Air Accident Investigation Central Directorate

AAICD

Final Incident Report

Involving Emirates Airlines

A345 and KLM Royal

Dutch Airlines A332

At Khartoum Airport

ON 30/09/2010 at 16 25 utc

بسم الله الرحمن الرحيم

Civil Aviation Authority	الهيئة العامة للطيران المدني
Central Directorate Of Air Accident Investigation & Prevention	الإدارة المركزية للتحقيق في حوادث الطائرات ومنعها
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Date:- 16.01.2011 Ref:-CAA/ACC/A6-ERE /PH-AOD/12

Incident
Final Report Title

1. Aircraft operator:	KLM Royal Dutch Airlines	Emirates Airline.
2. Manufacturer:	Airbus	Airbus
3. Model:	A330-200	A340-500
4. Nationality:	Dutch	United Arab Emirates
5. Reg. Mark:	PH-AOD	A6-ERE
6. Place and Date of Incident:	Khartoum Airport on 30/09/2010 at1625 UTC	

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Glossary

AAICD	Air Accident Investigation Central Directorate
ATIS	Automatic Terminal Information System
ATC	Air Traffic Control
DGCAA	Director General of Civil Aviation Authority
ICAO	International Civil Aviation Organization
Metar	Routine weather report
NOTAM	Notice to airmen
SMS	Safety Management System
S 3-1	Aircraft stand No. 1 apron 3
UTC	Universal Coordinated Time
GCAA	General Civil Aviation Authority
UAE	United Arab Emirates

PREAMBLE

This investigation report is on the incident involving Emirates Airline Airbus 340-500 registration A6-ERE and Royal Dutch Airlines (KLM) registration PH-AOD at Khartoum International Airport on the 30 of September 2010. This report has been prepared in accordance with Annex 13 to the Convention on International Civil Aviation and the Sudan Civil Aviation Safety Law 2010. In accordance with Annex 13, the sole objective of the investigation is the prevention of accidents and incidents; it is not the purpose of this activity to apportion blame or liability.

Synopsis:-

The Incident was notified to the AAICD by Khartoum airport authority.

Investigation has been conducted by AAICD with the participation of the (UAE) United Arab Emirates GCAA as an accredited representative.

Authority releasing the report: DGCAA.

While the KLM A330 was taxiing out for departure its left winglet hit the empennage of a parked Emirates Airline A345.

An investigation board was formed by the DGCAA consisting of the following:-

1- Kamil Ahmed Mohamed CAA AAICD head of the committee.
2- Engineer Abd ELsamai Adam Ali CAA AAICD adviser.
3- Abd Elwahid Ahmed Omar CAA AAICD.
4- Abu Bakar Mansoor Saed CAA ATC.
5- Sulaiman Abd Elrahim Ahmed CAA SAR Advisor.
6- Capt Elias Nikolaidis Regulation & Investigation of GCAA UAE Accredited Representative.

1- Factual Information:-

1.1 History of the flight:

Emirates Airline A340-500 C/S UAE734 Dubai/Khartoum landed at 1433 UTC and was parked on stand No.3-1. KLM A330 200 C/S KLM543 which landed before, was being parked on stand No. 3-7.When the A332 was ready for taxi-out it was instructed by the control tower to taxi via A taxiway for runway 18, after being started and pushed back without the presence of a marshaller, so while it was taxiing on the taxilane between taxiways A and B behind the parked A345 with passengers boarding at that time .The left winglet of the A332 hit the empennage of the A345.

1.2 Injuries to Persons :

Injuries	Crew	Passengers	Others
Fatal	Nil	Nil	Nil
Serious	Nil	Nil	Nil
Minor / None	Nil	Nil	Nil

1.3 Damage to aircraft:

A345 was substantially damaged. A332was slightly damaged.

1.4 Other damages:

No other damage.

1.5 Personnel information:
KLM Crew

	Pilot in Command	*First Officer*
Date of birth	27/05/1959	22/05/1964
License type and number	ATPL (A) JAA-LIC NL/ 053228546 valid until 12/03/2013 Netherlands	ATPL(A) JAA-LIC-2007 .93313-14836 valid until 16/03/2012 Netherlands
Total flight experience	10363.29 hrs	5621.36 hrs
Total hrs on type	1279.14	1833.51
Total hrs last 30 days	Not available	Not available
Total hrs last 7 days	Not available	Not available
IR Validation	05/03/2010 until 01/04/2011	Not available

1.6 Aircraft information: KLM A330

a) Aircraft PH-AOD A330-200, MSN 0738 had a valid certificate of airworthiness. And 20129 hours/3846 cycles.
b) Type of fuel used by A/C is jet A1.

1.7 Meteorological Information:

- METAR HSSS 301600Z 24004KT CAVOK 39/11 Q1005.
- METAR HSSS 301630Z 20003KT CAVOK Q1005.

1.8 Aids to Navigation:

VOR/DME freq 112.1 MHZ
ILS freq 109.7 MHZ
PAPI available for both runway 18/36
VOR is serviceable.

1.9 Communication:

Tower VHF freq 119.2 MHZ operating normal.

The following pertinent data transcripted from the control tower VHF recorder:-

Khartoum good evening KLM 543 we are in stand 3-7 ready in 5 minutes we have 142
we have about 7 HRS endurance

Tower
= 142- 7HRS endurance go ahead intended level and confirm requesting start?

KLM 543
= Flight level,..... Stand bye one ..... FL390 say again the last part

Tower
=Confirm requesting to start and push back now?

KLM 543
= YA we are ready in any time now

Tower
= KLM 543 when ready cleared to start and push back

KLM 543
= Thank you cleared to start and push back , can we expect "A" for departure Run way "18"

Tower
=No objection for that, report when ready for taxi

KLM 543
= Thank you will do

Tower
=Break , KLM 543 \ Khartoum

KLM543
= YA, we about to push back ..... Push back is all tried now

Tower
= No objection give you the Metar 1600 240 reported \ 04 CAVOK temp 39\11 QNH 1005

KLM 543
= Thank you copied KLM 543

KLM 543
KLM 543 we are ready to TAXI ,

Tower

= KLM 543 VIA tarmac into the TAXI VIA the TAXI WAY "A" hold short

KLM 543

= Cleared to TAXI VIA "A" hold short

Tower

= KLM 543 cleared to ADDIS VIA FPL ROUTE initially maintain 270 Request level change enroute

KLM 543

= OK cleared to Abu Dhabi Air port maintain 270 VIA flight plan route Request level change enroute

Tower

KLM 543 expedite enter and back track RWY 18 report ready for departure

KLM 543

= Will call ready for departure

KLM 543

= Tower just for you information KLM 543 we don't need back track we can take – off right away from the intersection

Tower

= 543 confirm ready to depart from the intersection taxi way "A" confirm .....

KLM 543

YA we are ..... That is correct

Tower

= Understand that you are ready for departure from intersection "A" confirm Rwy 18

KLM 543

= All correct 543

Tower

= Stand bye

Tower

= Break KLM 543 maintain 3000 H RWY heading and to contact 124.7 wind 240\04 clear for take – off

EK734

Khartoum\ Khartoum Emirates 734 =

Tower

= 734 stand bye

Tower
= KLM 543 confirm copied
KLM 543
= We have to wait sir signal, there is signaling on the ground
Tower
= Break stand bye one
Tower
= Emirates 734 go ahead
EK734
= Be advised , be advised KLM hit the aeroplane .....
EK734
= We have KLM strike our tail with their wing
Tower
= Station calling, say again
EK734
= KLM aircraft has hit Emirates 734
Tower
= Confirm has hit Emirates 734 confirm
EK734
= Affairmative hit with ?????????

TOWER
= Stand bye
KLM 543
= KLM 543
Tower
= 543 go ahead
KLM 543
= We taxied we track that the Emirates said before but hit him with wing so think we shutting down the engine and we will be towed back to our parking position
Tower
= KLM 543 confirm while you are taxing there is no any marshaller with you ?
KLM 543
= No, No like I said before we passed behind Emirates A330 and we hit him by our wing tip
Tower

= And the situation now you will towing back confirm position parking [position again

KLM 543

= But there is a lot of traffic around us

KLM 543

= Tower KLM 543 we shutting down and think will be towed to the gate

Tower

= Stand bye hold position sir will check with the marshaller for the situation about towing

1.10 Aerodrome Information:

Khartoum airport (HSSS) has one asphalt landing-and-takeoff runway (18/36). It measures 2980 x 45 meters.

Aerodrome reference point is N153525.28 E0323311.35 and elevation is 1260ft.

R/W 36 threshold coordinates are N153433.94 E0323311.83 and elevation is 1260 ft.

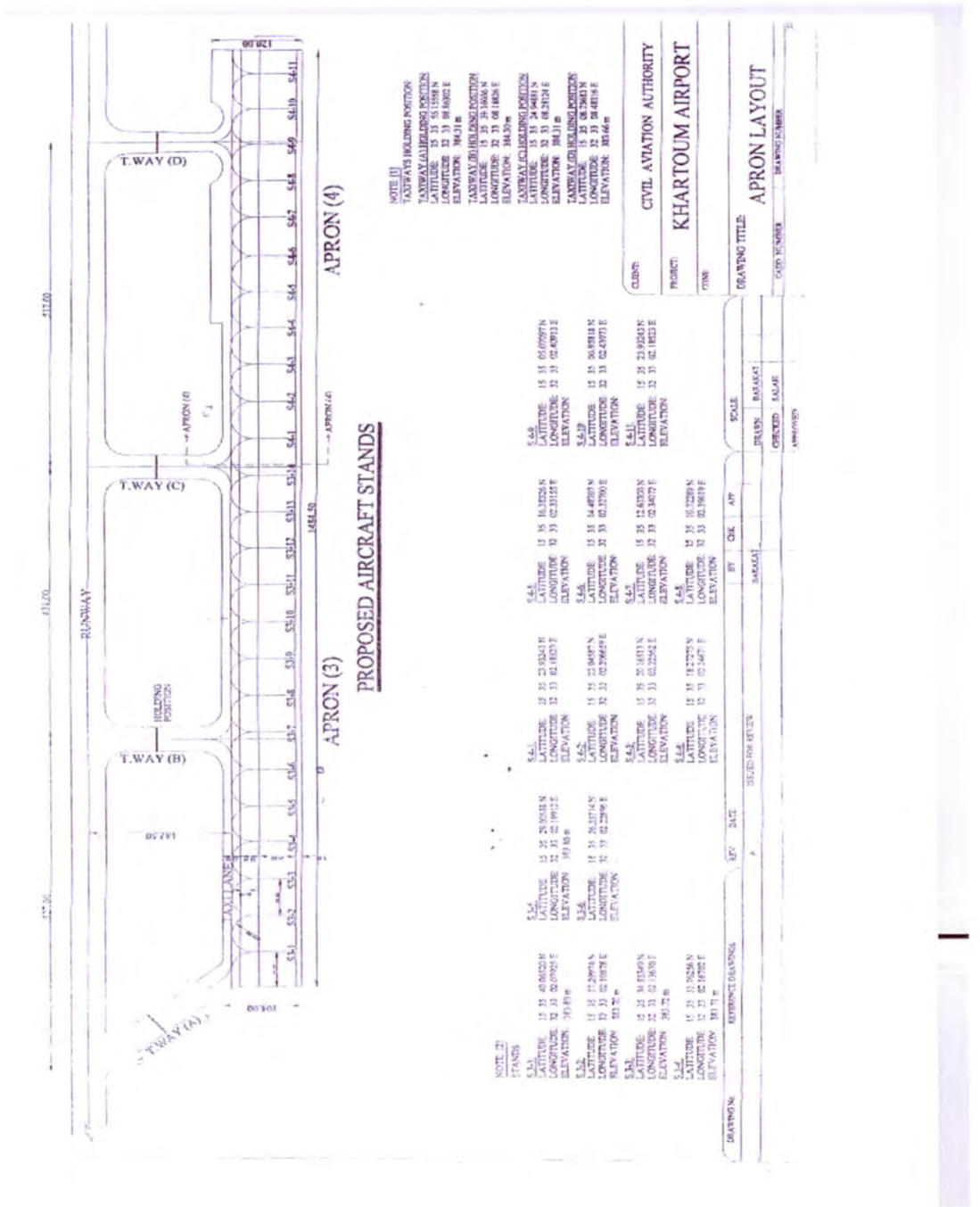
R/W 18 threshold coordinates are N153558.94 E0323311.03, elevation is 1265 ft.

The airport is (equipped) with:

- a 3 degree precision approach path indicator (PAPI)
- CAT 1 approach and runway lighting system for R/W 18 (approach lights unserviceable)
- CAT 2 for R/W 36.

Fire fighting and rescue facilities are CAT 9.

Khartoum Airport
Apron Layout



1.11 Flight Recorders:

Not being read.

1.12 Wreckage and impact information:

Emirates A34O sustained damage as follows:-

- The left winglet of KLM sustain slight damage
- Emirates A345 observed damage as follows:-
- Left hand stabilizer.
- Aft Fuselage lower frame.
- APU inlet splitter.
- APU fire bottle compartment access door.
- Right hand stabilizer.

KLM A330 sustained damaged as follows:-

- Left winglet damage.

1.13 Medical and Pathological Information:

Not carried out.

1.14 Fire:

No fire occurred.

1.15 Survival Aspect:

Survivable incident.

1.16 Tests and research:

No test or research took place.

1.17 Organization and management information:

Khartoum airport management policies and practices towards apron operations were not adequate in respect to the following observations:

1- The distance from taxilane centre line to its eastern edge is 15.55m and to its western edge is 11.5m.
2- A345 was parked on stand with nose wheel located approximately 10.75m from the edge of the service road. The distance of the aircraft nose located approximately 4.6m from that edge, clearance between parked aircraft and objects is not assured (Annex 14 v1 chapter 5).
3- The distance between the taxilane centre line and aft edge of aircraft was 22.25m.Wingtip clearance is not assured (Annex 14 v1 chapter 5) .

4- The distance between the taxilane centre line and the point of contact was 25.75.
5- A345 wings extended beyond the parking bay restraint line by 5.65m and 6.25m to the left and right respectively.
6- The Airtraffic Controller on duty at the tower during the incident was recently transferred (one month) to Khartoum Tower from Area Control Centre without prior briefing or refresher training.

1.18 Additional Information:

Nil.

1.19 Useful or effective investigation techniques:

None.

2- Analysis:-

The A345 a passengers flight arrived Khartoum and was parked on stand 3-1 this stand is allocated mainly by apron management for wide body aircraft. The A332 was parked on stand 3-7 a considerable distance south of taxiway (B) , it was instructed by ATC to taxi out for take off R/W 18 via (A) taxiway which means the aircraft has no other choice except to follow the taxi lane that passes behind stand 3-1 and leading to (A) taxiway, consequently this taxi route lead to the occurrence of the serious incident taking into consideration that no marshaller was present during taxi out and the tower controller did not ensure that marshaller was available before issuing taxi instructions as stated in the Standing Order 2009 dated 15/01/2009.So the tower controller was not complying with the said Standing Order 2009.And even if the marchaller had been present during KLM taxiing out, he wouldn't have done anything due to the lack of clear instructions forbidding using this taxi lane by wide body aircraft while similar ones were parked on S3-1 although this hazard was known but was not being mitigated by NOTAM or ATIS . The distance between the taxi lane centre line and the point of contact was 25.75m. Considering the A330-200 wingspan which is 60.3m length is 58.37m, the KLM wingtip appeared to have been along the taxi lane with the aircraft nose wheel approximately 5m to the right of centerline, in an indication that the pilot has identified the potential hazard of wingtip collision and turned right in an attempt to increase the space between his aircraft and the parked A345 whose length is 67.87m and wingspan is 63.45m, as the responsibility for aircraft safety when taxing remains wholly with each aircraft commander. The nose wheel of the Emirate A340 was 10.75m from the service road which does not satisfy the required clearance as stated in Annex 14 volume 1 to the Convention, as there was no sign or marking to indicate where the taxiing-in aircraft should stop. The incident could have been avoided if the KLM had been instructed to enter the runway via taxiway (B).

3- Conclusion:-

3.1 Findings

1- A345 wings extended beyond the parking bay restraint line by 5.65m and 6.25m to the left and right respectively.
2- The Airtraffic Controller on duty at the tower during the incident was recently transferred (one month) to Khartoum Tower from Area Control Centre without prior briefing or refresher training.
3- Emirates A345 was parked on stand with nose wheel located approximately 10.75m from the edge of the service road. The distance of the aircraft nose located approximately 4.6m from that edge.
4- There is no enough clearance between large aircraft taxing on the taxilane and the large parked aircraft on S3-1.
5- There are no markings on S3-1 where taxing-in aircraft should stop, it is just left to marchaller discretion.

3.2 Causes

1- Major factors:-
-Insufficient wingtip clearance between apron taxiway and S3-1.
-The absence of marshallers during A332 engines startup and taxi-out.
2- Contributing factors:-

- Instructions by aerodrome control tower to KLM A330 to taxi via taxiway A for runway 18.
- Non-standard construction of aircraft stands.
- Non distribution of information regarding liability of wing-tip clearance to all concerned.
- Limited and narrow width of apron 3.

3- Safety Recommendation:-

1-Approved SMS for Khartoum Airport is highly recommended.
2-All apron aircraft stands specifications should be according to ICAO requirements taking into consideration the types of aircraft that could use them.
3-Special procedures should be published reflecting the non-conformities to ICAO Standards in respect to taxiways and parking restrictions and circularized to all stakeholders.

4-Aerodrome tower controllers should have refresher training before exercising their duties whenever they have been working away from that position for a considerable period of time.
5-Utilization of apron 2.
6-Review the training of personnel responsible for providing marshalling guidance on the apron, to ensure that pilots are provided with safe and appropriate signals.
7-Review the coordination between ATC and apron marshallers, to ensure that clear guidelines and responsibilities are drawn between the two departments, in relation to aircraft operating in the apron.
8-Review the apron design at KRT airport, with a view to redesign of stands that are suitable for the safe parking and general handling of widebody aircraft. Such stands will provide adequate clearance from other aircraft so as not to impede the traffic movement.

Members of the Committee

1- Kamil Ahmed Mohamed. — Investigator in Charge

2-Engineer Abd ELsamai Adam Ali

3-Abd Elwahid Ahmed Omar.

4-Abu Bakar Mansoor Saed.

5-Sulaiman Abd Elrahim Ahmed.

Attachment A

The following are the consolidated comments of UAE GCAA for the report of the occurrence under the title Final Investigation Report on Ground Collision Incident between a A345 and a A332 aircraft on the 30th September 2010, at Khartoum International Airport.

COMMENTS:

Page 1

Remark: We suggest you consider removing the names of the airlines involved and replacing it with "UAE based Operator" and "EU based Operator".

Rationale: the name doesn't enhance flight safety.

Remark: We suggest you consider removing the names the registration marks of the aircraft involved and replacing it with "A345" and "A332" as applicable.

Page 4 PREAMPBLE

Remark: We suggest you consider removing the names of the airlines involved and replacing it with "UAE based Operator" and "EU based Operator".

Rationale: the name doesn't enhance flight safety. In case you would like to keep it please use the correct name of the airline which is Emirates Airline.

Page 5 SYNOPSIS

Page 5 SYNOPSIS

Remark: We suggest you consider removing the names of the airlines involved and replacing it with "UAE based Operator" and "EU based Operator".

Rationale: the name doesn't enhance flight safety. In case you would like to keep it please use the correct name of the airline which is Emirates Airline.

Remark: We suggest you consider removing the names the registration marks of the aircraft involved and replacing it with "A345" and "A332 " as applicable.

Remark: Please review the occurrence categorization. We suggest you remove the word 'serious incident' and replace with 'Aircraft Ground Collision Incident" or "Incident".

Rationale: The event was a ground collision for which there was no serious injury to any passenger or crew and Annex 13 to the Convention to Civil Aviation, attachment C, doesn't describe such an occurrence as a serious incident.

The History of the Flight:
Paragraph 1.1

Remark: We suggest you consider removing the whole text and replacing with the suggested text below.

Rationale: The information in the suggested text provides a better description of the events, gives the average reader of the report a better understanding of the actions that lead to this mishap. Additionally the information contained was obtained from interviews carried out with the Air Traffic Controller, Apron management staff. Furthermore the information obtained from the crew of the two airlines, various aeronautical publications and visualization aids.

The aircraft, an Airbus A345, was being operated on a scheduled service, from Khartoum (KRT) to Dubai (DXB). The flight was a return sector, to be operated by the same flight crew who had operated the arrival flight. The aircraft landed on runway 18 at time 1432 UTC and following a backtrack, was met at taxiway Bravo by a marshalling vehicle. The aircraft was then parked on stand 3-1 at 1439 UTC under marshalling guidance, with no irregularities.

Both crew of the A345 had been to KRT before and were familiar with the cautions for operating at the airport as noted in the company Route and Aerodrome Information Guide (RAIG) manuals. During the transit, the captain conducted a walk around inspection which found nothing untoward. On return to the cockpit, the flight preparation begun. At the time the aircraft was parked with park brake set, chocks in place and all exterior lights illuminated.

Both crew of the A345 were in the cockpit during passenger embarkation when the aircraft was jolted. The A345 crew reported the jolt was unusual from those normally associated with cargo loading operations. It became evident that the aircraft had been hit by another aircraft, and this was confirmed shortly after when the aircraft lost APU power. In addition, the air conditioning also failed. The crew alerted ATC. As crew had overheard the A332 aircraft crew reporting ready for departure approaching taxiway Alpha , they alerted the A332 aircraft crew of the collision. Due to the loss of electrical power from the APU, the floor seat emergency lights illuminated in the cabin. At the time of the occurrence, the cabin was half full of passengers.

The Captain of the A345 aircraft left the flight deck and went down the staircase before proceeding to the back of the aircraft to conduct an inspection of the damage. Concerned with possibility of a fire from the damaged hot section of the APU, the Captain decided to conduct a precautionary disembarkation. The flight purser was briefed and a PA was made to inform the passengers as to the reason for the disembarkation. The passengers were disembarked in an orderly manner via the L1 door to waiting buses and taken back to the terminal building.

The airport fire services attended to the scene.

The A332 aircraft crew subsequently observed somebody waving a flashlight at the aircraft and the aircraft was stopped. The man (probably a ground engineer) plugged in on the flight interphone system

and informed the crew that their wingtip had hit the A345 aircraft. Simultaneously the A345 aircraft crew advised ATC that they had been hit by A332 aircraft.

Tower Controller's Perspective

The tower controller had 25 years experience as an air traffic controller. He held ratings for the provision of area control service, approach control service and aerodrome (tower) control service. He had recently been transferred from area control to the control tower, and at the time of the occurrence had worked for one month in the tower. He had difficulty in recalling the last time he had worked in the tower, prior to the recent posting. In order to provide tower control service, the controller had been through an orientation course with a tower controller. At the time of the interview, the documents to support this training were not made available to the investigation team.

The controller's standard of spoken English appeared satisfactory. However at times, he attempted to convey that he did not understand correctly a number of questions, blaming poor grasp of English as a factor. The controller had undertaken English language proficiency training.

The minimum level of language proficiency to be demonstrated by operational air traffic controllers is prescribed as Level 4 as per ICAO guidelines. The controller had attained level 2 proficiency, which is an elementary level.

The controllers' afternoon shift was between 1130 UTC to 1830 UTC. The controller had taken watch at approximately 1430 UTC. The station ATC procedures required the presence of two controllers at any given time during the watch. The purpose of this was to alleviate controller workload. Due to a personal arrangement, at the time of the incident, only a single controller was present, both having agreed to split the shift.

The controller recalled that the afternoon shift was busy as usual, with successive landings. As per the local procedures, approach radar normally handed over arriving traffic at 10 nm final.
Consequently, the tower controller had to effectively coordinate runway entry and backtrack procedures, as required. Other duties were to provide visual separation of traffic within the aerodrome traffic circuit, in addition to coordinating with the marshallers. The airport had an approach and enroute radar. There was no monitor of the approach radar in the control tower to assist the controller in traffic sequencing. In addition, the airport did not have a surface movement radar.

The controller stated that at KRT airport, prior to start or pushback, an aircraft operator was required to have a pushback crew, fire service cover and a marshaller in attendance. This was arranged through the tower controller.

Due to the confined and congested apron, in accordance with normal practice, all arriving aircraft were handed over to the marshaller, once the aircraft were established on one of the 7 taxiways that connected to the runway. The controller added that he was unaware of, nor would any controller be aware of, the specific location on the apron where aircraft are parked. The stand chosen for aircraft parking was the prerogative of the marshaller on the day. It was his understanding that in an ideal situation, aircraft on taxi-out should be under a marshaller (follow me) guidance, until such time that the aircraft had joined one of the taxiways mentioned above.

The controller was aware that stand 3-1 was normally reserved for another carrier's B747 aircraft. When parked on that stand, other aircraft were not allowed to use the taxilane behind the parked B747. He did not state if this restriction applied to other aircraft. He was unaware of the AAICD report into a ground collision event involving a parked B747 on apron 3.

The controller reported that he had handled the arrival of the A332flight, which had landed at 1442 UTC. During the backtrack runway 18 to vacate via B for the stand, the A332crew had requested the use of taxiway A for departure. The controller informed the A332crew that the request would be considered when the aircraft was ready for pushback and start. The A332 aircraft was parked on stand 3- 7 at 1449 UTC.

Following turnaround, the A332 flight crew requested for a clearance to pushback and start. This was approved and the flight instructed to pushback facing north. The controller stated that from the tower position, he could see the A332 aircraft from where it was parked on stand 3 -7. After the pushback the A332aircraft was on the apron located south of taxiway Bravo.

When the A332 flight was ready for taxi, the controller cleared the A332 aircraft to taxi via taxiway Alpha to holding point of runway 18. This was the taxiway requested by the crew, even though the controller considered the A332 aircraft would have been able to use taxiway Bravo. In addition, given the extended runway occupancy due to backtracks at the airport, the flight crew request was accepted as the use of taxiway Alpha would provide expedited entry to the runway and minimal runway occupancy.

The controller then became engaged with approach radar, coordinating the handover of an arrival aircraft. Approaching taxiway Alpha, the A332crew were queried and reported they were ready for departure. When queried again if they could expedite the entry into the runway, the A332 crew reported that they were ready for immediate take-off from the intersection taxiway Alpha.

The controller reported that this was unusual request, and he once again requested A332 crew to confirm if they wanted to take the intersection take-off. The aircraft was then cleared for take-off with a frequency change to radar whilst not yet lined up on the runway. Shortly afterwards, the controller was alerted by the EK crew of the collision involving the A332 aircraft.
The controller alerted the marshaller and fire services, who attended to the scene.

Marshaller's and Pushback Report

On two separate occasions the AAICD arranged for the marshaller to be interviewed. However, on each occasion, after taking personal details of the marshaller, it was found that the person appearing for the interview was not the person directly involved with the pushback of the A332 aircraft. As such the interview did not take place. The AAICD conducted an interview with the pushback driver

In paragraph 1.1 **History of the flight**

Remarks: We suggest to include the text of paragraph 1.17 **Organization and Management Information** of your report in paragraph 1.1.

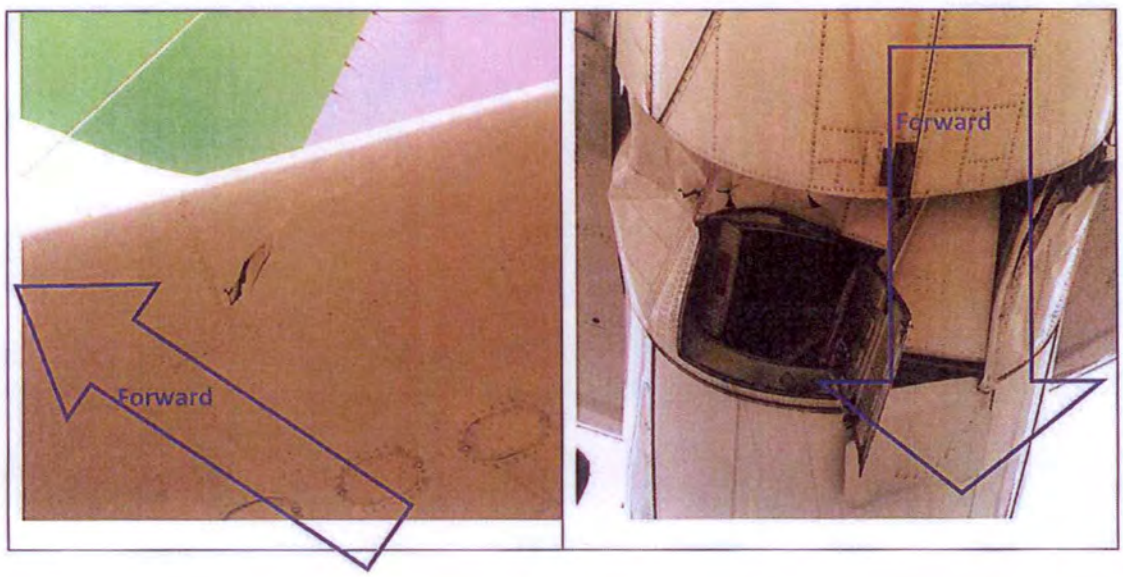
Rationale: We consider the details of the measurement relating to how the A345 aircraft was parked falls under 1.1 **History of the flight** as it included flight preparation, or the state the aircraft was prior to ground collision incident.

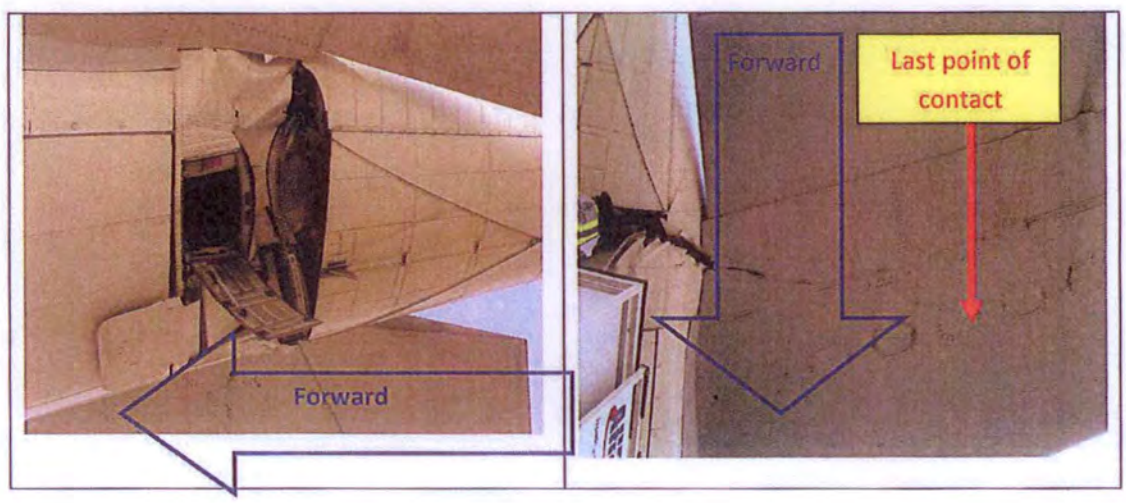
Paragraph 1.3 Damage to Aircraft

Remark: We suggest you consider including the suggested text as well as photographs below.

Rationale: The text as well as photographs below will enhance overall understanding of the damage.

The A345 aircraft sustained damage to the tail cone, aft fuselage lower frame 91, the left and right stabilizer, APU inlet splitter and the APU fire bottle compartment access door (see pictures below). The A332 aircraft sustained damage to the left winglet. The 345 flight was cancelled and the aircraft was removed from service for repairs. The A332 aircraft was released for service.





Paragraph 1.5 Personnel Information

Remarks: We suggest you consider removing the names of the A332 aircraft crew.

Rationale: The inclusion of the names is in contradiction to Annex 13 paragraph 5.12.2.

Remarks: We suggest you consider adding the information regarding the A332 aircraft crew "total hours over last 7 days".

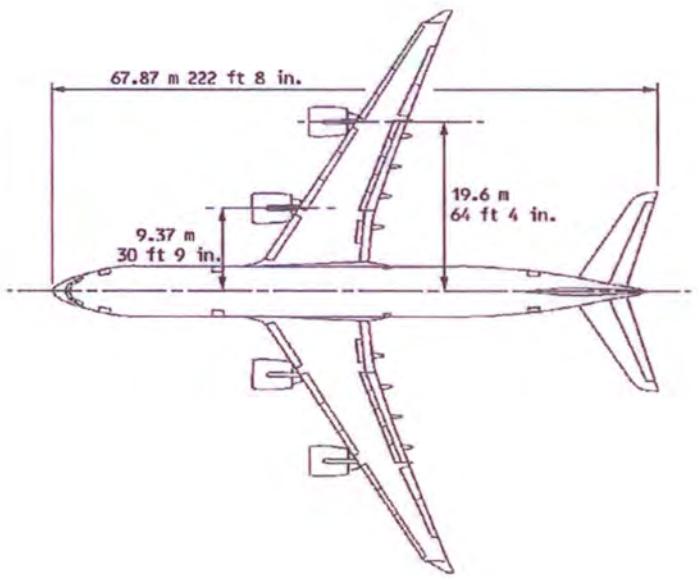
Rationale: The inclusion of the "total hours over last 7 days" will provide additional information that could prove relevant to the investigation i.e. how long the A332 crew were on duty, the rest period before commencement of duty etc.

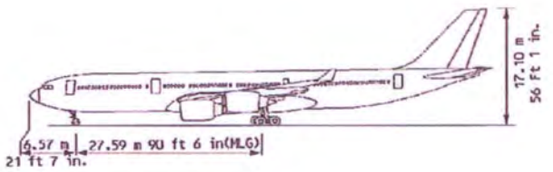
Paragraph 1.6 Aircraft Information

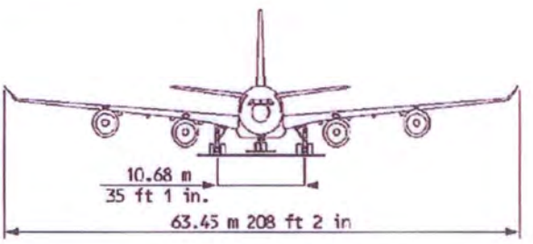
Remark: We suggest you consider include the aircraft dimensions depicted below.

Rationale: The dimensions below will enhance the overall understanding of the aircraft involved in the collision.

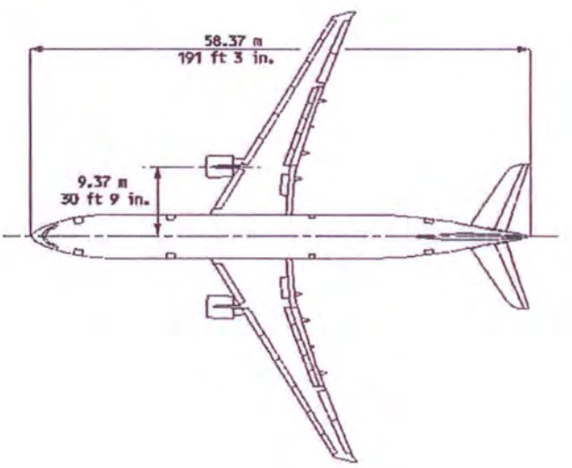
A345 aircraft

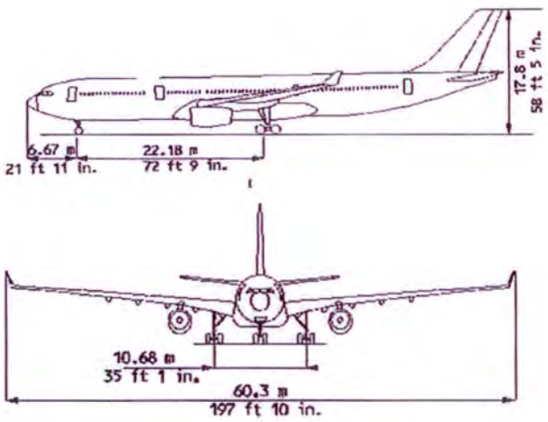






A332 aircraft





In paragraph 1.9 Communications

Remarks: We suggest you consider removing the ATC transcript or relocating it as an appendix to the investigation report.

Rationale: The information in the paragraph that states the VHF radio was operating normally is sufficient.

In paragraph 1.10 Aerodrome Information

Remarks: We suggest you consider including the text below. Please include aerial picture of the apron or diagram from the AIP as appropriate.

Rationale: The collision occurred on the apron and information on the dimensions of the apron is valuable to the overall understanding of the event.

The airport has no parallel taxiway to the runway, and a taxilane located at the eastern side of the apron serves as the link with the taxiways. Aircraft entering or leaving the apron utilise the taxilane.
The apron is approximately 104 metres wide from west to east, and the eastern part of it forms a taxi lane parallel to the runway. Aircraft are parked on the western edge, angled nose-in, to accommodate more aircraft at a time. The A345 and B747 aircraft are normally parked nose in on stand 3 -1. There are no parking stop markings. The yellow lines near the western edge delineate the access roadway for ground vehicles. The apron lines at the time of the incident were faint, and at the time of the collision, the airport authority were in the process of repainting the apron.

In paragraph 1.11 Flight Recorders

Remarks: We suggest you consider including the information on the flight recorders for both aircraft.

Rationale: The information on the flight recorders for both aircraft is relevant as per Annex 13 to the ICAO Convention.

In paragraph 1.12 Wreckage and impact information

Remarks: We suggest you delete all the text under this paragraph and replace with the words "there was no wreckage".

Rationale: The information in the paragraph belongs to aircraft damage paragraph 1.3. There was no wreckage or impact area for this ground collision incident.

In paragraph 1.13 Medical and Pathological information

Remarks: We suggest you delete word "relevant" and replace with the word "available".

Rationale: We consider the information was relevant but was not obtained during the investigation.

In paragraph 1.15 Survival Aspects

Remarks: We suggest you delete word "not relevant" and replace with the word "fully survivable incident".

Rationale: We consider the incident was fully survivable.

In paragraph 1.16 Tests and Research

Remarks: We suggest you delete words "No test or research took place" and replace with the suggested text and photo below.

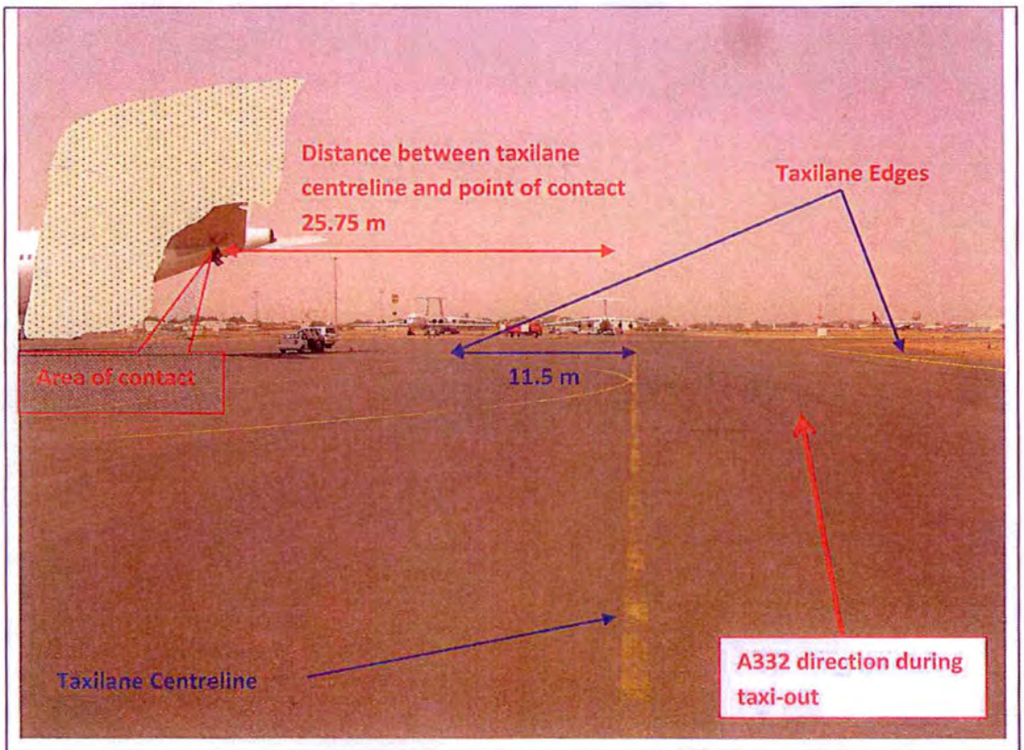
Rationale: We consider the text will enhance the awareness of the reader.

Apron / Taxilane Geometry and Aircraft Taxi Simulation

The KRT airport taxilane is 23 metres wide, and meets the ICAO Annex 14 specification for design of taxiways. The ICAO Annex 14 recommends that the design of the taxiway should be in a way that when the cockpit of an aeroplane for which the taxiway was intend remained on the taxiway centreline, the distance between the outer main gear and the edge of the taxiway should not be less than 4.5 metres. The taxilane design at KRT meets the criteria for accommodating aircraft based on the distance between the outer main gear and the edge of the taxiway. No provision was made for ensuring the aircraft on taxi maintaining the centreline were clear of obstacle that were on the apron side of the taxilane.

A scaled aircraft was overlaid on a Google Earth to simulate aircraft taxi and the available clearance. The simulation concluded that it was not possible to ensure safe passage of an A332 aircraft behind a parked A345.

It also concluded that safe passage of an A332 aircraft behind another A332 aircraft was only possible if the aircraft operating on the taxilane had the nosewheel either on the taxilane centreline or slightly to the right of the centreline.



Taxilane dimensions and point of contact

In paragraph 1.17 **Organization and Management Information**

Remarks: We suggest you delete the text and relocate it to paragraph 1.1 **History of the flight**.

Rationale: We consider the details of the measurement relating to how the A345 aircraft was parked falls under flight preparation, or the state the aircraft was prior to ground collision incident.

Remarks: We suggest you include information on the relationship between the CAA, the Khartoum Airport Authority, Air Traffic Control and Apron management. Please consider the suggested text below.

Rationale: We consider the text will enhance the awareness of the reader.

The Sudan CAA

Based on information from the ICAO Universal Safety Oversight Audit Programme (USOAP) Audit report, the Sudan CAA (SCAA) is an autonomous body headed by the Director General, who reports to the Civil Aviation Board (CAB). The CAB is responsible to the Minister of Presidential Affairs. The SCAA is made up of eight directories. There are three interested parties which are relevant to this incident; the Directorate of Khartoum Airport, Directorate of Aerodrome Engineering, and the Directorate of Air Navigation Services. The Aerodrome Engineering Directorate reported directly to the Director General of the SCAA and was responsible for the maintenance of aerodrome electrical equipment, civil engineering and visual aids. The Air Traffic Services reports to the Directorate of Air Navigation Services, and are responsible for provision of air traffic control at KRT.
Due to the above structure and local issues, the controllers and apron marshallers appeared uncoordinated and lacked clear guidelines in responsibility as pertains to aircraft movement on the apron.

The ICAO USOAP audit found that ".....Sudan has not clearly separated its responsibilities as the State regulatory authority from those as the State providing services in the areas of aerodromes, aircraft operations, aeronautical information services (AIS), and air traffic services (ATS). This may create a potential conflict of interest between the regulatory enforcement functions and the functions of a service provider. At a meeting with the Deputy Director of Civil Aviation, the investigation team was informed that appropriate legislation to address the recommendation had been promulgated. The full separation of the various services was expected to be implemented by October 2011.

Khartoum Airport has an aerodrome manual and an aerodrome emergency plan.

In paragraph 1.18 **Additional Information**

Remarks: We suggest you consider inclusion of the suggested text below.

Rationale: We consider the text will enhance the awareness of the reader.

Applicable Documentation
ICAO Annex 14 Width of Taxiways
The Annex recommends that the straight portion of a taxiway should have a width of not less than 23 metres. The taxilane at KRT meets this specific criteria.

ICAO Annex 2 Rules of the Air
Responsibility for compliance with the rules of the air

Responsibility of pilot-in-command

The pilot-in-command of an aircraft shall, whether manipulating the controls or not, be responsible for the operation of the aircraft in accordance with the rules of the air, except that the pilot-in-command may depart from these rules in circumstances that render such departure absolutely necessary in the interests of safety.

Authority of pilot-in-command of an aircraft
The pilot-in-command of an aircraft shall have final authority as to the disposition of the aircraft while in command.
Avoidance of collisions
Note.— It is important that vigilance for the purpose of detecting potential collisions be not relaxed on board an aircraft in flight, regardless of the type of flight or the class of airspace in which the aircraft is operating, and while operating on the movement area of an aerodrome.

Proximity

An aircraft shall not be operated in such proximity to other aircraft as to create a collision hazard.
It was an accepted industry wide practice under rules of the air that that pilots were responsible for collision avoidance whilst taxiing. The Sudanese CAA had not filed a difference with ICAO in regards to this specific provision.

ICAO Annex 14 Taxiway Minimum Separation Distances
The Annex defines a taxiway strip as an area including a taxiway intended to protect an aircraft operating on the taxiway and to reduce the risk of damage to an aircraft accidentally running off the taxiway. It recommends that the taxiway strip should extend symmetrically on each side of the centre line of the taxiway throughout the length of the taxiway.

It also recommends that the taxiway strip should provide an area clear of obstacles which may endanger taxiing aeroplane.
The Annex recommends that the minimum distance from the taxilane centreline to other aircraft or other object was 47.5 metres. The actual distance at KRT from the taxilane centreline to the aft edge of the parked A345 aircraft was 22.25 metres. Whilst parked and aligned with the aircraft stand taxilane, the A345 aircraft wings extended beyond the stand restraint line and were 5.65 metres and 6.25 metres to the left and right respectively.

ICAO Annex 14 Manoeuvring Area
ICAO Annex 14 defines manoeuvring area as that part of an aerodrome to be used for the takeoff, landing and taxiing of aircraft, excluding aprons.

Sudan AIP SUDAN
The Sudan AIP ***SUDAN ENR 1.1-13*** *stated the following:*
5.11 Taxiing
5.11.1 A pilot-in-command shall obtain clearance before leaving the parking area.
Note: Taxi clearance will relate to movement on the manoeuvring area, but excluding the marshalling area.
5.11.2 Aircraft taxiing on the manoeuvring area will be regulated by ATC to avoid or reduce possible conflict and will be provided with a traffic information and alerting service

The Sudan CAA Manual of Air Traffic Services (MATS) *gave guidance and instructions to controllers working in Sudan. Under roles of various ATC units it stated the following:*

*2 .4.3 **Aerodrome Control** Shall provide information and clearances to aircraft under it's control to achieve a safe, orderly and expeditious flow of air traffic on and in the vicinity of an aerodrome and prevent collisions between:*
(a) aircraft flying in the aerodrome traffic circuits around an aerodrome;
(b) aircraft operating on the manoeuvring area;
(c) aircraft landing and taking off ;
(d) aircraft and vehicles operating on the manoeuvring area;
(e) aircraft on the manoeuvring area and obstructions on that area.
*1. 5 **Control of Surface Traffic***
*1.5.1 **Control of Taxiing Aircraft***
1.5.1.1 When taxiing, a pilot's vision is limited. It is important therefore for Aerodrome Control to issue concise instructions and adequate information to the pilot to assist him to determine the correct taxi routes and to avoid collision with other aircraft or objects.
*2.3 **Taxiing Procedures***
2.3.1 Normal taxiing instructions will be given, and whenever possible a non-stop run to the take-off position should be provided. If restrictions to taxiing become necessary, instructions to slow down or speed up are preferable to stopping and restarting.

Previous incidents

The AAICD had previously investigated a similar occurrence involving a parked B747 aircraft on stand 3-5 and an A340 aircraft that was operating on the taxilane behind. Another incident also involved another carrier's A332 aircraft.

Other airlines had also reported taxiing incidents. Following an IATA sponsored joint visit to KRT, it was agreed with the airport authority, that the absence of apron markings, would be addressed. Furthermore, all arrivals would be guided to the parking position and on departure, a 'wing walker' would be provided in addition to a marshaller.

Industry Initiatives
The IATA Middle East Regional office visited KRT in January 2006. The IATA team reported that the main apron was very narrow and most areas had no stand markings or taxi lanes. Furthermore, the airport was very congested.

In paragraph 2. **Analysis**

Remarks: We suggest you consider inclusion of the suggested text below.

Rationale: We consider the text will enhance the awareness of the reader and will provide analysis.

ATC Actions
The controller had recently returned to work in the control tower. It had been some years since he worked in the tower. During that time there had been minimal aircraft movements. He was unaware of the dimensions of the apron, but was aware of the restrictions on the use of taxiway Alpha when a B747 was parked on stand 3-1.

On arrival, the flight crew of the A332 aircraft had requested to use taxiway A for departure. At this time the A345 aircraft had already parked on stand 3 -1. At the time of the A332 aircraft crew request, the controller would have alerted the A332 crew that taxiway Alpha

was not available for taxi-out. He however mentioned that the request would be considered when the A332 aircraft was ready for taxi .

From the control tower position, the controller was able see the A332 aircraft parked on stand 3-7 and would in most likelihood see the tail of the A345 aircraft parked on stand 3-1. Although not stated during the interview, it was possible that the controller was of the opinion that the aircraft on stand 3-1 was an A332. The crew certainly thought that the A345 aircraft was an A332 in the subsequent transmissions following the collision. Having thought the A345 aircraft was an A332, the controller would have concluded that there was no restriction to the movement of other aircraft using the taxilane behind the parked A332 aircraft.

When the A332 aircraft crew reported ready for taxi, the controller was of the opinion that any potential confliction with other aircraft had been resolved by the marshaller. He did not recognise that by the very nature of the taxilane, when used by an A332, would not ensure adequate separation from an A345 aircraft parked on stand 3-1. There was no indication that this observation had been documented by ATC management to assist in overall awareness by all controllers.

Prior to commencement of taxi, the A332 was facing north but was south of taxiway Bravo. In normal circumstances, with runway 18 in use and depending on traffic flow, the aircraft would have been cleared to taxi to holding point via taxiway Bravo, prior to entering the runway for a backtrack. However, as taxiway Bravo was being used to exit the runway, and with the planned arrivals, the use of taxiway Alpha as suggested by the crew provided the least disruption to the traffic flow. Whilst issuing taxi clearance to the A332 aircraft, the controller was also engaged in coordinating with Approach radar the handover of an arriving aircraft.

It could be concluded that controller's decision on the taxiway to be used was strongly influenced by the A332 crew suggestion to use taxiway Alpha. The use of taxiway Alpha allowed least runway occupancy time with no taxiway blockage for arriving aircraft. The above factors had resulted in the controller clearing the A332 aircraft to use the taxilane towards taxiway Alpha instead of taxiway B.

A332 Crew Action

Prior to taxi-out at KRT, the flight crew should follow marshalling signals. Having exited the apron the A332 aircraft taxied on the straight portion of the taxilane. Based on site investigation evidence, it was estimated that the A332 crew had placed the aircraft nosewheel approximately 5 metres to the right of the taxilane centreline. It is possible the A332 crew had observed the potential for collision and had thus displaced the aircraft to ensure separation. As the event occurred at dusk, it may have been difficult to precisely judge the lateral clearance from nearby aircraft in the prevailing light conditions.

In order to expedite the movement of aircraft, the controller was repeatedly requesting A332 crew to advise if the flight was ready for immediate take-off. The crew informed the controller the aircraft was ready for departure from intersection Alpha Without the corresponding information from the flight safety office, it is not possible to correctly arrive to a conclusion about the tasks that the A332 crew were conducting prior to the collision, and the role those tasks played. However, immediately after the A345 crew had alerted the crew of the collision, ATC recordings indicated the crew on numerous occasions reporting as having had a collision with 'an ------ A332 aircraft'. This probably explains why the crew had displaced their aircraft nosewheel 5 metres to the right of the taxilane centreline.

It could be concluded from the ICAO Annex and other industry best practice that notwithstanding

the ATC clearance, it remained the duty of the commander of an aircraft to take all possible measure to ensure that their aircraft did not collide with any other aircraft or object.

Apron Environment

The apron was too narrow to accommodate a number of widebody aircraft. As a result, the airport had adopted an angled parking system, which in most cases allowed aircraft to arrive and depart without the aid of a tug. As a result of a previous incident involving an aircraft which had with an apron lamp post, the airport had approved that A345 aircraft use conventional nose-in parking. The apron marshallers usually parked the A345 aircraft on stand 3-1. When this stand was utilised, taxiway A was normally not usable by other wide body aircraft. Whilst this arrangement had been in place for a considerable time and had resulted in no accident, it was not documented in any manual or ATC standing instructions. It was evident that the use of the taxilane in the A345 aircraft and A332 aircraft combination had not been fully evaluated with modern simulation tools. In addition, it could be argued that the markings on the taxilane were unnecessary, when applied to wide body aircraft, as they did not appear to serve any purpose to ensure aircraft separation.

The general layout of the apron at KRT was not desirable for handling widebody aircraft. Furthermore, the ramp activities and general vehicular and aircraft movement around a parked aircraft were of concern. The aprons were poorly lit.
This deficiency could be addressed by either extending the apron to the east, as an interim solution. The Sudan CAA and the airport authority had reported that the airport was to be relocated to a new location. No definite timeline was provided.

Subsequent Collision

Whilst taxing on the straight portion of taxilane, the apparent clearance between the moving A332 wing and stationary A345 tail cone was not sufficient, thereby resulting in a collision between both aircraft. At the time of the collision, the A332 crew were in communication with ATC who were requesting the A332aircraft crew to expedite taxi onto runway 18 for departure.

In paragraph 3.1 **Findings**

Remarks: In addition to your findings, we suggest you consider inclusion of the suggested text below.

Rationale: We consider the text will enhance the awareness of the reader and provide a better description of the event.

3.1.1 The A345 aircraft was parked on a stand 3-1 which was usually reserved for the A340 and B747 aircraft type.

3.1.2 The local procedures is that when a widebody is aircraft parked on stand 3-1, no other aircraft is to use the taxilane behind, either to or from taxiway Alpha.

3.1.3 The A345 aircraft sustained damage when it was struck by a A332 aircraft operating on a taxilane located behind the parked EK A345 aircraft.

Attachment B

AAICD Observation on UAE GCAA Comments

- Page 1, 4 and 5 please note that mentioning of Airlines names is Annex 13 requirement. .
- **The history of flight**
  Paragraph 1.1
  Your comments on this part elaborate on information most of it either has been included in the report or does not add any value to the report. You stated that "The controller's standard of spoken English appeared satisfactory. However at times, he attempted to convey that he did not understand correctly a number of questions, blaming poor grasp of English as a factor". Simply I would say this is a contradicting text. Also you stated that the controller had attained level 2 proficiency…., for your information this controller had attained level 3 in Dubai and level 5 in Khartoum, and please notes that issuing of take off clearance before lining up is not a violation of laws or regulations.
- Regarding your suggestion to include the text of paragraph 1.17 in 1.1 please be advised that this information is considered deficiencies in organization management and this is the right place for it. Please read the report again.
- **1.3 Damage to aircraft**
  Your suggested text is included in 1.12 of the report. Ref. Doc 9756 part 4 Para 1.3.1
- **1.6 Aircraft Information**
  The dimension of A332 wing span is included in the report, the length of A345 will be included as well which is quite enough for illustration.

- **1.9 Communication**
  This is the right place for ATS communication transcription as prescribed by DOC 9756 part 4 paragraph 1.9.1

- **1.10 Aerodrome Information**
  Please refer to DOC9756 part 4 paragraph 1.10 and note that the taxi lane is not parallel to whole runway and there are others taxiways used for entering and leaving the apron, other information in your suggested text has been included in the report and no need for repetition that associated with most of your comments. An apron layout chart will be included in the report.
- **1.11 Flight recorders**

  Not being read.

  1.12 Wreckage and impact information
  What we have written under this paragraph is according to Doc 9756 part 4 paragraph 1.31

- **1.16 Test and and research**
  Your suggested text is neither test nor research and none have been done on this respect. Reference Doc 9756 part 4 paragraph 1.16.1
- **1.17 Organization and management information**
  Your suggested text is completely irrelevant to the case. You have forwarded some information based on Sudan CAA Universal Safety Oversight Audit Programme, this activity has been conducted by ICAO Team in the year 2006 and since then the CAA has adopted and implemented many projects and activities to address and close findings among them is promulgation and implementation of new law and legislations, training, plans are on progress to separate the regularity body from service providers as well as establishing an independent Investigation Authority and so on, so in this respect you have provided information that is not updated.
- **1.18 Additional information**
  Your suggested text is extracted from ICAO Annexes and documents.

- **2 Analysis**

  The Doc 9756 part 4 paragraph 2.1 stated that:-
  (In the analysis part of the Final Report, the significance of the relevant facts and circumstances which were presented in the

factual information part should be discussed and analyzed in order to determine which events contributed to the accident.)
Your suggested text has significantly deviated from the above requirement and based only on assumptions.

- **3.1 Findings** (As numbered in your report)
  3.1.1 Not a finding. It is included in the report.
  3.1.2 Not a finding. No document is found to confirm that. This fact is mentioned in the report.
  3.1.3 Not a finding. This fact is mentioned in the report.
  3.1.4 Not a finding. This fact is mentioned in the report.
  3.1.5 Not a finding. This fact is mentioned in the report.
  3.1.6 It is a finding but is included in our report (finding No. 4 of report).
  3.1.7 Not a finding, actually it is an assumption and it is mentioned in the report (review analysis paragraph of the report)

- **3.2 Causes**
  3.2.1 Not a cause.
  3.2.2 Not a cause.
  3.2.3 On the same way this could be understood that the STAND is not separated from the taxi lane by the required minima which are expressed in terms of distance and Markings and all fall under insufficient wingtip clearance which is mentioned in the report (major cause).
  3.2.4, 3.2.5 and 3.2.6 all fall under the non-standard construction of aircraft stands that mentioned in the report which of course includes among other requirements , the guidance in and out of the Stand whether by electronic or by other available means.