the visual cues to predict the actual pushback maneuver.

33. The different assumption of pushback maneuver between headset-man and the push back tractor driver, and both were fixated to their own duties while working on a reduced alertness condition, resulted in the towing tractor driver did not aware of the headset-man position and the headset-man did not aware of the nose wheel position. These conditions led to the nose wheel passed over the headset-man foot.

34. The hospital observation indicated that the headset-man sustained fracture on his right tarsometatarsal. The headset-man was hospitalized for three days.

35. The engineer group leader on duty took over the duty of headset-man. The engineer group leader advised the PIC of the occurrence and to shut down the right engine. The pilot then set the aircraft parking brakes and shut down the engine. Thereafter, the PIC advised the engineer group leader to check the aircraft condition.

36. After performed aircraft visual check and no damage found on the aircraft, the engineer group leader suggested the PIC to continue the flight and was agreed. The engineer group leader considered the occurrence was not mandatory occurrence to be reported as there was no defect on the aircraft, and the pilots were not aware that the occurrence was classified as accident.

37. The aircraft continued to fly and arrived at the destination aerodrome uneventfully. After landed the PIC filed occurrence report to the Batik Air Operation Department and the Safety, Security and Quality (SSQ) Department. The Komite Nasional Keselamatan Transportasi (KNKT) was notified of the occurrence by the SSQ Department after the PK-LZJ aircraft had departed from Makassar.

38. The Flight Data Recorder (FDR) recorded the occurrence while the recorded voice communication on the Cockpit Voice Recorder (CVR) had overwritten.

39. According to the Civil Aviation Safety Regulation part 830 subpart 830.2 and Batik Air OM-part A, the PK-LZJ occurrence is classified as accident which must be reported to the KNKT with minimum delay and by the most suitable and quickest means available.

40. The Batik Air OM-part A subchapter 11.3.1 described in the event of an accident, either airborne or on the ground, PIC or a crew member if physically able or any other person will advise the OCC by the quickest means available that will in turn advise the SSQ Directorate.
41. The Batik Air OM-part A subchapter 11.3.3 described following accident or a serious incident, the company must attempt to preserve all FDR and CVR data and make it available to the investigation authority. The PIC shall secure CVR after experiencing accident or serious incident by pulling the CVR CB(s) on the ground after engine shutdown procedures completed and in coordination with maintenance personnel. However, the accident which require PIC to pull the CVR CB(s) was only when any person experiences serious or fatal injury due to weather encounters.
42. The BAT LMPM subchapter 7.2 described occurrence criteria of accident/incident as a condition which has resulted or may resulted in an unsafe condition that seriously affected the flight safety. The manual provided example of accident/incident to be reported which only referred to technical incident or defect problem.

3.2 Contributing Factors

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. The presentation of the contributing factors is based on chronological order and not to show the degree of contribution.

The KNKT concluded the contributing factors as follows:

The different assumption of pushback maneuver between headset-man and the push back tractor driver, and both were fixated to their own duties while working on a reduced alertness condition, resulted in the towing tractor driver did not aware of the headset-man position and the headset-man did not aware of the nose wheel position. These conditions led to the nose wheel passed over the headset-man foot.

4 SAFETY ACTION

At the time of issuing this Report, the KNKT had been informed of safety actions taken by the related parties resulting from this occurrence.

4.1 Batik Air

On 19 June 2019, the Batik Air published safety notice number 005/SSQ/SN/VI/2019. The notice was intended for pilot, flight attendant, line maintenance, flight operation officer and Integrated Operation Control Center (IOCC) officer with subject to ensure safety communication in regards with incident or accident could be performed appropriately.

The notice highlighted an occurrence which resulted in injury due to direct contact with any aircraft part as an example of abnormal situation that may categorized as accident. The detail of safety notice can be found in the appendix of this report.

The Batik Air also had conducted corrective action to address the KNKT safety recommendation in the Preliminary Report as follows:

04.L-2019-10.1

According to the Civil Aviation Safety Regulation part 830 subpart 830.2 and Batik Air OM-part A subchapter 11.1, the PK-LZJ occurrence is classified as accident which must be reported to the KNKT with minimum delay and by the most suitable and quickest means available. As the occurrence was not reported to the KNKT, the PK-LZJ aircraft continued the flight to the destination aerodrome which made the CVR was overwritten.

The Batik Air OM-part A subchapter 11.3.3 described following accident or a serious incident, the company must attempt to preserve all FDR and CVR data and make it available to the investigation authority. The PIC shall secure CVR after experiencing accident or serious incident by pulling the CVR CB(s) on the ground after engine shutdown procedures completed and in coordination with maintenance personnel. However, the accident which requires PIC to pull the CVR CB(s) was only listed when any person experiences serious or fatal injury due to weather encounters.

Therefore, the KNKT recommend the Batik Air to review and amend procedure to enable CVR data can be preserved for investigation following accident and serious incident.

Responding to the safety recommendation, the Batik Air had amended the OM-part A subchapter 11.3.3 with detail description of event that requires pilot to secure the CVR, and issued safety notice for pilot, flight attendant, engineer, line maintenance, flight operation officer which highlighted the requirement to secure CVR on the new subchapter 11.3.3.

4.2 Batam Aero Technic

On 3 June 2019, the Batam Aero Technic published safety notice for engineer, line maintenance, and training department which highlighted the hazard zone during pushback.

On 22 July 2019, the Batam Aero Technic amended the Line Maintenance Procedure Manual to include requirement for engineer, headset-man or wingman to have coordination with the pushback car driver prior pushback operation.

On 30 June 2020, the Batam Aero Technic issued Fatigue Risk Manual (FRM) to implement a fatigue risk and duty time management within the company.

The Batam Aero Techic also had conducted corrective action to address the KNKT safety recommendation in the Preliminary Report as follows:

- ***04.L-2019-10.2***

  According to the Civil Aviation Safety Regulation part 830 subpart 830.2, the PK-LZJ occurrence is classified as accident which must be reported to the KNKT with minimum delay and by the most suitable and quickest means available. As the occurrence was not reported to the KNKT, the PK-LZJ aircraft continued the flight to the destination aerodrome which made the CVR was overwritten.

  The BAT LMPM subchapter 7.2 described occurrence criteria of accident/incident as a condition which has resulted or may resulted in an unsafe condition that seriously affected the flight safety. The manual provided example of accident/incident to be reported which only referred to technical incident or defect problem.

  The engineer group leader suggested the PIC to continue the flight as there was no damage found in the aircraft and it was agreed. The engineer group leader considered the occurrence was not mandatory occurrence to be reported as there was no defect on the aircraft.

  Therefore, the KNKT recommend the Batam Aero Technic to review and amend procedures to enable accident or serious incident can be reported to the KNKT without delay.

Responding to the safety recommendation:

- On 27 September 2019 the Batam Aero Technic issued safety notice for engineer, line maintenance, and flight operation officer which highlighted the event that need to be reported to KNKT as soon as possible.
- On 6 February 2020, the Batam Aero Technic revised the Emergency Response Manual to include requirement to report accident and serious incident immediately with the minimum delay and by the most suitable and quickest means available to the aircraft operator when the occurrence occurs within Batam Aero Technic area of operations.
- On 19 June 2020, the Batam Aero Technic revised the BAT LMPM to include the definition of accident and serious incident which must be reported to the KNKT with minimum delay and by the most suitable and quickest means available.

- ***04.L-2019-10.3***

  The pushback was conducted at night time. During the pushback, the towing tractor driver and wing-man used high visibility vest while the headset-man used company uniform without any fluorescence strip or high visibility vest. The absence of fluorescence strip uniform or high visibility vest on personnel who working on aircraft movement area during night time or reduced visibility condition became hazard as those personnel might not be visible to other person.

  Therefore, the KNKT recommend the Batam Aero Technic to ensure all personnel working in the aircraft movement area is equipped with fluorescence strip uniform or high visibility vest, especially during night time or reduced visibility condition.

Responding to the safety recommendation, the Batam Aero Technic had issued safety notice to all personnel to use personal protective equipment including the high visibility vest while working.

4.3 Angkasa Aviasi Servis

On 3 June 2019, published safety notice to all Ground Support Equipment (GSE) personnel, which highlighted hazard zone during pushback.

The Angkasa Aviasi Servis also had conducted corrective action to address the KNKT safety recommendation in the Preliminary Report as follows:

04.L-2019-10.4

The pushback maneuver of the aircraft was not following the offset lead-in line which provided to maneuver aircraft for facing south west. The towing tractor driver considered that if the offset lead-in line was followed, the aircraft maneuver would be too close to the service road. However, there was straight lead-in line could be used as guidance during the pushback maneuver.

Since there was no requirement for briefing the wing-man and headset-man, the maneuver of towing tractor driver deviate from guidance line during pushback would only be known by the towing tractor driver. The deviation may make wing-man and headset-man are unaware of the maneuver.

Therefore, the KNKT recommend the Angkasa Aviasi Servis to ensure towing tractor drivers follow the available guidance line and/or conduct briefing for any plan of deviation maneuver from the guidance line.

Responding to the safety recommendation, the Angkasa Aviasi Servis had amended the Ground Support Equipment Operation SOP subchapter 5.1.1 and 5.1.2 which required to conduct briefing among ground personnel regarding to the pushback maneuver in every pushback operation, and also developed a Mini Briefing Form that must be referred during the briefing.

4.4 Angkasa Pura I Branch Office Sultan Hasanuddin International Airport

On 10 December 2019, the Angkasa Pura I Branch Office Sultan Hasanuddin International Airport conducted safety meeting with all aircraft operator and ground handling service provider. The topic of the discussions included reminder for the ground handling service provider follow the available lines during pushback operation.

On 24 June 2020, the Angkasa Pura I issued safety notice to all branch offices which highlighted the safety issue of pushback maneuver without following the available guidance lines, and blocked CCTV view to the parking stand that might make AMC officer was unable to notice pushback maneuvers that were conducted deviate from the guideline. The safety notice also instructed the branch offices to mitigate those highlighted safety issues, included several actions as follows:

1. Ensuring the readiness and reliability of the apron, guidance lines, CCTV and airside lightings; and
2. Improving the surveillance of the aircraft movement, including pushback, towing and taxi operation.

5 SAFETY RECOMMENDATIONS

The KNKT acknowledged the safety actions taken by the direct involved parties, however, there still remain safety issues that need to be considered. Therefore, the KNKT issues the following safety recommendations addressed to the Batik Air, Batam Aero Technic, Angkasa Aviasi Servis and Angkasa Pura I.

5.1 Angkasa Aviasi Servis

04.L-2019-10.7

According to the Dinges et al., (1996), on 24-hour cycle, between 0200 and 0600 is estimation for window of circadian low, when human biological functions and performance efficiency are at their lowest level. Maintaining wakefulness during the window of circadian low has a higher potential for fatigue and increased requirement for recovery.

The pushback operation was conducted during window of circadian low on night time condition which might create fatigue that decreases human alertness and increase requirement for recovery.

The reduced alertness combined with the different assumption of pushback maneuver, focused attention to the aircraft maneuver, decreasing visual condition, resulted in the towing tractor driver did not aware of the headset-man position and continued the maneuver until the accident happened.

Therefore, the KNKT recommends the Angkasa Aviasi Servis to consider establishing fatigue risk management.

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