SOUTH AFRICAN CIVIL AVIATION AUTHORITY

Section/division **Accident and Incident Investigations Division** Form Number: CA 12-12a

AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/9257		
Aircraft Registration	**G-BNLL**	**Date of Accident**	22 December 2013		**Time of Accident**	20:43Z	
Type of Aircraft	Boeing 747- 400		**Type of Operation**		Air Transportation		
Pilot-in-command Licence Type		ATPL	**Age**	57	**Licence Valid**	Yes	
Co-pilot Licence Type		ATPL	**Age**	51	**Licence Valid**	Yes	
Pilot-in-command Flying Experience		Total Flying Hours	±20 050,00		Hours on Type	±12 500.00	
Co-pilot Flying Experience		Total Flying Hours	± 5700,00		Hours on Type	± 1400,00	
Last point of departure	OR Tambo International Airport (FAOR) at Gauteng in Republic of South Africa.						
Next point of intended landing	Heathrow International Airport (EGLL) at London in United Kingdom.						
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)							
On "taxilane" Mike at FAOR							
Meteorological Information	Surface Wind: 090 ˚/08 kts, Temperature: 22˚C, Dew point: 14,˚C, Visibility: CAVOK.						
Number of people on board	3+14+185	**No. of people injured (On Ground)**	4	**No. of people killed**	0		

Synopsis

The British Airways aircraft B747-400, flight number BA034 with registration G-BNLL, was going to embark on a commercial international air transportation long haul flight from FAOR to EGLL. The ATC gave the crew instructions to push back, start and face south, then taxi using taxiway Bravo to the Category 2 holding point for Runway 03L. During the taxi, instead of turning to the left to follow Bravo, the crew continued straight ahead, crossing the intersection of taxiway Bravo and aircraft stand taxilane Mike. After crossing the intersection, still being on Mike, the aircraft collided with a building. An investigation was conducted and several causal factors were determined. Amongst others, it was determined that the crew erred in thinking they were still taxiing on Bravo while in fact they were taxiing on Mike. This mistake, coupled with other contributory factors such as the briefing information, taxi information, ground movement visual aids, confusion and loss of situational awareness led to the collision.

Probable Cause/s

The loss of situational awareness caused the crew to taxi straight ahead on the wrong path, crossing the intersection/junction of Bravo and Mike instead of following Bravo where it turns off to the right and leads to the Category 2 holding point. Following aircraft stand taxilane Mike; they collided with a building on the right-hand side of Mike.

Contributory Factors: The crew did not conduct a briefing to discuss the cleared route, nor did they refer to the correct taxiway information in chart 10-6. In combination with the ground movement visual aids, this created confusion and loss of situational awareness when taxiing on taxiway Bravo.

IARC Date		Release Date	

AIRCRAFT ACCIDENT INTERIM REPORT

Name of Owner	**:** British Airways PLC
Name of Operator	**:** British Airways
Manufacturer	**:** Boeing Company
Model	**:** B747- 400
Nationality	**:** United Kingdom
Registration Marks	**:** G-BNLL
Place	**:** OR Tambo International Airport (FAOR)
Date	**:** 22 December 2013
Time	**:** 2043Z

All times given in this report are Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

Purpose of the Investigation:

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (2011) this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and ***not to establish legal liability****.*

Disclaimer:

1. FACTUAL INFORMATION

1.1 History of Flight

1.1.1 On 22 December 2013, a British Airways Boeing 747-400 with registration G-BNLL**,** flight number BA034 was scheduled to embark on a commercial international air transportation long haul flight from OR Tambo International Airport (FAOR) at Gauteng/Johannesburg in the Republic of South Africa to Heathrow International Airport (EGLL) at London/England in the United Kingdom.

1.1.2 The British Airways flight plan filed with the local authority indicated that flight BA034 to EGLL was a night flight to be flown under instrument flight rules (IFR). The estimated time of departure (ETD) was 20.45:00 UTC (22.45:00 local time). The planned route or flight path of the aircraft was to follow multiple airways from FAOR to EGLL with estimated time of arrival (ETA) at 06.11:00 UTC (08:11:00 local time) on the morning on 23 December 2013.

1.1.3 According to information obtained from British Airways, at 19.40:00 UTC (21.40:00 local time) when the flight crew (Captain - P2, Co-pilot - P1 and Senior First Officer - P3) arrived at FAOR, they proceeded through immigration and went straight to the aircraft, boarding it at 19.45:00 UTC (21.45:00 local time) with the intention to prepare for the flight. The aircraft was standing on parking bay #6 at Alfa apron at the time.

1.1.4 During the preparation phase, the crew (pilots and flight attendants) carried out pre-flight inspections with the objective to get the aircraft ready for the flight. After the pre-flight inspections had been completed and the crew were satisfied that the aircraft was in a safe operating condition, at 20.09:00 UTC (22.09:00 local time) the pilots started with the taxi and take-off briefings. The purpose of the briefing was for the pilots to discuss the taxi, take-off and flight procedures. During the briefing the pilots shared views of critical safety information of the aerodrome (i.e. location, layout, operations, safety and security aspects).

1.1.4.1 According to the cockpit voice recorder (CVR), during the briefing session the Co-pilot requested information from the Captain and Senior First Officer about possible threats to look out for and previous experiences of FAOR. A summary of the briefing discussion follows below.

(i) Threats identified included pressurisation, density altitude, high speed take-off and rejected take-off, noise requirements, air conditioning and SID.

(ii) The expected taxi route, which was based on previous experience, was discussed and agreed on by the crew. They expected the taxi route to be facing tail south with the intention to use taxiway Echo, turning into taxiway Alfa for a “full length taxi” and “to keep going the extra 200 m straight to the end of Runway 03L”.

(iii) The Co-pilot made an observation about the narrowness of taxiway Echo, the possible threat at the corner when “turning into Alfa”, and the Captain agreed. The Co-pilot then made the comment “keep the aircraft nicely on the centreline” because he recalled a previous incident where the tail of an aircraft of another operator (not British Airways) had got stuck in that area.

(iv) At one point, the Captain appears not to have been too sure about taxiways Alfa and Bravo. The doubt concerned the location where Alfa and Bravo come together before entering Runway 03L. The Co-pilot offered the clarification that “taxiway Bravo was full length” and “Alpha morphs into Bravo”.

1.1.5 It appears that the crew was using the Navtech Aerodrome Overview Chart at the time. According to the CVR, at 20.16:00 UTC (22.16:00 local time), during a period of ±7 minutes, the crew completed the taxi and take-off briefing. The crew’s briefed (expected) route is shown below.

Figure 1 The expected taxi route which the flight crew discussed during the taxi and take-off briefing session

1.1.6 When ready, the boarding proceedings commenced and a total of 185 passengers were taken on board the aircraft. With the crew included, a total of 202 occupants were carried on board the aircraft. The boarding process was carried out with the cabin crew greeting the passengers as they were entering the aircraft and directed to their seats according to their boarding cards. At 20.27:00 UTC (22.27:00 local time), when the passengers were seated, the cabin crew conducted the passenger safety briefing.

1.1.7 At 20.28:00 UTC (22.28:00 local time) the Co-pilot transmitted to the FAOR tower. There was no immediate response from the tower at the time. At 20.30:00 UTC (22.30:00 local time), the cabin crew informed the Co-pilot that all the passengers had embarked. At 20.33:00 UTC (22.33:00 local time), the ground handling personnel reported to the crew stating “ready to do the push back”. The Co-pilot response to the ground handling personnel was “standby”. The standby call by the Co-pilot was made in response to the ground handling personnel asking for the parking brake to be released.

1.1.8 At 20.34:15 UTC (22.34:15 local time), the Co-pilot transmitted to the tower: “Speedbird BA034 ready to push-start”. At 20.34:18 UTC (22.34:18 local time), the ATC responded with the instruction: “Speedbird BA034 start, push back and face south”. After receiving the push and start clearance, the Co-pilot and Senior First Officer carried out the before start checks. The Senior First Officer made a comment “If you read I’ll check” to the Co-pilot. After the before start checks had been completed, the crew had a discussion about the ATC instruction. The discussion was about “facing south”.

1.1.9 According to ATNS there was nothing strange about the ATC instruction. The instruction was normal; as it depended on the tactical traffic management by ATC, and the instruction could just as well have been to push back and face north. But based on the discussion information it appears that the instruction to face south was not what the crew had expected. According to the crew briefing, the expectation was that they would be instructed to be "facing tail south". The Co-pilot decided to ask for confirmation of the instruction: "just confirm to push back and face south" with ATC. ATC's response was "Affirm Sir" to which he replied "Thank you", indicating acknowledgement of the instruction.

1.1.10 According the CVR, the following activities then followed:

(i) At 20.32:56 UTC (22.32:56 local time), the Co-pilot stated "Okay, we are clear to push and face south starting engine #4".

(ii) At 20.33:50 UTC (22.33:50 local time), engine #3 was started.

(iii) At 20:35:05 UTC (20.35:05 local time), engine #2 was started.

(iv) At 20:36:27 UTC (22.36.27 local time), engine #1 was started.

1.1.11 After all 4 engines had been started, the Co-pilot initiated "before taxi checks". The Captain then commenced with before taxi checks. At 20:38:31 UTC (22.38:31 local time), after completion of the before taxi checks, the Co-pilot called "Speedbird 34 requesting taxi" to which ATC responded "Speedbird 34, taxi Bravo to Cat 2 holding point, Runway 03L". The Co-pilot then read back "Bravo to Cat 2 holding point, Runway 03L, Speedbird 34".

1.1.12 The conditions inside the cockpit were as follows:

(i) The Co-pilot (Handling Pilot/Pilot Flying) was seated on the starboard (right) side. He was handling the aircraft.

(ii) The Captain (Monitoring Pilot) was seated on the port (left) side. He was the monitoring pilot with the role of assisting the Co-pilot.

(iii) The Senior First Officer (relief/heavy pilot) was seated at the back of the Co-pilot and Captain.

1.1.13 According to the Captain's statement: "The aircraft remained on what was perceived to be still taxiway Bravo. The taxiway edge lights illuminated in a continuous straight line with no signage indicating the change of the two taxiways Bravo & Mike. Also, some of the green centreline lights on taxiway Bravo were not illuminated in sequence thus leading to a false perception that the aircraft is still on taxiway Bravo. However, during the taxi while going through the before take-off procedure and checklist, after we entered the taxiway Mike, the Co-pilot voiced a concern about the width of the taxiway Mike and proximity of the building on the right side of the taxiway. The Co-pilot could not judge the proximity of the aircraft from the building because of the strong apron background glare".

1.1.14 According to the CVR, at 20.43:56 UTC (22.43:56 local time) the ATC made a call to the crew saying “Speedbird 34, Tower”. After the response from the crew “Speedbird 34, go ahead” the ATC instruction was “Just hold position”. It was then that the Captain responded stating “We actually hit something here. Standby please”, which was exactly the time the aircraft collided with a building. The starboard (right side) wing impacted the building, causing ruinous damage to both the aircraft and the building. The wing was found wedged in the brick halls of the Bid Air Services building.

1.1.15 According to ACSA, at the time when the Captain made the transmission to ATC about the aircraft hitting something there was an aerodrome rescue and fire fighting services (ARFF) vehicle identified as Foxtrot Tango Lead (FTL) listening to all the transmissions. After the ARFF personnel of FTL heard the transmission between BA034 and the tower, hence they immediately transmitted to Tower. The ATC then gave them instructions stating “Can you just respond to Bravo Cat 2 for British Airways”. The explanation from ATC to ARFF was that the “British Airways aircraft taxied past taxiway Bravo, the Cat 2, toward Mike apron”. That was when FTL drove to Mike where they found the aircraft being involved in the accident.

1.1.16 While FTL was driving to the scene, the ATC activated the crash alarm with the intention to dispatch FAOR ARFF to the accident. According to ACSA, the ARFF fire fighting trucks departed to the accident from different substations. When arriving on Mike, they secured the accident scene jointly with FTL. After arriving on the accident scene, it was evident that the fire and rescue operation needed careful co-operation between all parties involved.

1.1.17 The Captain stated that almost immediately after the aircraft had collided with the building the cabin crew made a call to the cockpit and reported information of the fuel leak being observed on the starboard (right side) wing. The cabin crew was waiting for the crew to give instructions to evacuate. The response from the cockpit first in this regard was to “get ready for a full evacuation”. The instruction was then changed that “normal disembarking will be conducted”. While the cabin crew was waiting for final order to disembark, all the passengers remained in their seats and observed the ARFF operations outside.

1.1.18 The evidence from the ARFF shows that at the time when they arrived on the accident scene, they found that the aircraft’s engines were still running. The ARFF made a transmission to the tower and reported the engine situation. They requested a complete engine shut-down before foam could be sprayed on the damaged starboard wing and building. According to the CVR, the crew heard the transmission and responded to the tower stating “We’re going to switch off the engines as soon as we have the auxiliary power unit (APU) going”. Only after the APU being switched on and engines shut down could the ARFF start to spray the foam on the fuel spillage to reduce the risk of fire.

1.1.19 According to ACSA, after the ARFF had completed the foam spraying to secure the scene, the crew made the decision to allow the passengers to disembark from the aircraft. The disembarkation was done through the rear cabin door #5 (left side). No escape slide was deployed, because they had arranged for the ground handling air step vehicle to be used. All the occupants on board the aircraft survived the accident without anyone sustaining any injury.

1.1.20 The evidence was that the situation for the people inside the damaged building was a little more serious. There were a total of 4 BidAir Services employees on duty inside the building at the time, and all 4 employees sustained minor injuries in the accident.

1.1.21 The actual route followed by the crew after it had been confirmed, but not followed as instructed by ATC, is shown below:

Figure 2 Actual taxi route which the pilots followed before the collision with the Bid Air Services Building

Figure 3 The aircraft starboard wing wedged in the Bid Air Services Grooming Operations Building

1.2 Injuries to Persons

Injuries	Pilot	Crew	Pass.	Other
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-	-	4
None	3	14	185	-

1.2.1 Injuries to aircraft occupants:

1.2.1.1 A total of 202 occupants were carried on board the aircraft. All the occupants survived the accident and none sustained any injury.

1.2.2 Injuries to the BidAir Services Employees:

1.2.2.1 A total of 4 BidAir Services employees were injured as a result of the accident while on duty inside the building. According BidAir Services, the injured employees were taken to a medical clinic at the airport terminal for assessment immediately after the accident. It was determined that the injuries were minor.

1.3 Damage to Aircraft

1.3.1 The aircraft sustained substantial damage in the accident.

Figure 4 Damage caused to the starboard wing of the BA034 aircraft

1.4 Other Damage

1.4.1 Damage to BidAir Services Operations Building:

1.4.1.1 Other damage caused was to the BidAir Building. The building was situated in the ground movement area on the south-eastern side of the aerodrome, between Mike on its eastern side and the super south gate roadway on its western side. The BidAir Services Building is shown below as indicated on the aerodrome chart:

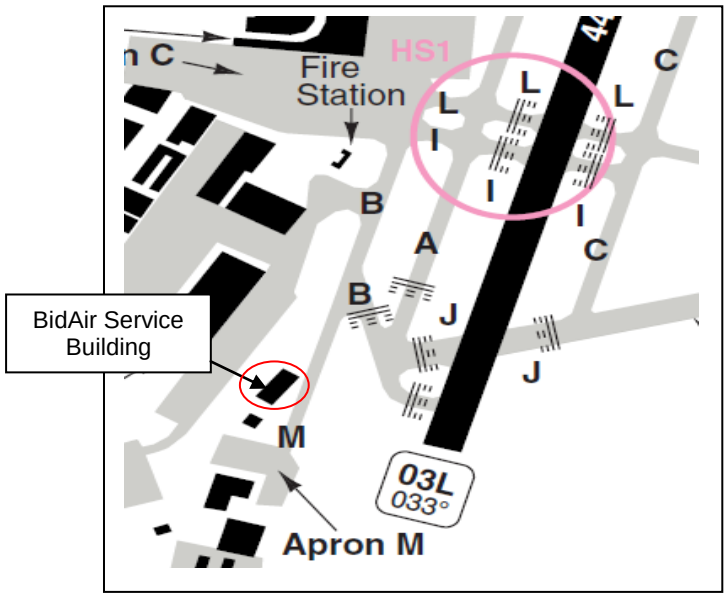
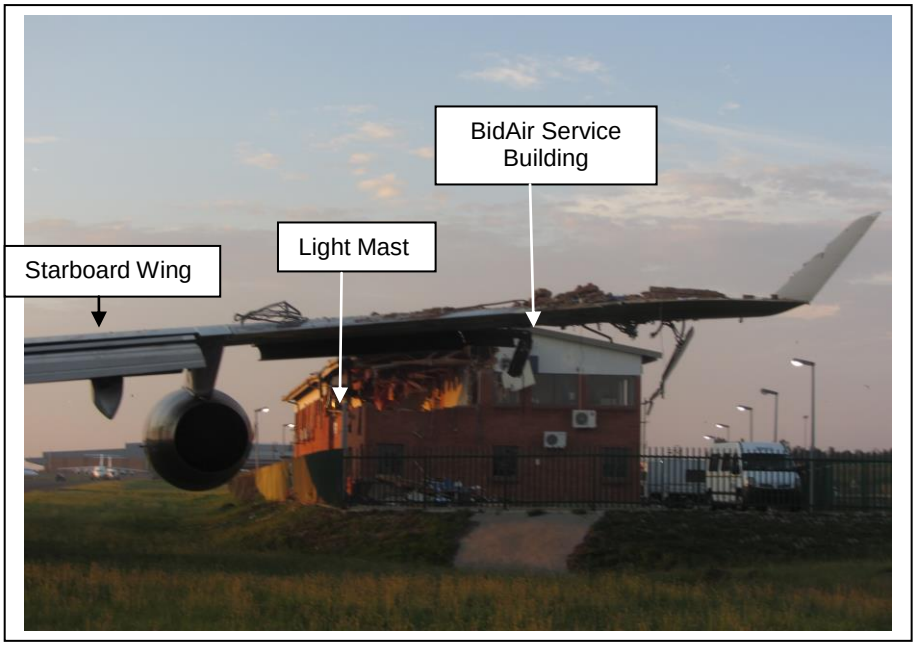


Figure 5 FAOR Aerodrome Chart showing location of BidAir Services Building

1.4.1.2 The investigation determined that the aircraft taxied facing south using taxiway Bravo and crossed the intersection straight onto Mike. The aircraft then taxied on Mike, where the starboard wing of the aircraft impacted the eastern side of the second floor of the BidAir Services building. The magnitude of the impact caused substantial damage to the building and facilities, as follows:



1.4.1.2.1 The first point of impact was determined to be a light mast installed next to the eastern side perimeter fence of the building. The light mast was cut at the same height as where the wing sliced through the hall. The remaining piece of the light mast was found standing at a distance of ±5 to10 meters from the building.

Figure 6 Light Mast damaged in the accident

1.4.1.2.2 The second point of impact was the halls on the eastern side of the building. The upper eastern hall was completely destroyed from the corner of the building.

Figure 7 Damage sustained by the BidAir Service Build

1.4.1.2.3 The debris of the building and light mast was found scattered on the premises. The starboard wing was visibly wedged in the building halls.

Figures 8 and 9 BA034 wing wedged in the building halls and debris of building material

1.4.1.2.4 It was observed that a substantial amount of fuel from the wing was spilled inside and outside the building. The building was subsequently declared unsafe for use as a result of the accident.

1.4.1.2.5 There were several BidAir Services vehicles in the parking area around the premises of the building. There is no evidence of information that any of the vehicles sustained damage. However, due to the fuel spillage and fire risk, all the vehicles were removed to safety immediately.

1.4.2 Damage to the environment:

1.4.2.1 Owing to the collision with the BidAir Services building, a large quantity (kilograms) of fuel was spilled, which caused extensive environmental damage.

Figure 10 Fuel spillage and fire fighting agent (foam) stains on building hall and grass below the point where the wing came to a stop.

1.4.2.2 The evidence was that the large quantity of fuel spillage filtered through the grass into the soil off the parameter fence of the building. In order to correctly determine the extent and nature of environment damage, the Operator (British Airways) in consultation with ACSA immediately contacted a locally based service provider, namely HazRisk Solutions. The service provider had to carry out an environmental damage assessment. The result of the assessment was that a jet-fuel spillage soil remediation was required**.**

1.4.2.3 On 23 to 25 January 2014, HazRisk Solutions performed the soil remediation process. The last work was completed on 3 March 2014.

Figure 11 and 12 Remediation of the fuel spillage area

1.4.2.4 According to the HazRisk Solutions Report, the remediation process included the removal of contaminated grass and building rubble from the accident site. Thereafter manual digging was done to expose a fibre-optic line in the ground. Other risk areas also had to be identified first before they could start with excavating contaminated soil to depths of 1.5 m to 1.8 m. However, during the remediation process, several challenges were identified:

1.4.2.4.1 There was contamination in the storm water drains that needed to be pressure-sprayed clean.

1.4.2.4.2 There was contamination of sewage and water that needed a clean-up.

1.4.2.4.3 The Project Manager of HazRisk had discussions with ACSA Officials into the "no plans" issue of the electrical power supply cables underground in the area of work. To assist a decision was made to involve an electrical contractor to help with underground cable detector equipment to carry out detection of electrical cables. It was suspected that 11,000 volt cables (x2) were found within the remediation area (also not on the plans). The inadequate electrical infrastructure plans provided by ACSA posed the following risk:

Note: In terms of ICAO, Aerodrome Design and Operations Manual, Chapter 8 (Electrical Systems) it states that "The safety of operations at aerodromes depends on the quality of the supplied power. The total electrical power supply system may include connections to one or more local generating facilities and to a distribution network including transformers and switchgear".


Figure 13 Electrical and Fibre Optic cables detected underground

1.4.2.4.4 In terms of aviation safety, the information simply shows that it is essential for ACSA to have identified the 11,000 volts electrical cable on the electrical infrastructure plans. The reason for this is if the identified electrical cable was one supplying power to the air navigation facilities (i.e. aerodrome visual aids and radio navigation aids). The apparent risk of damaging the cable would have resulted in equipment failure which could have exposed the crews of the aircraft flying to hazardous condition of inadequate visual and radio navigation aids.

1.4.3 After the remediation process had been completed, ACSA carried out inspections of the area. ACSA was satisfied with the remediation process. See attached complete reports explaining the activities of the remedial process.

Note: At the time of the investigation being conducted, the SACARS did not cover damage to the environment caused by the aviation industry. As such there is no formal or legislative rule of the CAA to give guidance in this regard. However, it appears that the CAA is in the process to develop relevant regulations to address the situation. However, in the absence of the aviation regulations being promulgated the matter is in the hands of the Department of Environmental Affairs.

1.5 Personnel Information

1.5.1 Captain (Monitoring Pilot)

Brief summary of pertinent information concerning the Captain:

Nationality	Irish	Gender	Male	Age	57
Licence Number	UK/AT/232324J/A	Licence Type	ATPL		
Licence valid	Valid	Type Endorsed	Yes		
Simulator Check	November 2013	Line Check	November 2012		
Ratings	Instrument and Night				
Medical Expiry Date	Class 1 – 16 February 2014				
Restrictions	VNL – corrective spectacles and carry a spare set of spectacles. FHA – functional hearing assessment required within 3 months of renewal/revalidation medical.				
Previous Accidents	None				

Flying Experience:

Total Hours	±20 050.00
Total Past 90 Days	240.10
Total on Type Past 90 Days	240.10
Total on Type	±12 500.00

1.5.1.1 According to British Airways, the Captain started his aviation career flying an assortment of aircraft (light and utility). When employed by them he flew as First Officer on the B747 Classic fleet aircraft. He was then appointed in the post of Captain on the B747-400 series.

1.5.1.2 The records show that while in the employment of British Airways, he was involved in two incidents on the B747-400 aircraft. These two incidents were of a technical nature (engine failure and equipment overheat), both followed by safe landings.

1.5.1.3 On the flight in question, the Captain was seated on the port side in the cockpit. His role was that of monitoring pilot (P2), having the responsibility to undertake the non-handling activities including communication with ATC during the taxi.

1.5.1.4 The Captain was familiar with FAOR. He had visited the airport a total of 7 times in the last 2 years on air transportation flights. During the visits his previous experience was that taxiway Alpha was used about 80-90% of the time for Runway 03L. However, on the day in question it was his first visit accompanied by the Co-pilot and Senior First Officer.

1.5.1.5 In as far as relevant training is concerned, the evidence is that he received Simulator Check on Line Orientated Evaluation (LOE) during November 2013.

1.5.2 Co-pilot (handling pilot)

Brief summary of pertinent information concerning the Co-pilot:

Nationality	British	Gender	Male	Age	51
Licence Number	334346 D.A	Licence Type	ATPL		
Licence valid	Yes	Type Endorsed	Yes		
Simulator Check	October 2013	Line Check	December 2012		
Ratings	Instrument and Night				
Medical Expiry Date	Class 1 – 18 February 2014				
Restrictions	None				
Previous Accidents	None				

Flying Experience:

Total Hours	±5700.00
Total Past 90 Days	203.45
Total on Type Past 90 Days	203.45
Total on Type	±1400.00

1.5.2.1 According to British Airways, the Co-pilot started his aviation experience in April 2004. Before his employment by British Airways, he flew SD3-60 and B737-300/500 aircraft). He was then appointed on the B747- 400 fleet by British Airways.

1.5.2.2 The records show that the Co-pilot had not been involved in any incidents previously.

1.5.2.3 On the flight in question, the Co-pilot was seated on the starboard side in the cockpit. His role was that of handling pilot (P1,) having the responsibility to undertake handling activities including communication with ATC. As regards communication, the Co-pilot called ATC for the purpose of pushback and initial taxi clearance only.

1.5.2.4 The Co-pilot was familiar with FAOR. He had visited the airport 6 times in the past 2 years on air transportation flights. His previous experience was that taxiway Alfa was used when cleared for take-off from Runway 03L. It was also his first flight from FAOR with the Captain and Senior First Officer.

1.5.2.5 The Co-pilot also received Simulator Check on Line Orientated Evaluation (LOE) during October 2013.

1.5.3 Senior First Officer (Relief Pilot)

Brief summary of pertinent information concerning the SFO:

Nationality	British	Gender	Male	Age	36
Licence Number	GBR327949J.A	Licence Type		ATPL	
Licence valid	Yes	Type Endorsed		Yes	
Simulator Check	September 2013	Line Check		March 2013	
Ratings	Instrument				
Medical Expiry Date	Class 1 – 15 July 2014				
Restrictions	None				
Previous Accidents	None				

Flying Experience:

Total Hours	±10 800.00
Total Past 90 Days	180.44
Total on Type Past 90 Days	180.44
Total on Type	±7 800.00

1.5.3.1 According to British Airways, the Senior First Officer was employed by them in 2000. He initially flew the B747 before being transferred to the B747- 400.

1.5.3.2 The records show that the Senior First Officer was involved in one incident previously on the B737 aircraft. The incident was weather related.

1.5.3.3 The Senior First Officer was seated behind the Captain and Co-pilot in the cockpit. He was the relief/heavy pilot (P3). His role was to assist the Captain and Co-pilot when required.

1.5.3.4 The Senior First Officer was also familiar with FAOR. He had visited the airport 3 times in the past 2 years. The First Officer's last visit was during October 2013. He also noted that taxiway Alfa was used for Runway 03L.

1.5.3.5 The Senior First Officer also received a Simulator Check on Line Orientated Evaluation (LOE) during September 2013.

1.5.4 British Airways Crew Training:

1.5.4.1 According to British Airways, all 3 pilots had received B747 conversion course training on practice in taxiing with emphasis on ground handling. Johannesburg (FAOR) was also included in the course details, but not taxiing:

(i) The B747 simulator check training mentioned above which they received included Line Orientated Evaluation (LOE) based on Johannesburg (FAOR). The LOE started with the aircraft holding short of Runway 03L/21R, but did not include the taxi phase.

(ii) The B747 simulator check training also contained a briefing module designed to manage risks in terms of the 6 elements of their Flight Operations Safety Plan.

(iii) There was a briefing module also which highlighted causes of loss of situational awareness, distractions, confirmation bias, misunderstanding R/T and not resolving ambiguity.

(iv) The briefing also prompted a discussion on how to share mental picture, use charts, use correct R/T, avoid unnecessary tasks and stop if in doubt.

1.5.4.2 The three pilots also attended a Leading Flight Safety (LFS) course on non-technical factors that influence operational performance:

(i) LFS 1 - building situational awareness, and

(ii) LFS 2 - identifying threats.

1.5.4.3 The three pilots were evaluated successfully on the above training.

1.5.5 Cabin Crew Information:

1.5.5.1 The attestation information of each cabin crew member carried on board the B747 aircraft is listed below.

	Attestation Number	Issue Date	Validity	Age	Gender	Medical
1.	GBR-97-GB441-850546	26 December 1997	Yes	32	Female	Medically Fit
2.	GBR-05-GB441-116923	4 March 2005	Yes	21	Female	Medically Fit
3.	GBR-06-GB441-121668	3 March 2006	Yes	25	Female	Medically Fit
4.	GBR-93-GB441-714625	4 February 1993	Yes	43	Female	Medically Fit
5.	GBR-94-GB441-724269	18 May 1994	Yes	45	Female	Medically Fit
6.	GBR-94-GB441-738503	31 July 1994	Yes	44	Male	Medically Fit
7.	GBR-97-GB441-831101	9 June 1997	Yes	43	Female	Medically Fit
8.	GBR-98-GB441-859044	13 February 1998	Yes	39	Female	Medically Fit
9.	GBR-98-GB441-870086	29 May 1998	Yes	40	Male	Medically Fit
10.	GBR-98-GB441-876953	26 June 1998	Yes	44	Female	Medically Fit
11.	GBR-98-GB441-876974	12 June 1998	Yes	43	Male	Medically Fit
12.	GBR-90-GB441-612837	21 January 1990	Yes	50	Female	Medically Fit
13.	GBR-90-GB441-680172	23 February 1990	Yes	40	Male	Medically Fit
14.	GBR-90-GB441-698903	13 January 1990	Yes	48	Male	Medically Fit

1.5.5.2 As already mentioned, there were a total of 14 cabin crew members. The cabin crew's duties and responsibilities were related to the safety of passengers.

1.5.5.3 The evidence shows that at the time of the accident, all the cabin crew were seated at their assigned stations (manning the doors) on both decks of the aircraft. They were ready for the take-off.

1.5.5.4 The cabin crew were given relevant information of their individual performance and functions during the emergency situation. The investigation could not find any anomaly in the cabin crew's duties and performance, as these were unrelated to the accident.

1.5.6 Crew Duty and Rest Time Period:

1.5.6.1 The duty roster of the crew shows that they started duty at 19.45:00 UTC (21.45:00 local time). It was an hour before commencement of the scheduled flight time at 20.45:00 UTC (22.45:00 local time). The crew reported that they were well rested in the hotel prior to the flight. The crew was picked up from the hotel at ±18.50:00 UTC (20.50:00 local time) an hour before duty starting time. They were transported to FAOR by bus.

1.5.7 Air Traffic Controller (ATC):

Nationality	South African			Gender	Male			Age	32
Licence Number	ATS 0837			Licence Type (issue Date)				Air Traffic Controller 06 June 2005	
Medical Expiry Date	Class 3 31 July 2015			AD Issue Date				20 April 2007	
				Instructor Issue Date				25 November 2011	
Language Issue	15 August 2007			Language Prof				Level 6	
Validated Ratings									
Ratings	AD	Unit	FAOR	Position	AD	Last Prof 16 May 2013		Expiry Date 15 May 2014	
Instructor Ratings									
Ratings	AD	Unit	FAOR	Position	AD	Grade	2	Examiner	No

1.5.7.1 According to air traffic and navigational services (ATNS), the ATC duties and responsibility were reviewed against the air traffic service unit's (ATSU), station standing instructions (SSI), and it was determined that the ATC performance was unrelated to the accident.

1.5.7.2 The ATC was providing ground movement control services to the crew of BA034. According to ATNS the ATC duty time was as follows:

(i) The ATC was authorised to exercise the privileges of the ratings included on his licence at FAOR. He performed his duties in compliance with the applicable regulation. On the night in question, he was assigned to carry out duty at tower west sector.

(ii) On 22 December 2013, the ATC's sign-on time to start duty was at 19.00:00 UTC (21.00:00 local time). He was on the night shift, which was going to last up to sign off time at 05.45:00 UTC (07.45:00 local time) the next day on 23 December 2013. According to ATNS, the ATC's time since last sign-off was 48 hours and the number of days since he was last off was one day.

(iii) At the time of the accident 20.43:56 UTC (22.43:56 local time), the ATC had been on duty for 1 h 43 min 56 sec since sign-on time.

1.5.7.3 The investigation determined that the ATC complied with the applicable SSI requirements. He issued clear and unambiguous push-back, start and taxi clearances to BA034 during their communication. The clearances were read back correctly by the crew (Captain and Co-pilot).

1.5.7.4 The work load of the ATC was considered to be reasonable that night. The ATC was controlling a total of 10 aircraft from the time that the crew of the BA034 transmitted stating that they were about to push back and start up to the time of the accident:

(i) A total of 8 aircraft (i.e. BA034, Emirates766, SAA375, Martinair086, Comair620, ZS-ZWR, SAA236, SAA374, Mauritius847 and Comair626) were on the ground movement area and getting ready to depart from FAOR.

(ii) The remaining 2 aircraft were in the approach for landing.

(iii) The tower tape (communication between ATC and the aircraft) shows that only BA034 was given instruction to push back and start facing south using taxiway Bravo to Runway 03L at the time in question.

1.5.7.5 According to the ATC, his intention was to clear Emirates766 ahead of BA034. He looked to see where BA034 was before clearing Emirates766 on taxiway Alfa. He then gave the Emirates766 clearance from Echo #3 to push back and start facing east.

Note: BA034 received its taxi clearance first, before Emirates766.

1.5.7.6 According to the ATC, who stated that while both aircraft were taxiing to the holding positions (Cat 1 & Cat 2):

(i) He was looking to see where the BA034 was on taxiway Bravo.

(ii) When he realised could not see the aircraft on Bravo, he decided to look on the A-SMGCS (ground radar) to see if he could find the aircraft.

(iii) He noticed a “squawk” leading to apron Mike. This was the time he realised that BA034 had taxied past taxiway Bravo toward Mike.

(iv) He then immediately transmitted to British Airways aircraft giving instruction to hold their position, meaning stop. But it was too late because the crew responded almost immediately reporting that they had collided with the building.

(v) He immediately pressed the crash alarm to dispatch the emergency services to the location of the accident.

(vi) He compiled an accident report, MOR and filled in the occurrence register/log in the tower.

(vii) All relevant parties, including the local investigation authority having the jurisdiction, were notified of the accident.

(viii) He complied with all applicable procedures relevant to the event (i.e. SSI, Standard and Procedure Manual/LOAs/Directives etc).

Figure 14 Daytime picture of the conditions inside the tower and ATC's view over FAOR

1.5.8 Aerodrome Rescue and Fire fighting Services (ARFF):

1.5.8.1 According to ACSA, the sequence of events of the ARFF response to the accident was as follows.

(i) The ARFF first responders stated: "We completed RWY inspection at 22:40 (20.40 UTC) and vacated via taxiway Bravo. We then gave way to BA034 that was in front of us on Bravo. We proceeded to the Swiss Port fire station. At 22:43 (20.43 UTC) while in the vehicle we overheard the BA pilot said – I think I've hit something. The ATC activated the crash alarm during that time we proceeded to the aircraft from Swiss Port sub-station".

1.5.8.2 ARFF Duty Time:

1.5.8.2.1 The ARFF duty time was divided into 4 shifts with 24-hour coverage per day. On 22 December 2013, the ARFF's sign-on time was 16.00:00 UTC (18.00:00 local time). They were on a 2-day night shift duty schedule. On 23 December 2013 the sign-off time was 04.00:00 UTC (06.00:00 local time). The ARFF had been on duty for 4 hours 43 minutes.

1.5.8.2.2 The number of ARFFs responding during an aircraft accident will be as per the accident emergency management system (AEMS) procedure. Whenever additional ARFF personnel are required, it will be from the neighbouring fire brigades as per the signed manual of understanding (MOU). However, in this case only the ARFF of FAOR was utilised to respond to the emergency situation.

1.5.8.3 ARFF Runway and Taxiway Inspection:

1.5.8.3.1 According to the ACSA Runway and Taxiway Inspection Form FR8 001, the ARFF in FTL carried out a runway and taxiway inspection prior to the accident. The FTL performed the inspection from 20.00:00 UTC to 20.40:00 UTC (22.00:00 to 22.40:00 local time). The ARFF observed that the taxiway lights were "acceptable". After completing the inspection, FTL reported to Tower "03L clear and serviceable".

Note: No centreline lights or signage were reported as unserviceable on taxiway Bravo during the inspection.

1.5.8.4 After FTL performed the runway and taxiway inspection, they vacated the airside near the intersection of Bravo and Mike to the Swissport Station. Thereafter they received information that the aircraft was involved in the accident and went to the scene.

1.5.8.5 The duties and responsibilities of the ARFF relevant to the emergency situation were assessed with the aim to determine if they had complied with all procedural requirements. The evidence was that they had complied with the provisions of the applicable procedures.

1.5.8.6 However, it was found was that 2 taxiway centreline lights were unserviceable and that the illuminated information sign – taxiway location sign on the left hand side of Bravo – was also unserviceable. The A-SGMCS system recording showed that the ARFF vehicle drove past the area of the unserviceable centre line lights and information signage, but they did not report it to the relevant party.

1.6 Aircraft Information

1.6.1 Airframe:

Type	B747-400	
Serial Number	24054	
Manufacturer	Boeing Company	
Date of Manufacture	Unknown	
Total Airframe Hours (At time of Accident)	110 578.00 Hours	12 832.00 cycles
Last Phase Inspection(Date/Hours & Cycles)	1A Check 4 December 2013	110 336.00 hours 12 805.0 cycles
Hours & Cycles since Last Phase Inspection	242.00 Hours	27.00 cycles
C of A (Issue Date)	19 May 2008	
C of R (Issue Date) (Present owner)	13 June 1990 British Airways PLC	
Operating Categories	Part 121 – Air Transportations Operation	

1.6.2 Engine: No. #1 (Starboard R/H – Outboard)

Type	Rolls Royce RB211-524G219-11	
Serial No.	13222	
Date of Installed	30 November 2009	
Hours & Cycles since New (HSN & CSN)	110 336.00 Hours	12 805.00 cycles
Cycles since Hot Section Inspection (CSHSI)	18 514.00 Hours	2 019.00 cycles

1.6.3 Engine: No. #2 (Starboard R/H – Inboard)

Type	Rolls Royce RB211-524G219-11	
Serial No.	13420	
Date Installed	6 July 2013	
Hours & Cycles since New (HSN & CSN)	70 229.00 hours	10 663.00 cycles
Cycles since Hot Section Inspection (CSHSI)	1 614.00 hours	181.00 cycles

1.6.4 Engine: No. #3 (Port L/H – Outboard)

Type	Rolls Royce RB211-524G2T19-11	
Serial No.	13012	
Date Installed	26 September 2011	
Hours & Cycles since New (HSN & CSN)	85 983.00 hours	13 463.00 cycles
Cycles since Hot Section Inspection (CSHSI)	10 045.00 hours	1 108.00 cycles

1.6.5 Engine: No. #4 (Port L/H – Inboard)

Type	Rolls Royce RB211-524G219-11	
Serial No.	13700	
Date Installed	25 October 2011	
Hours & Cycles since New (HSN & CSN)	63 008.00 hours	7 625.00 cycles
Cycles since Hot Section Inspection (CSHSI)	9 266.00 hours	1 028.00 cycles

1.6.6 The aircraft documentation (e.g. certificate of registration, certificate of airworthiness, radio station licence, mass and balance etc.) which was carried on board the aircraft was checked during the investigation process and found to be valid.

1.6.7 The aircraft maintenance information was obtained from British Airways. The maintenance information received shows that the aircraft was properly maintained and the documentation was in order.

1.6.8 The aircraft was found to be airworthy. No defect, malfunction or any system failure was experienced prior to the impact. However, an issue was identified with the CVR running time. The CVR running time did not fully correspond to the running time of the tower tape download relevant to the determination of the sequence of events. This issue was only discovered when analysing both transcripts in the investigation.

1.6.9 Aircraft Weight:

1.6.9.1 According to the British Airways Load Sheet Report, on 22 December 2013 at 20.05:49 UTC (22.05:49 local time) there was a special load notification to the Captain. At 20.39:39 UTC (22.39:39 local time) the load sheet was checked and approved.

1.6.9.2 The load sheet report shows that the aircraft take-off weight was 321 880 kg and taxi weight 322 690 kg. Both the take-off and taxi weight were within limits.

1.6.10 Aircraft Fuel Status:

1.6.10.1 According to the aircraft load sheet, on 22 December 2013 at 19.03:00 UTC (21.03:00 local time) the aircraft was refuelled with Jet A-1 at FAOR.

1.6.10.2 According to the aircraft load sheet, the aircraft fuel status before refuelling totalled 18 125 litres (14500 kg). A total of 125 672 litres (100 537,6 kg) was then uplifted.

1.6.10.3 According to the aircraft load sheet, at 20.39:42 UTC (22.39:42 local time) after the refuelling had been completed, there was a total of 143 797 litres (115 037.6 kg) on board. The fuel was carried as follows:

(i) Centre Tank = 4653.75 litres (3 723 kg)

(ii) Tail Tank = zero

(iii) Wings = 139 096.25 litres (111 277 kg)

1.6.10.4 Fuel Spillage:

1.6.10.4.1 The evidence shows that the starboard wing of the aircraft sustained substantial damage in the accident. Due to the damage sustained there was a fuel spillage from the wing.

1.6.10.4.2 According to the British Airways, the actual quantity of fuel lost from the aircraft was estimated by their engineering department to be approximately 1250 litres (1000 kg).

1.6.10.4.3 They were of the opinion that the fuel delivery vehicle (bowser) actually offloaded a total of 3713 litres (2970.4 kg) more than had been loaded for the flight. But they believe that this was an administrative error, and that the location of the damage on the aircraft would have limited the actual fuel that could be lost from the tank to 5000 litres (4000 kg).

1.6.10.4.4 According to Engen fuel delivery receipt, it states that the defueling took place on 27 December 2013 at FAOR. A total of 18 060 litres (14448 kg) was defueled from the aircraft.

Note: Fuel calculation according to British Airways information:

- Is 143 797 Litres – 3713 Litres = 140 084 Litres (total quantity)
- Is 140 084 Litres – [± 1000 Litres – defueled] = 139 084 Litres (fuel remaining)

Note: Fuel calculation according to Engen Records:

- Is 18 125 Litres + 125 672 Litres = 143 797 Litres (total quantity)
- Is 143 797Litres – [18 060 Litres – defueled] = 125 733 Litres (fuel remaining)

❖ NB: Error difference between two [139 084 Litres – 125 733 Litres = 126 351 Litres – remaining fuel after defueling]

1.6.10 Transponder:

1.6.10.1 According to the CVR transcript information, the time of the before start checks, the status of the transponder was checked. The A-SMGSC (ground radar) shows that the transponder code reply was decoded "2656" and appeared on the ATC monitor/screen, thus positively identifying the aircraft while taxiing on Mike. No anomaly was reported as the system operation shows that it was serviceable.

1.6.11 Flight Data Recorders: There was an issue identified with the CVR's running time. The CVR's running time did not fully correspond to the running time of the tower tape download relevant to the determination of the sequence of events. The issues were identified when analysing both transcripts during the investigation.

Note: Also, the same issue was identified by British Airways between the conversation times of the flight deck area mike and Intercom. The times against entry from the start of the recording had a discrepancy between the two recordings of approximately 3 min 57 seconds.

1.6.12 The evidence was that no aircraft part, system, operational process or performance limitation had any bearing on the accident.

1.7 Meteorological Information

1.7.1 The following weather data at the time and place of the accident was obtained from the crew of the aircraft:

Wind direction	090˚	Wind speed	08 kts	Visibility	CAVOK
Temperature	22˚C	Cloud cover	Nil	Cloud base	Nil
Dew point	14˚C				

1.7.2 The following weather data at the time and place of the accident was from weather bulletin for JNB (FAOR) – Johannesburg at 20.17:00 UTC (22.17:00 local time):

Wind direction	080˚	Wind speed	04 kts	Visibility	CAVOK
Temperature	24˚C	Cloud cover	Nil	Cloud base	Nil
Dew point	13˚C				

1.7.3 The accident took place at night after moonrise. Due to the prevailing natural light conditions (darkness) at the time, the crew largely depended on the available artificial lighting (i.e. aircraft lights, taxiway lights, taxiway markings and signage), which are ground movement light sources to assist the taxiing aircraft.

1.7.4 Apart from the “strong apron background glare” identified by the Captain. The investigation determined that the weather conditions prevailing on the day and time of the accident did not play any significant role.

1.8 Aids to Navigation

1.8.1 Aircraft Navigation Equipment:

1.8.1.1 The aircraft’s navigational equipment was as per the approved minimum equipment list (MEL). The crew did not report any defect or malfunction experienced with the aircraft navigation equipment. The aircraft’s navigational equipment was in a serviceable condition.

1.8.1.2 The aircraft was also equipped with a transponder used for navigational purposes. According to the cockpit communication, the Captain switched on the transponder before taxiing from Alfa apron. The transponder was important as it enabled ATC to identify the signal “squawk” received from it on the A-SMGCS system (ground radar).

1.8.2 Aerodrome Navigation Equipment:

1.8.2.1 The aircraft was to be flown under instrument flight rules (IFR) from FAOR to EGLL. However, during the taxi for take-off to Runway 03L the aircraft was involved in the accident. The aerodrome navigation aids used in this regard were limited to the A-SMGCS (ground radar) system only. Though not fully commissioned, the evidence was that the A-SMGCS system was serviceable.

1.9 Communications

1.9.1 The aircraft's communications equipment and its effectiveness:

1.9.1.1 The aircraft had very high frequency (VHF) and high frequency (HF) transmitter radio equipment installed. The radio communication equipment fitted was in accordance with the approved Minimum Equipment List (MEL). No reports of any defect or malfunction experienced with the radio communication equipment were reported. The aircraft radio communication equipment was serviceable.

1.9.1.2 With the VHF radio equipment installed, the crew could communicate with ATC by means of microphone, with cabin crew by means of passenger assist (PA) and the passengers by means of the aircraft's intercom system.

1.9.1.3 The radio transmission and reception of the VHF communication between the aircraft and ATC was determined to be normal throughout the duration of the recording.

1.9.1.4 According to the CVR, all communication between the crew and ATC prior to the accident was transmitted on 121.9 MHz (ORT Ground Control). At the time of the accident the ATC gave instruction to the crew to communicate with ARFF. No anomaly identified with the communication was identified.

1.9.2 The Air Traffic and Navigation Services (ATNS) of South Africa is responsible for managing the operations of FAOR ATSU. The ATSU communication facilities available at FAOR as per AIP are as follows:

Service Designator	**Call Sign**	**Frequency (MHz)**	**Hours of Operation**
APP	JHB Radar West	123.7 MHz	Daily 0500-1700
APP	JHB Radar South	124.5 MHz	H24
APP	JHB Radar East	124.5 MHz	H24
APP	JHB Radar Director	121.4 MHz	As required
ACC	JHB Area North	126.7 MHz	H24
ACC	JHB Area South	128.3 MHz 126.7 MHz	Daily 0430-1800 Daily 1800-0430
FIS	JHB Info North	127.4 MHz 126.7 MHz	Daily 0430-1600 Daily 1600-0430
FIS	JHB Info South	119.5 MHz 126.7 MHz	Daily 0600-1400 Daily 1400-0600
FIC/ACC RSR	JHB Central Info Control	120.3 MHz	H24
TWR West	***Tower West***	***118.1 MHz***	***Daily 0400-1900***
TWR East	***Tower East***	***118.6 MHz***	***Mon-Fri 0500-1700*** ***Sat 0700-1600*** ***Sun 0700-1700***
SMC	***ORT Ground***	***121.9 MHz***	***H24***
Clearance Delivery	Clearance Delivery	121.7 MHz 121.9 MHz	Mon-Fri 0400-1830 Sat/Sun 0500-1830
Apron	ORT Apron	122.65 MHz	H24
Apron	ORT Apron	123.05 MHz	H24
ATIS		115.2 MHz	H24
ATIS		126.2 MHz	H24

Note: The crew was communicating with SMC on frequency VHF 121.9 MHz. There was no proof of any anomaly experienced with ATNS communication facilities at the FAOR. The ATSU communication facilities were all serviceable.

1.10 Aerodrome Information

Aerodrome Location	OR Tambo International Airport (FAOR)	
Aerodrome Co-ordinates	S260801,30 E0281432,34	
Aerodrome Elevation	5558 feet	
Runway Designations	03L/21R	03R/21L
Runway Dimensions	4418 x 60	3400 x 60
Runway Used	03L	
Runway Surface	ASPH	
Approach Facilities	VOR, NDB, ILS, Radar, PAPI and lighting.	

1.10.1 The aerodrome information included in the column above was obtained from the South African Aeronautical Information Publication (AIP).

1.10.2 The accident occurred on FAOR ground movement area and the location was on "taxilane" Mike. The accident occurred after the aircraft had continued straight on past the intersection of Bravo and Mike. The crew was interviewed during the investigation and they reported having experienced a confusion caused by ground movement aids (e.g. lighting, signs and markings etc.) when on Bravo and Mike. Based on the information of the crew, the investigation determined the following:

1.10.2.1 Ground movement aids on Bravo and Mike:

1.10.2.1.1 The investigation found that while the aircraft was taxiing on Bravo, the following available ground movement aids to manoeuvre for safe passage were observed:

(i) Taxiway Markings (Centre, Edge & Stop):

- Centreline markings; The ICAO Aerodrome Design and Operations Manual, Chapter 6 states that on a straight section of a taxiway the centreline markings shall be located along the taxiway centreline and on taxiway curves and the marking shall continue from the straight portion of the taxiway at a constant distance from the outside edge of the curve.

- In the same chapter it states that the design of the taxiway shall be such that the cockpit of any aeroplane for which it is intended remains over the taxiway centreline markings, the clearance distance between the outer main wheels of the aeroplane and edge of the taxiway shall be not less than that given by the following tabulation:

  - Code Letter A, clearance 1,5 m;
  - Code Letter B, clearance 2,25 m;
  - Code Letter C, clearance 3 m if the taxiway is intended to be used by aeroplanes with a wheelbase less than 18 m and 4,5 m if the taxiway is intended to be used by aeroplanes with a wheelbase equal to or greater than 18 m;
  - Code Letter D, E and F clearances 4,5 m.

- The investigation determined that both Bravo and Mike had a single continuous yellow centreline, which was found to comply with the centreline marking standard:

  - Further, Bravo is a Code Letter E taxiway, clearance distance (4.5 m) between the outer main wheels of the aeroplane and edge of the taxiway.
  - Mike can be described as being a Code Letter C “taxiway”, clearance distance (3 m) between the outer main wheels of the aeroplane and edge of the taxiway.
  - The aircraft outer main wheel clearance distance to the edge of taxiway should not be less than that specified.

  Note: The information is important because the design of Mike was not suitable for B747- 400 aircraft.

(ii) Taxiway Lights (Centre and Edge):

- According to ICAO, Aerodrome Design and Operations Manual, the “taxiway centre line lights shall be provided on an exit taxiway, taxiway, de-icing/anti-icing facility and apron intended for use in runway visual range conditions less than a value of 350 m in such a manner as to provide continuous guidance between the runway centre line and aircraft stands, except that these lights need not be provided where traffic density is light and taxiway edge lights and centre line markings provide adequate guidance”.

- According to ACSA complied with the above standard as follows:

  - There are centre lines lights installed from the apron all the way up to taxiway India.
  - The centre line lights are installed again from about 75 m prior to the split between Bravo and Mike and further for another 60 m.
  - At the areas where there are no centre line lights, the taxiway edge lights are fitted.

  Note: The information about the centre line lights is published in the AIP.

- The evidence of the above information from ACSA supports what the crew observed:

  - The taxiway edge lights illuminated in a continuous straight line, with no signage indicating the change of the taxiway Bravo and Mike.
  - Also, that some of the green centre line lights on taxiway Bravo were not illuminated in sequence.

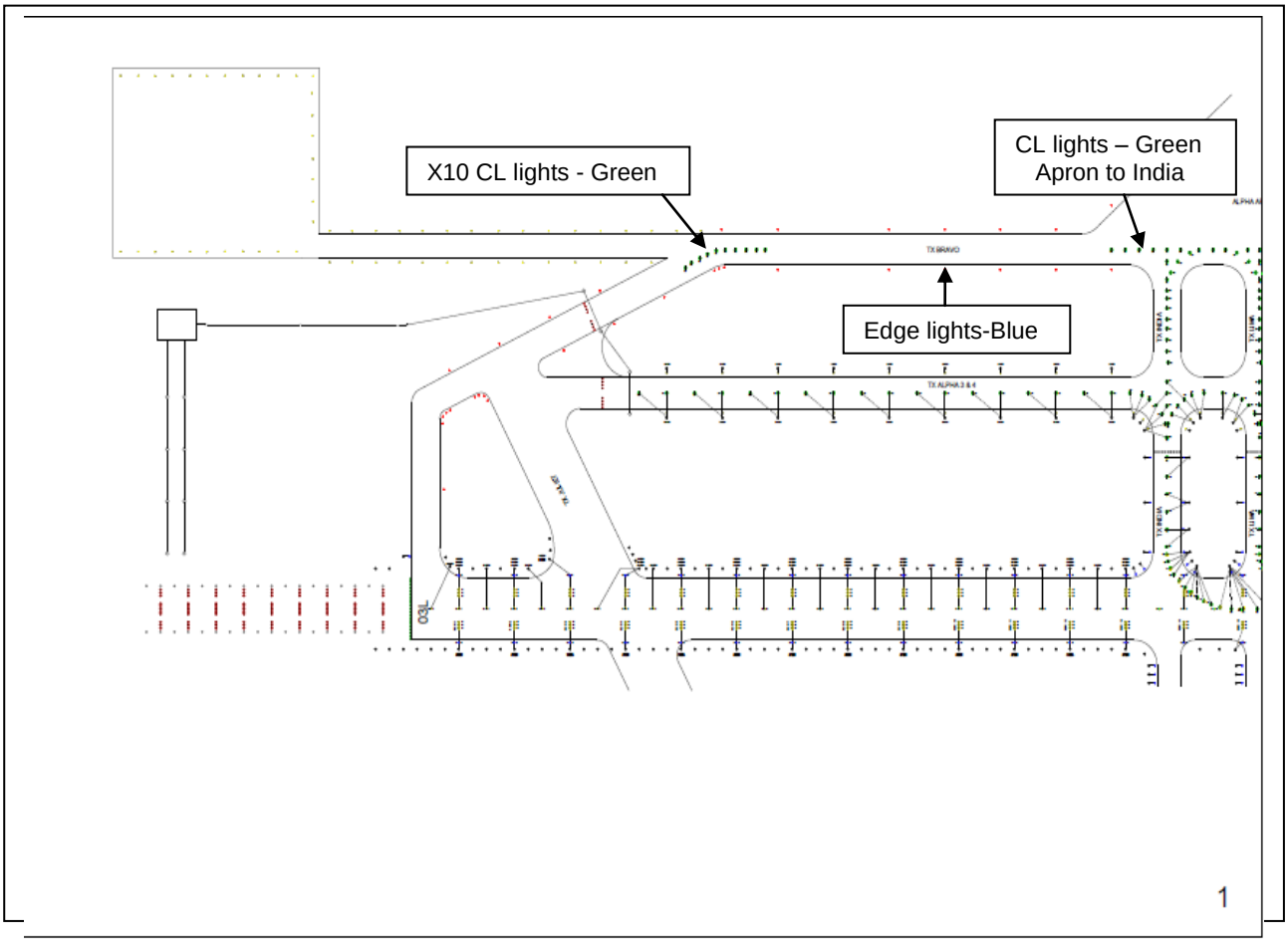


Figure 15 Centreline lights installed on Bravo in the area of the intersection/junction

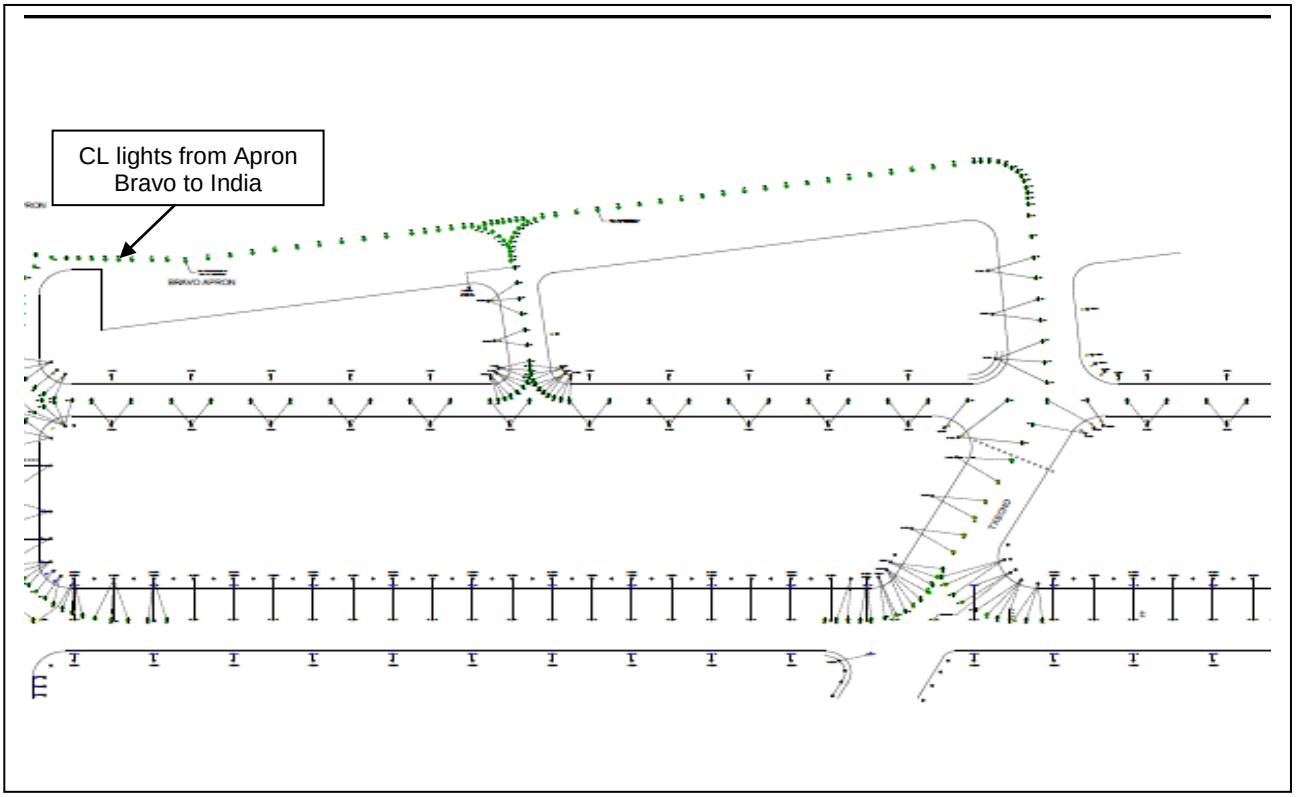


Figure 16 Centreline lights installed on taxiway Bravo from apron Bravo

- The investigation determined the taxiway centreline lighting situation as follows:

  - The investigation did find centreline lights installed on taxiway Bravo.
  - A total of 15 centreline lights were counted and switched on (serviceable). Below is a picture taken on the night in question.
  - The picture was taken from the intersection area of Bravo and Mike showing the 15 green centreline lights installed on Bravo.

Figure 17 Green centreline and blue edge lights illuminating on taxiway Bravo

- Below are short descriptions of the condition of centreline lights installed:

  - There were 3 centreline lights switched on when leaving the apron;
  - There were 4 centreline lights switched on at the intersections of Bravo, Lima and India;
  - There were 5 lights centreline lights switched on in the straight line prior to the split between Bravo and Mike;
  - There were 3 centreline lights switched on in the straight line leading to the Category 2 holding point.

Note: There were empty spaces between the identified lights. This created confusion, as the remaining lights did not give continuous guidance as required by the ICAO standard.

- It is important to note that 2 centreline lights installed on the curve/bend of Bravo toward the Category 2 holding point were found unserviceable (not illuminating). The picture below was taken on the night in question showing the location of the 2 unserviceable centreline lights.

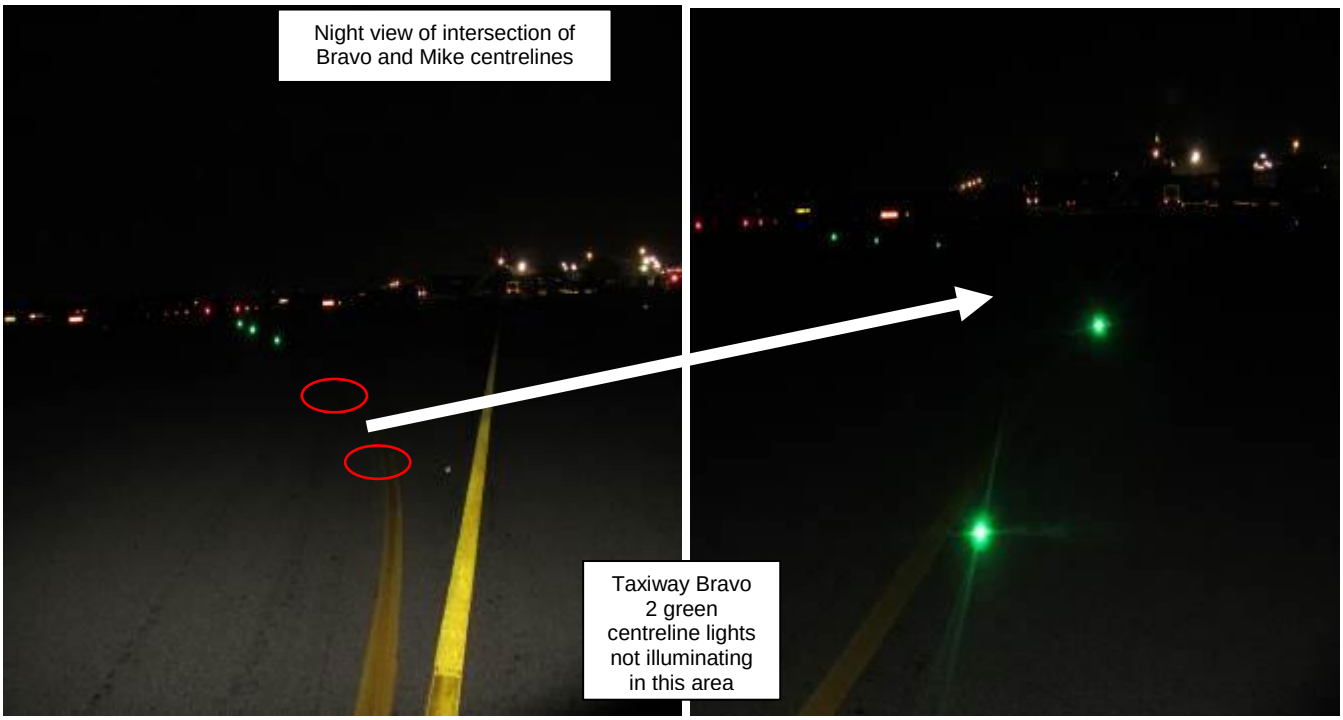


Figure 18 & 19 Two centreline lights not illuminating on curve to Cat 2 holding point

- During the investigation, the blue taxiway edge lights on Bravo and Mike were also inspected. The evidence was that a few blue edge lights were unserviceable on Mike (on both side of the taxilane).

(iii) Taxiway Signs:

- According to ICAO Aerodrome Design and Operations Manual, signs shall be provided to convey a mandatory instruction, information on a specific location or destination on a movement area or to provide other information to meet the requirements. The signs are intended to simplify surface movement, particularly in conditions of low visibility. There are mandatory and information signs. This was also the case on Bravo and Mike.

- The signs on Bravo consisted of an inscription in black on a yellow background.

- According to ACSA's Airfield Signs Diagram, a total of 11 signs (# 61 to #69 and #241) were installed on Bravo and Mike.

1. Sign #241 (information) located on intersection of taxiway India and Bravo on left and right side of Bravo.
2. Sign #69 (information) located 60 m from intersection of Bravo and Mike on left side of Bravo when facing south.
3. Signs # 66, #67 & #68 (mandatory and information) located at Category 2 holding point on left side.
4. Signs # 62, #62 & #63 (mandatory and information) located at Category 2 holding point on right side.
5. Sign # 65 (information) located on right side of Mike, facing south.

1.10.2.2 During the investigation it was found that the direction information sign #69 was OFF; it was not illuminated. The purpose of the sign was to give direction information of Bravo before the intersection as shown by the arrow.

1.10.3 Taxiway Electrical Maintenance Record:

1.10.3.1 ACSA was requested to submit electrical maintenance documents relevant to Bravo and Mike with the view to check if at any given time they had been aware of the lighting and signs being unserviceable and what corrective actions were taken to rectify the situation, if any.

1.10.3.2 ACSA then submitted an airfield electrical maintenance job package which was for the maintenance activities carried out on the ground movement area (e.g. runways, taxiways and aprons etc.). Specific to Bravo and Mike, the electrical maintenance documents showed the following:

(i) Taxiway Bravo:

- According to the document "Airfield Maintenance 4 – Taxiways" inspections were carried out on all the taxiways.
- On 22 December 2013 (the time was not stated) an airfield maintenance inspection was carried out on Bravo. After the inspection no anomalies were reported.
- On 23 December 2013 (time not identified) another airfield maintenance inspection on Bravo was done. After the inspection an entry was made stating "2 x U/S, 23 December 2013, Secondary Fault, and ABC fixed it on 24th".

(ii) Taxilane Mike:

- The taxiway airfield maintenance check sheet does not have an inspection item "taxilane Mike" on it. Therefore the investigation could not determine whether or not any maintenance inspections were carried out on taxilane Mike to the same extent as Bravo and other taxiways listed on the check sheet.

- However, ACSA's explanation was that the inspection sheet uses the term "Mike Apron (Bravo circuit)" which refers to "Taxilane Mike".

(iii) Taxiway Signs:

- On the airfield maintenance checklist (signs 03L threshold to Echo) certified on 17 December 2013, all signs on Bravo and Mike were ticked off, which probably means that all the signs were serviceable at that time.

- There was no other information of sign maintenance being performed from 17 December 2013 to 22 December 2013. This implies that the unserviceable sign may have become defective during this time. However, the ARFF personnel performed runway and taxiway inspection daily. The ARFF personnel did not report that the affected taxiway sign was unserviceable, during the last inspection prior to the accident.

1.10.4 Aerodrome Aeronautical Information:

1.10.4.1 There was an investigation into the published aeronautical information relevant to the intersection of Bravo and Mike. Verification of the status of the aeronautical information published was important because the crew stated that the aeronautical information in their possession was inadequate and did not provide them with the necessary information about Bravo turning to the left and not continuing straight ahead.

1.10.4.2 The information below is evidence of aeronautical information revisions/updates relevant to the intersection of Bravo and Mike that was published in the South African AIP between January 2013 to December 2013.

(i) AIP 1/13 (EFF 15 JAN 13) stated:

- "Pilots to exercise caution when taxiing on taxiway Bravo as the Mike apron extends immediately south of taxiway Bravo where the taxiway bends at the CAT 2 holding point", and:

- "Pilots to exercise caution when taxiing on the full length of taxiway Bravo as confusion may exist at the intersection of taxiway Bravo and the Mike apron"

AIP 3/13 (EFF 15 JUL 13) stated:

- "Pilots to exercise caution when taxiing on taxiway Bravo as the Mike apron extends immediately south of taxiway Bravo where the taxiway bends at the CAT 2 holding point"

(ii) AIP 4/13 (EFF 15 OCT 13) stated:

- "Pilots to exercise caution when taxiing on taxiway Bravo as the Mike apron extends immediately south of taxiway Bravo where the taxiway bends at the CAT 2 holding point"

(iii) AIP, Chart AD-02 (EFF 12 DEC 13) states:

- "Aircraft to exercise caution when taxiing on TWY B south bound to THR RWY 03L due to Apron taxilane M extending from TWY B in a southerly direction".

1.10.4.3 Given the above information, the crew was expected to be in possession of the latest revision/update of aeronautical information which complies with that published in the South African AIP. The evidence found was that the crew carried the Operator's Aerodrome Booklet which had the Navtech Aerodrome Overview Chart with description on it: "South Africa – FAOR/JNB 10-2, dated 16 October 2013". The crew indicated that they used the identified chart to plan the taxi route during the briefing. A copy of the Navtech chart is shown below:

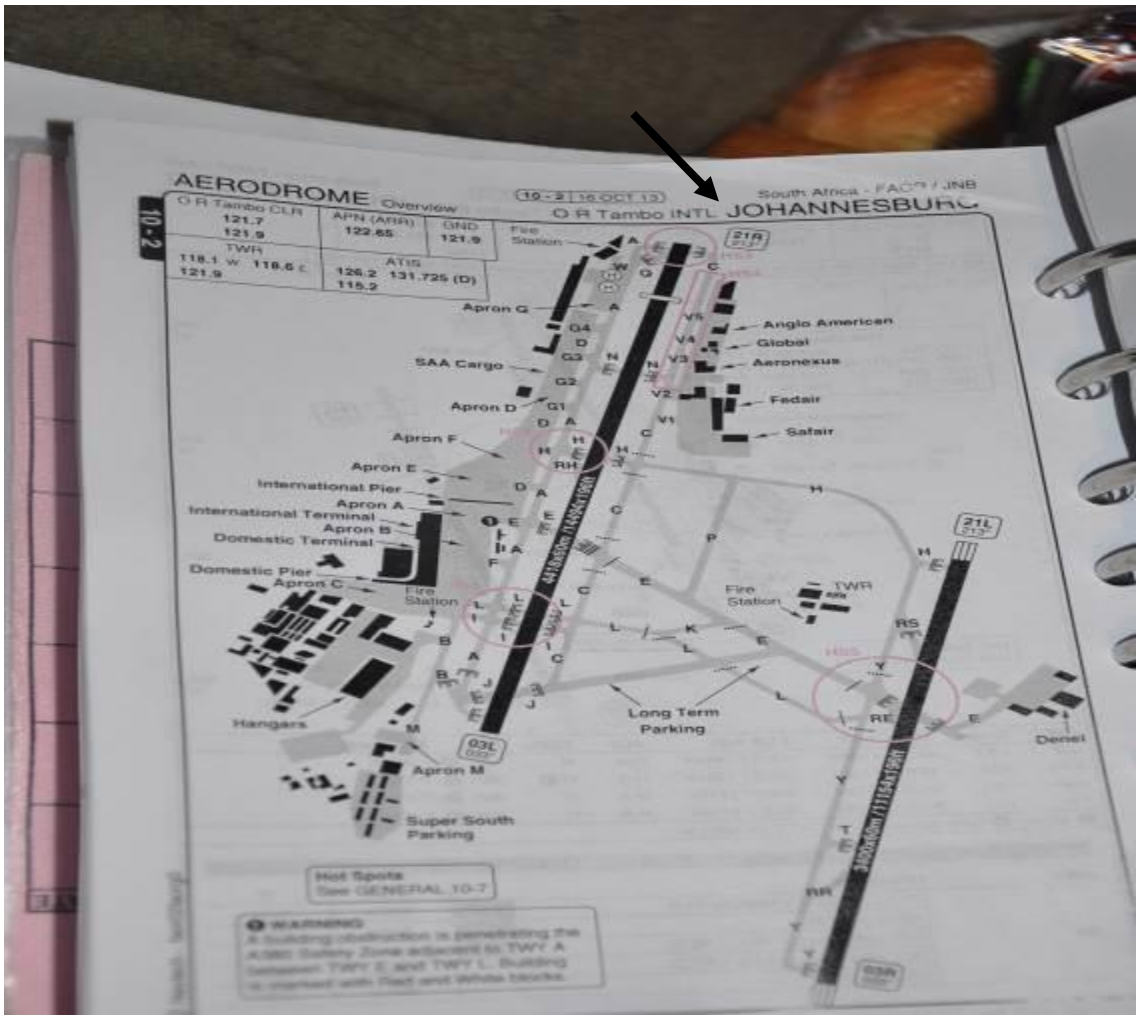


Figure 20 Navtech Aerodrome Overview Chart 10-2

1.10.4.4 The Navtech Chart 10-2 information was reviewed against that published in the South African AIP (e.g. Chart AD-02 eff. 12 DEC 13). The evidence was that the wording of the Navtech Chart had not been revised/updated to the latest revision of the South African AIP.

1.10.4.5 The ICAO Annexures 4 and 15, International Standards and Recommended Practices for aeronautical charts and aeronautical information service (ASI), state that:

(i) Contracting States shall when so specified, ensure the availability of charts:

- Meaning that every contracting State shall take all reasonably measures to ensure that the aeronautical information it provides and the aeronautical charts made available are adequate and accurate and that they are maintained up to date by an adequate revision service.

- The contracting State's aeronautical information service (AIS) shall ensure that aeronautical data and aeronautical information necessary for the safety, regularity or efficiency of air navigation are made available in a form suitable for the operational requirements of the ATM community including those involved in flight operations, flight crews, flight planning, flight simulators and air traffic services units.

1.10.4.6 The investigation determined that South Africa had complied with the ICAO requirements in this regard:

- The State aviation regulating authority (SACAA) was requested to clarify the aeronautical information revision relevant to the Bravo and Mike intersection in relation to the British Airways/Navtech Aerodrome Overview Chart (South Africa – FAOR/JNB 10-2, dated 16 October 2013).

- In response, the SACAA submitted an aerodrome ground movement chart (AD-02 eff. date 12 Dec 2013) of Johannesburg/OR Tambo International Airport (FAOR), which was the latest version published.

- The publication of AD-02 meant that they complied with applicable civil aviation regulations (CAR), aeronautical information circular (AIC) and relevant procedures requirements in that they made a submission, validation, approval and publication of the aeronautical information as required by the originator (ACSA).

- See below copy of chart (AD-02, eff. date 12 Dec 2013):

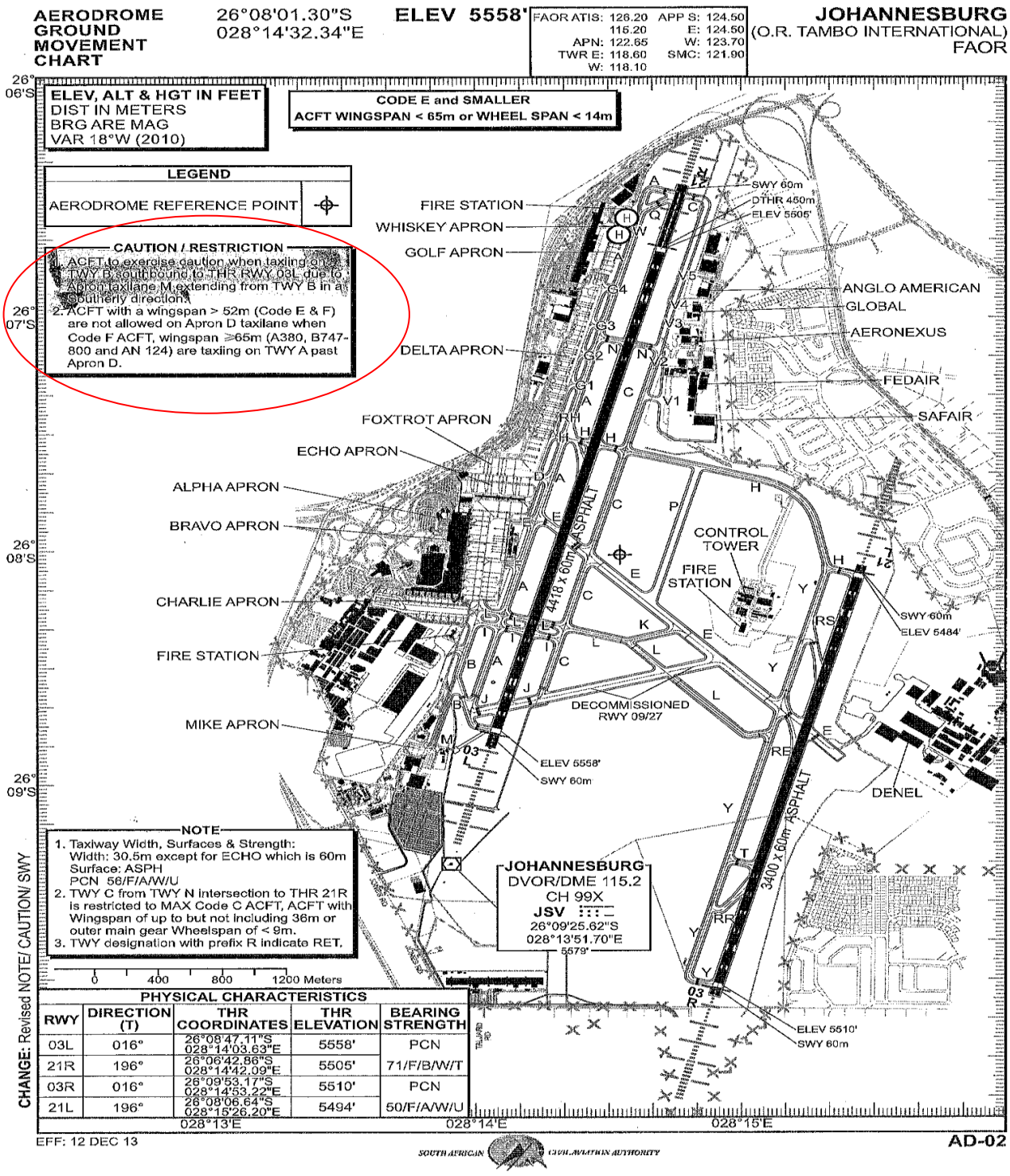


Figure 21 Aerodrome ground movement chart AD-02

1.10.5 Based on the above information, British Airways was requested to clarify the issues related to the aeronautical information revision/amendment status and focusing on the anomaly relevant to intersection of Bravo and Mike. British Airways response was that the aerodrome overview chart (i.e. FAOR/JHB dated 16 Oct 2013) carried on board the aircraft had been supplied to them by the service provider Navtech.

Note: British Airways and Navtech entered into a Service Level Agreement (SLA) involving the aeronautical information.

1.10.6 British Airways was asked to clarify why their quality system had not identified the anomaly of the revision/update and rectified it. They responded to explain that their quality oversight programme was considered acceptable by the UKCAA. They expected that the AIP changes will be incorporated by Navtech in accordance with the safety assurance process agreed between them in the SLA. The quality oversight programme would thus not be expected to identify any anomalies in this regard.

Note: The AIP changes were entrusted to Navtech.

1.10.7 The Service Provider - Navtech response was that they complied with the AIRAC system requirements. As regards the changes in December, these were not deemed significant enough to revise/update the charts. They put this statement in context with the explanation that based upon the information received of AD-02 eff. 12 DEC 13, they reviewed it against their existing Overview Chart 10-6 and determined that no change was required because the wording of the caution note accurately reflected the situation involving the intersection of Bravo and Mike. Navtech also stated that there was no requirement that the South African AIP wording be reproduced verbatim.

1.10.7.1 Navtech was not certain what the anomaly which the AIID was referring. Apparently they reviewed all charts when the South African AIP information was issued and they revised/updated accordingly.

1.10.7.2 The South African AIP issued eff. 12 DEC 13 had a caution note that stated “Aircraft to exercise caution when taxiing on TWY B south bound to THR RWY 03L due to Apron taxilane M extending from TWY B in a southerly direction”.

1.10.7.3 When Navtech reviewed its own existing caution note “Exercise caution when taxiing on taxiway Bravo due to confusion with Apron Mike”, no language change was made to the caution note because the words used already provided the crew with accurate information. Navtech argued that the various tweaks to the language in the South African AIP did not warrant tweaks to their language, as the substance of the caution note was essentially unchanged.

1.10.7.4 Navtech is of the opinion that their charts continue to accurately reflect the caution note provided by South Africa. Thus, it was not necessary to make a change when the note continued to provide accurate information to the crew.

1.10.7.5 Navtech also pointed out that the aerodrome overview chart 10-2 which the crew used during the briefing did show Bravo turning to the left and not continuing straight ahead.

1.10.8 Referring to the above information, Navtech developed its own standard format to present their aeronautical information. The standard format was designed and communicated in conjunction with the customers, including British Airways. Consequently, the charts are not exact duplications of the various states’ AIPs, but do accurately represent the information as per their specification.

1.10.9 The British Airways crews are familiar with the specification (e.g. the charts), which includes the following:

(i) Chart 10 – 2 for overview providing the crew with aerodrome layout of FAOR;
(ii) Chart 10 – 6 for taxi details and cautions;
(iii) Chart 10 – 7 for hotspots.

1.10.10 According to British Airways, the above documents (e.g. charts 10-2, 10-6 and 10-7) were included in the aerodrome booklet carried on board the aircraft. As the crew were familiar with Navtech documents, they should have known where to find the relevant caution notes concerning FAOR. The crew's response was that they did not brief from the text pages (e.g. chart 10-6) in the aerodrome booklet. This means that they were unaware of the caution note regarding Bravo and Mike. The crew would have seen that the text of the caution note given was sufficient to alert them to the need to show increased attention to their routing at the intersection between Bravo and Mike.

1.10.11 Taxiways

1.10.11.1 In ICAO, Doc 9157 - Aerodrome Design Manual (Table 1-1), the design criteria for a taxiway are: "Taxiway routes should be as simple as possible in order to avoid pilot confusion and the need for complicated instructions. A properly designed system should be capable of maintaining a smooth, continuous flow of aircraft ground traffic at the maximum practical speed with a minimum of acceleration or deceleration. This requirement ensures that the taxiway system will operate at the highest levels of both safety and efficiency". These taxiway planning principles and functional requirements were used as a basis to evaluate the design characteristics of both Bravo and Mike relevant to the accident.

(i) Issues relevant to the design of taxiway Bravo:

- A document obtained from SACAA, FAOR Pavement Infrastructure Layout, shows that previously taxiway Bravo consisted of two sections, namely Bravo 1 and Bravo 2.

- Bravo 1 (Code Letter E), heads south from Bravo apron. Its dimensions are: length 400 metres, width 30 metres up to the intersection with Mike. The surface 1 is ASPH with a strength of PCN 56/F/A/W/U, LCN 74.

- Bravo 2 (Code Letter E), bends to the left in a south-easterly direction. Its dimensions are: length 400 metres and width 30 metres up to the Category 2 holding point. Its surface 2 is ASPH with strength of PCN 56/F/A/W/U, LCN 74.

- In relation to the above information of Bravo 1 and 2, according to Doc 9157 (Table 1-1), the physical characteristics of a taxiway (Code Letter E) are:

  - Minimum width of pavement 23 m,
  - Clearance from outer main wheel to taxiway edge 4,5 m,
  - Separation distance between taxiway centreline and object 47,5 m.

- Also, according to table 1-2, which is the aerodrome reference code (number and letter), Bravo 1 and 2 correspond to:

  - Wingspan of 52.0 m up to but not including 65.0 m,
  - Outer main gear wheels span 9.0 m up to but not including 14.0 metres and,
  - Aeroplane reference field length 1800 metres and over.

- Doc 9157 (Table 3-1), Aircraft Dimensions, shows that the aircraft type B747- 400 (Code 4E) has:

  - Length of 70.67 m,
  - Wingspan of 64.90 m,
  - Outer main gear wheels pan of 14.0 m.

- When comparing the physical characteristics of Bravo 1 and 2 with those of the B747- 400. The conclusion is that Bravo 1 and 2 conformed to the critical physical aerodrome design characteristics as required by ICAO Annexure 4. No anomaly was identified in the design of taxiway Bravo.

(ii) Issues relating to the design of taxilane Mike:

- The same document - FAOR Pavement Infrastructure Layout – shows that “taxilane” Mike was constructed during 2007.

- The document shows that the apron Mike extended into taxiway Bravo. This is corroborated by the relevant AIP publication.

- Probably at some point during 2007, ACSA classified the ASPH surface section extending from apron Mike to taxiway Bravo into what is now known as “taxilane” Mike.

- It is from this time that “taxilane” Mike (Code Letter C) heads south from the intersection with taxiway Bravo. Its dimensions are:

  - Length 200 metres,
  - Width 18 metres

- Aerodrome Design Manual (Doc 9157 Part 2) states the following about the physical characteristics of a taxilane:

  - Taxiways located on aprons are divided into two types, one is an “apron taxiway”, located on an apron and intended either to provide a through taxi route across the apron or to gain access to an “aircraft stand taxilane”, which is defined as a portion of an apron designed as a taxiway and intended to provide access to aircraft stands only.

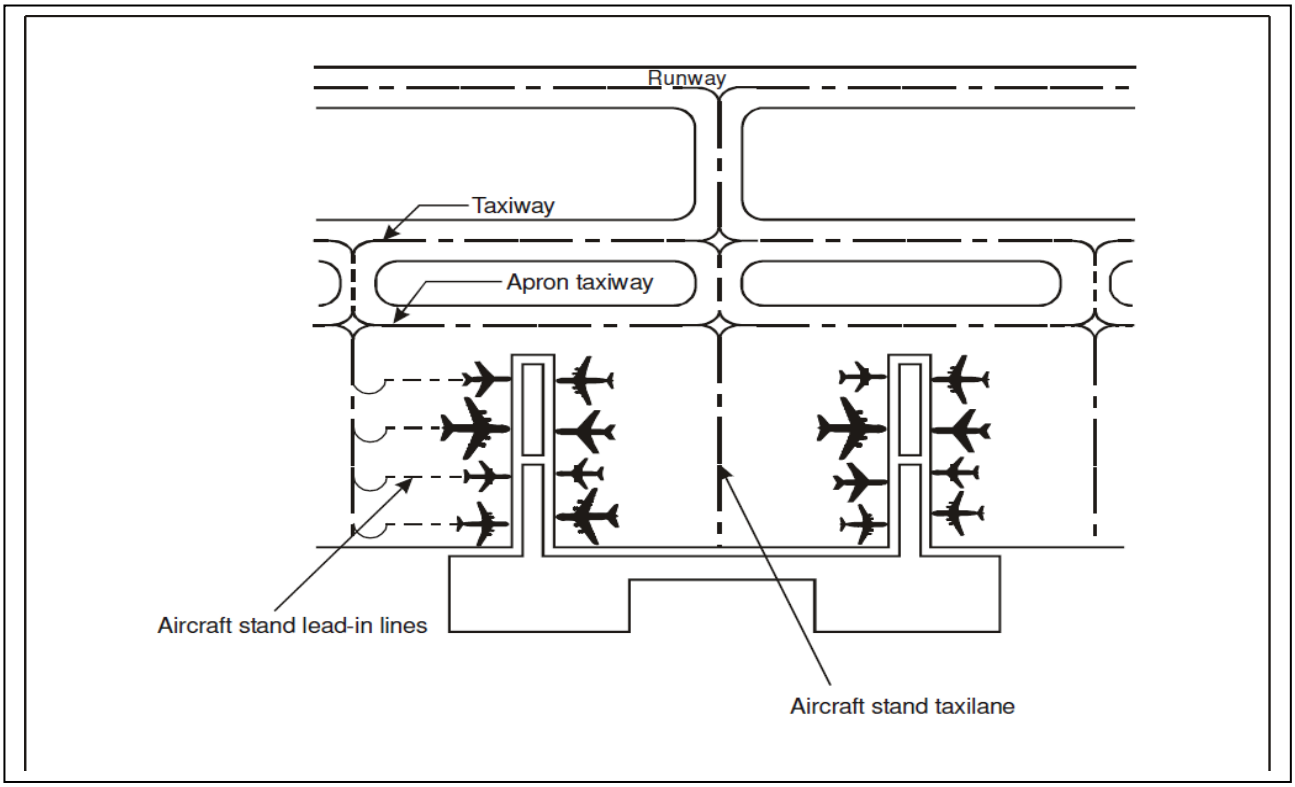


Figure 22 shows taxiways on aprons – aircraft stand taxilane physical characteristic

- The airport operator (ACSA) stated that the use of the terms “aircraft stand taxilane” and “taxilane” was a matter of semantics. Both terms are used interchangeably, which is the case at FAOR.

- According to Doc 9157, the physical requirements for apron taxiways regarding strip width, separation distances etc. are the same as for any other type of taxiway. The requirements for aircraft stand taxilane are also the same, except that the transverse slope is governed by the apron slope, an aircraft stand taxilane need not be included in a taxiway strip and separation distances to object are less stringent.

- Doc 9157 (Table 1-1) states that for a Code C taxiway the minimum pavement width is 18.0 m, clearance distance of outer main wheel to taxiway edge is 3.0 m – 4.5 m and separation from centreline to object is 26.0 m. The Code C taxiway would correspond to a wingspan of 24 metres up to but not including 36 metres, the outer main gear wheels span 6 metres up to but not including 9 metres and the aeroplane reference field length of 1200 metres up to but not including 1800 metres.

- With specific reference to the separation issue related to the BidAir Building, the requirements for taxiway minimum separation distances for a Code C taxiway other than an aircraft stand taxilane, centreline to object and aircraft stand taxilane centre line to object are tabulated below:

Code Letter	Instrument Runway Code Number 2	Taxiway, other than aircraft stand taxilane, centreline to object	Aircraft stand taxilane centreline to object
A	82,5	16,25 m	12 m
B	87	21,5 m	16,5 m
C		**26 m**	**24,5 m**
D		40,5 m	36 m
E		47,5 m	42,5 m
F		57,5 m	50,5 m

- A comparison of the dimensions of a type B747-400 aircraft with the physical characteristics of a taxiway Code C or taxilane shows that in terms of the wingspan, clearance distance of outer main wheel to taxiway edge and separation from centreline to object the aircraft was too large to taxi on Mike.

- It is also clear that taxilane Mike does not conform to the physical design characteristics required by ICAO, Annex 4 and Doc 9157.

Note: The problem with "taxilane Mike" is that it does not conform to the defined criterion of being a portion of an apron providing access to aircraft stands only. It has the design characteristics of a taxiway.

1.10.12 According to the aerodrome design manual, the provision of taxiing guidance, i.e. markings, lighting and signs which are adequately conspicuous in all operational conditions, is considered paramount for achieving a high degree of taxiing accuracy. This is substantiated by the fact that the pilot of a large aeroplane, being unable to see the wing tips, will have to rely primarily on taxiing guidance, the accurate tracking of which will guarantee proper wing tip clearances.

1.10.13 Rescue and Fire Fighting Infrastructure

1.10.13.1 The ARFF infrastructure at FAOR includes a total of 3 fire stations:

(i) The fire substation located toward the far northern side of the aerodrome near Runway 21R/03L. The ARFF was operating 1 fire fighting truck from this substation.

(ii) The main fire station, located toward the eastern side of the aerodrome in close proximity to the tower. This ARFF was operating a total of 2 fire fighting trucks.

(iii) The third fire station, located toward the southern side of the aerodrome near Swissport. The ARFF vehicle (FTL) was at the third fire station when the accident was reported. There was also another fire truck operating from this station.

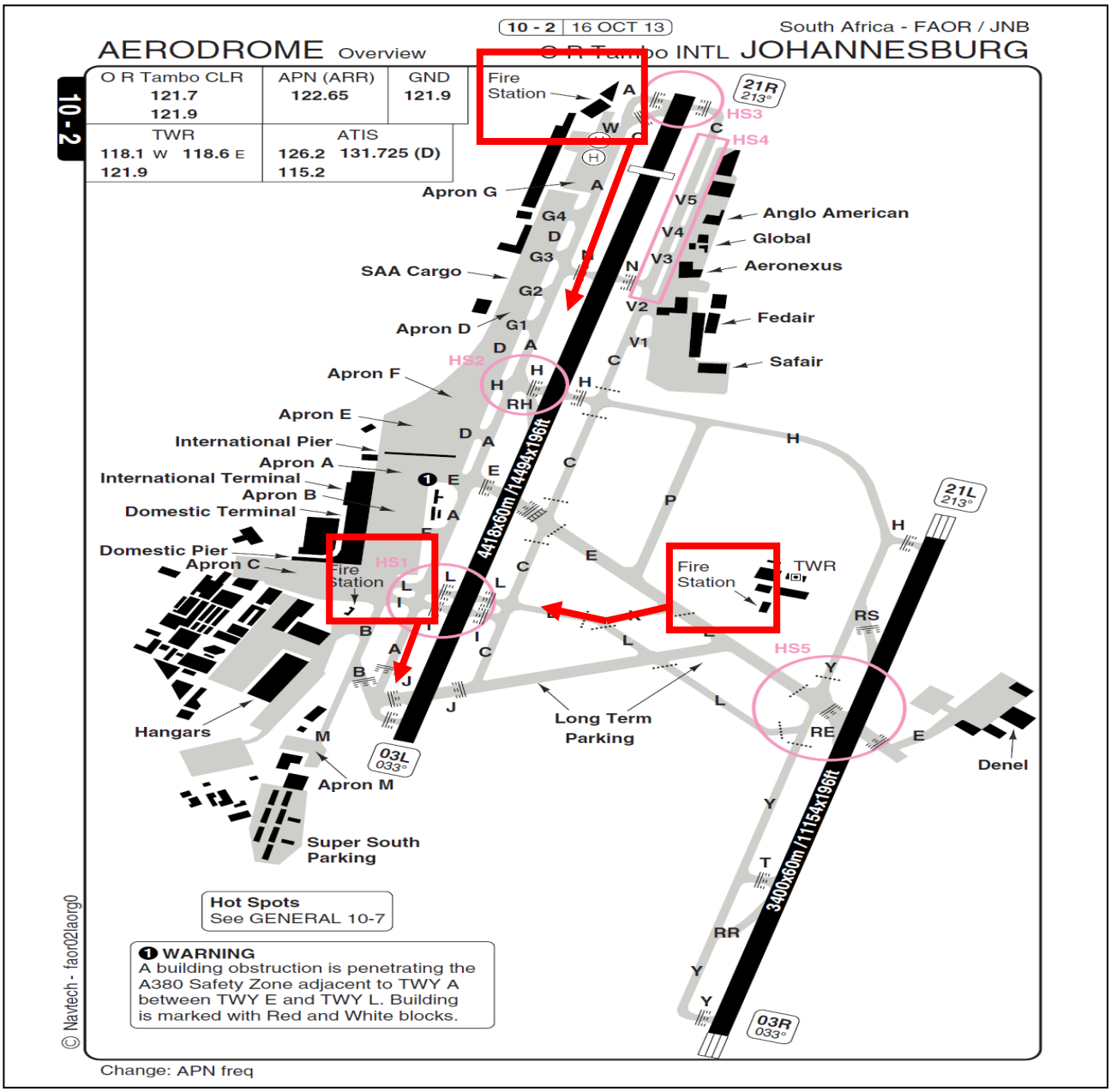


Figure 23 ARFF Fire Stations on FAOR

Note: After the ATC had activated the crash alarm, the ARFF dispatched 2 fire fighting trucks to the scene to render assistance to BA034. The response time of the ARFF was reviewed and determined to be in compliance with the applicable regulatory requirements. No anomaly was identified with the ARFF response time or performance on the day.

(iv) The fire substations were operating normally on the night and no anomalies were reported.

1.11 Flight Recorders

1.11.1 The flight recorders installed on the aircraft were the following:

(i) The cockpit voice recorder (CVR) installed in the aircraft was a Honeywell type, Part No 980-6022-001 and Serial No 1056.

- This CVR was removed from the aircraft by South African Airways (SAA) on behalf of AIID in order to download the communication recording.

- After the CVR had been downloaded, a transcript of the communication was made. A copy of the CVR transcript with the communication indicating the sequence of events is attached as an appendix.

(ii) The flight data recorder (FDR) installed in the aircraft was a Honeywell type, Part No 980-4700-042, Serial No 6762.

- This FDR was removed from the aircraft by South African Airways (SAA) and the pertinent data was downloaded as follows:

Data	Description
1. TIME	Co-ordinated Universal Time – UTC, denoted by (Z)
2. DATE	Calendar (day, month and year)
3. PALT	Pressure altitude
4. CAS	Calculated airspeed (kts)
5. GSPD	Ground speed (kts)
6. HEAD	Aircraft nose facing direction (degrees)
7. PLONG	Longitude (degrees, minutes, seconds – East/West)
8. PLAT	Latitude (degrees, minutes, seconds – North/South)
9. ACLONG	Aircraft longitude (degrees, minutes, seconds – East/West)
10. ACLAT	Aircraft latitude (degrees, minutes, seconds – North/South)

Note: Unfortunately, the FDR does not record any information of wheel braking, which would have helped determine the crew's (pilot's) actions in terms of applying brakes to bring the aircraft to a stop.

(iii) The recorders were removed from the aircraft on 23 January 2014 in good and completely serviceable condition after a request by the AIID.

1.11.2 FDR Data Graph:

1.11.2.1 The graphs below present a summary of the FDR read-out information as discussed in the paragraphs above.

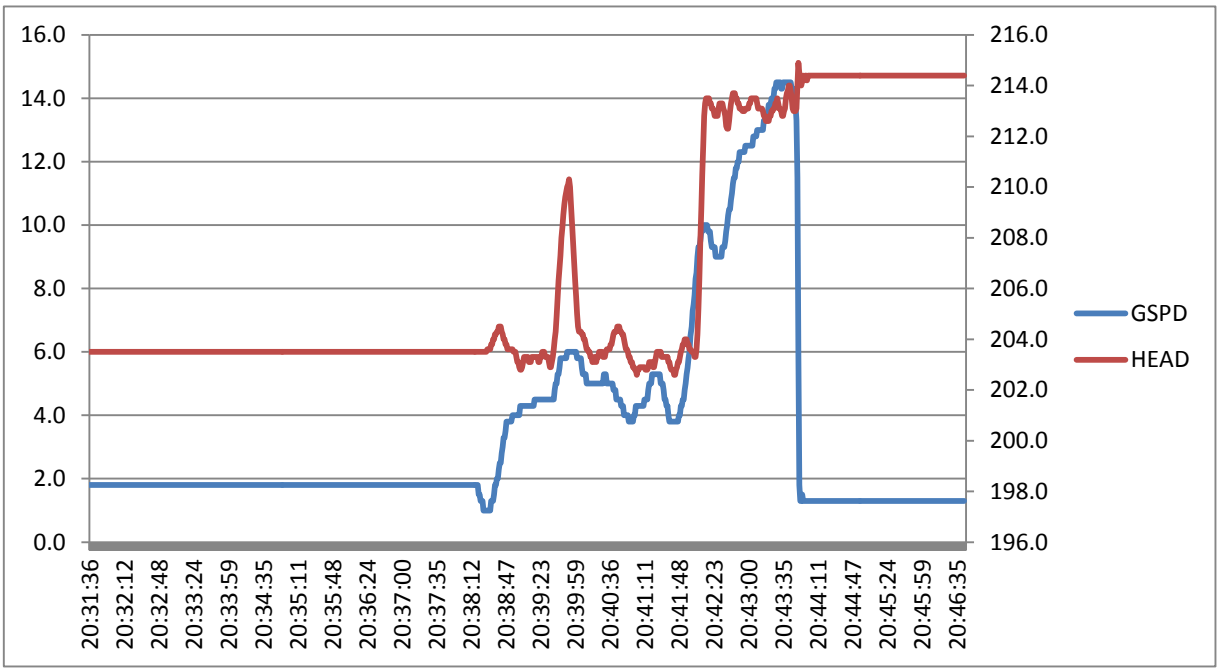


Figure 24 FDR read-out graph of BA034

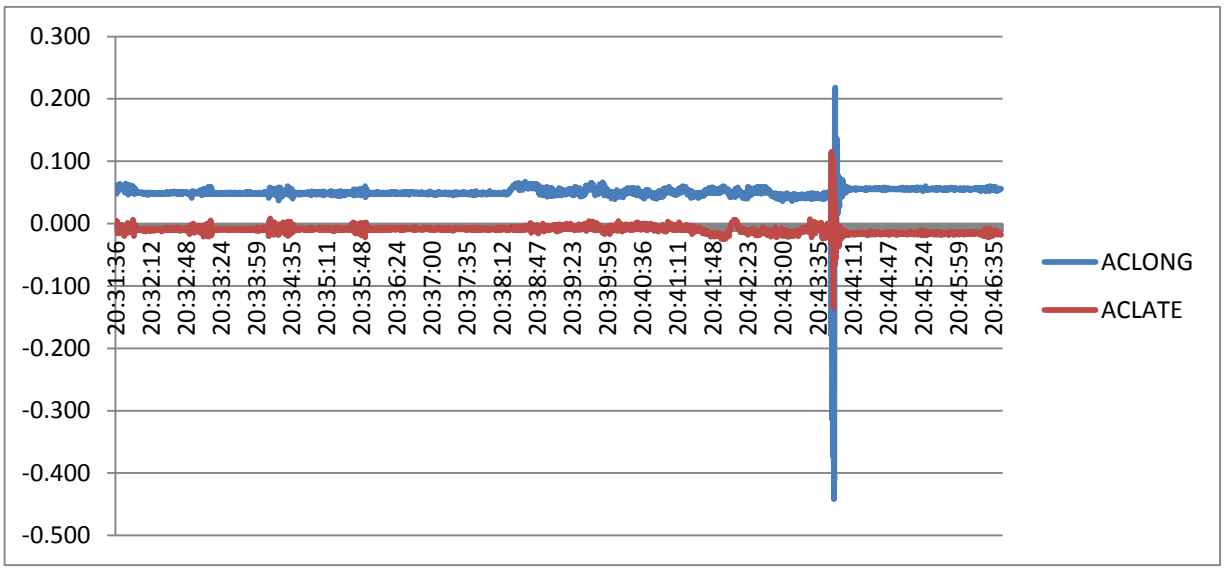


Figure 25 FDR read-out graph of BA034

- A copy of the FDR data detailing the parameters of items identified on the graphs is attached as an appendix.

1.11.3 ATSU recording facilities:

(i) All communications between ATSU and aircraft were recorded. For the purpose of the investigation, the ATSU recordings (tape) were immediately impounded for downloading. After downloading the communication, the information was transcribed by the local investigation authority having the jurisdiction.

(ii) A copy of the ATSU communication transcript is attached.

1.11.4 Surface Movement Guidance and Control System (A-SMGCS)

1.11.4.1 The recording of the A-SMGCS installed in the tower, which is surface movement radar (SMR), was downloaded for the purposes of the investigation. The downloaded recording was then handed to the relevant investigation authority as evidence to assist in determining the cause of the accident.

1.11.4.2 The SMR recordings (images) with corresponding FDR read-out data which illustrates the significant taxi sequence pertinent to the accident are presented below:

1. TIME AIRCRAFT ON ALFA APRON - BAY#6 – START UP & PUSH-BACK SEQUENCE FACING SOUTH									
Time	Date	PALT	CAS	GSPD	HEAD	PLONG	PLAT	ACLONG	ACLAT
20:31:21	131222	5249	0	1.8	203.5	28.23630	-26.13740	0.059	-0.007

Note: At this point the situation is uneventful and there was no report of any anomaly by the crew.

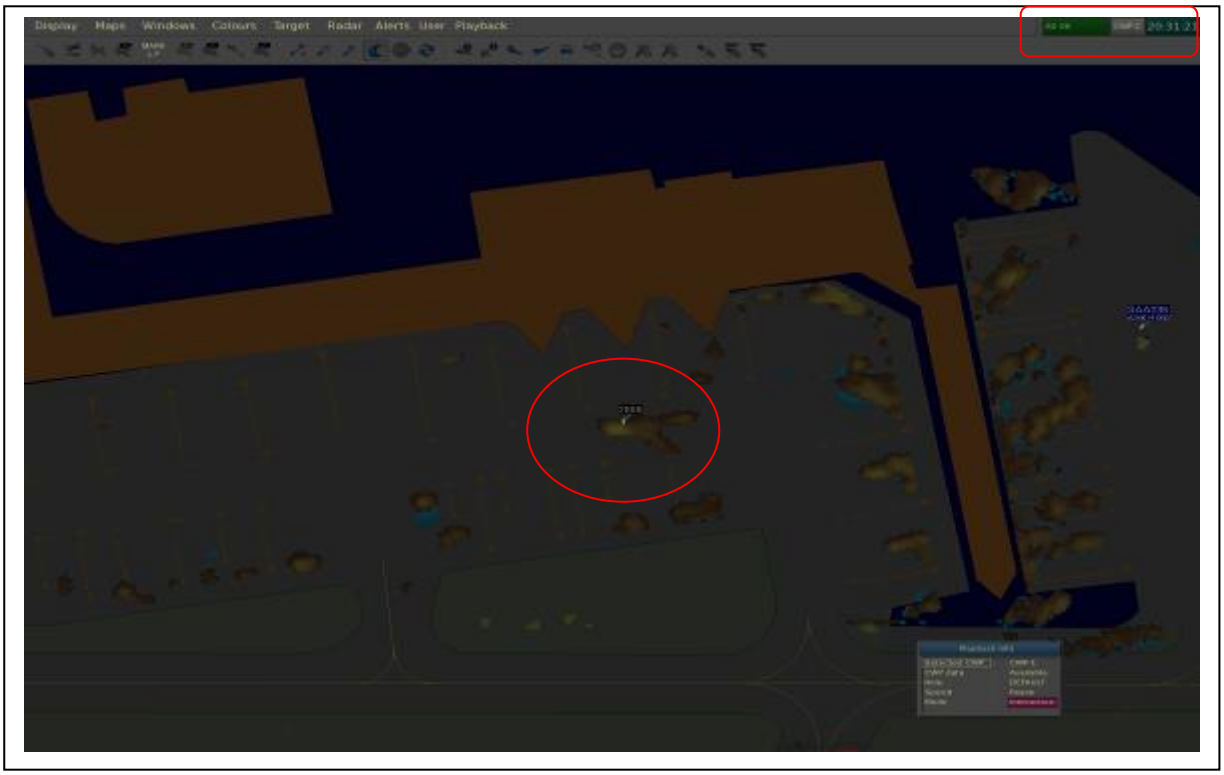


Figure 26 A-SMGCS image showing BA034 on Alfa apron

1.11.4.3 The FDR and A-SMGCS show that at 20.31:21 UTC (22.31:21 local time), BA034 pushed back out of parking bay #6 on Alfa apron (GPS reading: E28.23630 S26.13740), facing south (heading 203,5 degrees) and getting ready to taxi to taxiway Bravo. At this time, no defect or malfunction was reported by the crew.

2. TIME AIRCRAFT TAXIES FROM ALFA APRON - SOUTHBOUND IN DIRECTION OF TAXIWAY BRAVO									
Time	Date	PALT	CAS	GPSD	HEAD	PLONG	PLAT	ACLONG	ACLAT
20:40:45	131222	5247	0	2.0	204.3	28.23493	-26.13465	0.059	-0.006

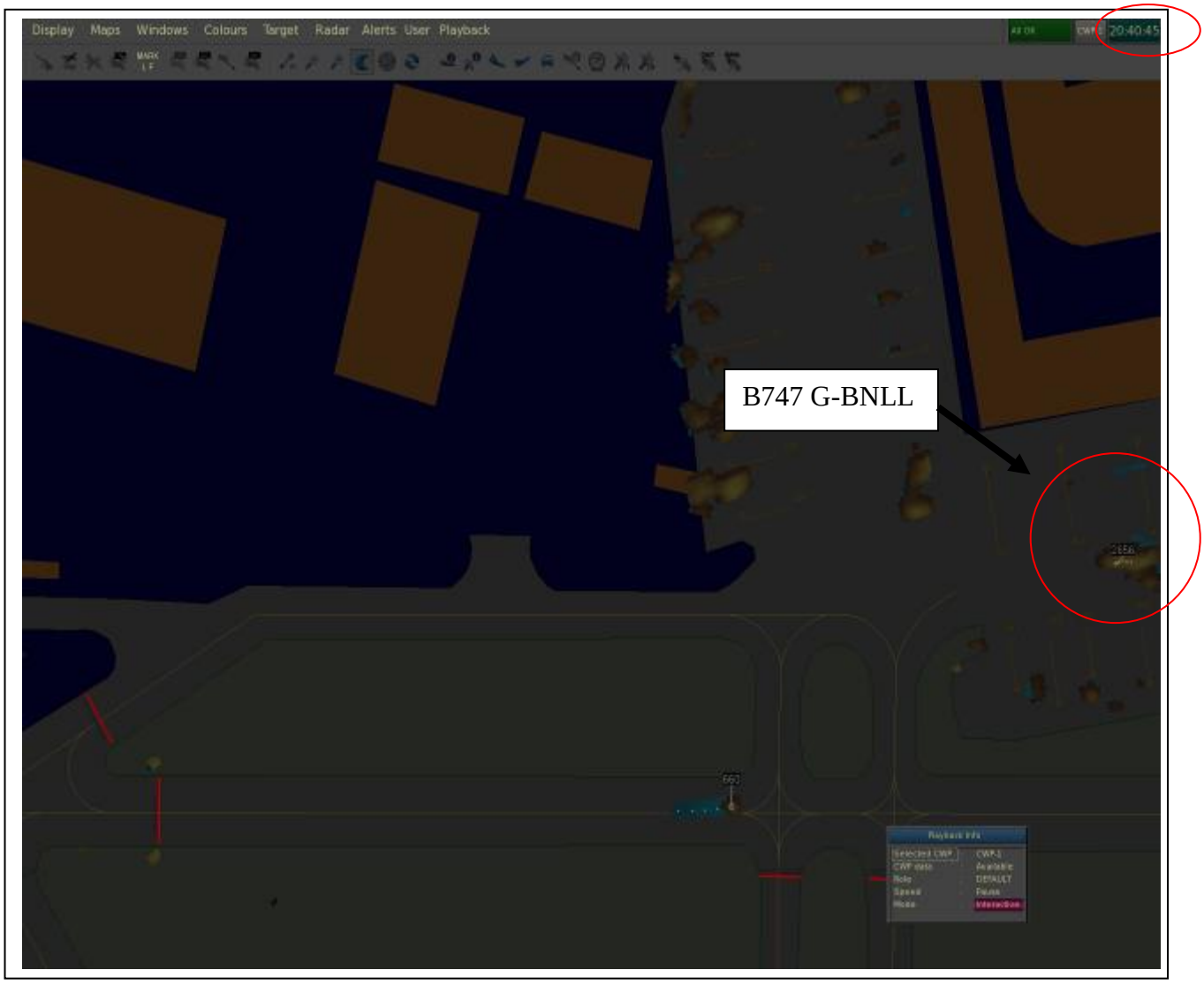


Figure 27 A-SMGCS image of BA034 taxiing to Bravo

1.11.4.4 The FDR and A-SMGCS show that at 20.40:45 UTC (22.40:45 local time), BA034 started taxiing from parking bay #6 on Alfa apron, southbound (heading 204,3 degrees) toward taxiway Bravo. At this time, there was no report of any defect, malfunction or anomaly and the situation was still uneventful.

3. TIME AIRCRAFT REACHES INTERSECTION OF ALFA AND TAXIWAY BRAVO									
Time	Date	PALT	CAS	GPSD	HEAD	PLONG	PLAT	ACLONG	ACLAT
20:41:30	131222	5264	0	6.5	203.6	28.23355	-26.13877	0.059	-0.025

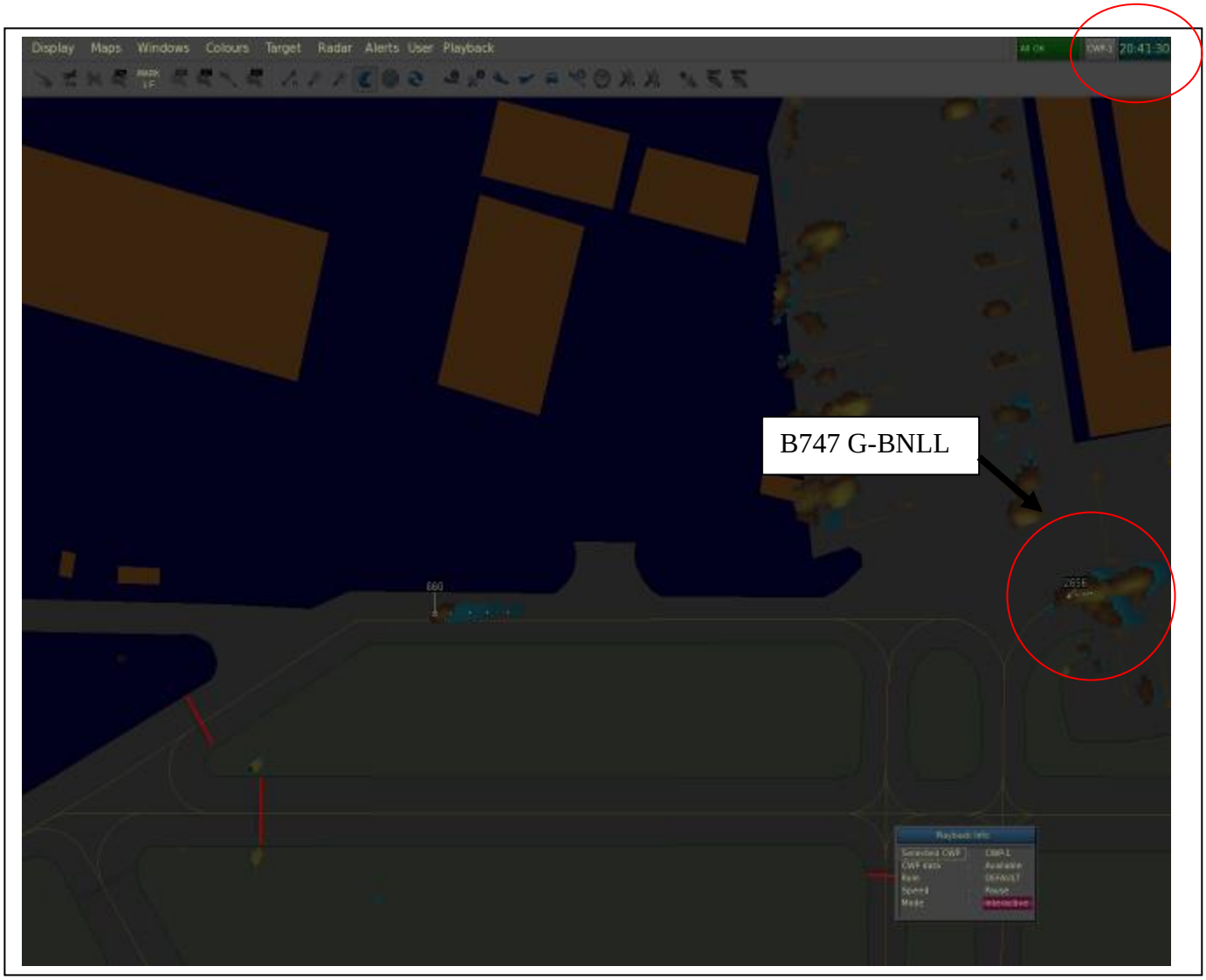


Figure 28 A-SMGCS image of BA034 joining taxiway Bravo

1.11.4.5 The FDR and A-SMGCS show that at 20:41:30 UTC (22.41:30 local time), BA034 was taxiing (GSPD: 6.5 kts), reaching the intersection of Bravo apron and taxiway Bravo (GPS reading: E28.23355 S26.13877), southbound (heading 203.6 degrees) and taxiing down taxiway Bravo. At this time, there was no report of any defect, malfunction or anomaly and the situation was still uneventful.

1.11.4.6 At this time, there is no evidence of any communication between BA034 and ATC, only communication on board between the crew members. The information considered relevant to the cause of the accident at this stage was the following:

(i) Communication between Captain (P2) and Co-pilot (P1) stating: "Straight down all the way isn't it? It is, yeah makes it nice and easy doesn't it? And Bravo will take us all the way to the threshold (agrees). I'm following this line jinking slightly to the right and then straight ahead. Perfect".

4. TIME AIRCRAFT REACHES INTERSECTION OF TAXIWAY BRAVO & MIKE AND PROCEEDS STRAIGHT ON MIKE TOWARD MIKE APRON									
Time	Date	PALT	CAS	GSPD	HEAD	PLONG	PLAT	ACLONG	ACLAT
20:43:29	22/12/13	5264	0	14.5	213.3	28.23149	-26.14289	0.046	-0.005
20:43:36		5265	0	14.5	213.0	28.23149	-26.14358	0.042	-0.010
20:43:40		5266	0	14.5	213.8	28.23149	-26.14358	0.044	-0.024
20:43:42		5265	0	14.5	214.0	28.23149	-26.14358	0.050	-0.005
20:43:47		5267	0	14.0	213.0	28.23081	-26.14426	0.043	-0.014

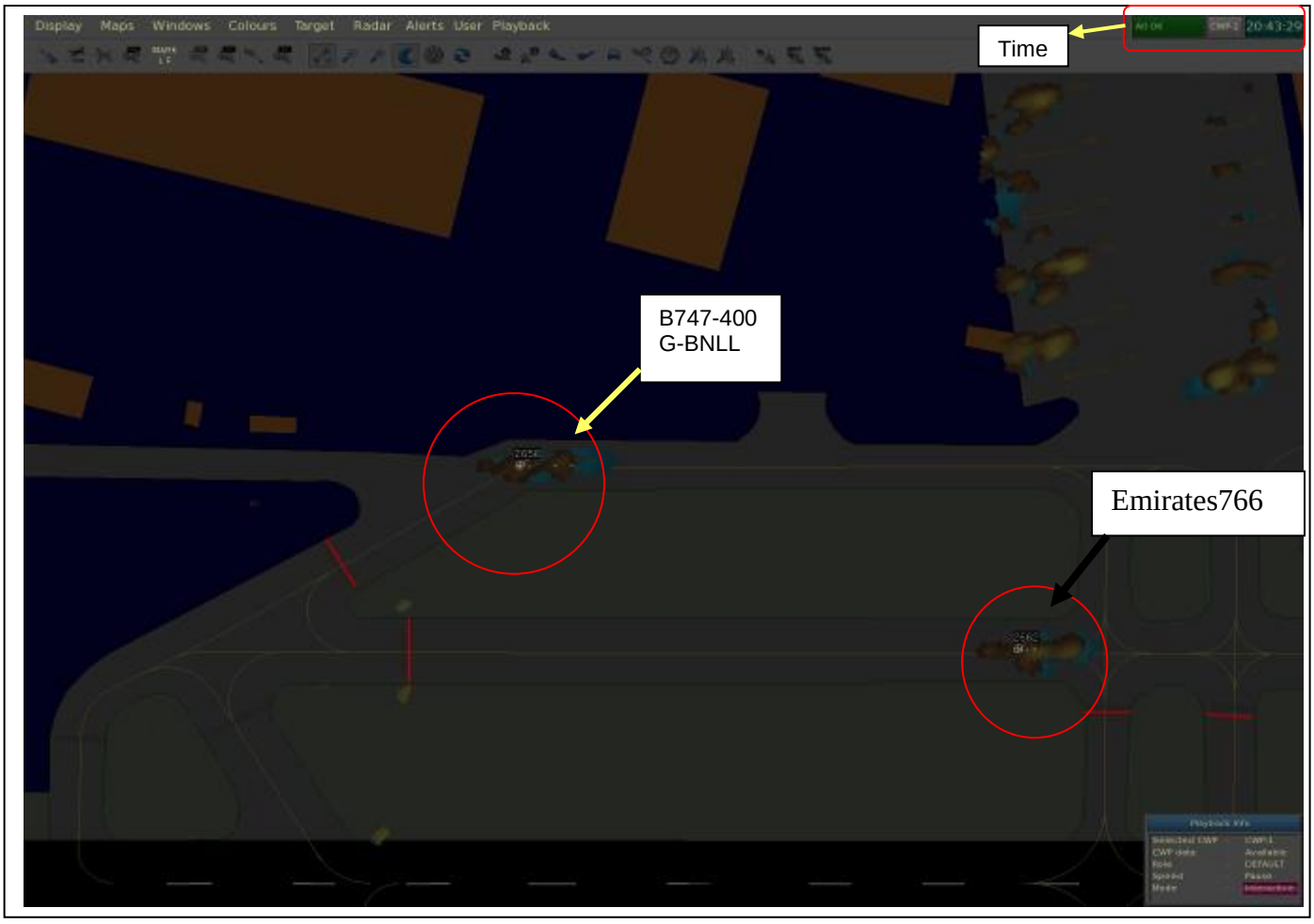


Figure 29 A-SMGCS image of BA034 at intersection of Bravo and Mike

1.11.4.7 The FDR and A-SMGCS show that at 20.43:29 UTC (22.43:29 local time), BA034 was taxiing (GSPD: 14.3 kts), reaching the intersection of Bravo and Mike (GPS reading: E28.23149 S26.14289), southbound (heading 213.3 degrees). At this time, there was no report of any defect, malfunction or anomaly and the situation was still uneventful.

1.11.4.8 On taxiway Alfa, the Emirates766 aircraft was also taxiing southbound toward Cat 1 holding point en route to Runway 03L/21R.

1.11.4.9 There is no evidence of any communication on between BA034 and Tower (ATC), communication was among the crew (pilots). Nothing was said that is considered relevant to the accident at this time.

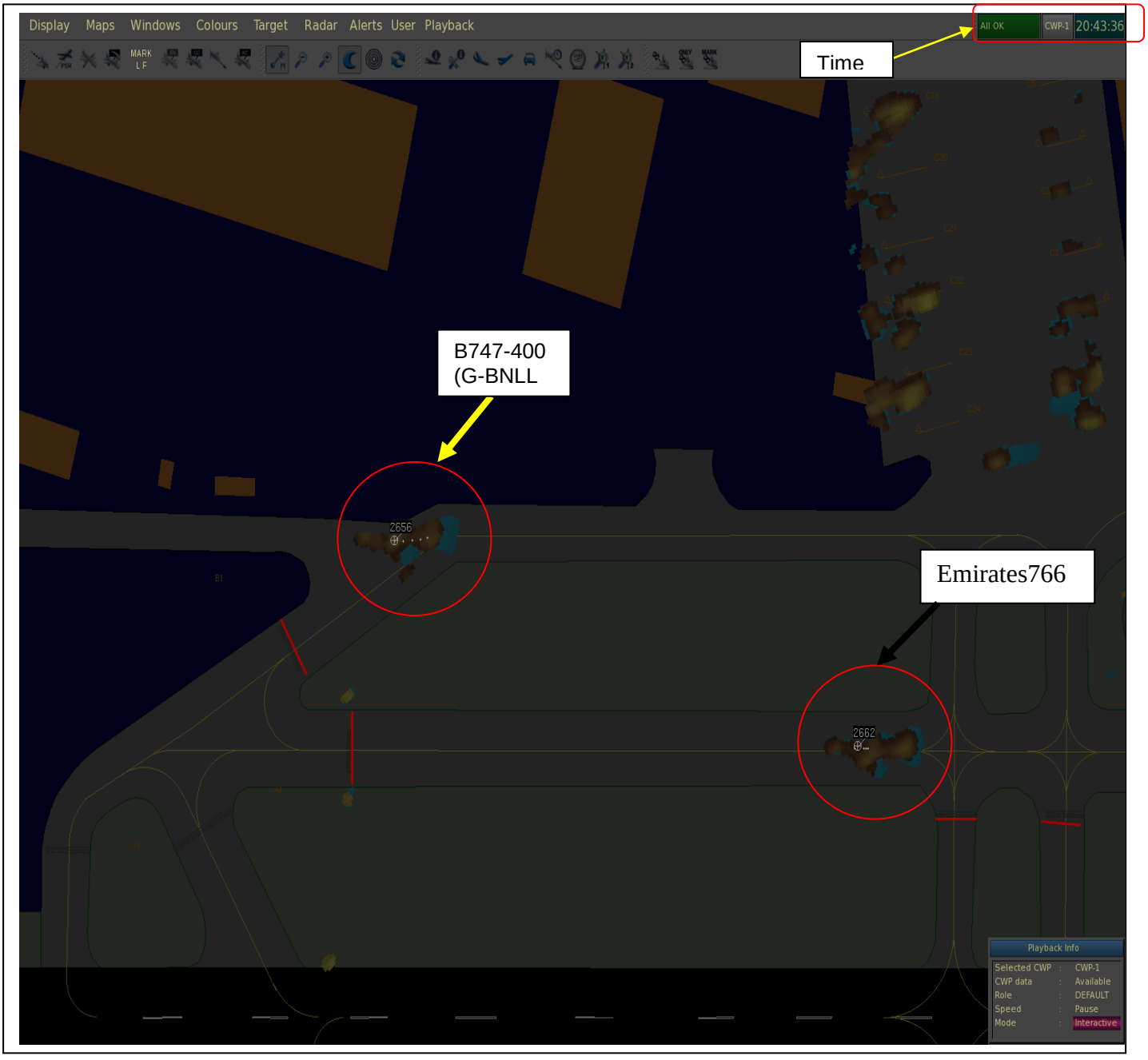


Figure 30 A-SMGCS image of BA034 proceeding onto Mike

1.11.4.10 The FDR and A-SMGCS show that at 20.43:36 UTC (22.43:36 local time), the BA034 aircraft was taxiing (ground speed 14.3 kts), turning slightly to the left (± 0.5 degrees).

- At this time, there was no report of any defect, malfunction or anomaly and the situation was still uneventful.

Note: At this point (GPS reading E28.23149 S26.14426) the aircraft heading was 213.8 degrees and it was entering the intersection/junction area of taxiway Bravo and aircraft stand taxilane Mike. The width of Bravo is 30 metres and Mike is 18 metres. The observation here is that the centreline continues straight ahead, but the right-hand edge line is not continuing straight; it decreases at an angle.

- The picture below was taken during the morning on the day after the accident. It shows the right-hand edge lines of Bravo and Mike at the intersection/junction.

Figure 31 Right-hand edge lines of Bravo and Mike

Note: Annex 14, Volume 1 recommends a minimum clearance between the outer main wheels of the aircraft which the taxiway is intended to serve and the edge of the taxiway when the cockpit of the aircraft remains over the taxiway centreline markings. This clearance is discussed in section (1.10.12 – taxiways) of the report.

- According to the aerodrome design manual, to meet the clearance requirements when an aircraft is negotiating a turn, it may be necessary to provide additional pavement on taxiway curves and at taxiway intersections/junctions. It is to be noted that in case of a taxiway or an intersection/junction section of taxiway with another taxiway the appropriate term used is “fillet”.

- The aerodrome design manual further states that taxiway design as well as relevant visual aids specification is based on the concept that the cockpit of the aircraft remains over the taxiway centreline. Another method for manoeuvring aircraft on taxiway intersections is based on offsetting the guideline.

- The advantages of offsetting the guideline are not as great as they seem. The multiplicity of lines is impractical, particularly when the taxiway is intended to be used at night or during poor visibility conditions.

1.11.4.11 The A-SMGCS images below show the sequence of events that followed when the B747-400 aircraft crossed the intersection/junction of Bravo and Mike, intending to go straight ahead.

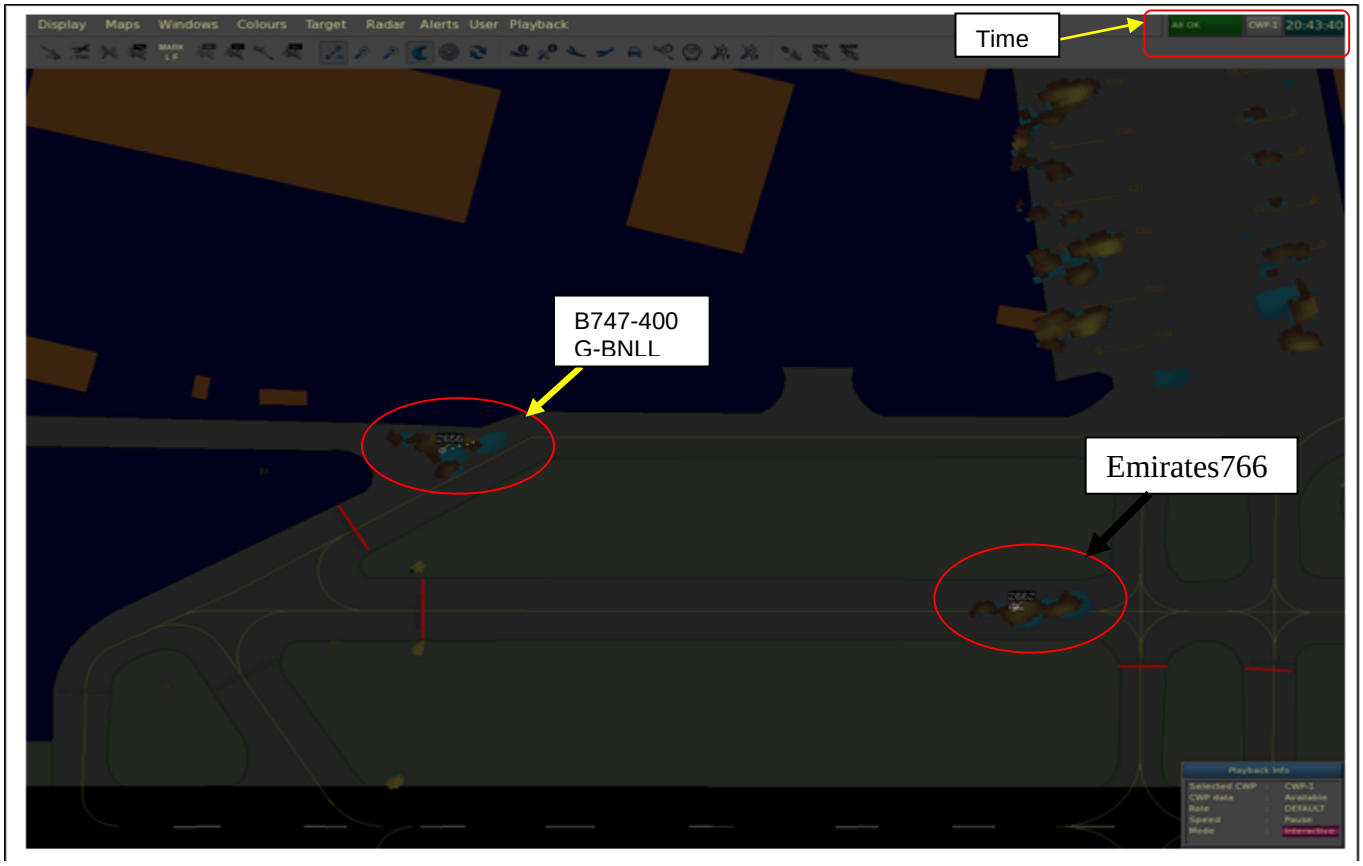


Figure 32 A-SMGCS image of BA034 proceeding to Mike

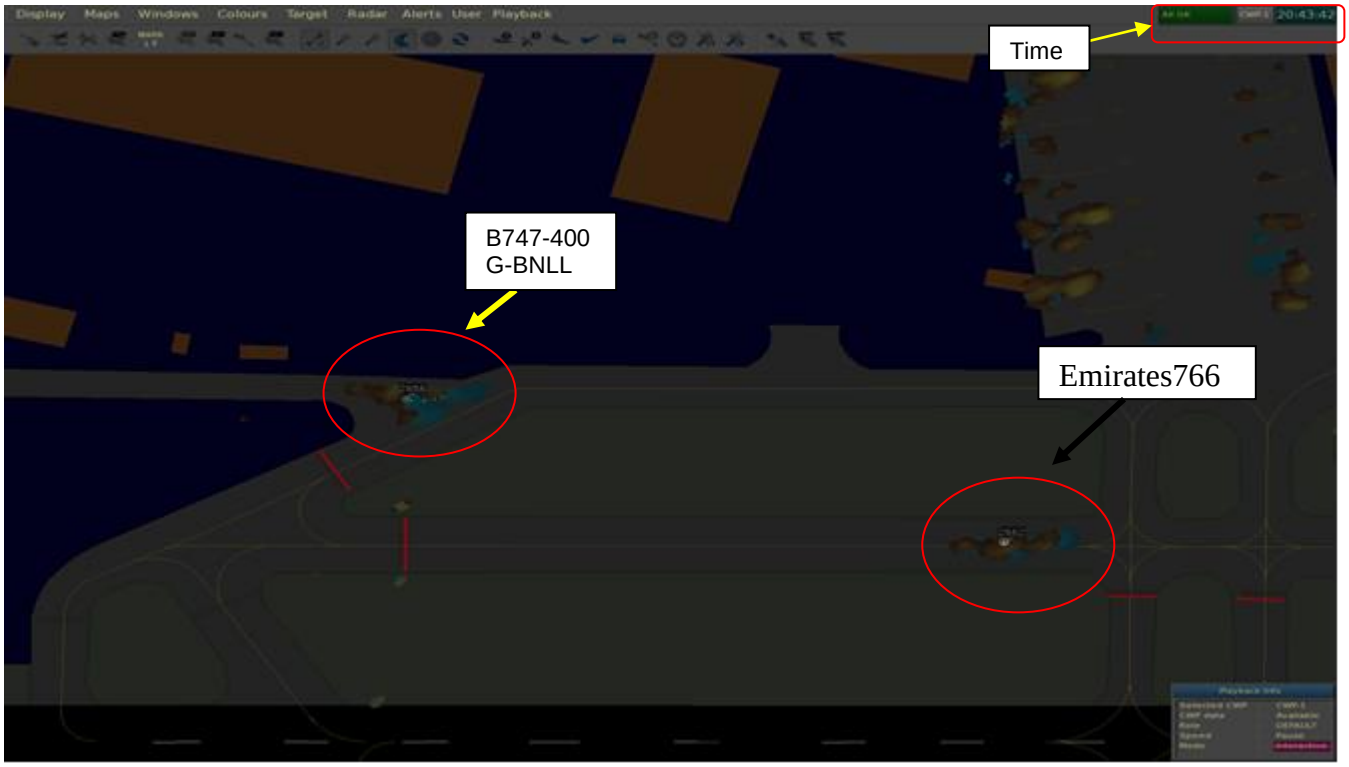


Figure 33 A-SMGCS image of BA034 proceeding to Mike

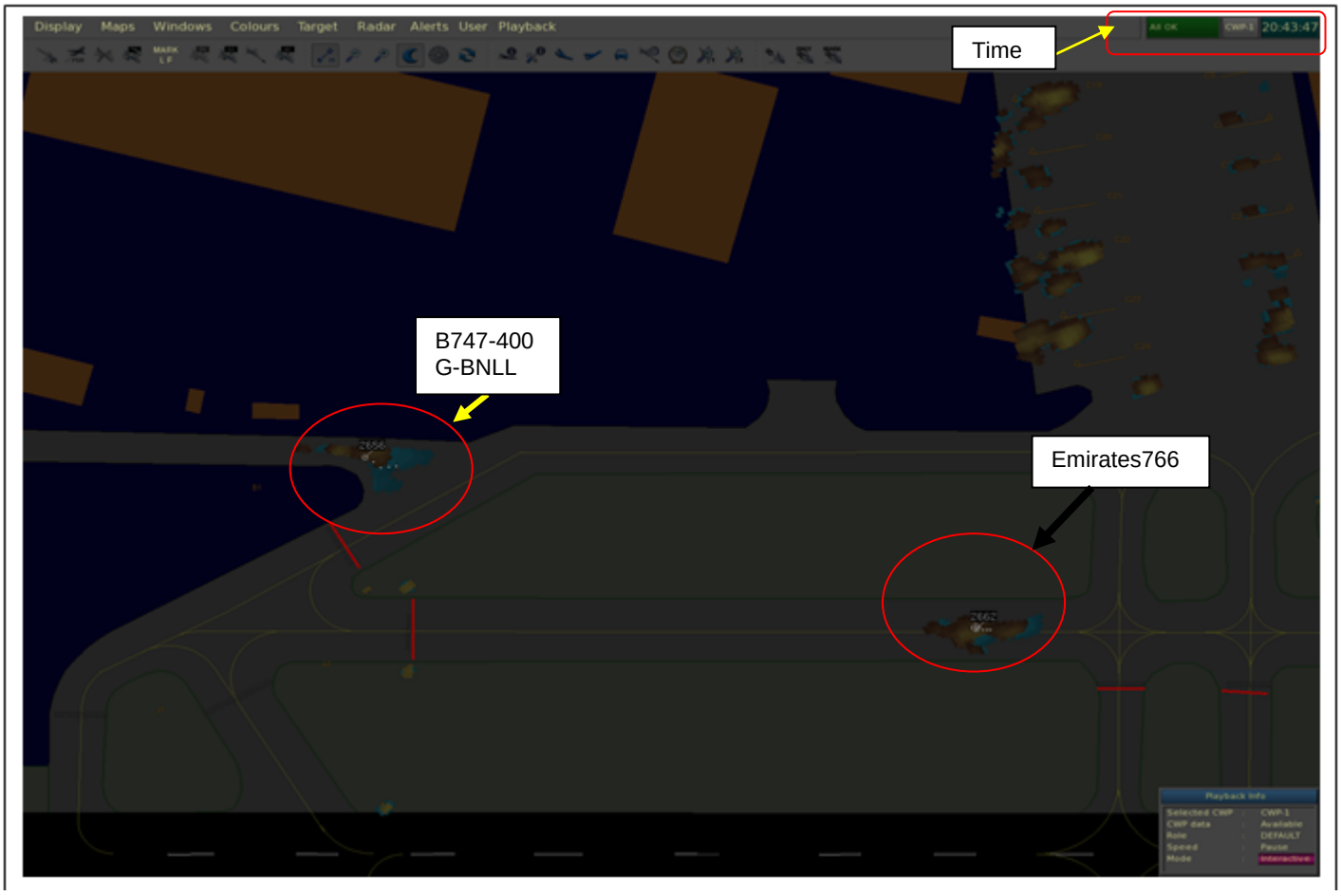


Figure 34 A-SMGCS image of BA034 proceeding to Mike

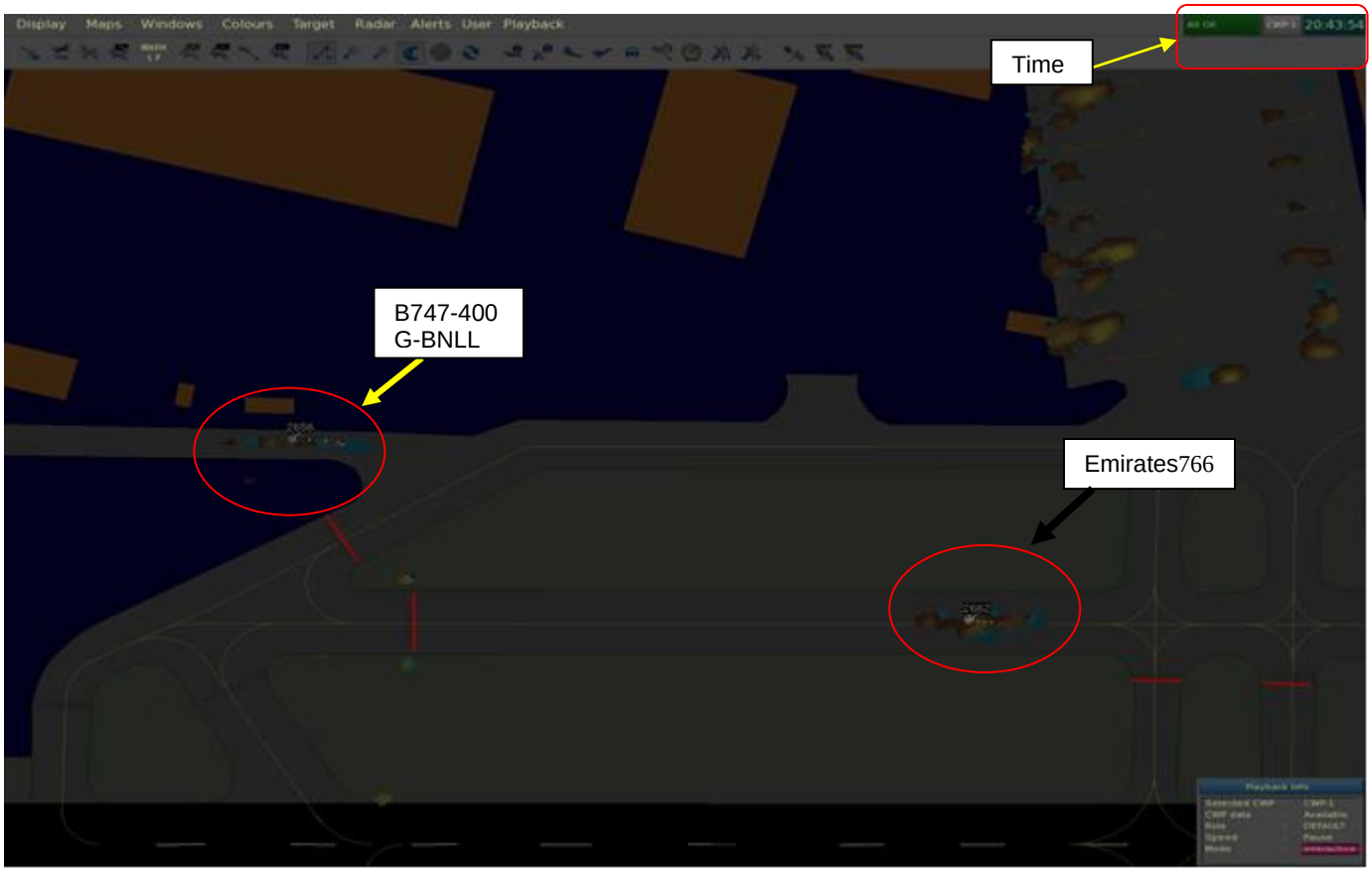


Figure 35 A-SMGCS image of BA034 on Mike

1.11.4.12 The FDR and A-SMGCS show the following:

(i) At 20:43:40, 20:43:42, 20:43:47, 20:43:54 through to 20:43:59, BA034 was taxiing at GSPD 14.5 kts, 14.5 kts, 14.0 kts, 14.3 and 1.3 kts respectively. The GPS readings were E28.23149 S26.14358, E28.23149 S26.14358, E28.23149 S26.14426, E28.23149 S26.14426 and E28.23081 S26.14426 with headings 213.8, 214.0, 213.0, 214.0 and 214.4 degrees.

Note: Though the change in heading is not significant, the important fact to bear in mind is that the aircraft was no longer tracking the centreline continuing straight ahead. The information shows that the aircraft was being steered to the left of the centreline and right onto the centreline as identified headings (degrees).

(ii) At the stated times, there were no reports of any defect, malfunction or anomaly experienced during the taxi and the situation was considered uneventful.

1.11.4.13 At the stated times, there was no evidence of any communication between BA034 and Tower (ATC). The communication was on board among the crew members (pilots). The information that was considered relevant at this stage was the following:

(i) At 22.43:41 UTC (20:43:41 local time), about 10 seconds before the collision, the communication between Co-pilot (P1) and the Captain (P2) was: "Is it me or does this taxiway feel narrow? We're on the right one, aren't we? Yeah…, Narrow…"

5. TIME AIRCRAFT WAS INVOLVED IN COLLISION WITH BUILDING ON TAXILANE MIKE									
Time	Date	PALT	CAS	GSPD	HEAD	PLONG	PLAT	ACLONG	ACLAT
20:43:59	131222	5269	0	1.3	214.4	28.23081	-26.14426	0.047	-0.009
20:44:23	131222	5269	0	1.3	214.4	28.23081	-26.14426	0.055	-0.017

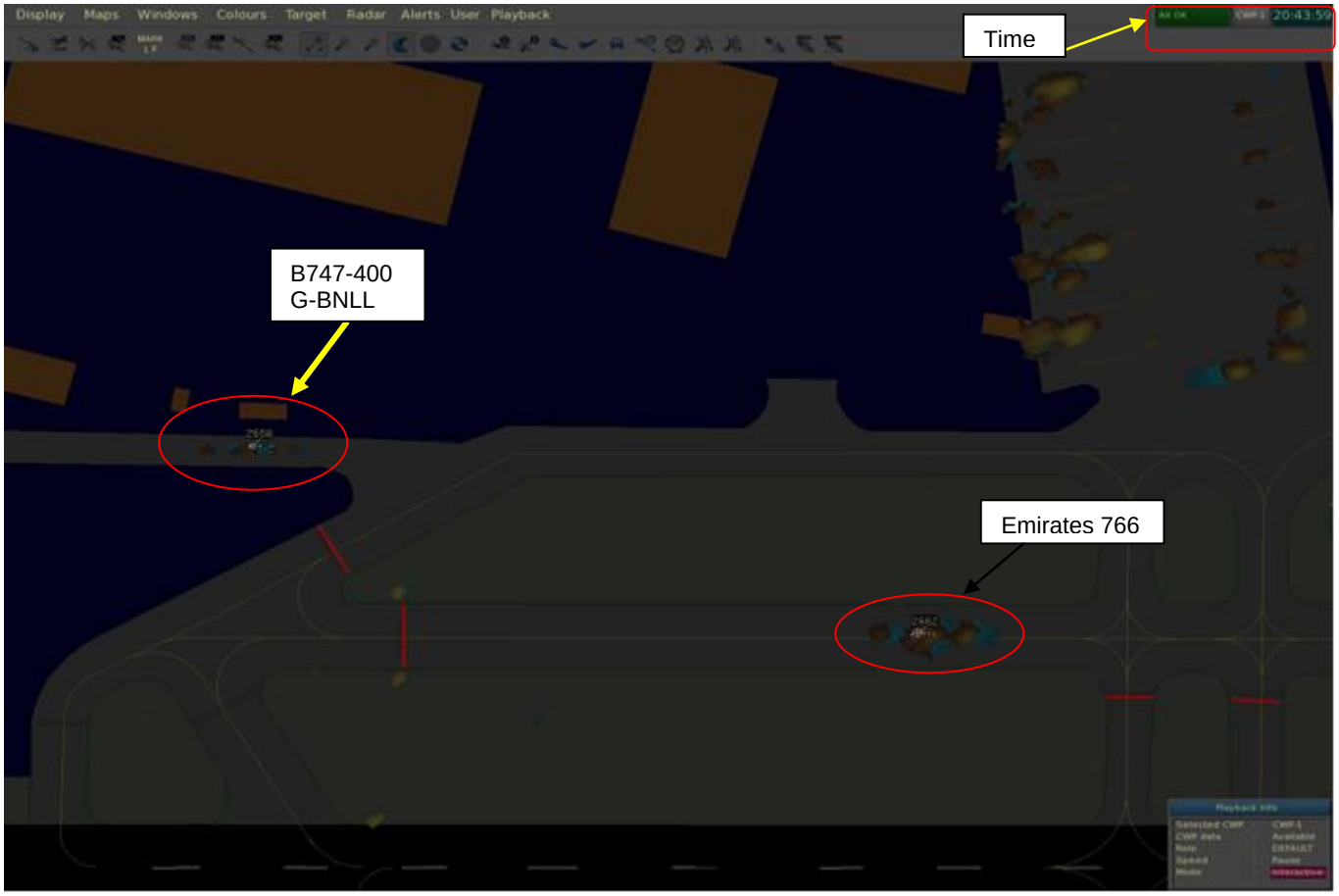


Figure 37 A-SMGCS image of BA034 involved in accident

1.11.4.14 The FDR and A-SMGCS show that at 20:43:59 UTC (22.43:59 local time), BA034 was taxiing on taxilane Mike. The aircraft was then involved in a collision with Bid Air Services Building (GPS reading: E28.23081 S26.14426). The heading was 214.4 degrees. At this point in time, as a result of the impact the aircraft ground speed dropped to 1.3 kts.

1.11.4.15 The Captain indicated that the Co-pilot could not judge the proximity of BA034 to the building because of the strong apron background glare. The evidence of the A-SMGCS, FDR and CVR shows that BA034 had long since passed the aprons. The investigation determined that the background glare which the Captain referred to might be the lights on the right side from the SAA technical building.

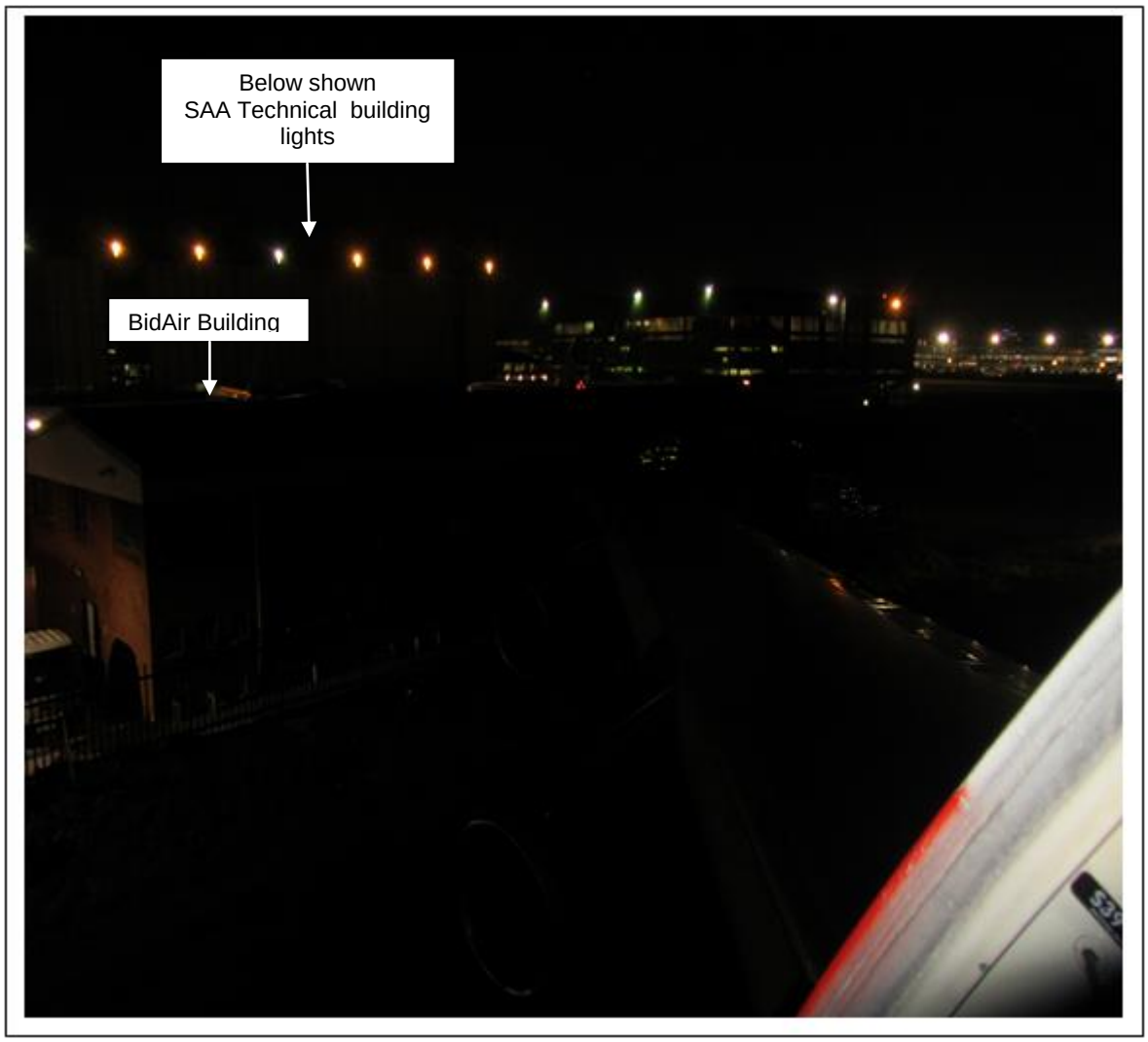


Figure 36 SAA technical building lights at the back of BidAir Services building toward the right side

1.11.4.16 At 20:43:59 UTC (22.43:59 local time), the recorded communication from the Co-pilot (P1) was "That wing is not far from that…s***t s***t". Then followed the communication from ATC to BA034 wherein the following was said "Speedbird 34 Tower,...Go ahead,…Just hold position, to which the Captain (P2) responded "think we've hit something here…standby please".

1.11.4.17 After the aircraft had impacted the building, the final communication from the Co-pilot (P1) was as follows: "I saw it.. it just didn't look right, I wish I'd stopped, It just didn't look right… it looked too close, I didn't pick up the fact… I was looking for it to go straight…I didn't see any turn off towards the end?"

1.11.5 A-SMGCS download of ARFF vehicle (FTL):

1.11.5.1 Below the A-SMGCS shows, at 22.41:04 UTC (20:41:04 local time), the ARFF vehicle (FTL) entering taxiway Bravo. The vehicle then continued to drive in front of BA034, heading south in the direction of intersection/junction of Bravo and Mike. The separation was 022˚/2674 m between the vehicle and BA034. The evidence is that the ARFF person inside the vehicle completed the runways and taxiways inspection. They were heading back to the station.

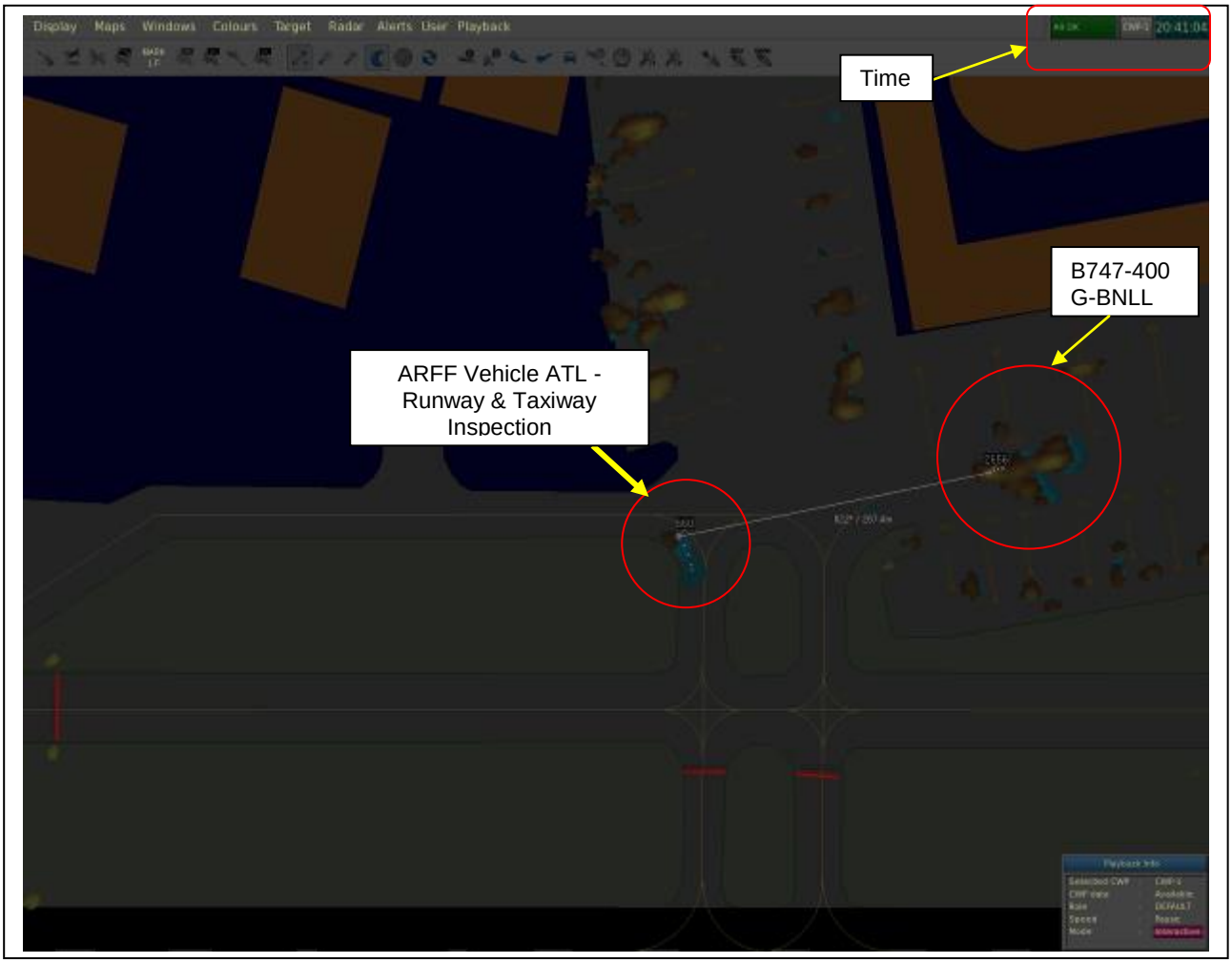


Figure 37 A-SMGCS image of ARFF vehicle (FTL) heading to Bravo

1.11.5.2 Below the A-SMGCS shows the ARFF vehicle (FTL) heading toward the intersection/junction of Bravo and Mike, which is where the two green centreline lights were found not illuminating and not reported.

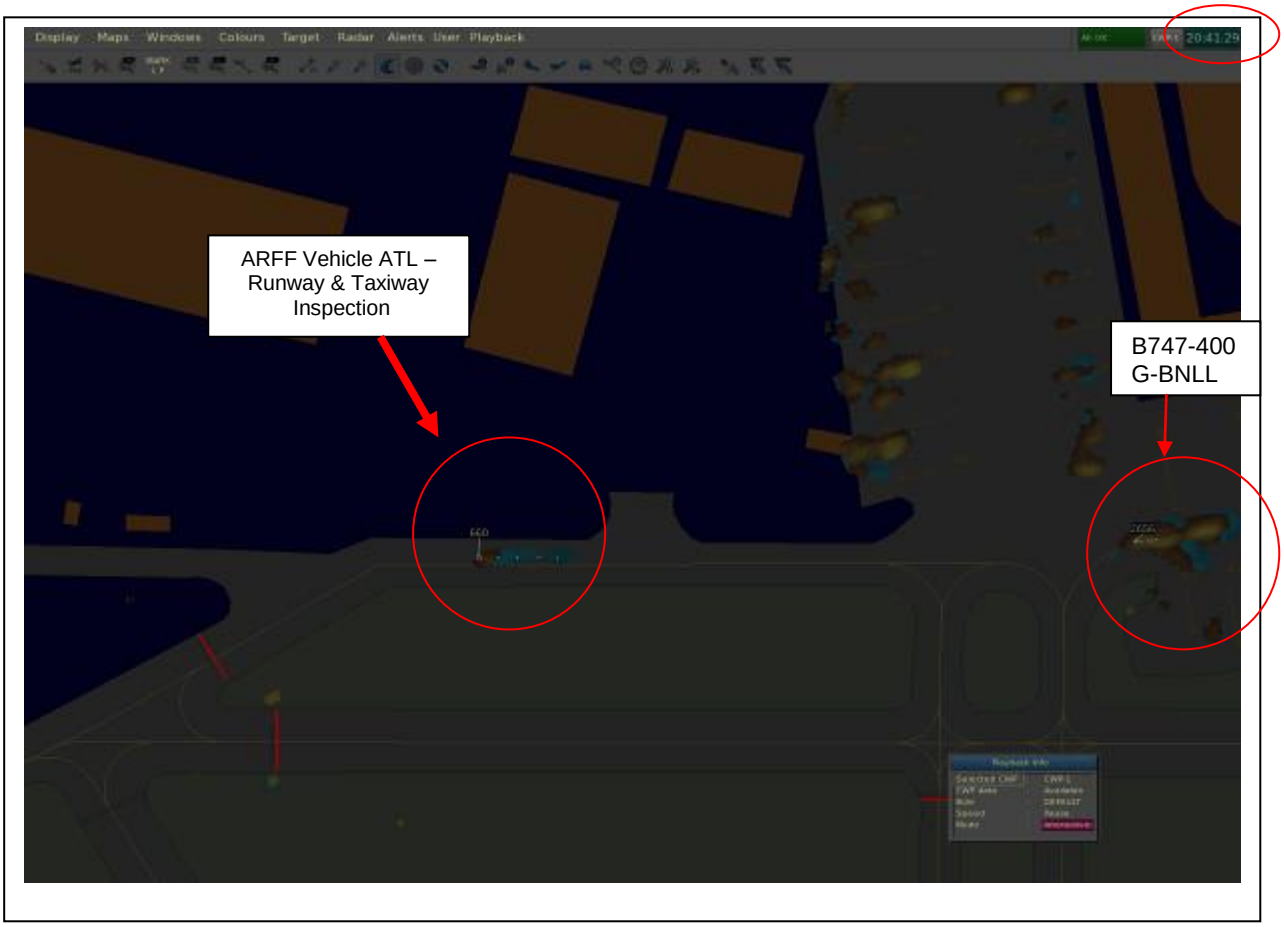


Figure 38 A-SMGCS image of ARFF vehicle (FTL) near intersection of Bravo and Mike

1.12 Wreckage and Impact Information

1.12.1 Aircraft Impact Information:

1.12.1.1 BA034 was taxiing from Alfa apron bay #6 on taxiway Bravo heading south toward Cat 2 holding point for Runway 03L. The intended distance to taxi was measured as approximately 1425 metres.

1.12.1.2 The aircraft was expected to turn to the left following taxiway Bravo at intersection with Mike. The distance from Alfa apron to the intersection of Bravo and Mike was measured as approximately 1284 metres.

1.12.1.3 The aircraft proceeded straight onto taxiway Mike heading into the direction of Mike apron. On taxiway Mike, at a distance of approximately 150 metres from the intersection, the aircraft right wing collided with the BidAir Services Operations Office building.

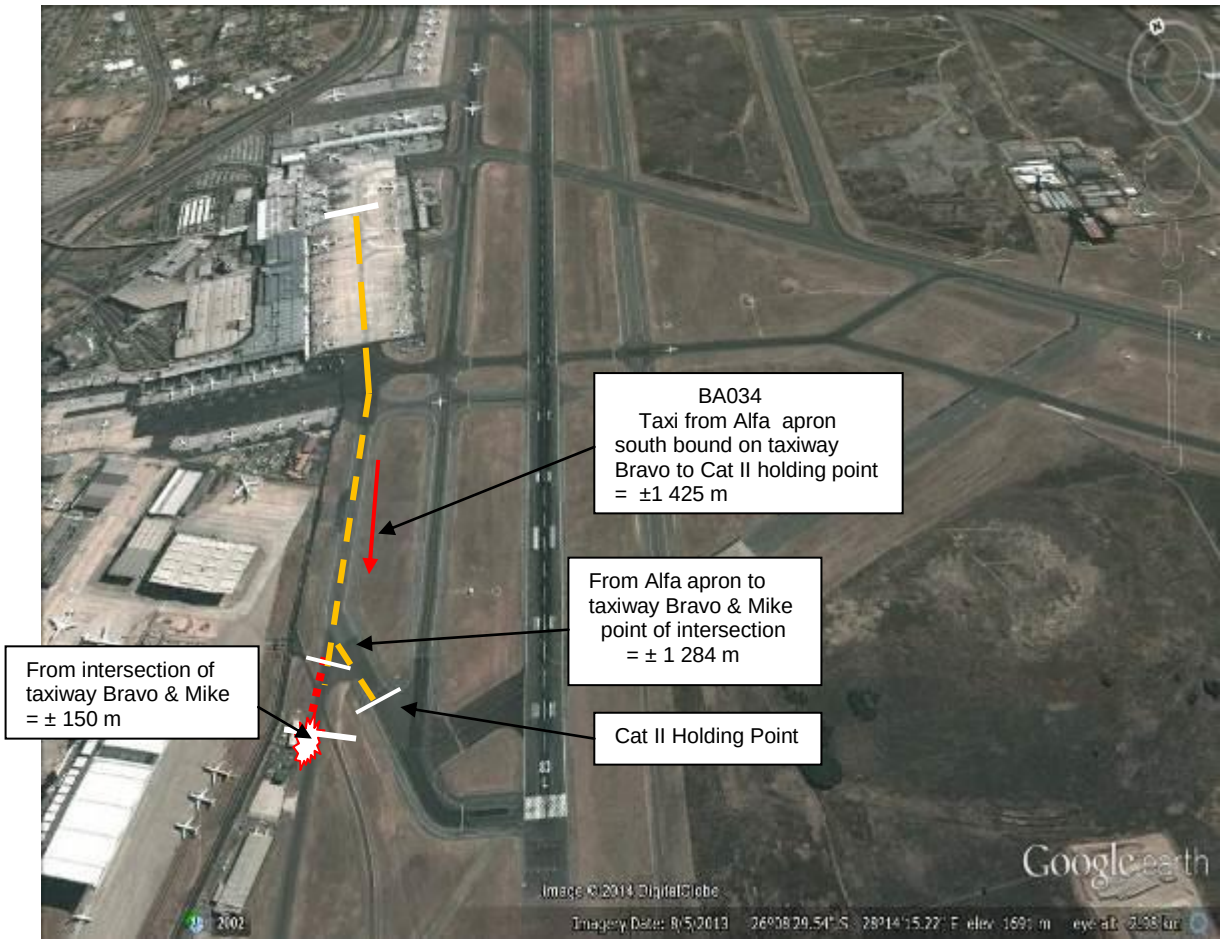


Figure 39 Google Earth ground map of taxi route

1.12.2 Wreckage Impact Information:

1.12.2.1 BA034 starboard (right side) wing impacted the BidAir Services building. The identified wing and its structural elements had sustained substantial damage resulting from the impact.

Figure 40 Damage caused to wing leading edge

Figure 41 Damage caused to wing upper skin structure and winglet

1.13 Medical and Pathological Information

1.13.1 The 202 occupants sustained no injuries.

1.13.2 No evidence was found of any medical condition which could have impaired the human performance of the crew (cockpit and cabin). The crew members had valid aviation medical certificates without limitations. All the crew members were found to be fit for the flight at the time of the accident.

1.13.2 There was evidence of injuries sustained by BidAir Services employees inside the building. A total of four employees injured in the accident. The employees sustained minor injuries (abrasions and lacerations).

1.14 Fire

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

1.15 Survival Aspects

1.15.1 The accident was considered to be survivable. The fuselage was completely intact after the impact. Substantial damage was caused to the starboard wing. No injuries were sustained by any crew and passengers on board the aircraft. All occupants had their seat belts properly fastened and ready for take-off at the time of the accident.

1.15.2 Aerodrome fire fighting and Rescue Services (ARFF) duties:

1.15.2.1 The aerodrome fire fighting and rescue services (ARFF) activities at FAOR were reviewed during the investigation process and no anomalies could be identified. According to a report submitted by ARFF, the crash alarm was activated by ATC at approximately 20.43:00 UTC (22.43:00 local time). The ARFF then immediately departed to the location of the accident to render fire and rescue assistance.

1.15.2.2 The performance of the ARFF was as follows:

(i) Before the crash alarm was activated, the ARFF vehicle (FTL) had just completed a runway inspection and left via taxiway Bravo. The ARFF vehicle was going to taxiway Bravo and gave way to BA034. The ARFF vehicle proceeded to the Swissport substation. At 20.43:00 UTC (22.43:00 local time), when the crash alarm was activated, the fire fighters of FTL were listening to the radio broadcast between BA034 and ATC in which the Captain reported "I think I've hit something"**.** They then heard the crash alarm, upon which they immediately departed to the location where the accident had occurred.

(ii) No problems were experienced with accessibility to the scene. The ARFF took approximately 60 seconds to arrive. They were called out at 20.43:00 UTC (22.43:00 local time) and arrived at 20.44:00 UTC (22.44:00 local time). The ARFF fire trucks (R1 and R2) used taxiway Bravo from the Swissport substation. They used half of their fire extinguishing media (foam) to spray on the fuel spillage to reduce the fire risk.

1.15.3 The ARFF switched off all electrical power to the BidAir Services building in order to remove the risk of the fuel that had spilled inside and outside the building being ignited.

(i) Several ARFF vehicles were dispatched to attend to BA034. On arrival at Mike, the ARFF personnel found that the starboard wing of BA034 had collided with the Bid Air Services Operations Mooring Office building, resulting in a large quantity of fuel being spilled from the affected wing. The aircraft engines were still under power, hence the request to ask the crew to shut down the engines. After the engines had been shut down, the ARFF sprayed foam on the affected wing. When the ARFF was satisfied that the fire risk had been removed, the information was communicated to ATC and crew.

Note: During the time the ARFF was handling the situation by spraying the foam on the fuel spillage; all the occupants remained on board of BA034. The Captain (P2) did not make a decision to evacuate, but considered it as an option. The Captain discussed the option of having an evacuation with the cabin services director (CSD) and was told to be prepared for a command to evacuate.

1.15.4 Disembarking Process:

1.15.4.1 The ARFF arranged a step vehicle and buses.

(i) At 21.15:00 UTC (23.15:00 local time), a step vehicle and two buses from Menzies Handling Company arrived at BA034. The step vehicle first drove to Door #1 (left side) of the aircraft, as the initial decision was to do the evacuation from Door #1. However, the step vehicle had to drive off Mike into grass and got stuck in the soft grass. The step vehicle could not reach Door #1 and decided to use Door #5 (left side) instead. Eventually, at 21.20:00 UTC (23.20:00 local time, which was 5 minutes later), the step vehicle was properly positioned at Door #5 and the passengers started to disembark from the aircraft.

Figure 42 Door #5 and step vehicle used to disembark

1.15.5 The cabin crew statements relating to the disembarkation:

(i) The cabin crew seated at Doors #1 to #6 had their seat belts properly fastened, as they were ready for the take-off. According to the cabin crew seated at these locations, they felt that BA034 was suddenly shaking, rumbling and juddering violently before the brakes were applied. The cabin crew seated at Doors #2, #4 and #6 (right side) then looked out through their windows and saw that the right wing had hit a building. Some people were seen running from the building. The cabin crew then also observed the fuel spillage from the wing. They then reported this information to the cockpit and waited for instructions about the evacuation.

(ii) According to the cabin crew, following the report to the cockpit, the Captain made a call on the public address (PA) system to inform the cabin occupants that the aircraft had been involved in an accident and about the plans to evacuate. The initial decision from the cockpit was to do a full evacuation; however, it was changed to normal disembarking from Door #5.

(iii) At the time of the evacuation the aircraft was dark inside because the auxiliary power unit (APU) was not running. All the cabin crew then put on their dayglow reflective jackets for visibility to the passengers. When the step vehicle was properly in position at Door #5, the passengers started to disembark from the aircraft row by row at a steady pace to avoid a rapid weight shift (tail heavy situation) that would cause the aircraft to tip over on its tail.

(iv) The Captain gave permission for the passengers to disembark with their hand luggage. The groups of passengers were then loaded into the buses re waiting outside and transported back to the terminal building. All 185 passengers disembarked using Door #5, and there was no evidence of any injuries.

1.16 Tests and Research

1.16.1 ICAO – ATS Planning Manual, Doc 9426, Part 3, Section 2, Chapter 2, paragraph 2.1, specific requirements for aerodrome control towers:

- *"*An aerodrome control tower has two major operational requirements for an air traffic controller to be able to properly control aircraft operating on and in the vicinity of the aerodrome. (i) The tower must permit the controller to survey those portions of the aerodrome and its vicinity over which he exercise control. (ii) The tower must be equipped so as to permit the controller rapid and reliable communications with aircraft with which he is concerned.

- Surveillance by the aerodrome controller is normally done by visual means (eyesight) alone, mechanical through the use of binoculars to improve eyesight or electronically through use of radar or close-circuit television. The controller must be able to discriminate between aircraft and between aircraft and vehicles while they are on the same or different runways and/or taxiways. The most significant factors contributing are the siting of the tower and height of the control tower cab".

1.16.1.1 Surveillance Visually (Eyesight):

- The higher the tower, the more easily optimum surveillance (visual – eyesight) is attained.

- The height of the window sills should be low as practicable since they affect the controller's ability to scan the area.

- Thus, suitable minimum glare or non-glare lighting must be provided so that it does not diminish the ability to survey the aerodrome.

Note: The ATC was visually surveying the aerodrome manoeuvring area to locate BA034, but could not see it on taxiway Bravo. He then looked on the A-SMGCS (ground radar) to see if he could find it. (See the visual (eyesight) surveying capacity from the tower in Fig 11 above.) What is important in this instance is that the event happened in night time conditions.

1.16.1.2 Surveillance Electronically by Advance Surface Movement Guidance and Control System (A-SMGCS):

Note: According to website; http:/www.atns.co.za/capital investment/a-smgcs:

(i) "An A-SMGCS consists of the provision of guidance to, and control or regulation of, all aircraft, ground vehicles and personnel on the manoeuvring area of an aerodrome.

(ii) Guidance relates to facilities, information and advice necessary to enable the pilots of an aircraft or the drivers of ground vehicles to find their way on the aerodrome and to keep the aircraft or vehicles on the surfaces or within the areas intended for their use.

(iii) Control or regulation means the measures necessary to prevent collisions and to ensure that the traffic flows smoothly and freely.

Figure 43 shows positioning of the A-SMGCS Traffic Context screen at FAOR Tower

(iv) Traffic Context:

- The traffic context contains all data (e.g. mobiles position and identity) which is necessary for ATC to carry out its surveillance task. Data includes:

  - Airport layout (e.g. geographical representation – runways & taxiways)
  - Reference points (e.g. holding points & thresholds)
  - Fixed obstacles (e.g. buildings)

(v) Mobiles:

- Transponders are examples of such equipment. The identified mobile should be activated to interact with A-SMGCS in order for position and identity of the aircraft or vehicle to appear or be provided by the system.

(vi) Benefits of the A-SMGCS:

- Enhances the safety and capacity at both airports.

- Provides continuous detection, tracking, monitoring and display of aircraft, vehicles, people, animals and obstruction positions on and near the surface of all airport movement areas, including grass areas.

- All vehicles on the airport infield areas will also be detected and tracked.

- Coverage will be provided on all manoeuvring areas and for 200 m adjacent to manoeuvring areas and on other operational and approach areas.

- Provides controllers with accurate information to assist with the control or regulation of all aircraft on or near the surfaces as outlined previously on high-resolution colour displays. It also provides the tools, facilities and information for guidance and routing.

- Meets operational requirements in reduced visibility conditions such as heavy rain, smoke and fog".

Note: After the ATC looked on the A-SMGCS, he realised that the aircraft had passed the intersection of Bravo and Mike. Immediately he called the aircraft and requested the crew to stop.

1.16.2 According to ATNS, the A-SMGCS was installed for the following purposes:

(i) To enhance the safety and efficiency of aerodrome surface movement control during low visibility operations (LVOs) and at night, with the specific intention to reduce the probability of runway incursion and not for capacity enhancement.

(ii) It is a secondary tool and not the primary tool used for surveillance of the tower environment and is used as a monitoring tool providing a situational picture to the controller. It should be emphasised that this tool is an adjunct and not an alternative to the visual aids and procedure currently used for the control of aircraft and vehicles in the manoeuvring area.

(iii) The A-SMGCS system at FAOR is, according to the ICAO definition, still classified as surface movement radar (SMR) only. The system is used by tower controllers in a monitoring role based on Level 1 surveillance. All A-SMGCS level 1,2,3 and 4 services as defined in the ICAO Manual (Doc 9830) require that all aircraft operating on or within the manoeuvring areas at FAOR are fitted with Mode-S transponders for correct correlation of the Mode-S transponder and the submitted flight plan (FPL) for correct labelling and display of the aircraft call sign. Each vehicle operating on or within the manoeuvring area must be fitted with a Mode-S transponder and registered on the A-SMGCS target database for the correct display of the vehicle's call sign.

(iv) ATNS can only fully commission a level 1 A-SMGCS when all vehicles and aircraft operating in ORTIA and/or CTIA are fitted with Mode-S. The absence of legislation regarding the use of Mode-S transponders is also an issue to be addressed in order to achieve a fully commissioned A-SMGCS system at both FACT and FAOR.

- Aircraft without Mode-S transponders:

  - According to the last evaluation conducted by ATNS in 2012, some 96% of aircraft operating into and from FAOR and FACT are fitted with Mode-S transponders.

- An aircraft not fitted with a Mode-S transponder will only display an A-SMGCS system target code and is not easily identifiable and/or correlated with a flight plan.

- Vehicles without Mode-S transponders:

  - A vehicle registration process was initiated in 2011 by consensus between ATNS, ACSA and SACAA as a measure for the installation of Mode-S transponders on all vehicles operating on the aerodrome.

  - The FAOR and FACT TWR controllers report false targets or any anomalies identified. The reports are then investigated and where necessary adjustments are made to the A-SMGCS parameters.

(v) It became apparent that not all airline operators operate their Mode-S transponder correctly as per procedure stipulated in the AIP (AIRAC AIP Supplement S069/13) while entering the parking bays on the apron. Transponders were either not switched on correctly or left on in the parking bay, which causes reflections and consequently false targets.

(vi) The A-SMGCS can make a valuable contribution to the safety and efficiency of aerodrome surface movement control during low visibility operations (LVOs) and at night, especially to provide active alerts to controllers as a means of early warning of potential incursions.

(vii) ATNS can only fully commission a level 1 A-SMGCS when all vehicles and aircraft operating in ORTIA are fitted with Mode-S.

1.16.3 Incident history determined to be relevant to the accident:

1.16.3.1 During the investigation process, there was information of an earlier incident similar to the one in question. The incident was involving an aircraft that also taxied past the intersection of Bravo and Mike. Enquiries among relevant parties to obtain information were conducted, and the following evidence was found:

(i) Air Safety Report (ASR) – Incident Ref: 246174, dated 30 December 2013 received from British Airways through ACSA.

(ii) According to this incident report, on 20 April 2005 at 18.35:00 UTC (20.35:00 local time), a British Airways B747-400 aircraft, flight number BA056 with registration G-BYGA having 312 occupants on board, entered the wrong taxiway.

(iii) The aircraft was given clearance to taxi from Delta #31 via Delta & Echo aprons to holding point of Runway 03L/21R (a section of taxiway Alfa – the usual route – was closed).

(iv) The pilots reported that as they came to point Bravo 2 some confusion arose as the lighting and markings were not clear.

(v) The pilots stopped the aircraft to ask ATC to clarify the clearance and they were told by ATC to continue straight ahead.

(vi) The pilots realised that obviously something was wrong and decided to stop again. Due to the narrowness of taxilane Mike, they could not manoeuvre and had to be pushed back.

1.16.2.1 Given the limited information in the ASR and records, it was not possible for the investigation to clarify of some of the issues raised in the ASR.

1.16.2.2 The evidence found shows that ACSA was aware of the incident. Back then ACSA's response to British Airways was: "When the new Mike Apron was commissioned a few years ago, it became apparent that aircrew could mistake the taxiway to the apron as an extension of taxiway Bravo. To prevent the unfortunate events as recorded on the ASR, ACSA had a paragraph added to the Airfield Chart SA AIP FAJS AD 2.9 note 12 to warn pilots to exercise caution in this area. In addition, taxiway centreline lights were installed on Bravo so as to guide aircrew. There is also significant illuminated signage in the area and specifically the Cat 2 holding point on Bravo, which is right at the split well displayed".

1.16.2.2. The crew observation was that "There is a note on page E1 of the Aerodrome booklet but it is in wrong place on the page. Also the scale of taxiways and buildings are not identified. I accept I made a mistake but I do feel if all 3 of us were confused enough to stop to clarify the situation something is not right".

Note: FAJS did not have any Surface Movement Radar (for example A-SMGCS); therefore ATC relied on visual reference only in order to give guidance.

1.16.2.3 The Air Safety Report was forwarded to ACSA, ATNS, SACAA and British Airways with the view to obtain relevant information on it. The parties responded as follows:

(i) Representative of ACSA indicated that "Following the British Airways accident on the night of 22 December 2013, the attached document on a similar incident on 20 April 2005 has since been brought to our attention".

(ii) Representative of British Airways indicated that "I have reviewed our own Safety Database and the report you have is the same as the one I have. Following the event the EAG chart (this is the company chart we used before Navtech) was amended to add additional notes as per the AIP. I do not have a copy of this chart. This is the only reference to action taken following the event I can find due the length of time since the incident occurred".

(iii) ATNS had not responded at the time of concluding the report.

1.16.4 Taxiway Centreline Visual Aids Serviceability:

1.16.4.1 In terms of ICAO – Aerodrome Design and Operations, Volume 1, Chapter 10 (Aerodrome Maintenance – Visual Aids):

(i) "Taxiway centre line lights on a taxiway other than an exit taxiway and on a runway forming part of a standard taxi-route shall be fixed lights showing green with beam dimensions such that the light is visible only from aeroplanes on or in the vicinity of the taxiway.

(ii) The system of preventive maintenance employed for a taxiway intended for use in runway visual range conditions less than a value of 350 m shall have as its objective that no two adjacent taxiway centre line lights be unserviceable.

(iii) A light shall be deemed to be unserviceable when the main beam average intensity is less than 50 per cent related to design value".

(iv) Taxiway centre line lights on a straight section of a taxiway shall be spaced at longitudinal intervals of not more than 30 m.

(v) On a taxiway intended for use in runway visual range (RVR) conditions of less than a value of 350 m, the lights on a curve should not exceed a spacing of 15 m".

Note: FAOR complied with the above (straight section taxiway lights spaced at 30 m and lights on curve spaced at 15 m). However, there was evidence that 2 adjacent centreline lights on the curve toward the Category 2 holding point of taxiway Bravo were unserviceable. The effect of the 2 lights being unserviceable was that a total distance of 45 m was not illuminated on the curve of taxiway Bravo.

1.16.3 Taxiway Edge Visual Aids Serviceability:

1.16.3.1 In terms of ICAO – Aerodrome Design and Operations, Volume 1, Chapter 10 (Aerodrome Maintenance – Visual Aids):

(i) ''Taxiway edge lights shall be provided at the edge of a runway turn pad, holding bay, de-icing/anti-icing facility, apron, etc., intended for use at night and on a taxiway not provided with taxiway centre line lights and intended for use at night, except that taxiway edge lights need not be provided where, considering the nature of the operations, adequate guidance can be achieved by surface illumination or other means.

(ii) Taxiway edge lights on a straight section of a taxiway and on a runway forming part of a standard taxi-route should be spaced at uniform longitudinal intervals of not more than 60 m. The lights on a curve should be spaced at intervals less than 60 m so that a clear indication of the curve is provided.

(iii) Taxiway edge lights shall be fixed lights showing blue. The lights shall show up to at least 75˚ above the horizontal and at all angles in azimuth necessary to provide guidance to a pilot taxiing in either direction. At an intersection, exit or curve the lights shall be shielded as far as practicable so that they cannot be seen in angles of azimuth in which they may be confused with other lights".

Note: FAOR complied with the above (straight section taxiway edge lights spaced at uniform longitudinal intervals of not more than 60 m). The only anomaly was that some of the edge lights on taxilane Mike were unserviceable.

(iv) The presence of objects which must be lighted shall be indicated by low (Red in colour – fixed), medium (Red or White in colour – flashing) or high (White in colour – flashing) intensity obstacle lights or combination of such lights. The number and arrangement of low, medium or high intensity obstacle lights shall be such that the object is indicated from every angle in azimuth.

(v) The point of marking and/or lighting of obstacles is so as to make them clearly visible to pilots in all weather and visibility conditions.

Note: WWW.Experimentalaircraft.info/wx/weather-visibility.php states: "Visibility range, in so far as the contrast of an object to its background has a notable effect on its visibility, if contrast is low (for example a white building against a snowy white mountain) then the range at which objects can be seen is reduced. Illumination by the sun or the moon does not alter visibility, it does alter range".

1.16.4 B747- 400 Cockpit Layout in terms of individual crew members' (pilots') view of taxiway Bravo:

(i) The B747-400 aircraft are equipped with a two-crew glass cockpit on the upper deck which features CRT displays showing flight instrumentation along with engine indication and crew alerting systems.

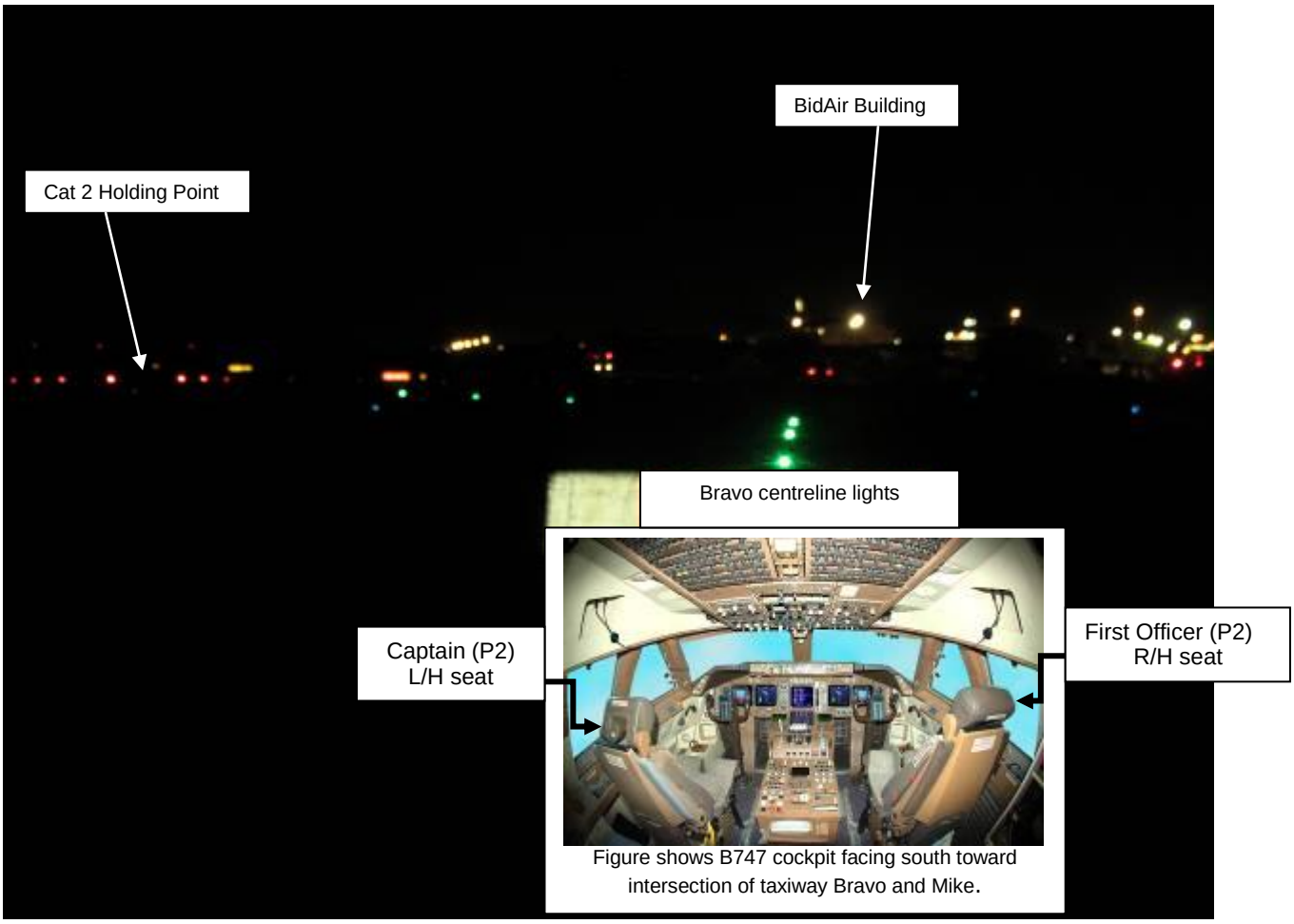


Figure 44 Cockpit with reference to airside surrounding on the night

1.17 Organisational and Management Information

1.17.3 ACSA organisational and management information relevant to the accident:

1.17.3.1 The aerodrome FAOR is operated and managed by the Airports Company of South Africa (ACSA). The aerodrome was issued with a valid Category 9 Aerodrome Licence on 24 July 2013. The licence was valid until 31 July 2014.

1.17.3.2 The Manual of Procedures (MOP) of ACSA was reviewed during the investigation. The aim of the review was to determine whether the ARFF personnel complied with ACSA's organisational and management requirements in respect of the MOP.

1.17.3.3 As mentioned above, the ARFFS carried out a runway and taxiway inspection at FAOR on the day prior to the incident. ACSA was requested to provide copy of the inspection checklist Form ARFFS 001.

1.17.3.4 According to ACSA, ARFF Runway and Taxiway Inspections Procedures, C020 001M dated 29 March 2011, the following is required:

(i) The scope of the procedure is to cover details of activities to be carried out by ARFF when undertaking scheduled and ad-hoc runway and taxiway inspections.

(ii) The runway and taxiway inspection team shall consist of an ARFF Officer, Safety Officer and Maintenance or Engineering representative. It is recommended that where practical, airports establish a joint inspection team, however, where not possible a minimum of at least 2 (two) persons is required for the mandatory inspection and all areas listed on Form ARFFS 001 shall be inspected.

(iii) Inspections in the procedure include the manoeuvring area (used for take-off, landing and taxiing) and rapid exit taxiways.

(iv) The inspections shall be carried out by fully trained, qualified and designated ARFFS Officers.

(v) Inspections must be carried out at speeds as slow as practicable.

(vi) At ACSA International Airports, the electrician on duty is required to complete an inspection focusing on the serviceability of lights during the course of the day or night.

1.17.3.5 Lighting inspections are to check that the following are operational, and that the optical lighting systems are not obscured by vegetation or deposits of foreign material:

(i) Runway and Taxiway Edge Lights,
(ii) Apron Edge Lights,
(iii) Runway Centreline and Touchdown Zone Lights,
(iv) Taxiway Centreline Lights,
(v) Taxiway Edge or Centreline Reflectors,
(vi) Guidance Signs,
(vii) Stop Bar Lights

1.17.3.6 On completion of the inspection, the ARFFS Senior Officer will complete Form ARFFS 001 confirming that the inspection was completed in a structured way. Under usual conditions when the inspection has been completed and no defects/deficiencies have been identified, the ARFFS Senior Officer carrying out the inspection then advises ATC that the manoeuvring area has been declared serviceable.

1.17.4 ATNS Operational and Management Information relevant to the accident:

1.17.4.1 The Air Traffic and Navigation Services (ATNS) were responsible for controlling the air traffic at FAOR. The ATSU at FAOR was issued with a valid approval certificate. According to the approval certificate, FAOR ATSU was approved to provide aerodrome, approach, approach radar, area radar and flight information services as per CAR Part 172.

1.17.4.2 The Standard Station Instructions (SSI) of ATNS was reviewed during the investigation. The aim of the review was to determine if the ATC personnel complied with ATNS organisational and management requirements in respect of the SSI.

1.17.4.3 The ATNS Safety Office conducted an internal investigation of the accident. A report was compiled and submitted to the AIID. The report stated the following:

(i) All environment conditions were within the limits of a safe working environment. At the time of the accident there were low traffic volumes for ATC to control. Thus the work environment did not have any significant negative effect on the ATC performance.

(ii) The actions taken when ATC realised that the BA034 aircraft had taxied past the intersection of Bravo and Mike were determined to be satisfactory and traffic information was correctly exchanged.

1.17.5 British Airways Operational and Management Information relevant to the accident:

1.17.5.1 The investigation determined that British Airways had a valid international air service licence and air operating certificate (AOC). In terms of the air service licence and AOC, the B747- 400 aircraft G-BNLL was duly authorised to be operated under Part 121 (International Commercial Operations).

1.17.5.2 The Standard Operating Procedures (SOP) of British Airways were reviewed during the investigation. The aim of the review was to determine if the flight crew (pilots) complied with the organisational and management requirements. The SOP in question was the taxi and before take-off briefing.

1.17.5.2.1 According to the B747 Flight Crew Training Manual, the before and during taxi requirements are the following:

A. Prior to Taxi

(i) Review NOTAMS and current ATIS for any taxiing or runway closures, construction activity or other airport risks that could affect the taxi route.

(ii) Both pilots verify that the correct airplane position in the FMC and the EFB airport moving map (as installed) show correct placement.

(iii) Brief application items from airport diagrams and related charts to include the location of hold short lines.

(iv) Ensure both crew members understand the expected taxi route.

(v) Write down the taxi clearances when received.

(vi) An airport diagram should be readily available to each crew member during taxi.

B. During Taxi

(i) Progressively follow taxi position on the airport diagram.

(ii) During low visibility conditions, call out all pertinent signs to verify position.

(iii) If unfamiliar with the airport consider request a FOLLOW ME vehicle or progressive taxi instructions.

(iv) Use standard radio phraseology.

(v) Read back all clearances. If any crew member is in doubt regarding the clearances, verify taxi routing with the assigned clearances or request clarification. Stop the airplane if clearance is in doubt.

(vi) If ground/obstructions clearance is in doubt, stop the airplane and verify clearance or obtain a wing walker.

(vii) Avoid distractions during critical taxi phases; plan ahead for checklist accomplishment and company communication.

(viii) Consider delaying checklist accomplishment until stopped during low visibility operations.

(ix) Do not allow ATC or anyone else to rush you.

(x) Consider using the taxi light to visually indicate movement.

(xi) At night use all appropriate airplane lighting.

1.17.5.2.2 Briefing and Taxi Policy and Procedures:

A. Briefing Policy and Procedure:

(i) According to British Airways, the Operations Manual Part A (2) contains the policy for flight crew take-off briefings. The policy states that before every take-off the Captain must ensure that his Co-pilot is familiar with the standard take-off briefing for the concerned aircraft. When a Senior First Officer (relief/heavy) pilot is on the flight deck (cockpit) for take-off, he/she should listen to the departure briefing and contribute as required with any salient points in the briefing. All crew members should participate in the briefing.

(ii) The B747 FCOM Vol 1 contains the procedures for taxi and take-off briefing.

Note: The taxi and take-off briefing procedure requirement to consider potential threats is mentioned three times in the aims and framework, including how to avoid associated risk. The framework also includes a section on taxi route, with guidance to review the likely taxi routing and identify relevant taxi restrictions.

B. Taxi Policy and Procedure:

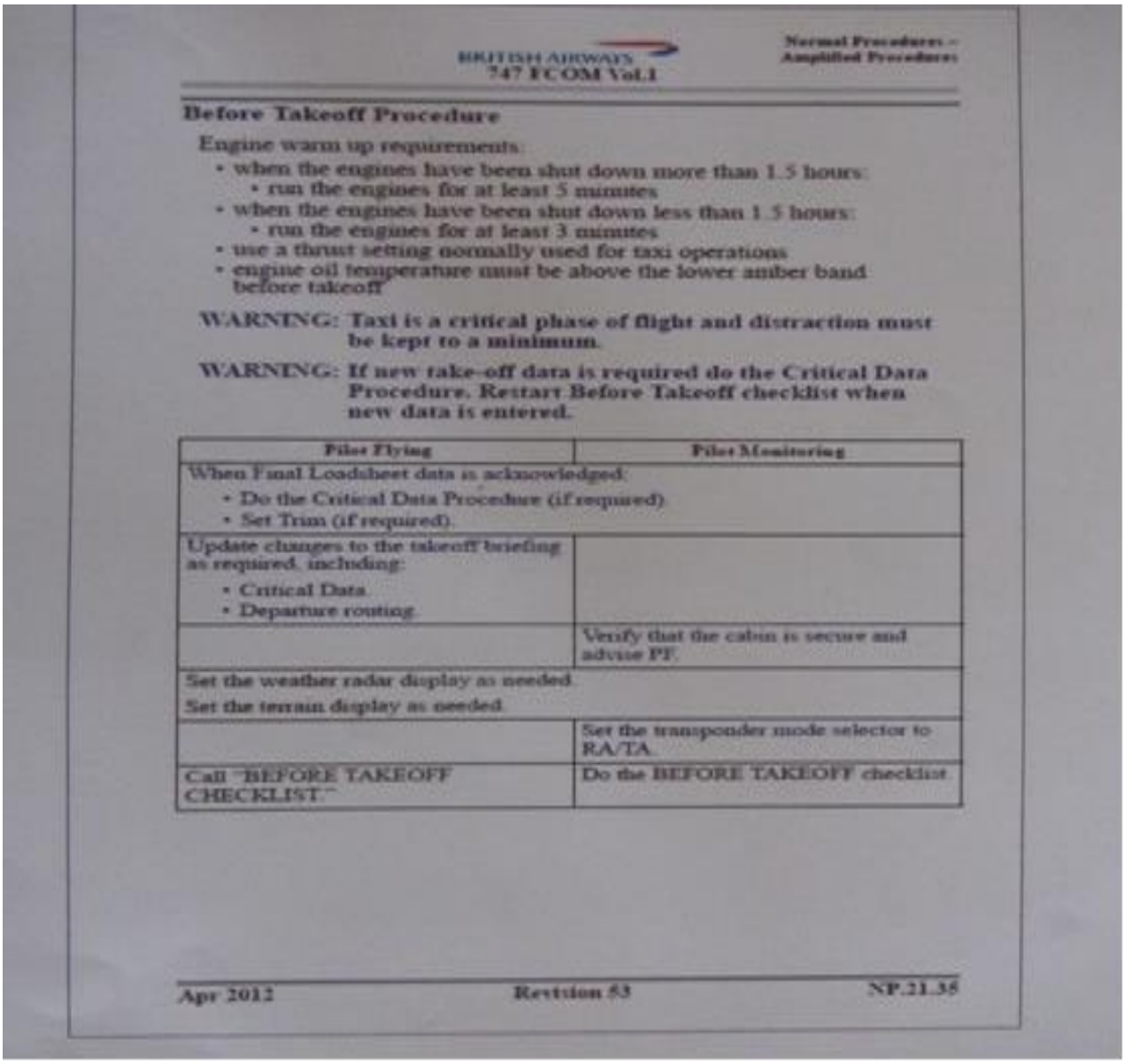
(i) According to the ground navigation responsibility during taxiing, both pilots (Captain and Co-pilot) are responsible for accurate navigation and collision avoidance on the ground. At least one pilot must display the relevant taxi chart to ensure correct interpretation of ATC taxi instructions, to monitor taxi progress and to achieve a general situational awareness of the airfield.

(ii) Except where ground surveillance radar is available to assist ATC, the separation of traffic is entirely dependent upon the information originated on the density at all levels, and it is essential that this information be as accurate as possible. A high standard of navigation must be maintained at all times.

1.17.5.2.3 According to the B747 FCOM Vol 1, Before Take-Off Checklist and Procedure, the following is noted:

A. Before Take-Off Procedure

(i) The before take-off procedure is a document held by the flight crew inside the cockpit. The procedure is used by the flight crew in preparation for the take-off. The procedure has activities and actions for both Captain (monitoring pilot) and Co-pilot (handling pilot).



BRITISH AIRWAYS
747 FCOM Vol.1

Normal Procedures – Amplified Procedures

Before Takeoff Procedure

Engine warm up requirements:

- when the engines have been shut down more than 1.5 hours:
  - run the engines for at least 5 minutes
- when the engines have been shut down less than 1.5 hours:
  - run the engines for at least 3 minutes
- use a thrust setting normally used for taxi operations
- engine oil temperature must be above the lower amber band before takeoff

WARNING: Taxi is a critical phase of flight and distraction must be kept to a minimum.

WARNING: If new take-off data is required do the Critical Data Procedure. Restart Before Takeoff checklist when new data is entered.

Pilot Flying	Pilot Monitoring
When Final Loadsheet data is acknowledged: • Do the Critical Data Procedure (if required) • Set Trim (if required).	
Update changes to the takeoff briefing as required, including: • Critical Data • Departure routing.	
	Verify that the cabin is secure and advise PF.
Set the weather radar display as needed. Set the terrain display as needed.	
	Set the transponder mode selector to RA/TA.
Call "BEFORE TAKEOFF CHECKLIST."	Do the BEFORE TAKEOFF checklist.

Apr 2012 Revision 53 NP.21.35

Figure 45 shows a copy of B747 FCOM Vol 1, Before Take-off Procedure.

(ii) According to British Airways, B747 FCOM Vol 1 Before Take-Off Procedure has actions for both Captain and Co-pilot, carried out from memory at a suitable time after the aircraft has started taxiing. The procedure only requires the Co-pilot (handling pilot) to look in at his glare shield once: “Set the weather radar display as needed” and “Set the terrain display as needed” and remain “head out” the rest of the time. The procedure requires the Captain (monitoring pilot) to look in and down at the centre console three times: “Verify that the cabin is secure and advise PF” and “Set the weather radar display as needed” and “Set the terrain display as needed” to make selections on the panels.

B. Before Take-Off Checklist

(i) The before take-off checklist is a document also held by the flight crew inside the cockpit. The checklist is used by the flight crew in preparation for the take-off. The checklist again lists activities and actions for both Captain (monitoring pilot) and Co-pilot (handling pilot).

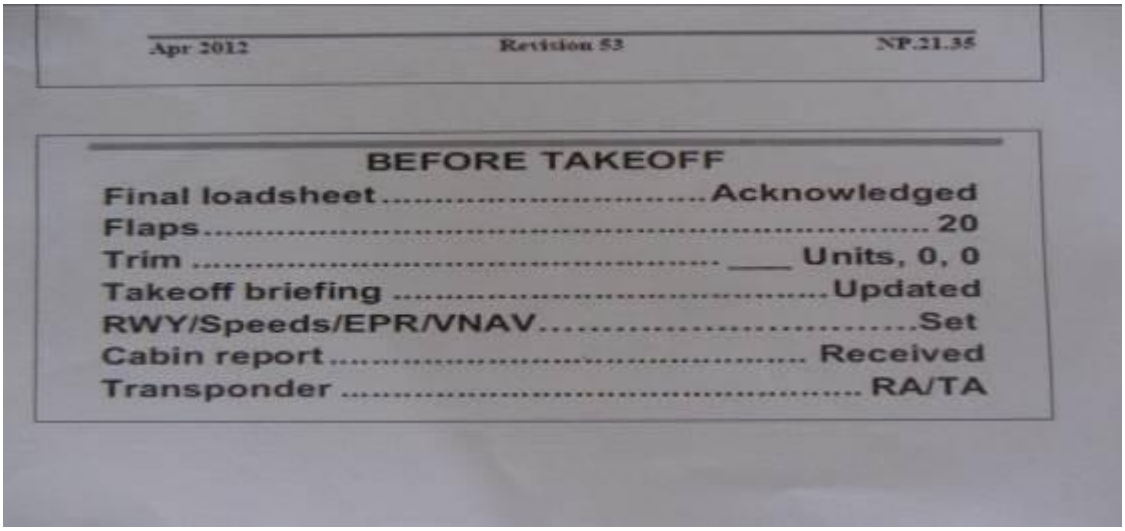


Figure 46 Copy of B747 before take-off checklist

(ii) According to British Airways, the B747 Before Take-Off Checklist is carried out in a "challenge and response" manner and requires the Co-pilot (handling pilot/pilot flying) and Captain (monitoring pilot) to look in and down at the centre console four times (flaps, trim, cabin report and transponder), plus a further look in across each of the displays on the forwards instrument panels (RWY/Speeds/EPR/VNAV).This necessarily reduces both pilots' ability to monitor taxi progress for short periods.

1.17.5.2.4 British Airways Operations Manual, Part C, Route Information Manual:

(i) According to British Airways, the operations manual has an aerodrome brief for Johannesburg (FAOR). The Airfield and Parking paragraph makes no reference to any taxiway hazards.

(ii) The AIS information (FAJN/A3919/13 24Nov13) available to the crew as part of their briefing documentation had a number of entries relating to taxiway restrictions and a single item referencing:

"All aircraft to be towed in and out of apron M"

(iii) There was no information limiting the use of taxilane M and no restrictions on aircraft size.

1.17.5.3 British Airways Quality Oversight Process over Navtech:

1.17.3.3.1 According to British Airways Navtech was subjected to the following quality oversight processes:

(i) Air Safety Reports (ASR) and Flight Crew Reports (FCR):

- ASRs and FCRs regarding charting discrepancies are forwarded to Navtech, and the SLA requires a response/acknowledgement within 12 hours (ASRs) or 72 hours (FCRs).

(ii) Meetings

- There are monthly performance review meetings.
- During these meetings, there are discussions between British Airways and Navtech on all ASRs, FCRs, quality issues and charting issues. Developments are logged/tracked.

(iii) Quarterly Management Meeting

- High-level quarterly meetings between British Airways and Navtech are held to discuss any contractual issues or serious quality issues/trends picked up through ASR/FCR monitoring.

(iv) Audits

- Navtech is audited on an annual basis by the British Airways Corporate Compliance department.

(v) Random Checks

- Random checks are carried out as part of the oversight provided by the above measures to ensure that Navtech is certified as conforming to standards AS9100 Rev C and ISO 9001:2008 governing "the compilation, amendment, production and supply of aeronautical information documents, together with their distribution, translation, format and integration of information that originates from State aeronautical information services into electronic databases for airborne and ground based navigation systems".

Note: According to Navtech, they classify changes according to a severity code matrix contained within the service level agreement. This then determines the appropriate revision cycle. In the present case, the changes were not deemed significant enough to change the chart.

1.17.6 SACAA Organisational and Management Information relevant to the accident:

(i) Foreign Operators Ramp Inspections

- According to the SACAA procedures, the Flight Operations Department, Airworthiness and Aviation Security will, in terms of the Master Surveillance Plan (MSP), at the same time carry out ramp inspections of Foreign Operators. The CAA's inspections are to ensure that the operators comply with applicable regulations, requirements and international practice relevant to aeronautical information/data (e.g. navigation and airport charts). During the investigation, the CAA submitted evidence of copies of ramp inspection reports and foreign operators' ramp inspection reports (Part 121) as proof that inspections had been carried out as per procedure.

  Note: The procedure in question requires that the monthly ramp inspections be planned on a quarterly basis.

(ii) Air Safety Infrastructure (ASI) Section

- According to the CAA, the ASI section responsible for the publication of aeronautical information verifies with other technical departments within the CAA whether information can be published.

- The ASI section does not decide whether the information is portrayed in an adequate form, as it is not responsible for oversight of airports and infrastructure. No physical inspections are done by the ASI section to verify integrity of information.

- The investigation determined that the ASI section, supported by the other CAA technical departments, complied with all applicable regulations and requirements. The ASI section ensured reasonable measures were taken to adequately and accurately provide the aeronautical information to the industry.

  Note: As regards the accident in question, the ASI section took extra measures by means of email communication to ensure that the airline – British Airways and its service provider Navtech – received the aeronautical information/data personally.

(iii) ASI section process flow in terms of aeronautical information

- According to ASI records, information/data was submitted requesting the change/revision which came from the owner/operator, in this case ACSA, and handed to the CAA in the prescribed format.

- After receiving the submission from ACSA, the CAA's ASI section together with other technical departments collated, edited and verified the information/data.

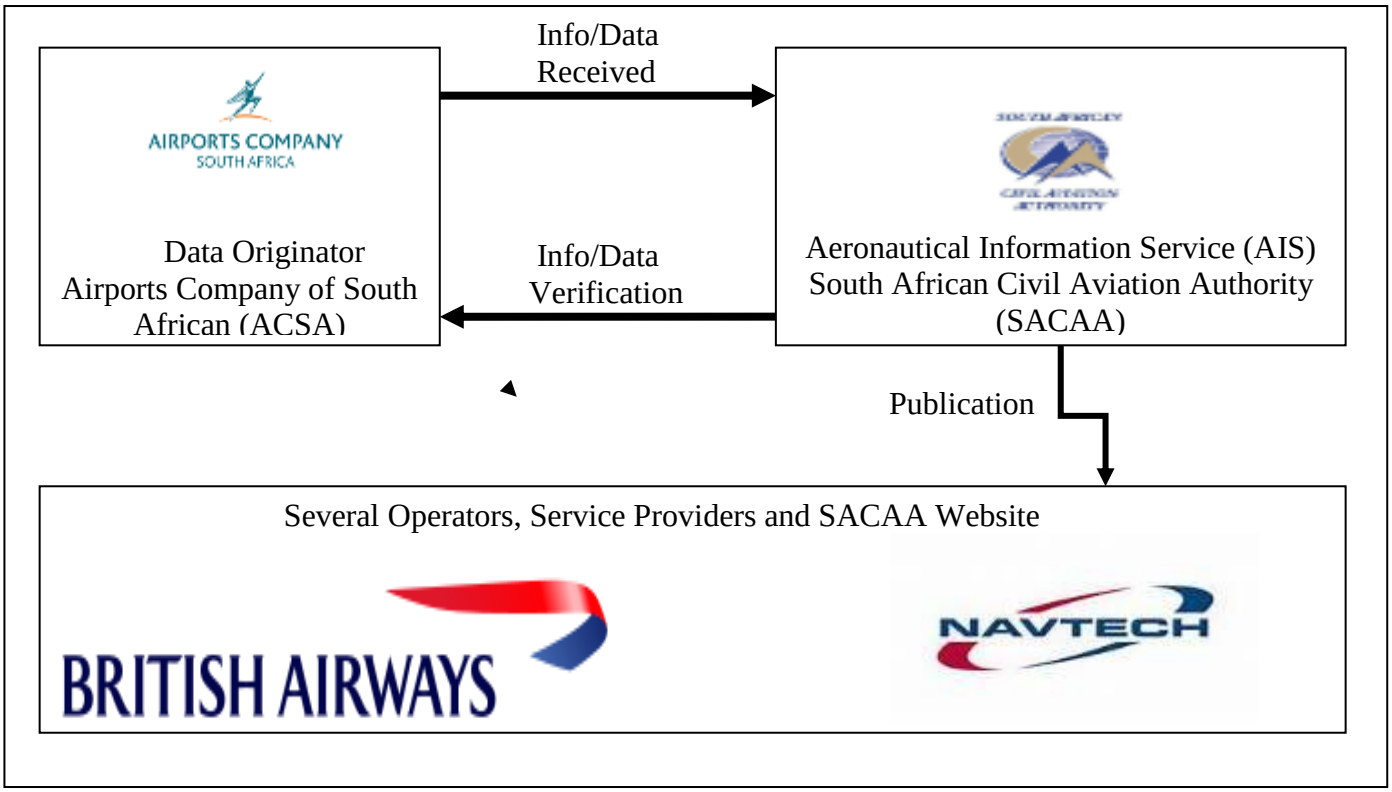


Figure 47 Mock-up block diagram with AIS process flow in terms of charts

- The ASI section on its own is not in a position to decide whether the information/data is portrayed in an adequate form. The ASI section depended on relevant technical departments to assess the applicability or adequacy of information/data before approving publication. In this case, the Airports Department gave the approval for publication.

- The CAA found the updated aeronautical information/data to be accurate, unambiguous and easily readable; hence it was published for public consumption. The CAA accepted that all interpretations of the information/data met the requirements of the originator because there was no proof of any advice of errors or omissions detected and queried.

- Meeting the requirements in this regard simply means that the aeronautical information/data conformed to the following criteria:

  - Routine: use of the information/data will result in a very low probability that the continued safe flight and landing of an aircraft would be severely at risk, with the potential for catastrophe;

  - Essential: use of the information/data will result in a low probability that the continued safe flight and landing of an aircraft would be severely at risk, with the potential for catastrophe;

  - Critical: use of the information/data will have a high probability that the continued safe flight and landing of an aircraft would be severely at risk, with the potential for catastrophe.

- At the time when the approval was given, the ASI section published the information/data using the following means: Aeronautical Information Circulars (AISs), Notices to Airmen Plain Language Summaries (NOTAMs), Aeronautical Information Publications (AIP amendments/supplements).

- The evidence shows that the CAA's updated aeronautical information/data was forwarded to different operators and service providers by email dated 15 November 2013 11:41 AM (i.e. ATNS, British Airways, Navtech, SAA, Lufthansa, KLM and various individual email addresses).

- This email, with the subject heading "South African AIP Supplements AIRAC 12 December 2013. Charts will be available for download from CAA web-site shortly" was received by the operator (British Airways) and the service provider (Navtech). There was no evidence of communication received from any of the operators and/or service providers raising a dispute on the applicability or adequacy of the aeronautical information/data.

1.17.7 Aeronautical Information Regulation and Control (AIRAC) System:

1.17.7.1 The CAA used the AIRAC system, which is aimed at advance notification (based on common effective dates at intervals of 28 days) of circumstances that necessitate significant changes in operating practices. The CAA ASI complied with the AIRAC system by controlling and regulating the changes requiring amendments to the charts, and such changes were issued on the predetermined effective dates.

SOUTH AFRICAN CIVIL AVIATION AUTHORITY

AERONAUTICAL INFORMATION SERVICES

AIRAC EFFECTIVE DATES 2013

Final Date for information to reach SACAA AIS	Publication Date	AIRAC Effective Date
31 Oct '12	13 Dec '12	10 Jan '13
16 Nov '12	10 Jan '13	7 Feb '13
14 Dec '12	7 Feb '13	7 Mar '13
23 Jan '13	7 Mar '13	4 Apr '13
15 Feb '13	4 Apr '13	2 May '13
18 Mar '13	2 May '13	30 May '13
16 Apr '13	30 May '13	27 Jun '13
14 May '13	27 Jun '13	25 Jul '13
11 Jun '13	25 Jul '13	22 Aug '13
9 Jul '13	22 Aug '13	19 Sep '13
6 Aug '13	19 Sep '13	17 Oct '13
3 Sep '13	17 Oct '13	14 Nov '13
2 Oct '13	14 Nov '13	12 Dec '13

AIS AIRAC Dates 2013 Page 1 of 1

Figure 48 AIRAC system common effective dates relevant to the charts

1.17.7 After the SACAA had approved, circulated and published the aeronautical information/data, the operator (British Airways), being an end-user, depended on the service provider (Navtech) to provide them with the latest updates. The crew depended on the operator (British Airways) to give them the latest updates on board the aircraft.

1.17.8 When asked whether the operator's quality oversight process included any requirement set for the activities of the service provider, Navtech responded as follows:

(i) Air safety reports (ASRs) and flight crew reports (FCRs) on charting discrepancies are forwarded to Navtech.

(ii) The service level agreement (SLA) with Navtech requires that British Airways will receive a response or acknowledgement within 12 hours on the ASRs or 72 hours on the FCRs.

Note: The use of the words *"charting discrepancies"* clearly shows that the British Airways quality oversight process is designed to identify charting disparities, which they communicate to the service provider (Navtech). The service provider is then obliged in terms of the SLA to respond or acknowledge receipt of the discrepancies, if any, within the specified time.

1.18 Additional Information

1.18.1 The evidence of the ATC was that when he looked for BA034 on the taxiway Bravo and could not see it, he decided to look at the A-SMGCS (ground radar). He then had to rely on the "squawk" to establish BA034's position and saw it had passed the intersection and was going straight ahead in the wrong direction toward apron Mike. In terms of ICAO requirements and regulations, under circumstances where ATC cannot clearly see the activities in a particular aerodrome ground movement area, that area must be identified as a hotspot.

Note: The activities at the intersection/junction of taxiway Bravo and aircraft stand taxilane Mike could not be seen clearly by ATC. This implies that it should have been identified as a hotspot.

1.18.2 Operation of auxiliary power unit (APU): According to Boeing 747 – 400, Normal Procedures Checklist, during the before taxi checks the APU condition is OFF. The APU switch positions are OFF, ON and START. When the switch is rotated to START, the APU will start within seconds. Once the APU is running, it will provide hydraulic and pneumatic pressure and electrical power to the aircraft. Hence all pre-flight activities can be performed with the APU. During start-up the APU bleed air is important to start the engines. Once the engines have started successfully and are running, the APU is turned off because the engines will serve the purpose of powering the hydraulics, pneumatic pressure and electrical systems. The APU is no longer required.

Note: At the time when the APU is switched off, the engines are powering the systems which were powered by the APU. Shutting down the engines will result in loss of these systems. The APU (or the ground/external power unit) is used to power the systems. Once the APU has been switched on and started, the engines may be shut down by setting the fuel control to cut-off.

1.19 Useful or Effective Investigation Techniques

1.19.1 None.

2. ANALYSIS

2.1 The AIID received notification of an accident and instituted an investigation into the circumstances of a British Airways B747- 400 aircraft, registration G-BNLL and flight number BA034. The accident happened at OR Tambo International Airport (FAOR) on 22 December 2013. In terms of ICAO, Annex 13, the AIID investigation objective was to determine the cause of the accident. During the investigation process the following was identified:

2.1.1 In relation to aircraft technical (i.e. structures, power plants & systems) aspects, the investigation concluded that the aircraft was standing on the ramp while being prepared for the flight. The crew carried out a pre-flight inspection to establish the airworthiness of the aircraft. All indications were that the crew was satisfied with the overall condition of the aircraft, as there was no information of any defects or malfunction being experienced or reported. The aircraft was considered to be completely serviceable for the flight, hence the decision to taxi.

2.1.2 In relation to the air traffic control (ATC) performance aspect, the investigation concluded that on the day of the accident the employer's (ATNS's) shift time was from 19.00 to 05.45 UTC (17:00 to 03:45 local time). The tower operations for this period were reasonably moderate. Due to the low traffic volumes at the time, the tower operations were combined. The practice of combining the tower operations was determined to be normal, as it helps with ATC staffing. In terms of the traffic volumes on the day, the A-SMGCS ground radar shows that the ATC was handling a total of 10 aircraft *(*Emirates766, SAA375, Martinair086, Comair620, ZS-ZWR, SAA236, SAA374, Mauritius847, Comair626 and BA034) from 22.31:21 to 22.43:56 UTC (20.31:21 to 20.31:21 local time). This evidence was further corroborated by the tower tapes.

2.1.3 The investigation determined that the ATC on duty as per the roster was manning the tower from 20.31:21 to 20.43:56 UTC (22.31:21 to 22.31:21 local time). ATNS provided a summary of the ATC information, and the conclusion was that the ATC had received appropriate training. He had adequate experience and had a valid licence which authorised him to exercise the privileges to perform duties at FAOR. The ATC fully complied with ATNS station standing instructions (SSI) and applicable regulations.

2.1.4 According to the A-SMGCS ground radar and tower tape recordings, it was determined that at about 20.34:15 UTC (22:34:15 local time), when the aircraft was still standing on Alfa #6, the ATC received a transmission from BA034 on VHF 121.9 MHz. The Co-pilot (P1) said: "Speedbird BA034 ready to push-start" and the immediate response from ATC was "Speedbird BA034 start, push back and face south". Following the ATC instruction and discussion amongst the crew about it, the Co-pilot then made another call asking ATC to "confirm push back and face south". The ATC response was "Affirm". Satisfied with ATC response the Co-pilot then transmitted: "Speedbird 34 requesting taxi" and the response was "Speedbird 34, taxi Bravo to Cat 2 holding point, RWY 03L". The conclusion was that the ATC's instruction, after it had been confirmed, was clear, concise and without any ambiguity. Hence the crew was expected to have followed the ATC instruction.

2.1.5 The investigation obtained a statement from the ATC in which he gave all the information pertaining to his performance on the day. A report obtained from ATNS contained the required ATC information. The ATC reported that when BA034 was taxiing from Alfa #6 and heading toward taxiway Bravo, BA034 was being controlled by the Co-pilot. The ATC was talking to Emirates 766, responding to the crew's request to push back. While talking to Emirates 766, he decided that he was going to allow them to depart ahead of BA034. On taxiway Bravo he had BA034 taxiing to Category 2 holding point. On taxiway Alfa he had Emirates 766 taxiing to Category 1 holding point.

2.1.6 The ATC observation was that all operations were normal until the time he was looking out from the tower to check the position of BA034 on taxiway Bravo. He could not see BA034 and decided to look for it on the A-SMGCS (ground radar). Seen from the tower, the intersection/junction of taxiway Bravo and aircraft stand taxilane Mike was in a blind spot. The ATC was unable to visually survey the ground movement area in which BA034 was taxiing. The A-SMGCS ground radar assisted him in that regard, as it provided him with information to locate BA034's position. He was surprised to see that BA034 had taxied straight ahead, crossing the intersection/junction of taxiway Bravo to aircraft stand taxilane Mike. BA034 was taxiing in the wrong direction, heading toward apron Mike. The ATC realised this and immediately made a transmission.

Note: According to ICAO aerodrome standards, the aerodrome authorities should under circumstances where ATC cannot clearly see the activities at a particular aerodrome ground movement area, identify the area as a hotspot. The evidence showed that hotspots were indicated on two locations on taxiway Alfa, but none on taxiway Bravo or aircraft stand taxilane Mike.

2.1.7 The ATC transmitted to BA034 at about 20.43:50 UTC (22.43:50 local time), instructing "Speedbird 34, hold your position". The ATC's intention was to get BA034 to stop. It was clear to him that BA034 was going the wrong way. Shortly (±6 seconds) after the transmission, at about 20.43:56 UTC (22.43:56 local time), the Captain responded "We actually hit something here, standby please". BA034 had collided with the Bid Air Services building on the right side of aircraft stand taxilane Mike. Immediately after ATC received the information that "something" had been hit, he sent ARFF vehicle FTL to assist. Upon receiving more information from FTL, he activated the crash alarm to dispatch the aerodrome and rescue fire fighting service (ARFF) to the scene. While ARFF was moving to the scene, the ATC reported the accident to all the different role players as required by the relevant emergency procedures.

2.1.8 It is important to note that there is no evidence of any transmission between ATC and BA034 in which an “emergency” was declared. The ATC did call BA034, but with the intention to stop them from continuing in the wrong direction to apron Mike. At the time when the call was made, BA034 had already collided with the Bird Air Services building. The ATC was not made aware of the situation at the time. Only after ATC instructed them to “hold position” did the Captain say they “we hit something”. No additional information was reported to ATC to explain what had happened. The crew asked ATC to “stand by” which means “wait, I will call you back”. However, the ATC immediately reacted with an instruction to the ARFF to go and “assist” BA034. While the ATC was communicating with ARFF personnel, the crew remained silent and did not speak to ATC. The ARFF FTL vehicle drove to the scene as ATC had instructed. On arrival on the scene they provided ATC with more substantial information on BA034’s situation. As soon as ATC received the right information from FTL, the crash alarm was activated to dispatch the fire trucks to the scene.

2.1.9 The investigation concluded that the ATC had complied with all applicable procedures and regulations and no anomaly was identified. This can be seen in way he executed the radio telephony procedure requirements. There was effective acknowledgement and read back of messages between him and BA034, and he used his training, experience and skills to interface with available ATS surveillance equipment in order to provide the best service. He did this without any apparent problem. When push-back was required, he gave proper instructions to inform the crew of their taxi route. He was satisfied that the crew would taxi the aircraft at their own discretion to the Category 2 holding point safely. He continued to control other aircraft and monitor the taxi movements of BA034. He responded appropriately to BA034 when the observation was made that it was going the wrong way on aircraft stand taxilane Mike and advised the crew accordingly. However, if he had looked at the A-SMGCS a moment sooner, when BA034 taxied into the blind spot, he might have realised the error earlier and succeeded in stopping BA034 before it collided with the Bid Air Services building.

2.1.10 As regards the operational aspects of the aerodrome rescue and fire fighting services (ARFF), the performance and manner in which they complied with procedures and regulations, the investigation concluded that the ARFF were the first responders to the accident. They arrived at the scene quickly because vehicle FTL was in the immediate vicinity at Swissport. According to the tower tape recording, the ARFF personnel were listening to the ATC and BA034 transmissions. This enabled them to call ATC and to receive instructions as follows: “FTL if you just respond to British Airways on Bravo. It went past the Cat 2 towards Mike apron. Can you just respond, Bravo Cat 2 for British Airways”. The ARFF FTL immediately drove to the location where BA034 was reported on aircraft stand taxilane Mike. They arrived at the scene in less than a minute, which was in compliance with the relevant requirements.

2.1.11 When FTL arrived on the scene, there were other fire trucks dispatched from the main fire station (located near the tower) and substation (located near the cargo area). In the end a total of three fire trucks were on the scene to give rescue and fire fighting assistance to BA034. After arriving on the scene, the ARFF personnel reported to ATC that BA034 had collided with the BidAir Services building. The aircraft had caused damage to the Bird Air Services building; damage to the aircraft was to the starboard wingtip. The ARFF also reported that they observed a very large quantity of fuel leaking from the damaged wing. Otherwise, BA034 was intact with the occupants on board the aircraft. The ARFF could not immediately start the rescue and fire fighting process because BA034's engines were still running. They called ATC requesting to inform the crew of the engine situation. Another issue they had deal with was switching off the electrical power supply to the BidAir Services building. Only once the engines had been shut down and the power supply to the Bid Air Services building had been switched off did the ARFF start the rescue and fire fighting process. The Chief Fire Officer (CFO) was co-ordinating the operation.

2.1.11.1 The issue of the engines still running at the time when the ARFF personnel arrived on the scene was investigated. The Captain's explanation was that the engines were left running with the intention to power the electrical system ("keeping lights switched on") and thus prevent the passengers from panicking. This is a reasonable explanation; however, it would have been better if they had used the APU and shut down the engines. The fuel spillage was a fire risk due to its volatility. Keeping the engines running, particularly with the exhaust temperatures in close proximity to the fuel, was considered to be a hazard; starting up the APU would have been a better option in terms of safety. Also, the APU starts within seconds of its knob being turned to START. Once up and running the APU would have powered the hydraulic, pneumatic and electrical systems. It was only after the ARFF personnel requested the engine shutdown that the crew decided to switch off the engines as soon as they had the APU running, further delaying the ARFF activities.

2.1.11.2 The damage to the electrical power supply in the BidAir Services building was substantial. The information shows that the eastern hall on the second floor was destroyed. There were electrical appliances and broken electrical wires hanging around still receiving electrical power. Also, a large quantity of fuel (Jet-A1) from BA034 had spilled inside and outside the building. A risk assessment of the situation, taking into consideration all factors, was required. This is exactly what the ARFF CFO did.

2.1.12 Only after the engines had been shut down and electrical power supply switched off did the fire trucks start to spray foam (extinguishing medium) on the fuel spillage with the aim to contain it and completely remove the fire risk. While the fire trucks were containing the fuel spillage, the CFO arranged for an air step vehicle and buses for the occupants to disembark. At about 23.20:00 UTC (21.20:00 local time), after approximately 37 minutes, the fuel spillage had been contained. The air step vehicle and buses also arrived and commenced with the disembarkation. The evidence shows that the ARFF complied with the applicable procedures and regulations; no anomaly was found in the manner in which they handled the rescue and fire fighting process. The way they performed their duties, their quick response, commitment to aviation safety, their deserves to be commended. They successfully protected the safety of the aircraft, life and property. After they had contained the fuel spillage, they remained on the scene to help with the disembarkation process.

2.1.13 The accident was considered to be survivable. Although it had collided with the BidAir Services building, the aircraft was still largely intact. All the occupants on board were properly restrained with safety belts when the accident occurred. The evidence shows that at the time of the accident, the crew and all the passengers were seated and ready for take-off. During the taxi suddenly they felt the aircraft *"*shaking, rumbling and juddering*"* before the brakes were applied.

2.1.13.1 The evidence shows that the brakes were applied before the collision. The aircraft was taxiing at a maximum ground speed of 14,5 kts (about 26,9 km/hour). According to the FDR, at the time when the starboard wing impacted the building, the impact force was as follows: ACLONG (aircraft longitude East/West = + 0.2˚ to – 0.4˚) and ACLATE (aircraft latitude North/South = + 0.1˚ to – 1.5˚), which explains the violent vibrations felt. However, it is important to note that it was not possible to determine any information relevant to the braking operation, which could have assisted in determining the crew's actions in terms of applying the brakes. The FDR does not record any braking information.

2.1.14 When the violent vibrations were felt and aircraft came to a stop, the cabin crew conducted an investigation to see what had happened. This is when they realised that the aircraft had collided with a building. The observation was that the situation was serious. Fuel spillage was observed, and they immediately reported the information to the cockpit (crew). The investigation to determine the amount of fuel spilled was inconclusive.

2.1.14.1 The reason for this was conflicting information about the quantities of fuel uplifted, carried on board, spilled and defuelled. The British Airways load sheet contains the following information: Fuel carried before refuelling = 125 672 litres (100 537.6 kg), Fuel uplifted = 18 125 litres (14 500 kg), Fuel carried after refuelling = 143 797 litres (115 037.6 kg). According to the airport fuel agent (Engen), the fuel delivery receipt shows that total of 18 060 litres (14 448 kg) was defueled from the aircraft. However, British Airways did not agree with Engen's fuel information. They indicated that their engineering department estimated ("roughly calculated") that approximately 1250) litres (1000 kg of fuel were spilled. The fuel delivery vehicle actually offloaded 4641.25 litres (3713 kg) more than was loaded for the flight, and the location of the damage on the aircraft would have limited the actual fuel that could be lost by the tank capacity of 5000 litres (4000 kg). After all the deliberations on the fuel information, it was evident that an *"*administrative error*"* had occurred. In any case,, the simple fact was that a substantial amount of fuel was spilled, which required a complete or thorough soil remediation process in the area of the spillage.

2.1.15 After the cabin crew had reported the information of the collision and fuel spillage to the cockpit crew, everyone remained seated in the cabin and waited for further instructions about the evacuation. Upon receiving the information, the Captain engaged in a discussion with CSD around an evacuation. After the discussion with the CSD, the Captain informed the passengers about the accident on the public address (PA) system. He also explained the plans for the evacuation.

2.1.15.1 The cabin crew then prepared themselves to execute a full evacuation. Under normal circumstances, a “full evacuation” will include deploying the escape slides and passengers escaping down the slides to safety. Research shows that in most instances, during full evacuations passengers suffer injuries which could have been prevented. Based on the information one sees that it is quite clear that taking a decision to do a full evacuation was very risky. The responsibility rests on the shoulders of the Captain to order an evacuation, meaning the evacuation happens in his discretion, after he has looked at the circumstances and immediate danger. Therefore it is important for crews to analyse the situation and weigh up the different options in the interest of passenger safety. It is important to remember that failure to evacuate in a timely manner could lead to injuries or deaths. The crew of BA034 determined it was safer to disembark normally rather than risking passenger injuries with an evacuation.

2.1.16 It was very important for everyone on board BA034 not to panic and to remain calm in this emergency situation. The cabin crew plays a very important role to ensure that the situation is handled appropriately. It is for this reason that the information of confusion amongst the passengers was investigated. The information received from certain passengers was that there was confusion on board the aircraft about the sequence of disembarkation.

2.1.16.1 The passengers were informed that the disembarkation would be through the front door (Door #1). The passengers were under the impression that preference was being given to the first class passengers to leave the aircraft. But the decision to use Door #1 was then changed and they were informed that the disembarkation would be through Door #5. It was determined that the confusion inside the aircraft was due to what was happening outside the aircraft. The passengers were not aware of the step vehicle situation. The air step vehicle first drove to Door #1, but got stuck in the grass just off taxilane Mike and could not reach the door. It was then put into position at Door #5 instead. Now that the step vehicle was in position at Door #5, another challenge popped up, which was the risk that the aircraft could become unstable if the disembarkation was not controlled properly. It was feared that the tail end would tip over. In order to mitigate the risk, the cabin crew guided all the passengers carefully row by row to exit the aircraft. It was concluded that the time the passengers remained seated in the aircraft was approximately 37 minutes before disembarking.

2.1.17 There were some safety concerns about the disembarking process. There was the concern of the ARFF personnel finding BA034’s engines running. This prevented them from commencing with containment of the fuel spillage. The Captain explained that the engines were running for purpose of keeping the aircraft lights switched on. The time taken by the Captain to discuss the matter of evacuation before final decision was made to do normal disembarkation, the confusion in the cabin about the exit points used for disembarking, the air step vehicle getting stuck in the grass and risk of imbalance causing the tail to tip over if disembarking was not controlled orderly – all these issues were a threat to aviation safety. However, the cabin crew’s performance on the day contributed largely positively. They remained calm throughout and laid the fears of the passengers to rest. They performed their duties with a high level of professionalism and commitment. The skills they displayed reflected well on the training and experience acquired. No anomaly was identified in the cabin crew’s performance in dealing with the emergency situation. They fulfilled their responsibilities successfully in protecting

the safety of the aircraft and passengers despite the identified safety concerns.

2.1.18 Another issue that received attention during the investigation related to the ground handling services. The investigation determined that the step vehicle arrived on the scene at 23.15:00 UTC (21.15:00 local time). The step vehicle was put into position at Door #5 at 23.20:00 UTC (21.20:00 local time). This was roughly about 42 minutes after the accident. This period gives an indication of the time taken before a decision was made to disembark. The evidence shows that the issue of evacuation was discussed on board BA034. Probably the discussions were to assess the gravity of the situation or even to obtain information to help decide on the evacuation. And whether the situation was seen as urgent or less urgent would have determined the use or not of escape slides for evacuation or disembarkation.

2.1.19 Based on the above information, the problem identified was the time the Captain took to make a decision. While he was deciding, the passengers remained seated and waiting. The passengers were watching the ARFF activities outside. Only after the fuel spillage had been contained and the step vehicle was positioned at Door #5 the passengers were guided to disembark. The disembarkation and transportation of the passengers to the terminal was from 23.43:56 UTC (22.43:56 local time) to 24.30:00 UTC (00.30:00 local time), which was 1 hour 47 minutes.

2.1.20 All the occupants of BA034 were safe and sustained no injury. However, the situation was not the same for the BidAir Services personnel inside the building. A total of 4 employees sustained injuries from the accident. The employees ran out of the damaged building to safety outside. They were then taken for medical care at the medical facility at the airport. The medical practitioners determined that the BidAir Services personnel had sustained only minor injuries.

2.1.21 After all the above activities has been completed, BA034 was safely recovered from the accident site. The AIID continued the investigation with the aim to determine the circumstances of the accident. The AIID obtained statements from crew members, explaining in their own words their observations about what happened, and gave instructions for the removal of the flight data recorders to have the information downloaded. The AIID engaged with all relevant parties (i.e. SACAA, AAIB, ACSA, ATNS, British Airways and a range of individuals) for the sole purpose of obtaining significant and substantial information relevant to the accident. The following important factors were then identified:

2.1.21.1 The evidence involving the operational aspects of the crew's performance in terms of the pre-flight processes was reviewed. The Captain explained that the following happened: "The aircraft remained on what was perceived to be still taxiway Bravo. The taxiway edge lights illuminated in a continuous straight line with no signage indicating the change of the two taxiways Bravo & Mike. Some of the green centreline lights on taxiway Bravo were not illuminated in sequence, thus leading to a false perception that the aircraft is still on taxiway Bravo. During the taxi, after entering the taxiway Mike, the Co-pilot voiced a concern about the width of taxiway Mike and the proximity of the building on the right side of the taxiway. The Co-pilot could not judge the proximity of the aircraft from the building because of the strong apron background glare. The chart used did not have any information to warn them about taxiway Bravo and Mike intersection".

2.1.21.2 The information from the other two pilots (Co-pilot and Relief Pilot) was largely the same as the Captain's. In order to verify the claims made by the Captain, it was important to investigate the factors involving taxiway Bravo and aircraft stand taxilane Mike. Both taxiway Bravo and Mike were examined while BA034 was still on the scene. The position of BA034 showed that it had taxied in the wrong way south toward Mike apron. The investigation then had to determine the reason for BA034 taxiing the wrong way.

(i) The CVR download information helped a great deal in drawing up a mental picture of what happened. The information showed that during the flight preparation phase the crew had a briefing in the cockpit which included discussion on pre-flight, taxi and take-off. It is important to note that they talked about the expected taxi route. The crew was expecting to be cleared to "push out tail south, taxiing down taxiway Alfa". They planned to "turn into taxiway Alfa for a full length taxi and keep going the extra 200 m straight up to the end of Runway 03". The briefing discussion lasted for ± 7 minutes. During the briefing the crew pointed out the high risk areas (e.g. potential dangers and hazards) which they identified. When reaching the high risk areas, caution was required to avoid the risk of collisions. Throughout the briefing discussion the crew's mind was set on the expected route using taxiway Alfa. The evidence of this fact can be seen in the Captain asking: "Am I looking at the right thing here, Oh! Alfa is the full length just there" and the Co-pilot's response was "yes, it morphs into Bravo".

(ii) According to the crew they carried an aerodrome booklet which had a Navtech aerodrome overview chart (South Africa – FAOR/JNB 10-2, dated 16 October 2013). The crew indicated that they used this chart to plan the taxi route during their briefing. The Captain indicated that the taxi chart was clipped onto the control column. Also, they did not brief from the textual pages of the aerodrome booklet. The evidence shows that if they had briefed from the textual page (i.e. Chart 10-6 for taxi details and cautions), they would have seen the *"*caution note*"* regarding taxiway Bravo and aircraft stand taxilane Mike. The caution note stated "Exercise caution when taxing on taxiway Bravo due to confusion with apron Mike".

Note: The review of the Navtech's caution note information indicated that it was not exactly the same as the one published in the South African AIP. The evidence received from Navtech indicates that they were complying with the AIRAC system requirements. Also, they used business processes compliant with ASI 9100 (equivalent to ISO). With this said, they are being audited by the British Standards Institute (BSI) against the requirements of ASI 9100. Though they are not regulated by aviation authorities, they have entered into a SLA with British Airways which carries out audits on them with respect to the SLA. It appears that there is no requirement of Navtech to reproduce the AIP information exactly as published. However, it is important that the information provides accurate information to the crew. The responsibility to read the correct information and apply it lies with the crew. The evidence is that the crew did not read the correct information.

(iii) According to the above information, the crew adhered to the British Airways briefing procedure in the Operations Manual, Part A. The crew was familiar with and participated in the standard take-off briefing procedure for the concerned aircraft. The crew discussed the potential threats, avoiding potential risks, the expected taxi route and restrictions. No anomaly was identified in the manner in which they handled the briefing up to that point.

(iv) At approximately 20.18:15 UTC (22.18:15 local time), the crew completed the briefing. The Co-pilot then transmitted to ATC stating "Speedbird 34 ready to push-start". The ATC response was "Speedbird 34 start, push back and face south". Based on the crew's conversation inside the cockpit about "facing south" it would appear that the ATC instruction came as a surprise to them. Their response was to resolve the doubt by asking for clarification and making sure that they had heard the instruction correctly. The proof of this can be seen in the Co-pilot's query: "Who says he thinks it was face south?" The Captain decided to confirm the instruction with ATC by asking: "confirm push back and face south", to which the response was "affirm". The ATC response was clear, precise and direct, without any ambiguity.

(v) Crews routinely receive unexpected clearances from ATC. The crews accept them (unless considered unsafe) and amend their plans accordingly. When unexpected clearances are given, the crews will not usually be expected to pause because the push-back instruction is not the one expected; they will push back as cleared and then ask for the taxi clearance. An unexpected push-back clearance is not a substantial change or an abnormal occurrence.

(vi) The evidence is that after the crew received the confirmation from ATC, the response "thank you" shows that they understood the instruction. At about 20.34:31 UTC (22.34:31 local time) the Co-pilot then made a transmission in which he told the ground handling personnel "clear to push and start facing south". They understood the instruction to "face south", which would take them down taxiway Bravo and not what was expected ("facing tail south", which would have taken them down taxiway Alfa). After having received the taxi clearance, they did not alter their expectation and review the new route. If they had, they might have foreseen the conditions on taxiway Bravo. They might have discussed the information on the bend ("curve") to the left near the intersection/junction with Mike. Also, they would have been prepared to look for cues to indicate that they were approaching the bend.

(vii) After the push-back, the crew proceeded with before start checks. From 22.32:56 to 22.36:27 UTC (20:32:56 to 20.36:27 local time) they performed a successful engine start. With the engines running ready for taxi, the Co-pilot requested "before taxi checks". The Captain responded to the request and started to read the before taxi checks. Immediately after the Captain had completed the before taxi check, the Co-pilot made another transmission to ATC. He stated "Speedbird 34, requesting taxi". The ATC instruction was "Speedbird 34, taxi Bravo to Cat 2 holding point, runway 03L". Again the ATC instruction was clear, precise and direct, without any ambiguity. The crew's read-back was also clear, which indicated that they received and understood the instruction. With the aircraft cleared to taxi, the Co-pilot called for "taxi checks". The Captain reported "clear on the left" and Co-pilot "clear on the right".

(viii) The CVR download information helped to establish that during the taxi the atmosphere inside the cockpit was very relaxed after a session of heightened workload when completing the different checks. The Co-pilot as the handling pilot was responsible for taxiing the aircraft at the time. He was seated in the starboard seat. The Captain was the monitoring pilot, responsible for monitoring the Co-pilot. He was also supposed to be on the lookout for any errors on the flight deck and alert the Co-pilot to prevent them from becoming a hazard to safety. He was seated in the port seat. The relief/heavy pilot, seated at the back of the Captain and Co-pilot, had to perform tasks during cruising to allow the Captain and Co-pilot to take their planned rest during the flight.

(ix) There was an obvious advantage to having the three skilled, trained and experienced pilots flying the aircraft. The advantage was that they had adequate exposure to the requirements of multicrew operations. They had the knowledge and understanding of the objective of co-operation with one another such that the aircraft was operated safely. Their effective and efficient interaction was to have optimum decision making, communication, sharing of tasks, teamwork and supervision while giving support to one another during the taxi phase. In order to verify whether the crew displayed these characteristics (e.g. adequate exposure, skilled, trained, experienced, knowledge and co-operation) it was necessary to take a close look at all the cockpit activities during the taxi phase.

2.1.21.3 At approximately 20.38:31 UTC (22:38:31local time), the Co-pilot started taxiing. He followed the route ATC had instructed them to use. When the aircraft joined taxiway Bravo, the Co-pilot stated “I’m following this line, jinking slightly to the right and then straight ahead”.

(i) This shows that the Co-pilot was manoeuvring BA034 to follow the centreline of taxiway Bravo. The Co-pilot made this remark when BA034 was taxiing in the area of intersection/junction of taxiways Bravo, Lima and India, according to the A-SMGCS. The A-SMGCS shows BA034 turning to follow the centreline after joining Bravo, in the area where centreline lights (distance ±180 metres) were not installed. At 20.41:07 to 20.41:15 UTC (22.41:07 to 22.41:15 local time), BA034 was jinking slightly to the right and taxiing south, heading 202.9º at 203 metres from Bravo apron. The A-SMGCS shows that BA034’s ground speed was increasing from ±4.3 to 4.8 kts at the time. According to the A-SMGCS and the FDR, from 20.41:15 to 20.43:39 UTC (22.41:15 to 22.43:39 local time) the centreline was lighted up again. A total of 4 green centreline lights (distance ±150 metres) to the intersection. BA034 was taxiing south, heading 213º, ground speed 13.3 kts at the time.

(ii) The taxiway green centreline lights issue did not just stop there. More anomalies with the lighting and signage on Bravo were identified in the investigation.

- The investigation determined that a total of 7 (distance ± 235 metres) of green centreline lights were not illuminating. From the apron after the curve leading to taxiway Bravo, 5 lights (distance ±180 metres) were not illuminating.

- On the curve leading to the Cat 2 holding point, two more lights were out (distance ±45 metres).

- Over a distance of ±300 metres to the holding point, no lights were installed.

- The total distance not illuminated was ±535 metres.

- The total length of Bravo is ±1425 metres, of which ±535 metres was not illuminated – approximately 36.84%.

- The investigation determined that the direction information sign on the left side of Bravo (±60 metres from the intersection of taxiway Bravo and taxilane Mike) was not illuminated. This sign consists of a black inscription on a yellow background which is supposed to glowing brightly in the direction of approach to the intersection. It is possible that because it was not illuminated and visible to the crew, they may have not seen it, which means that the sign did not serve its design purpose.

Note: The crew did not do a briefing using both Charts 10-2 and 10-6 together to obtain or familiarise themselves with relevant published information about the expected conditions on taxiway Bravo. They would have been prepared or alerted to look out for the centreline lights on taxiway Bravo and for the direction information sign on the left side indicating the bend of taxiway Bravo. Also, they were not fully prepared for or aware of the conditions of taxiway Bravo, which is why they lost situational awareness later during the taxi.

2.1.21.4 It is important to take note that FAOR is an international airport, licensed by the SACAA. The airport is managed by ACSA (license holder) which, in terms of its licensing provisions, is required to comply with ICAO and applicable regulations. , ACSA is in possession of an approved manual of procedures (MOP) which gives guidance on issues of operation and outlines the procedures in the management of the aerodrome facilities. The facilities which are of importance to the investigation in this instance include the taxiway lighting and signage on Bravo as identified above.

(i) According to ICAO requirements, there shall not be 2 adjacent taxiway centre line lights unserviceable. This requirement is also set in the applicable regulations. Therefore ACSA contravened the applicable regulations. The issue of the unserviceable lights was investigated with ACSA and ATNS.

(ii) ACSA provided daily runway and taxiway daily inspection sheets and maintenance checklists as proof of actions taken. The runway and taxiway inspection checklist of the day in question had no entries of any defects related to the centreline lights or signage on it. This information is quite strange, because evidence exists that about the same time that BA034 was taxiing to taxiway Bravo, ACSA ARFF was carrying out runway and taxiway inspections. The A-SMGCS information attests to it that the ARFF vehicle FTL carried out this inspection. It was driving in front of BA034 on taxiway Bravo passing the area where the centreline lights and signage were unserviceable. The ARFF personnel drove past the affected area without reporting the anomalies to the relevant authorities. It was night, and the anomalies of centreline lights and signage would have been clearly visible to them. Not reporting them is clearly a violation of the applicable inspection procedure.

(iii) ATNS also provided a response to the taxiway lights issue. ATNS indicated that on the night in question, there were no centreline lights due to maintenance activities being performed. ACSA was busy installing and in certain circumstances replacing some centreline lights. Also, they indicated that taxilane Mike did not have centreline lights, only edge lights.

Note: No evidence could be found of a NOTAM published to alert the crews of aircraft operating at FAOR. None of the three entities (SACAA, ACSA and ATNS) could provide evidence to show that a NOTAM had been issued.

2.1.21.5 Another issue concerns the designation *"*aircraft stand taxilane*"* Mike. According to the ICAO definition a taxiway is "a path on an airport connecting runways with ramps, hangars, terminals and other facilities". This definition applies to taxiway Bravo, which is a path from the ramp and terminal which connects with Runway 03L. As taxiway Bravo conforms to the definition, it has to be fully equipped with ground movement visual aids to ensure safe operation. This is the responsibility of ACSA. But ICAO also states that there are two types of taxiways, namely the "apron taxiway", which "provides through taxi route across the apron or access to an aircraft stand taxilane", and the "aircraft stand taxilane", which is the "portion of an apron designed as taxiway intended to provide access to aircraft stands only".

(i) There is no contradiction in the way ICAO defines the taxiways. For the purpose of international uniformity, ACSA was required by regulation to comply with the set requirements. However, the evidence shows that ACSA identified Mike as being a "taxilane". ACSA stated that the use of the terms "aircraft stand taxilane" and "taxilane" was a matter of semantics and that both terms were used interchangeably at FAOR. The first problem that was identified with "taxilane" Mike was that nothing like a "taxilane" in isolation is defined. If it was the intention that Mike should be an "aircraft stand taxilane", then in terms of the definition it ought to have been a "portion of an apron", which it is not. Instead, the aerodrome layout shows that Mike conforms to a "path" leading to an apron, which matches the definition of a taxiway. Mike in its current form does not give "access to aircraft stands", as an "aircraft stand taxilane" is required to.

(ii) In the light of the above information about Mike, Mike's contribution to the confusing situation was identified as the following:

- the name "taxilane";
- Installation of blue taxiway edge lights;
- blue edge lights switched on (illuminating) at night, even when the "taxilane" was not in use;
- its smaller width compared with taxiway Bravo, but blue edge lights on the right side identifying edge line carries straight on from Bravo to Mike;

- no information signage in vicinity of the intersection of taxiway Bravo and Mike to identify the starting point of Mike;

- the intermediate taxi-holding position marking across Mike just opposite the Bid Air Service building;

- poor visibility of the obstacle (Bid Air Services building) during night-time (no appropriate red or white flashing lights).

(iii) All the above contributory elements were supposed to be identified by the role player to whom the tasks were assigned. After identification, the best would have been to bring the issue to the Airside Safety Committee to review and take corrective actions as required. The minutes of the Airside Safety Committee monthly meetings show no discussion item relevant to the hazards of the Bravo and Mike intersection.

- It comes as no surprise in the investigation that ACSA did not include the issue of aircraft movements and visual aids (markings, information signs, taxiways and runways lights) as one of the top 20 hazards at FAOR.

- The above comment about aircraft movements and visual aids not being included in the top 20 hazards is made on the back of the evidence of a previous incident involving a British Airways B747-400 aircraft, G-GYGA, BA056 on 20 April 2005 at FAJS (now FAOR). The circumstances of the incident were found to be similar to those of the BA034 incident.

Note: It was found that the BA056 incident (ARS Ref:246174) was never reported to the SACAA or AIID to investigate. All the issues relating to the BA056 incident were resolved between the parties involved (i.e. British Airways, EAG, ACSA and ATNS). All parties identified contravened the State regulations by not reporting the incident.

- ACSA's response to the issue of the top 20 hazards was that prior to 2008 there was no requirement to report on it. The requirement to report annually came in force only post 2008. ACSA points out that the airport safety forum was not aware of the particular risk (movement of aircraft and visual aids), therefore it could not be reported or captured. The investigation agrees with ACSA about the requirements prior to 2008, but disagrees as regards the risk of aircraft movements and visual aids. Surely this risk should have been included as a Top 20 Hazard.

2.1.21.6 The CVR download information shows that during the taxi the Captain attended to the load sheet, switched on the radar and carried out the before take-off checks:

(i) At 20.41:33 UTC (22.41:33 local time), the Co-pilot stated that he was waiting for the load sheet.

(ii) At 20.42:08 UTC (22.42:08 local time), the Captain was handed the load sheet, after which he took ±38 seconds to read through it.

(iii) After reading the load sheet, at 20.42:46 UTC (22.42:46 local time) the Captain switched on the radar.

(v) For both the load sheet and radar the Captain was occupied inside the cockpit; he was not looking out.

(vi) According to the A-SMGCS information, the aircraft was taxiing south, heading 213.7º, position 1100 metres from Bravo apron, with ground speed increasing from ±7.8 to 11.8 kts at the time.

2.1.21.7 The Co-pilot called for the before take-off checks. The CVR download information shows that at approximately 20.42:03 UTC (22.42:03 local time), the Captain said "I'll take the before take-off checks". The assumption is that the Captain was referring to the document that lists the activities to prepare the aircraft for take-off. The Captain and Co-pilot carried out the before take-off checks. The before take-off checks were completed about 1 min 53 sec before impact. The Captain indicated that the before take-off checklist was completed well before the time BA034 collided with the building. Also, he does not believe that they were distracted while carrying out the checklist. It was the time when the aircraft was reaching the intersection. According to the A-SMGCS information, the aircraft was taxiing south, heading 213.5º, position 1284 metres from Bravo apron. The ground speed increased from ±13.3 to 14.5 kts at the time.

2.1.21.8 At approximately 20.43:39 UTC (22.43:39 local time) the Captain said: "Looks like we're staying on ground the whole way there", meaning that he expected to remain on the ATC ground control frequency until the aircraft reached the runway. According to the A-SMGCS and FDR information, this was when BA034 entered the intersection of taxiway Bravo and "aircraft stand taxilane" Mike. BA034 was turning slightly left and right to compensate for the decrease (30 metres down to 18 metres) in the taxiway width. They were heading south (213.0º) and maintaining a ground speed of 14.5 kts.

2.1.21.9 According to the A-SMGCS and FDR information, at 20.43:54 UTC (22.43:54 local time) BA034 was crossing the intersection. The Co-pilot immediately made this observation and asked: "Is it me or does this taxiway feel very narrow?" The assumption is that he was alerted by the taxiway width becoming less (12 metres narrower). Though not supported by evidence, it would appear that the Co-pilot was looking at the position of the blue edge lights (indicating the edge line of the taxiway) on Mike, which helped him gauge the width of the "taxilane" from the cockpit. Despite his concern, the Co-pilot continued straight on.

2.1.21.10 Based on information from British Airways, the ground navigation responsibility for taxiing is that of the Captain and Co-pilot. They are responsible for accurate navigation and collision avoidance on the ground. There should be at least one pilot who must display the relevant taxi chart to ensure correct interpretation of ATC taxi instructions, to monitor taxi progress and to achieve a general situational awareness of the airfield. Thus, a high standard of navigation must be maintained at all times. Also, the crew must ensure that they understand the taxi route prior to taxiing.

2.1.21.11 The investigation determined that the crew complied fully with the above requirements. As they had visited the airport before, is can be assumed that they were familiar with it. They continued taxiing towards the Cat 2 holding point for take-off from Runway 03L. The crew was maintaining a high standard of navigation. During the taxi they carried out before take-off procedure. During this time the crew carries out checks independently, so that one person is looking out at all times. While the before take-off procedure and checks are in progress, both pilots' ability to monitor taxiing progress is reduced for short periods of time only.

2.1.21.12 The CVR download information shows that at approximately 20.43:51 UTC (22.43:51 local time) the Co-pilot commented: "That wing is not very far from that". The evidence is that he was referring to the right wing.

(i) The position of BA034 at the time was ±140 metres from the intersection on Mike. The heading was 214.5º and the ground speed 14.0 kts.

(ii) BA034 was approximately 10 metres from the building at the time.

(iii) The wing proximity to the building on the right side of the taxiway was threatening.

(iv) The Captain stated that they could not correctly judge the proximity of BA034's right side wing to the building because of the strong apron background glare. ACSA had a different opinion of the matter. They believe that only the apron high masts lights at apron Mike, which were some 650 m away, could have been visible to the crew at that point. These lights could not have been the source of the glare. The investigation determined that the glare might have been from the lights on the SAA technical building.

2.1.21.13 The evidence was that immediately after the Co-pilot had made the observation about the wing, the collision with the building followed. The wreckage and impact information showed that the starboard wing hit the eastern side of the building, cutting through its halls on the second floor and completely demolishing the upper eastern side. The severity of the impact caused substantial structural damage to the wing.

(i) The FDR download information shows the acceleration forces (ACLONG = +0.12 to -0.13 & ACLATE = +0.23 to -0.45) BA034 was exposed to in the collision. BA034 had reached the ground speed of 14.5 kts at the time of the collision.

2.1.21.14 ATC transmitted to BA034, instructing them “Just hold your position”. The ATC stated that he looked out to see the position of BA034 on taxiway Bravo. He was complying with the operational requirement to survey the portions of the aerodrome over which he had jurisdiction and exercised control. The surveying of the portions of the aerodrome could include one of the following mediums:

- visual (eyesight) inspections;
- mechanical (binoculars) inspection;
- electronic (radar and/or closed-circuit television) inspection.

2.1.21.15 The ATC reported that at the time when he carried out the survey, he could not see BA034 on taxiway Bravo. He then decided to look on the A-SMGCS (radar) and noticed a “squawk” on Mike. The A-SMGCS was detecting and tracking the aircraft by means of the signal emitted by the transponder. Through the interaction of the A-SMGCS and transponder, the position and identity of BA034 were displayed by the system.

2.1.21.14 The CVR download information shows that the crew engaged in a conversation in the cockpit during the time ARFF was attending to the fuel spillage problem. They had a discussion about the sequence of events leading to the accident. The subject of importance in their conversation which is of particular interest is the statements from the Co-pilot: “I saw it. It just didn’t look right. I wish I’d stopped. It just didn’t look right. It looked too close. I didn’t pick up the fact…I was looking for it to go straight. I didn’t see any turn off toward the end”. The conclusion is that through lack of situational awareness he could not make sense of or understand the events unfolding and was therefore unable to make the right decision to stop. They had just completed before take-off checks, and his mind was focused on the objective of getting to the runway.

CONCLUSION

3.1 Findings

3.1.1 A Boeing 747-400 aircraft operated by British Airways Airline collided with the BidAir Services building during a taxi at FAOR. The evidence was that the aircraft headed the wrong way, straight across the intersection/junction of taxiway Bravo and “aircraft stand taxilane” Mike in the direction of apron Mike. The investigation concluded that the “aircraft stand taxilane” Mike (Code Letter C) was not designed to accommodate the B747-400 aircraft type.

3.1.2 The occupants carried on board the aircraft sustained no injury. The four BidAir Services employees working in the building at the time of the accident sustained minor injuries.

3.1.3 The ATNS stated that at the time of the accident there were low traffic volumes for ATC to control. The working conditions therefore did not have any significant negative effect on the ATC's performance.

3.1.4 The ATC reported that he was looking out to see the aircraft but could not see it, so he looked on the A-SMGCS (ground radar) system and noticed a "squawk" signal of the aircraft taxiing on Mike. This made him realise that the aircraft was going the wrong way.

3.1.5 The evidence was that ACSA used the term "taxilane" Mike, which to them is the same as "aircraft stand taxilane" Mike. The ICAO aerodrome design manual (Doc 9157) defines an "aircraft stand taxilane" as a portion of an apron designed as a taxiway and intended to provide access to aircraft stands only. The investigation concluded that "taxilane" Mike does not match the definition. ACSA is found to be non-compliant in this regard.

3.1.6 The evidence was that ATNS had installed an A-SMGCS ground radar system at FAOR to assist the ATCs with surveillance especially in the areas where capacity was an issue. It was the A-SMGCS that showed the ATC the exact position of BA034 and made it possible to contact the crew and instruct them to stop. The problem with the A-SMGCS is that it is not currently fully commissioned; hence its monitoring is solely at the ATC's discretion. The ground radar system is very important for safety, but its incompletely commissioned state does not serve aviation safety very well. ATNS can only fully commission a Level 1 A-SMGCS when all vehicles and aircraft operating at ORTIA are fitted with Mode-S.

3.1.7 In terms of ICAO aerodrome standards, the aerodrome authorities should identify areas where ATC cannot clearly see the activities in a particular ground movement area as hotspots. The evidence is that the aerodrome authority did not comply with this requirement on taxiway Bravo.

3.1.8 In the collision, the B747 aircraft and BidAir Services building both sustained substantial damage. Other damage caused in the accident was to the environment. There was a large fuel spillage from the right wing, which resulted in a soil remediation process by HazRisk Solutions. The total quantity of fuel spilled could not be determined accurately because the fuel status information received was inconsistent due to an administrative error.

3.1.9 The ARFF was dispatched to the scene of the B747 aircraft accident in order to give emergency assistance. The ARFF could not immediately proceed with its rescue and fire fighting activities because the B747's engines were still running. They were shut down only after the ARFF requested ATC to raise the matter with the crew of the aircraft. The ARFF had to wait until the APU was running and the engines had been shut down before they could continue with emergency assistance. The assistance was limited to eliminating the fire risk by containing the fuel spillage.

3.1.10 There are currently no regulations promulgated to give the industry guidance into damage to environment caused by aviation disasters (incidents or accidents).

3.1.11 The ATC instructions to the aircraft crew were clear, concise and without any ambiguity. He gave them instructions to push back, face south and taxi down taxiway Bravo to the Cat 2 holding point for Runway 03L. The crew's response to the unexpected clearance to face south was to resolve the doubt by asking for clarification from ATC. After the instruction had been clarified, their read back indicated to ATC that they clearly understood and were ready to comply.

3.1.12 The crew reported that they pushed back and started from Alfa bay #6 facing south and taxied on taxiway Bravo to the Cat 2 holding point, just as ATC had instructed. However, while taxiing down Bravo, they found an anomaly in the ground movement navigation aids (centreline lighting, information signage to identify the turnoff of Bravo and starting point of Mike) which created a sense of confusion about taxiway Bravo. It is noted that they never reported to ATC that they were confused.

3.1.13 The Captain's observation was that some of the green centreline lights on Bravo were not illuminating in sequence, thus causing a false perception that the aircraft was still on taxiway Bravo.

3.1.14 The ground movement navigation aids (centreline lights and direction information signage) on taxiway Bravo was examined during the investigation. It was found that two of the centreline lights and the information signage (left side) were unserviceable. The investigation concluded that these two navigation aids did not serve the design purpose, which was to appropriately guide the crew to taxi safely on Bravo on their way to the Cat 2 holding point.

3.1.15 The evidence was that the ARFF carried out runway and taxiway inspections at FAOR a few minutes prior to the accident. The ARFF vehicle drove past the area of the unserviceable ground movement navigation aids, but did not report them to the relevant authorities for corrective action. The ARFF was found to be non-compliant with ACSA MOP and regulations in this regard.

3.1.16 The serviceability of the ground movement navigation aids (centreline lights and signage) then caused the crew to lose situational awareness as they reached the intersection/junction of taxiway Bravo and "aircraft stand taxilane" Mike. They thought they were still taxiing on Bravo after crossing the intersection/junction.

3.1.17 It was evident that the crew suffered the loss of situational awareness due to the unserviceable ground movement navigation aids (centreline lights and signage) and simultaneously to the fact that they had no knowledge of the exact design layout of taxiway Bravo. Therefore, when they arrived at the intersection/junction, they were not even aware that "aircraft stand taxilane" Mike started beyond that point.

3.1.18 It was ACSA's responsibility to ensure that the ground movement navigation aids were maintained and inspected to keep them in a serviceable condition. It was determined that ACSA had not kept these aids in a serviceable condition, nor did they publish a NOTAM of the defects. ACSA was found to be acting in contravention of ICAO, CAR and its own MOP.

3.1.19 The evidence was that the BidAir Services building was not appropriately lit (using relevant colours) as directed by ICAO standards so as to be clearly visible.

3.1.21 The lack of knowledge of the design layout of taxiway Bravo was a result of the crew not informing themselves of the conditions on taxiway Bravo. The evidence shows that they did not read the textual pages in the aerodrome booklet (i.e. Chart 10-6 for taxi details and cautions), where they would have seen the "caution note" stating "Exercise caution when taxiing on taxiway Bravo due to confusion with apron Mike".

3.1.22 The taxi policy and procedure require that at least one pilot must display the relevant taxi chart to ensure correct interpretation of ATC taxi instructions, to monitor taxi progress and to achieve a general situational awareness of the airfield. The investigation concluded that the chart was clipped onto the control column, but not referred to during the taxi, which to a degree also contributed to their loss of situational awareness.

2.1.23 An anomaly was identified in that the wording of the Navtech aeronautical information (caution note) had not been amended or updated with the latest revision of the South African AIP. The investigation concluded that as the crew did not read the textual pages (Chart10-6) and were unaware of the caution note, that anomaly did not play a role in the accident.

2.1.24 The investigation determined that Navtech is not regulated and has the right to present the data to their clients (airlines) in their own standard format. However, since British Airways are regulated and required to have adequate and up-to-date route documents, the investigation determined that it is their responsibility to ensure that the data (charts) received from Navtech and carried on board the aircraft conform to the data in the South African AIP.

3.1.25 The evidence was that the crew was not briefed on using taxiway Alfa. On all previous visits to FAOR, the crew experience was that they were instructed to use taxiway Alfa. Therefore, they expected ATC to clear them to use taxiway Alfa. Hence they carried out an in-depth briefing on taxiway Alfa. The crew was using the Navtech Aerodrome Overview Chart (South Africa – FAOR/JNB 10-2, dated 16 October 2013) during the briefing.

3.1.26 The evidence was that the SACAA was required to carry out foreign operators ramp inspections, scheduled as per the master surveillance plan (MSP). The aim of the inspections includes ensuring compliance with international practices relevant to aeronautical information (charts) of airlines. The investigation concluded that the SACAA was compliant in this regard.

3.1.27 The investigation concluded that the crew did not comply with the B747 Flight Crew Training Manual requirements, British Airways Operations Manual, Part A (2) and B747 FCOM Vol 1 procedures requiring them to familiarise themselves with the new taxi route after having received the information. They did not review the new taxi route for threats prior to taxiing.

3.1.28 The evidence shows that the crew had previously operated to and from FAOR. This proves that the crew had a mental picture or they were familiar with FAOR based on these previous visits. Also, they were found to be proficient after having undergone relevant training and having been provided with the necessary information about FAOR. The investigation concluded that the crew was fully equipped to ensure safe operation.

3.1.29 The Captain stated that during the taxi after entering Mike (he was not aware at the time that they had entered Mike), the Co-pilot voiced a concern about the width of "taxiway" Mike. The evidence was that even after the Co-pilot had expressed concern about its width, lack of situation awareness made him continue taxiing straight ahead in the direction of apron Mike.

3.1.30 The Captain stated that the Co-pilot did voice concern about the proximity of the building on the right of the "taxiway".

3.1.31 The Captain stated that the chart 10-2 which they used did not have any information to warn them about taxiway Bravo and Mike. The investigation concluded that they used the incorrect chart. Still, the chart they used did have the layout of taxiway Bravo (indicated by letters x2 **B**) showing that it turns to the left toward the holding point and does not run straight ahead. Also, the chart shows clearly that beyond the point where Bravo turns to the left, the letter **"M"** indicates "taxilane" Mike.

3.1.32 After the collision, the Co-pilot said: "I saw it. It just didn't look right. I wish I'd stopped. It just didn't look right. It looked too close. I didn't pick up the fact…I was looking for it to go straight. I didn't see any turn off toward the end".

3.1.33 There was evidence of an incident (ASR Ref: 24674 on 20 April 2005) where the sequence of events was similar, but with exception that there was no collision. It was also a B747-400 aircraft type which had taxied straight ahead, across the intersection, but stopped before reaching the building. The investigation determined that the incident was not reported to the relevant State investigation authorities (SACAA or AIID) to investigate. The ASR shows that the parties (British Airways, ACSA and ATNS) dealt with the incident. Corrective action was taken to improve the aerodrome facilities (ground movement navigation aids and installation of the A-SMGCS (ground radar) system).

3.2 Probable Cause

3.2.1 The loss of situational awareness caused the crew to taxi straight ahead on the wrong path, crossing the intersection/junction of Bravo and Mike instead of following Bravo where it turns off to the right and leads to the Category 2 holding point. Following aircraft stand taxilane Mike; they collided with a building on the right-hand side of Mike.

3.3 Contributory Factors

3.3.1 Failure of the crew to carry out a briefing after they had received instruction from ATC that the taxi route would be taxiway Bravo.

3.3.2 The lack of appropriate knowledge about the taxiway Bravo layout and relevant information (caution notes) on threats or risks to look out for while taxiing on taxiway Bravo en route to the Cat 2 holding point.

3.3.3 The aerodrome infrastructure problems (i.e. ground movement navigation aids anomalies), which created a sense of confusion during the taxi.

3.3.4 Loss of situation awareness inside the cockpit causing the crew not to detect critical cues of events as they were gradually unfolding in front of them.

3.3.5 Failure of the other crew members to respond adequately when the Co-pilot was commenting on the cues (i.e. narrowness and proximity to the building).

3.3.6 The intersection/junction of Bravo and Mike not being identified as a hotspot area on the charts.

4. SAFETY RECOMMENDATIONS

4.1 It is recommended that the AAIB enter into consultations with the operator (British Airways) about the crew's non-adherence to applicable briefing and taxi policies, procedures and requirements. The AAIB to communicate to AIID what the appropriate corrective action shall be to prevent recurrence.

4.2 It is recommended that the SACAA should intensify the ramp inspections on all foreign operators to South Africa to ensure that they comply with international air operation standards, recommended practices and regulatory requirements in terms of the matters raised (i.e. availability and validity of aircraft documentation) wherever their destination in South Africa. The SACAA should also ensure that they put in place a proper, effective and efficiently system of traceability in this regard.

4.3 It is recommended that the AAIB look into or address the matter of the revision status of the aeronautical data issued by the third party service provider referencing the issues raised of Navtech. It should be noted that the South African AIP is a legal document prepared in accordance with the Standards and Recommended Practices (SARPs) of ICAO Annex 15 of which the charts contained in it are produced in accordance with ICAO Annex 4. Its purpose is to provide appropriate safety information (i.e. aeronautical data) to the aviation industry; therefore operators are to ensure that the aeronautical data they use, irrespective of the source, complies with the information published in the South African AIP.

4.4 It is recommended that the SACAA should finalise the commitments made to ICAO concerning the SACAA aeronautical information service (AIS) safety oversight responsibility over service providers, so that situations similar to the one of Navtech will not recur in South Africa.

4.5 It is recommended that the SACAA should consult with ACSA about the inadequacies of the ground movement infrastructure issue (e.g. taxiway centreline green lights and signage) identified on Bravo, which may include other taxiways and/or runways at FAOR. It is important to point out that the infrastructure inadequacies identified there caused confusion which could have been prevented with proper maintenance and/or infrastructure development.

4.6 It is recommended that the SACAA should intensify the safety oversight inspections over ACSA operations relevant to the integrity of the airport infrastructure (e.g. lights and signs) with the aim to completely prevent the recurrence of non-compliance by ACSA with quality processes.

4.7 It is recommended that ACSA should consider complete removal of the building into which the British Airways aircraft collided, as in future it will continue to pose a safety risk to crews taxiing on taxiway Bravo en route to the Cat 2 holding point. This recommendation is made based on the evidence of the ASR Ref:24674 incident during April 2005 when the aircraft stopped short of colliding with the building, followed by this accident Ref:CA18/2/3/9257 on the day in question.

4.8 It is recommended that the SACAA should consult with AAIB about the British Airways flight crew's non-compliance with the clear and unambiguous taxi instructions, which were to push back facing south using Bravo to Category 2 holding point for take-off from Runway 03L and not what they actually did, which was to taxi full length to end of the taxiway.

4.9 It is recommended that the SACAA should consult with the AIIB about the British Airways flight crew's action in that they did not comply with the SOP requirement that they should immediately have stopped when in doubt about the conditions on taxiway Bravo during the taxi phase.

4.10 It is recommended that the SACAA should consult with ATNS about their plans to fully commission the A-SMGCS system. This will ensure that the identified radar system is integrated completely with ATNS's quality control process to effectively and efficiently carry out surveillance over ground movement areas. The aim is to contribute to the safety and efficiency of aerodrome surface movement control during low visibility operations (LVOs), e.g. at night, especially to provide active alerts to controllers as a means of early warning of potential incursions and/or taxiing into unsafe locations.

5. APPENDICES

5.1 Appendices A:
Copy of BA034 Flight Plan details

5.2 Appendices B:
Copy of BidAir Services Report

5.3 Appendices C:
Copy of ACSA ARFF Report

5.4 Appendices D:
Copy of ACSA Report

5.5 Appendices E:
Copy of ATNS Report

5.6 Appendices F**:**
Copy of BA Damage Assessment Report

5.7 Appendices G:
Copy of ACSA Facility (BidAir Building) Damage Assessment Report

5.8 Appendices H:
Copy of HazRisk Remediation Report

5.9 Appendices I:
Copy of ACSA Taxiways Maintenance & Inspections Reports

5.10 Appendices J:
Copy of Air Safety Report (ASR) Ref: 246174

5.11 Appendices K
Copy of SACAA and Navtech email communication

5.12 Appendices L
Copy of Navtech Severity Codes Matrix

5.13 Appendices M
Copy of Navtech Charts

5.14 Appendices N
Copy of ACSA Aeronautical Information Amendments

5.15 Appendices O
Copy of ATNS email communication relevant to the CL lights

5.16 Appendices P
Copy of ATNS Report relevant to NOTAM's

-END-

Appendices A

Copy of extract of flight plan details:

```
CIRRUS FLT PLAN    FTD.STEVE EXT.30671 ACARS.LHRWCBA
P 1 OF 16 BA034/22 JNB-LHR ETD  2045/22DEC13 7474 G-BNLL
C/S BAW34     P 2.0 FAOR-EGLL M 0.0  T/O SLOT ....
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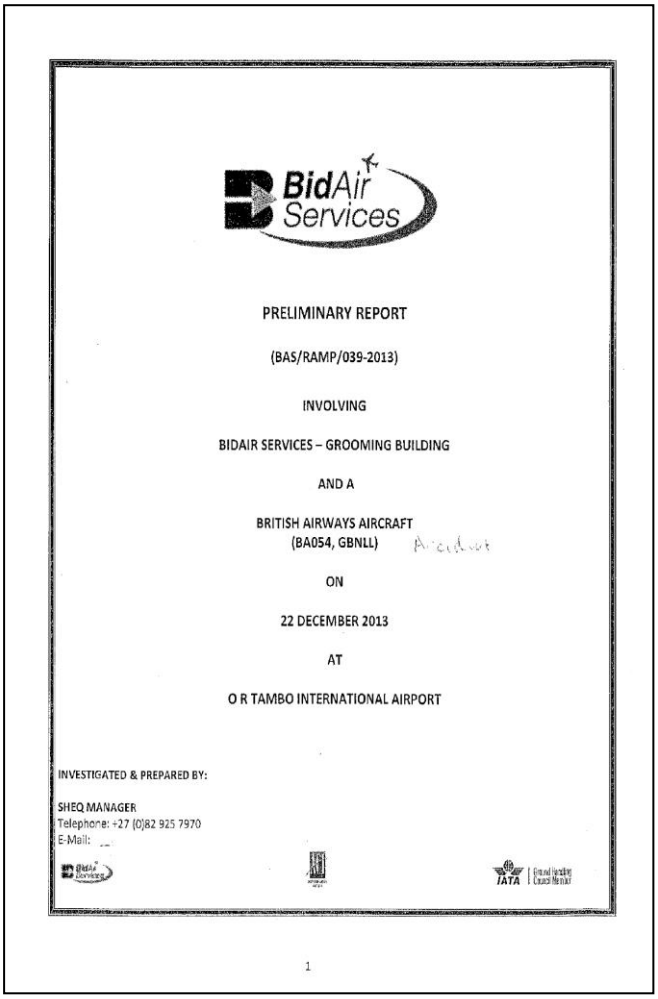
Appendices B

Copy of BidAir Services Report: (Note certain items de-identified)



BidAir Services

PRELIMINARY REPORT

(BAS/RAMP/039-2013)

INVOLVING

BIDAIR SERVICES – GROOMING BUILDING

AND A

BRITISH AIRWAYS AIRCRAFT
(BA054, GBNLL)

ON

22 DECEMBER 2013

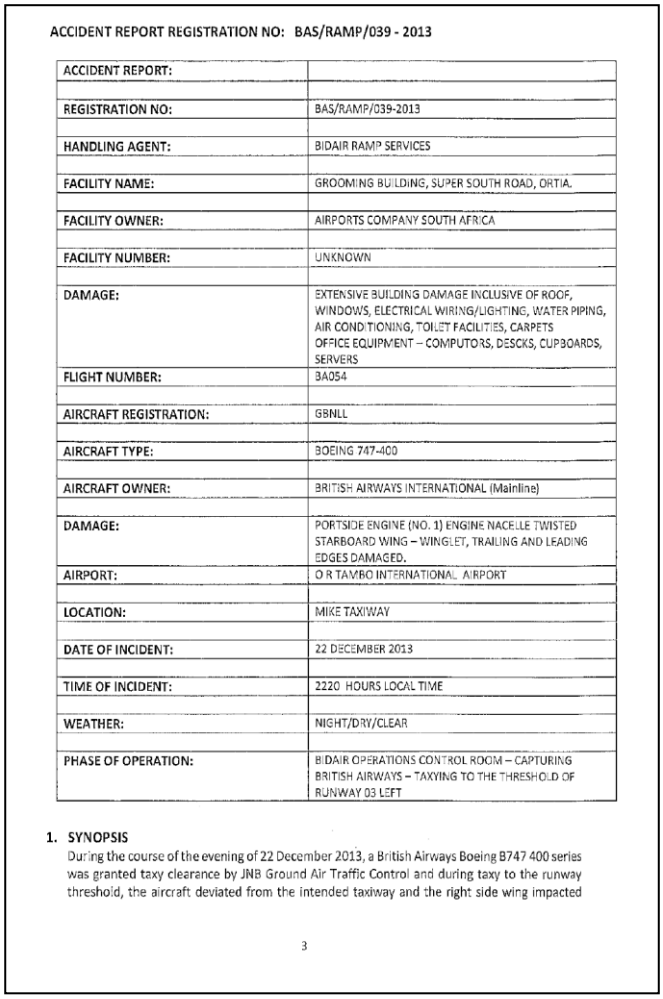
AT

O R TAMBO INTERNATIONAL AIRPORT

INVESTIGATED & PREPARED BY:

SHEQ MANAGER
Telephone: +27 (0)82 925 7970
E-Mail:

1



ACCIDENT REPORT REGISTRATION NO: BAS/RAMP/039 - 2013

ACCIDENT REPORT:	
REGISTRATION NO:	BAS/RAMP/039-2013
HANDLING AGENT:	BIDAIR RAMP SERVICES
FACILITY NAME:	GROOMING BUILDING, SUPER SOUTH ROAD, ORTIA.
FACILITY OWNER:	AIRPORTS COMPANY SOUTH AFRICA
FACILITY NUMBER:	UNKNOWN
DAMAGE:	EXTENSIVE BUILDING DAMAGE INCLUSIVE OF ROOF, WINDOWS, ELECTRICAL WIRING/LIGHTING, WATER PIPING, AIR CONDITIONING, TOILET FACILITIES, CARPETS OFFICE EQUIPMENT – COMPUTORS, DESCKS, CUPBOARDS, SERVERS
FLIGHT NUMBER:	BA054
AIRCRAFT REGISTRATION:	GBNLL
AIRCRAFT TYPE:	BOEING 747-400
AIRCRAFT OWNER:	BRITISH AIRWAYS INTERNATIONAL (Mainline)
DAMAGE:	PORTSIDE ENGINE (NO. 1) ENGINE NACELLE TWISTED STARBOARD WING – WINGLET, TRAILING AND LEADING EDGES DAMAGED.
AIRPORT:	O R TAMBO INTERNATIONAL AIRPORT
LOCATION:	MIKE TAXIWAY
DATE OF INCIDENT:	22 DECEMBER 2013
TIME OF INCIDENT:	2220 HOURS LOCAL TIME
WEATHER:	NIGHT/DRY/CLEAR
PHASE OF OPERATION:	BIDAIR OPERATIONS CONTROL ROOM – CAPTURING BRITISH AIRWAYS – TAXYING TO THE THRESHOLD OF RUNWAY 03 LEFT

1. SYNOPSIS

During the course of the evening of 22 December 2013, a British Airways Boeing B747 400 series was granted taxy clearance by JNB Ground Air Traffic Control and during taxy to the runway threshold, the aircraft deviated from the intended taxiway and the right side wing impacted

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into the Grooming Control Room and further sliced through the building until it came to a stop when the wing hit the Gents Toilet on the upper level of the building.

2. INVESTIGATION

On 22 December 2013, at approximately 2220 hours local time, in dry and clear weather circumstances, a British Airways Boeing 747-400 aircraft impacted into the Grooming Operations Building situated between taxiway Mike in the east and the Super South Gate Roadway in the west.

The main impact of the aircraft into the building happened into the glass windows of the eastern Operations Control Room, where Controllers and were data capturing the evening's aircraft movements. The impact knocked both employees to the ground whilst roofing material and stone work rained down. These employees had not seen the aircraft approaching due to focussing on their computers.

Two further employees, two Duty Managers, by the names of and , were also in the building in a room immediately behind or south of the Control Room. These Duty Managers were busy with their shift reports when they became aware of a heightened aircraft noise and attempted to look out the eastern windows and saw the forward fuselage of the Boeing 747. Simultaneously there was a crash and the ceiling of the building collapsed throwing them to the floor where they stayed until the noise and raining of building material stopped.

When the noise settled, both Duty Managers proceeded into the Control Room where they found nobody and then found the Control Room ladies in the passageway, where after they made a speed exit out the building.

By this time the other Duty Manager had arrived and arranged for the staff to be taken to the Airport Clinic for assessment of their injuries.

On returning to the building SHEQ Manager and Ramp Manager were on site and systematic assessment was made:-

1. On the southern side of the building water was leaking from the brickwork at the upper floor level. It was assumed that this was due to the broken water pipes in the building and that floor flooding was now taking place.
2. The staff restroom had a very pungent aircraft fuel smell and all windows were opened. Fortunately at the time of the accident all working teams of cleaners were still busy with last flights and night stop aircraft.
3. Fire and Rescue had laid a thick blanket of foam all along the eastern side of the building and on the grassed area between the building and the aircraft.
4. All electrics in the building had been turned off with the exception of one fluorescent light in the building foyer. The AMC were requested to get a fire officer present to search for the final isolator.
5. It was noted that there were a significant amount of vehicles present around the building and on enquiry it was discovered that the keys were present in the key safes in the control room. This presented a risk if there was a fire.
6. On-going around to the northern face of the building it was noted that the eastern half of the face of the building was missing and a section of the roof had collapsed over the control room.

7. The air conditioning units had broken off the wall and crashed to the ground.
8. The light mast along the eastern perimeter fence had been cut off at the approximate height of impact of the wing on the building.
9. On evaluating the eastern side of the building, the upper eastern wall was completely missing from the corner of the building to the gent's toilet area and central stair well. Building debris was scattered all over! The right side wing was now visible inside the building,
10. Fire and Rescue were requested to provide ladders and break the window of the western Control Room Office to enable retaining vehicle keys and relocating them to other points on the airport to minimise the risk of fire should a fire break out. Whatever vehicle keys were obtained, vehicles were moved to a safer place.
11. It was observed that due to positioning of the aircraft fuelling points under the wings, defuelling was not possible as the ground under them was too soft and muddy for trucks to offload the fuel.
12. Other office windows were opened and management laptops retrieved from the building.
13. Arrangements were made to set up a temporary control room in the Bidair Echo 9 Operations Control Room.
14. Arrangements were made to base the toilet service trucks at Delta Camp.
15. Due to the other water source on the Ramp being contaminated it was decided to retain filling potable water trucks at Grooming so that the auto dosing system is still deployed. The water supply would be controlled from outside to prevent unnecessary waterlogging of the building.
16. Passenger removal from the aircraft took some time and it was well after 0100 when all passengers had been removed from the flight and taken to the terminal.
17. The SACAA kept the crew on board for investigative requirements and authority was given by CAA to Fire & Rescue at approximately 0300 to commence rubble removal and clearance of the building for the aircraft removal.
18. By approximately 0530 the aircraft was safely removed from the building and taken to the South African Airways Technical Area.

2.1 AIRCRAFT CREW DETAILS

This information will be made available at the discretion of British Airways and the South African Civil Aviation Authority.

2.2 ACSA VIDEO FOOTAGE

Footage was requested but is not expected to be available in this dark taxiway area.

2.3 RADIO TRANSCRIPTS – BRITISH AIRWAYS / CONTROL TOWER.

This information will be made available at the discretion of British Airways and the South African Civil Aviation Authority.

2.4 DECLARATION OF AN UNSAFE BUILDING

ACSA Fire & Rescue as well as ACSA Maintenance & Engineering declared the Grooming building "unsafe" and that no party may have access until further notice. Alternative accommodation in the southern part of the Bravo building complex is being sought. It is expected that it will be some time before structural experts can assess and implement safety measures to enable the building evacuation and relocation.

2.5 INJURIES OF THE STAFF INVOLVED IN THE ACCIDENT

2.5.1 – Soft tissue injury to left shoulder / abrasions of face and fingers.
2.5.2 – Multiple abrasions on the body, face and left elbow.
2.5.3 – Laceration of the forehead.
2.5.4 – abrasion of left temporal area.

Taking into account the impact of the aircraft on the building and the location of these staff at the time of impact, the injuries are minor and that they were exceptionally lucky as no serious injuries were suffered.

3. REPAIR COST

The repair costs pertaining to the both the aircraft, the building and building contents damaged were not known at the time of compilation of this report and are subject to specialist assessment by the insurance assessors of all parties.

4. INITIAL FINDINGS

4.1 The root cause for this incident will be determined by the SACAA investigation.

BIDAir Services does not carry liability for this accident and the subsequent claims to follow.

5. CORRECTIVE ACTION SCHEDULE:

5.1 British Airways – TBA after completion of the investigation.

CORRECTIVE ACTION/S TO BE IMPLEMENTED	ACCOUNTABLE MANAGER & SIGN	DATE ACTIONED	IMPLEMENTATION AUDITED
No corrective action to be forwarded	Manager ORTIA Operations. ..... Print name ..... Signature		Name of Auditee ..... Date ..... Comments ....

Note:
The specified corrective actions shall ensure that the risk is either properly managed or eliminated. The relevant corrective action evidence shall be forwarded to BAS Safety department. The person accountable is to sign acknowledgement of each corrective action as applicable to him/her, report on the corrective action and the date that such action is to be implemented. Please note that each operating division must provide feedback to their respective Managing Directors / Senior Divisional Executives of the corrective action they intend to implement following this investigation. The respective Managing Directors / Director Operations/ General Managers and or Business Unit Managers will acknowledge the above corrective action(s) by means of their signatures prior to e-mailing to Corporate Safety nickan@bidair.co.za within fourteen (14) days of this Investigation Report.

23 December 2013

....
SHEQ Manager Date

Copies to:

Managing Director BIDAir Services

Director – BIDAir Services ORTIA Operations

Director – BIDAir Finance

Director - Marketing

General Manager – BIDAir Services ORTIA Operations

ANNEXURES

Annexure 1- Photographs
Note: Only a few selected photographs have been included for this report due to size limitations of e-mail. Should a request be made for a comprehensive set of photographs, this request will be facilitated by the issuance of a CD.

Appendices C

Copy of ACSA ARFF Report (Note certain items de-identified)

O·R·TAMBO INTERNATIONAL AIRPORT
AIRPORTS COMPANY SOUTH AFRICA

GENERAL INFORMATION REPORT

Shift Controller			
Date	22 December 2013		
Call out Time	22: 43	**Arrival Time**	22:44
Place of occurrence	Mike taxiway towards Mike apron		
Reported by	ATC		
Description	ATC activated the crash alarm for BA 034.		
Findings	On arrival FTL reported to ATC that BA 034 damaged the bid air building and its starboard wing tip.		
Injury (s)	Three people that were in the building.		
Airport Clinic	Fire tower contacted the clinic		
Manager	called CFO		

Re

At 22:40 and we've completed RWY Inspection and vacated via taxiway Bravo. We then gave way to BA 034 that was in front of us on Bravo.

We proceeded to the swissport fire station to collect vehicle check list. At 22:43 while in the vehicle we the overheard the BA pilot said (I think I've heat something).Atc also activated the crash alarm during that time were where proceeding to the aircraft from the Swiss port sub-station.

On arrival BA 034 already into mike taxiway and the starboard wing tip inside the Bidair building large amount of fuel leaking. I then requested ATC to inform the pilot to cut off the engines of which they did so. R1 and the crew sprayed the foam over the spilling fuel after I gave them the instruction. At 22:45 I called CFO Informing him about the situation. I also called the AMC manager request him to organize the steps and the buses. The entire fire vehicle and the crew were on the scene supplying the spill with foam. R1, R2 used half of their extinguishing media to contain the spill. LFF reported that all the power in the building has been cutoff.

CFO reported on and renders assistance to coordinate the situation.

At 23:15 The step from menzies reported on scene with two buses. The step was properly position at 23:20 in order to facilitate the off-loading of the passengers.

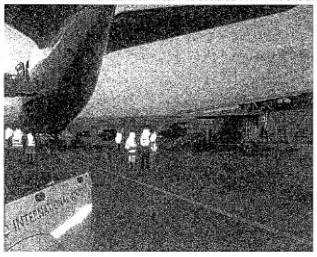
All the passengers were of loaded and transported to the terminal building up until 00:10.

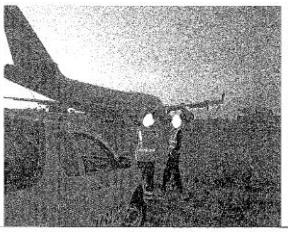
The Bid air structure was inspected for any signs of sudden building collapse meanwhile fire crew prepared their equipment to enter. The SACAA indicated to us that we can make preparations to remove the aircraft. Fire crew

1

O·R·TAMBO INTERNATIONAL AIRPORT
AIRPORTS COMPANY SOUTH AFRICA

entered the building cutting and remove all lose debris along the wing part. The Engineers completed the fuel transfer and gave us a go ahead to push the jumbo. At 03: 15 fire crew completed removing all the lose debris along the wing tip part. The Menzies tug reported on scene and left the tug unhooked. We then waited for the morning tug driver to come in. The morning tug driver reported on site and the aircraft slowly pushed back at 04:50. A fire tender roof monitor used to spray off the remaining debris from the wing tip of an aircraft. The towing of the aircraft continued till SA technical area. FTL declared TWY Mike and Bravo open for operational use at 05:15.





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Appendices D

Copy of ACSA Report (Note certain items de-identified)

ACSA

Occurrence Detail for Occurrence ID : 35171

General Occurrence Detail

Print Date: 09/01/2014 14:40:32 Page 1 of 7 Current User ID: JIAAI1reports

ACSA

Occurrence Detail for Occurrence ID : 35171

Occurrence ID	35171
Organisation Unit	JNB
Occurrence Status	In Proccess
Logged By	
Verified By	
Captured Date	23/12/2013
Day Of Week	Monday
Occurrence Date And Time	22/12/2013 08:43:00 PM
Reported By	
Geographical Location	I.like
Grid Reference	KI-56
Floor Level	Ground Floor
Surface Type	ASPHALT
Short Description Of The Occurrence	Accident - at approximately 20:43 an incident occured whereby a British Airways Boeing 747-400 Aircraft Collided with an ACSA Facility
Detail Description Of Occurrence	BA 034 was due to Depart from ORTIA to LHR BA-034 was granted clearance by ATC to Taxi via Taxiway Bravo for departure on Runway 03L. BA-034 continued to taxi southbound, passing the Runway holding point, entering a narrower Taxiway leading to Mike Apron, whereby the Boeing 747-400 Aircraft collided with ACSA facility (Bidair grooming offices), cutting through the building till it came to a stop. Four Bidair employees were injured by the building debris. The incident scene was attended to by the ACSA Fire and Rescue crew, they covered the jet A1 fuel with foam stabilising the site for the recovery process. NOTE: More information to be obtained and included, after CAA has completed the investigation.
Should This Occurrence Be Investigated	Yes

Print Date: 09/01/2014 14:40:32 Page 2 of 7 Current User ID: JIAAI1reports

Occurrence Detail for Occurrence ID : 35171

Operational Consequences	AIRCRAFT DELAY DAMAGE ENVIRONMENTAL IMPACT LIABILITY OPERATIONAL DELAY POLLUTION

Weather Conditions

Visibility	MODERATE
Sky	NO CLOUD
Lighting	NIGHT
Precipitation	CLEAR
Wind Direction	NORTH
Wind Speed	CALM - NO WIND
Category	CATEGORY I
Temperature: (°C)	0

Witnesses

Name	Initials	ID Number	Cell No	Home Tel	Work Tel	Email Address

Linked Documents

Linked Document Name	Linked Document Description	Linked Document File
Annexure 1	ACSA Internal Media Statement	/ACSA/Uploads/eca538c4-9f06-4293-9b4b-1ed7329dde39.htm
Annexure 10	CAA AIP - Surface movement guidance and markings	/ACSA/Uploads/cdc0bff9-e91b-4335-a822-c879ed6a23e9.pdf
Annexure 11	TWY B movements	/ACSA/Uploads/4f98f2a2-0aad-4d67-9b63-c30452c0190a.xlsx
Annexure 12	Email -questions posed to ACSA	/ACSA/Uploads/146b5ebc-c8a8-4ec2-bac7-2997e1f73af4.msg
Annexure 13	BA Safety report - p1	/ACSA/Uploads/863e3eb9-bbe8-489e-84c7-1f6d30638683.pdf
Annexure 14	BA safety report - p2	/ACSA/Uploads/aa3772ec-dbc6-4ff8-e7b4-fc9d95a9fc5f.pdf
Annexure 15	BA safety report - p3	/ACSA/Uploads/f704ab1e-ebe4-4feb-b7f3-f2dcb41edd0e.pdf

Occurrence Detail for Occurrence ID : 35171

Annexure 16	BA safety report - p4	/ACSA/Uploads/c2375c84-bc24-44f2-ba86-adfc52d50d9a.pdf
Annexure 17	BA safety report - p5	/ACSA/Uploads/514dcec2-3a98-4b0a-bade-a6f38e943b42.pdf
Annexure 2	SA CAA Statement	/ACSA/Uploads/7aa83690-3d15-4860-8534-aef9cbc2736b.pdf
Annexure 3	Bidair prelim report	/ACSA/Uploads/1081a127-e365-4611-91a5-d1ff99a799d7.pdf
Annexure 4	ACSA follow-up info to be obtained	/ACSA/Uploads/9239fc8a-95c7-497f-a6b7-32757731f628.doc
Annexure 5	Zues 1	/ACSA/Uploads/8041c706-0f43-4893-ae7f-efb17401958a.xls
Annexure 6	Zues 2	/ACSA/Uploads/1cb07cc9-6922-4956-650c-cdee3defc329.xls
Annexure 7	Medical report - Bidair WCL 4 -	/ACSA/Uploads/8d437f46-ofbe-4ba5-afba-398ffc958f65.pdf
Annexure 8	Medical report - WCL 5	/ACSA/Uploads/471b43ef-792b-4515-8ad3-93e4198e6678.pdf

Additional Notifications

Name	Initials	ID Number	Cell No	Work Tel	Work Fax	Email Address

Occurrence Classifications

Spillages
Aircraft
Facility
Injury
Additional Injury
Additional Injury
Additional Injury

Classification Detail

Investigation Detail

Occurrence Detail for Occurrence ID : 35171

Investigator	
Investigators Designation	Safety
Investigation Start Date	22/12/2013
General Agencies	BUILDING/STRUCTURE
Related Helpdesk Number	

Root Cause Analysis

Sub Standard Acts	OTHER
Sub Standard Conditions	HUMAN ERROR
Suspected Causes	Under Investigation

Basic Causes

Lack Of Control

Corrective Or Preventative Steps

Type of Steps Taken	PREVENTATIVE
Recommendations by Investigator to Prevent Reoccurrence	TBA
Actions Taken By Employer to Prevent Reoccurrence	TBA
Remarks By Health and Safety Committee	TBA

Completion

Date of Investigation Completion	01/01/00

Verification Detail

Verified By	
Date Verified	31/12/2013
Do you verify this occurrence as valid	Yes
Occurrence Type	ACCIDENT
To which authority was this occurrence reported	ACSA AIRPORT SPECIFIC

Occurrence Detail for Occurrence ID : 35171

Risk Factor

Risk Factor Value	105
Frequency	3
Legend	Monthly
Severity / Scope of Damage / Spillage extent	5
Legend	Catastrophic

ACI Classifications

ACI Classification	ACI Classification Description	Parent
Aircraft manoeuvring (taxiing/towing/pushing)	Aircraft manoeuvring (taxiing/towing/pushing)	PART B - Damage to/by moving Aircraft caused by:
Fixed objects	Fixed objects	PART B - Damage to/by moving Aircraft caused by:

Action Detail

Assigned By	Assigned To	Start Date	Due Date	Reminder Frequency	Description

Action Completion Details

Description	Completion Date	Completed By	Completion Detail

In Process Detail

Reason	Comments	Date Tracked	User

Closing Detail

Closer	**Closed(Yes/No)**	No	**Date Closed**
Reporting Category	Aircraft and Property/Facility		

Re-opened Detail

Re-opened By	**Date Re-opened**
Reason	

Insurance Detail

ACSA

Occurrence Detail for Occurrence ID : 35171

Insurance Claim Number

Was this occurrence reported to the ACSA Insurance Broker? No

Date when claim was submitted

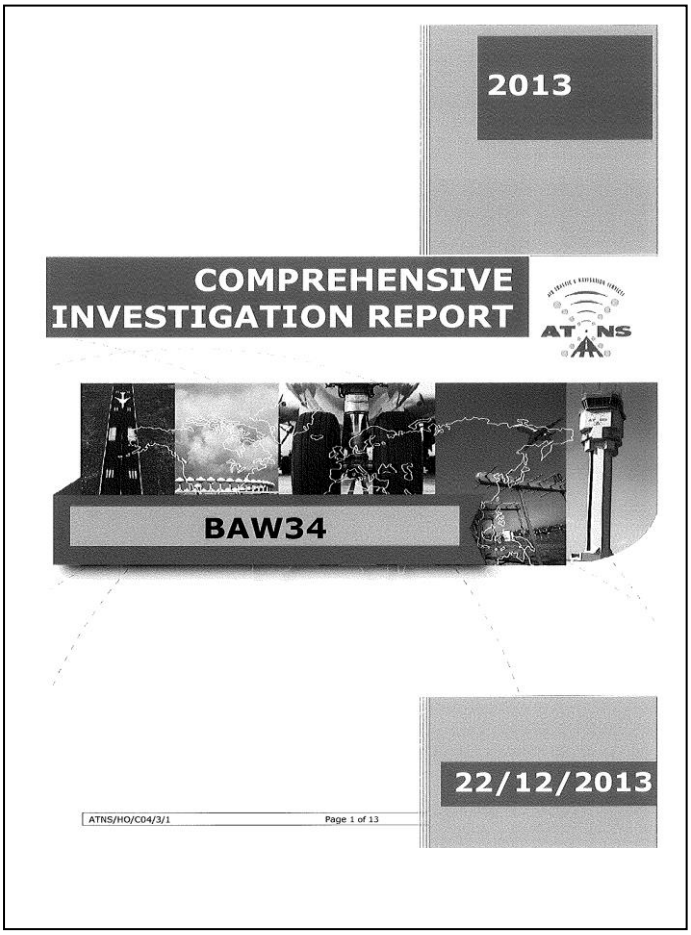
Amount of claim (Rand)

Type of insurance claim

Print Date: 09/01/2014 14:40:32 Page 7 of 7 Current User ID: JIAAI1\reports

Appendices E

Copy of ATNS Report (Note certain items de-identified)



ATNS PRELIMINARY INVESTIGATION/REVIEW REPORT

Non-Disclosure of Information

The contents of this Report are Protected under SA-CAR 12.04.6 *Non-Disclosure of Records (Accident and Incidents)* and shall not be made available other than for the purpose of Investigation of Accident and Incident investigations, unless a court of law determines that their disclosure outweighs the adverse domestic and international impact such action may have on that or future investigations, taking into account all applicable law. On receipt of this report the individual or entity to which it is addressed hereby undertakes to protect this released data accordingly and shall notify **ATNS** should any application be made to release this data either to the judiciary or to external parties.

Confidentiality

This Report is intended for only use of the individual or entity to which it is addressed and contains information that is privileged and confidential. If the reader of this message is not the intended recipient, or the employee or agent responsible for delivering the message to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us immediately by telephone and return the original message to us at the above address at our cost.

Mandatory Occurrence Reference (MOR) number :

Date of Event (DD/MM/YYYY):	22/12/2013	Time UTC (Hh:mm:ss):	20:43
Initial Report Submitted by: (Mandatory Occurrence Report/ ASR /Hazrep etc)	N/A	Type of ATS Service	Aerodrome
ATSU / Sector	Aerodrome/GMC	ATSU Unit Approval Expiry	July 2014
NAV Aids Used (Relevant to Event)	N/A	Unit Investigator ISS	

ATNS/HO/C04/3/1 Page 2 of 13 11 February 2014

1. INTRODUCTION

1.1 On 22 December 2013 at 20:43 UTC a Taxiway excursion occurred of Taxiway "B" at OR Tambo International Airport.

1.2 One controller was involved during the Taxiway excursion - licence number ATS0837.

1.3 A unit investigation was conducted in conjunction with the SRA office on the 23 December 2013.

1.4 All times 00:00:00 (hh:mm:ss) reported in this report are UTC (Universal Time Constant); event local time, minus two hours.

2. DETAILS

2.1 Aircraft Details

Aircraft/Vehicle Callsign	BA34	Aircraft/Vehicle Registration	G-BNLL
Aircraft/Vehicle Operator	BRITISH AIRWAYS	Aircraft/Vehicle Type	B744
Departure Aerodrome	FAOR	Destination Aerodrome	EGLL
PIC Lic No (If Avail)	UK/AT/2323241		

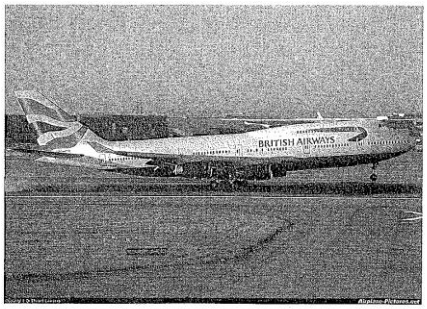


Figure 1 Boeing 747-400

2.2 ATCO Details

2.2.1 Event Controller 1:

ATCO Lic No	ATS0837		
ATCO Age	32	ATCO Gender	MALE
License: Ratings (1)	AERODROME	Rating (1) Issue Date	20.04.2007
License: Ratings (2) If Applicable	N/A	Rating (2) Issue Date If Applicable	N/A
Validation (1) Expiry	15.05.2014	Validation (2) Expiry If Applicable	N/A
Medical Class	CLASS 3	Medical Expiry Date	31.07.2015
Medical Restrictions		English Language Proficiency	6 PERMANENT
OJTI Rating Issue Date (if applicable)	25.11.2011	Sector Worked	TWR WEST
Sign-on Time	1900	Sign off Time	0545
Time Since Last Break	N/A	Duration of Last Break	N/A
Time Since Last Sign Off	48 HRS	Days Since Last Off Day	1

2.3 Separation Details

Separation infringement type:		Separation standard used:	
IFR/IFR (Los)		Procedural VOR/DME/NDB	
IFR/VFR (Los)		Procedural Time Based (AD/en-route)	
Runway Incursion		ATS Surveillance	
Taxiway, Surface near collision		Deemed separation	
Wake Turbulence/Vortex		Composite separation	
Other (Specify Below)	X	Other (Specify Below)	
ACFT Collided with a building			

2.4 Data Collection

Has the following Data has been collected for the Investigation?
Note 1: *Refer Section 4 of the ATNS SMS for all data required for a complete investigation.*
Note 2: *Pending would indicate that the data has been requested but not yet attained by the Investigator.*

Data	Y	N	Pending	Data	Y	N	Pending
Audio Recordings	X			Controller Statements	X		
Surveillance Recordings	X			Pilot Statements		X	
Occurrence Log	X			Roster			
U/S Log				Sign-on Registers			
Equipment Status Reports				Leave Records			
Met Reports				Traffic Count (ATM Capacity document)			
Transcript Made	X						

2.5 Position where Safety Event occurred:

Lat	Long.
Geographic position.	**TXY "M" towards "M" apron**

3. DESCRIPTION OF EVENT

All times 00:00:00 (hh:mm:ss) reported in this report are UTC (Universal Time Constant); event local time, minus two hours, whereby each transmission has a time stamp e.g. At 00:00.

3.1 On 22 December 2013 at 20:43 British Airways (BA34 – 747-400) had an excursion of TXY BRAVO.

3.2 ***The controller issued BA34 a clear and an unambiguous taxi clearance. British Airways was cleared to TXY "B" CAT II holding point runway 03 Left from parking bay A6. This clearance was read back correctly by the pilot.***

3.3 At the same time an Emirates aircraft was cleared via TXY "A" to the CAT II holding point RWY03L.

3.4 The controller's intention was to depart the Emirates traffic ahead of the British Airways aircraft. According to the event controller, they looked to see where the British Airways aircraft was before clearing the Emirates to the CAT I holding point.

3.5 At that time the event controller did not see the British Airways aircraft on TXY "B" and looked on the A-SMGCS (ground radar) to see if they could find them.

3.6 The event controller noticed a squawk on the taxiway leading to "M" apron and this is when they saw the British Airways aircraft passed TXY 'B" towards "M" apron.

3.7 The event controller called the British Airways to check if operations were normal upon which the crew responded to **"standby, we might have hit something"**. The event

controller immediately pressed the crash alarm upon which FTL responded and they were directed to the aircraft to assist. It should be noted that the response time of the Fire Crew was very good.

3.8 FTL advised that the British Airways' wing had collided with a building and that they should shut down their engines as there was a large fuel leak. The aircraft complied and the controller then changed the frequency of the British Airways and Fire vehicles to 118.1 MHz so they could communicate with each other without effecting operations on 121.9 MHz.

3.9 An Accident report and MOR filed was filed as well as the occurrence log in the TWR was completed. The event controller kept a detailed log of all persons spoken to at ACSA and the SACAA with their respective telephone numbers.

4. ANALYSIS OF THE EVENT

4.1 **Procedures applicable to the event (SSI, Standard and procedure manual/LOA's/Directives etc)**

4.1.1 **AIP South Africa – FAOR 2.9-5**

RSA AIP FAOR AD 2.9 – 5 Surface Movement Guidance And Control System and Markings dated 4/13-15 October 13 has reference.

As per paragraph 8, *"pilots to EXER CTN when TAX on TWY "B" as the "M" APN extends immediately S of TWY B where the TWY bends at the CAT II HLDG point".*

This warning is once again reiterated in paragraph 11 on page RSA AIP FAOR AD 2.9 – 6 which states:*"Pilots to EXER CTN when TAX on the full LEN of TWY "B" as confusion may exist at the INT of TWY "B" and the "M" APN.*

4.1.2 **A-SMGCS**

Johannesburg Tower SSI's Section 4 paragraph 4.1.10 dated October 2013 has reference.

The present system at FAOR is, according to the ICAO definition, still classified as Surface Movement Radar (SMR) only. Level 1 will be achieved once all the ICAO requirements for squitters etc. are met.
The A-SMGCS can be used as a monitoring aid. It should be emphasized that it is an adjunct and not an alternative to the visual aids and procedures currently used for the control of aircraft and vehicles on the manoeuvering area.

4.2 Communication (R/T phraseology)

4.2.1 The event controller used the correct R/T phraseology as per the Standards and procedure manual Chapter 8.

4.3 Personnel performance

4.3.1 The event controller should be commended for the quick action taken to assist the ACFT, as at the time the damage to the ACFT had not been ascertained until such time the RFF responded and advised the event controller of the damage.

4.4 NOTAMS

4.4.1 (A3919/13 NOTAMR A2653/13
Q)FAJA/QMNXX/IV/NBO/A/000/999/2608S02815E005
A)FAOR B)1311240409 C)1401281400 EST
E)ALL AIRCRAFT TO BE TOWED IN AND OUT OF APRON M.)

No NOTAM INFO regarding TWY B.

4.5 Flight Plan Information

```
(FPL-BAW34-IS
-B744/H-SDE3FGHIJ3J5J6M1M2RWXYZ/B1D1L
-FAOR2045
-N0494F340 DCT VASUR UZ21 ITROL UQ25 RUDAS UM731 VSA/N0491F360 UM731
 USKAV/N0487F380 UM731 FARES/N0475F380 UM731 TUC UM733
 OSMAR/N0474F400 UQ213 CORSI UM858 AJO UM622 BARSO UM733 KOPOR UM976
 ABNUR UT10 ALESO DCT
-EGLL1011 EGKK
-PBN/A1B1D1O1S2 NAV/RNVD1E2A1 SUR/TCAS DOF/131222 REG/GBNLL
 EET/FBGR0021 FLFI0113 FNAN0144 FZZA0227 FCCC0335 FTTI0424 HLLL0609
 DTTC0722 LIRR0807 LFFF0832 EGTT1000 SEL/BPCH CODE/40040B RVR/075
 OPR/BAW RALT/FAOR FOOL FTTJ DTTA EGBB RMK/LAHSO NOT AUTHORISED TCAS
 REFID221201097)
```

5. CONCLUSION

5.1 The safety event is not attributed to ATNS.

5.2 On 23 December 2013, as instructed by EO, , I requested (CFO) and , as a precautionary, to inform the ATNS insurance company regarding the event.

6. PRESS RELEASE

British Airways accident injures four officials at OR Tambo

Midrand. The South African Civil Aviation Authority (SACAA) confirms that a British Airways flight outbound to Heathrow International airport from OR Tambo International airport had an accident on Sunday evening just after 23h00 injuring 4 people. According to the preliminary report, the SACAA was informed that the B747-400 aircraft was cleared

for takeoff on Runway 03L. Further, it was confirmed to the SACAA that the air crew got instructions from the Air Traffic Control to taxi using taxi way B. The crew continued onto taxi way M which is narrower resulting in the aircraft impacting on an office building behind the SAA Technical hangers. Four officials who were in the building were injured by the debris from the building. The 17 Crew and 185 passengers who were in the aircraft escaped unharmed and were evacuated from the aircraft through door no. 5.

Fuel spillage was reported from the aircraft but this was contained by the airport fire services without further incidents.

The SACAA dispatched investigators last night and early this morning they witnessed the recovery of the aircraft as well as the removal of the flight recorder from the aircraft. The investigation continues.

SM:SRA **E:ATM**

Date 11 February 2014

Appendices F

Copy of aircraft damage assessment report

Item	Structural element	Damage location	Damage details
1	D-nose section	OLES 1465 thru to tip of wing (WBL 1243.75).	Nose skins crushed and/or missing.
2	Nose Beam	OLES 1465 thru to tip of wing (WBL 1243.75).	Nose Beam crushed and/or missing
3	Overwing composite panels	All overwing panels (composite design) OLES 1318 to WBL1241	All are either severely damaged or missing
4	L/E ribs (in damage area)	All ribs from OLES 1462 thru to the wing edge. This includes secondary ribs and rotary actuator ribs (OLES 1411 to OLES 1607)	All are either severely damaged or missing
4A	L/E ribs (outside damage area)	At OLES 1453.35, 1462.85 and OLES 1411.85, 1421.35	Undamaged, but may have been stressed during incident.
4B	Stabilizing rods	OLES 1462 WBL 1243.75	All L/E stabilising rods were either destroyed or damaged. These attach the lower L/E panels to the ribs
5	Straps upper panel	OLES 1318 to OLES 1243	Straps are damaged and missing from OLES 1318 to MSS 1560
6	Lower composite panels	OLES 1425 to WBL 1241	All panels either damaged or missing.
7	Wing RH Up-stop beam	OLES 1425 to OLES 1617	Beams are damaged and missing in this area
8	#24 Position	OLES 1329 to OLES 1401	This is repairable IAW the SRM, The option to replace it with one from a donor A/c is also an option
9	# 25 Position	OLES 1401 to OLES 1483	Partially severed
9A	# 26 Position	OLES 1483 to OLES 1555	Missing from wing
9B	# 26E Position	OLES 1555 to OLES 1617	Missing from wing
10	Front spar	Between WS 1480 and WS 1551 (FSS 1493 TO 1566)	Two holes in front spar. Web, vertical stiffeners, upper and lower chords all damaged. Production splice located at FSS 1446 and at WS 1551. This replacement will include all vertical stiffeners, splices and attachment brackets. The spar comprises of an upper chord, lower chord and web assembly
11	Front spar splice plate	At WS 1551 (OFSS 1571)	Some gouges evident. Depth only known when clean-up completed
12	Upper wing skin panel #1	Between WS 1485 and WS 1551 (BBL 127 to MSS 1558, FS to RS)	Panel is bent and distorted from WS 1475 to WS 1547. Panel has multiple scrapes and gouges .005" to .16" deep
13	Upper vent stringers	Stringer 12/13 and 10/11 between WS 1551 and 1485. (BBL 127 to MSS 1558)	Stringer 10/11 is damaged and cracked from WS 1504 to WS 1556 Stringer 12/13 is damaged and cracked from WS 1485 to WS 1560
14	Mid spar upper	From WS 1490 to WS 1519 (BBL127 to MSS 1519)	Chord severed at WS 1485 and destroyed till O/B edge.
15	Lower wing skin #1	From BBL 127 to MSS 1558	Panel has scrapes and gouges at WBL 1110 in a 3" x 16" area with a max depth of .003"
16	Lower wing skin #2	Between WS 1484 and WS 1516 (BBL 127 to MSS 1558)	Skin ruptured at this location from front spar extending 13" aft to Stringer 6. Numerous scratches between WBL 1112 to WBL 1117 running to aft spar
17	Lower wing skin #3	Between WS 1484 and WS 1496 (BBL 127 to WS 1496)	Skin severed at WS 1490 from front spar to mid spar
18	Lower stringers	Stringer 9 is damaged from WS 1487 to WS 1541. Stringer 8 is damaged from WS 1493 to WS 1538.	Stringers 8 and 9 are broken and bent considerably
19	Mid spar lower	From WS 1485 to WS 1519 (BBL 127 to MSS 1528)	Chord severed at WS 1490 and destroyed till O/B edge.
20	WS 1484 Rib	Located in the tank area, running perpendicular to the front spar. The FWD edge that connects to the front spar was found severed.	Attachment post on FWD edge to be replaced. The remainder of the rib appears in good order and requires no further repair
21	WS 1516 Rib	Located in the tank area, running perpendicular to the front spar.	Found severely damaged from front spar to S-6
22	Wing extension Upper skin	Between WS 1551 to WBL 1243.75 (MSS1558 to WBL 1243, FS TO RS)	A number of scratches and one dent are all evident on the upper skin. Panel has multiple minor scratches that are .001" to .004" deep. At MSS 1660 the panel has a 6" x 2.5" x .012" smooth dent.
23	Wing extension Lower skin	WS 1551 through to wing tip WBL 1243.75 (MSS 1558 to WBL1243, front spar to rear spar)	Panel is deflected .008" in a 2.5" x 4" area at MSS 1558 c/t the fwd edge. (fwd of front spar).There is a 2.5" x .2" gouge on the fwd edge at FSS 1578 to 1580.There is a 1.5" x .25" x .100" gouges at ERSS 1465.

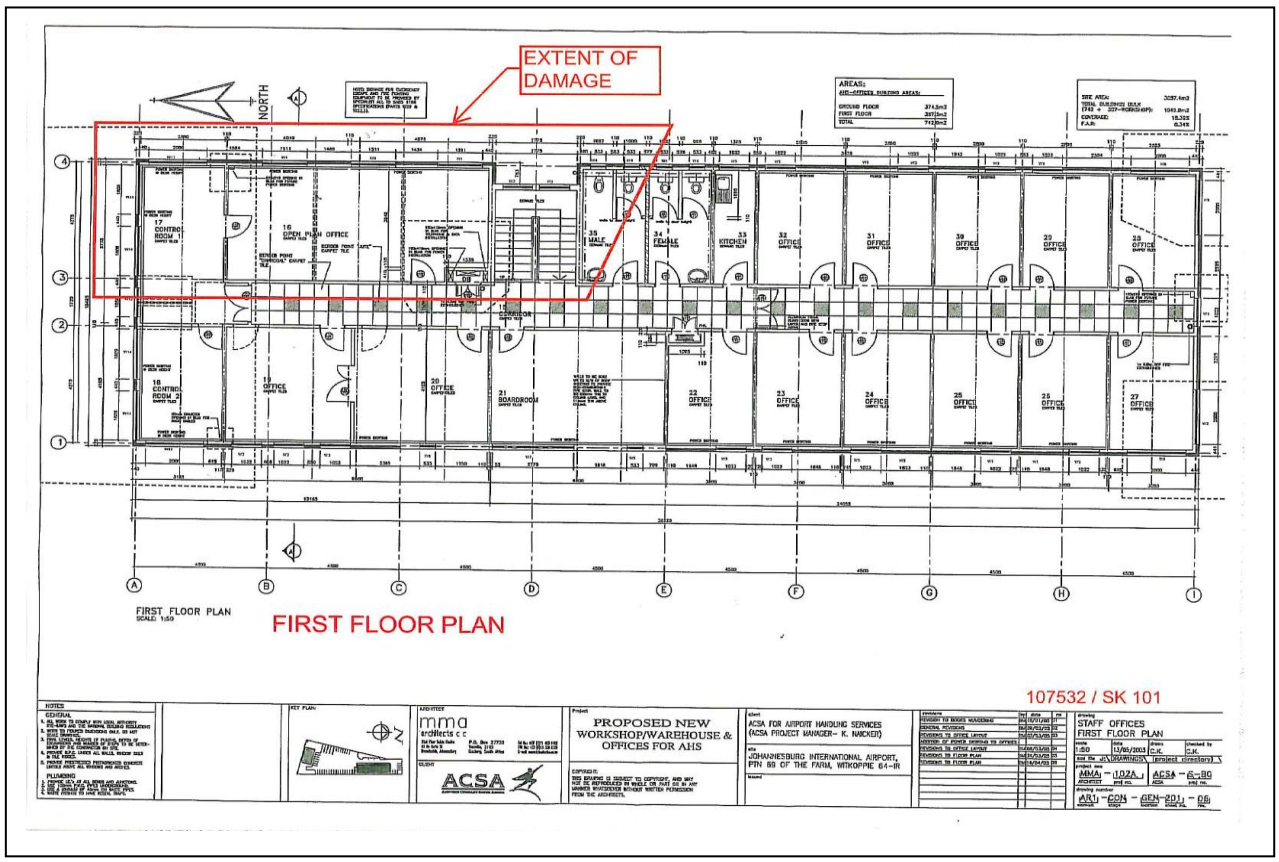
26	T/E structure lower skin	Area extends from WBL.1115 to WBL.1243.75 (WS 1385 to WBL 1247)	There are a number of dents and one large hole on the T/E wedge lower skin close to the access panels.
27	Winglet assembly	At WBL 1243.75	Winglet is damaged substantially on all surfaces.
28	RH winglet to wing Fairings	At WBL 1243.75	WBL 1241 all fairings are suspect due to contact with building
29	Wing RH navigation light/FWD fairing	At WBL 1241	WBL 1241 unit is broken and destroyed.
30	Rotary actuators for LE flap	OLES 1421 to OLES 1600	All actuators are suspect or missing from drive unit outboard
31	Torque tubes	OLES 1365 to WBL 1243.75 (OLES 1400 to OLES 1597)	Either damaged or missing. Those I/B of OLES 1400 are undamaged.
31	Camber Flap drive motor	O/B most gearbox OLES 1390 to OLES 1411) was connected to the damaged torque tubes	Drive unit undamaged but was connected to the damaged torque tubes and may have sustained hidden damage
33	Fuel venting tubes	WS 1490 to MMS ERSS 1615	Tubing is destroyed from WS 1490 to ERSS 1558
34	Fuel ducts	WS 1485 to WS 1520 between S 9/10 and S 12/13	Ducts are damaged or missing outboard of WS1485
35	Navigation light power supply and transformer	OLES 1617 between FS and LE	Units are suspect due to incident
36	Anti Ice ducting	WS 1116 to WS 1522 behind nose skin	Ducts are destroyed from OLES 1450 to WS 1522.
37	Systems – Electrical Equipment	From OFSS 1503 to WBL 1243.75	Wiring on front spar is severed
38	Electrical Equipment Static Dischargers	On T/E wedge structure and winglet	Should all be replaced
39	Winglet attachment	At WBL 1243.75	None
40	Overwing panels on I/B R/H wing	At ILES 310, 416 and 992.	Found three areas with pulled rivets on the junction between the front spar and leading edge. This is a common maintenance occurrence. It is however not ideal that we have found these following a recent D-check. Also found two areas on the L/H wing that were similar. Will raise G.O.R. Rivets can all be changed at facility.
41	I/B T/E panel	Crack was found upon removal of the wing to body fairing fairings at the wing route	It appears it may have been broken when a seal was replaced on the wing. Will raise a G.O.R. Can be repaired at SAA facility
42	Sheared rivet	On removal of the wing to body fairings, it was discovered that a rivet had sheared at the wing route area, common to the fuselage	On closer inspection it was noted that the rivet showed signs of fatigue and it was determined this was the cause of the shearing and not the incident. Rivet can be replaced at SAA facility.
43	Hard landing phase II	Some inspections are complete, with no defects found.	See attached list of items outstanding. Also added are the requirements by Boeing to have the entire rear spar inspected to wing route.

ABBREVIATIONS
OLES - Outborad Leading Edge Structure
ILES - Inboard Leading Edge Structure
RSS - Rear Spar Station
WBL - Wing Buttock Line
ERSS - Extended Rear Spar Station
WS - Wing Station
OFSS - Outboard Front Spar Station
MSS - Mid Spar Station
BBL - Body Buttock Line
T/E - Trailing Edge
I/B - Inboard
O/B - Outboard
L/E - Leading Edge
RS - Rear Spar
FS - Front spar
VCF - Variable Camber Flap

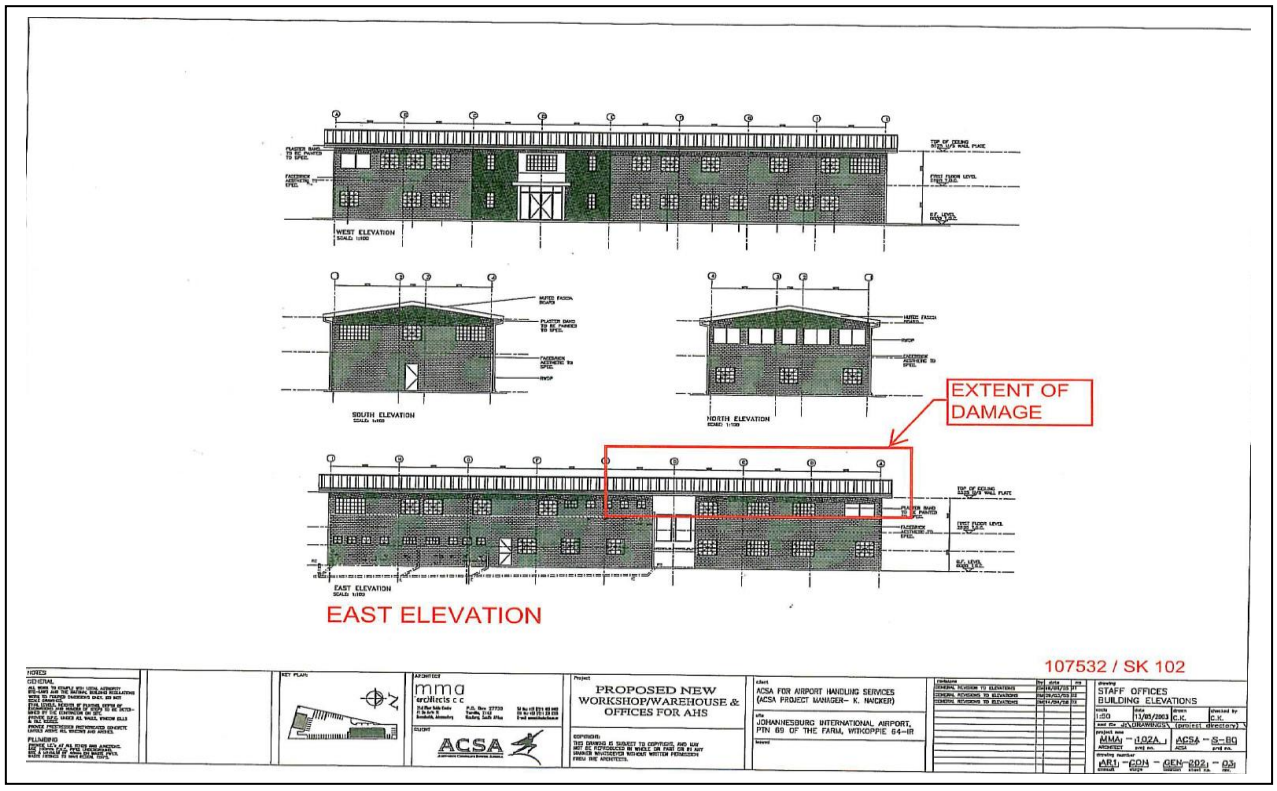
Appendices G

Bird Air Service Building Structure Layout showing damage:

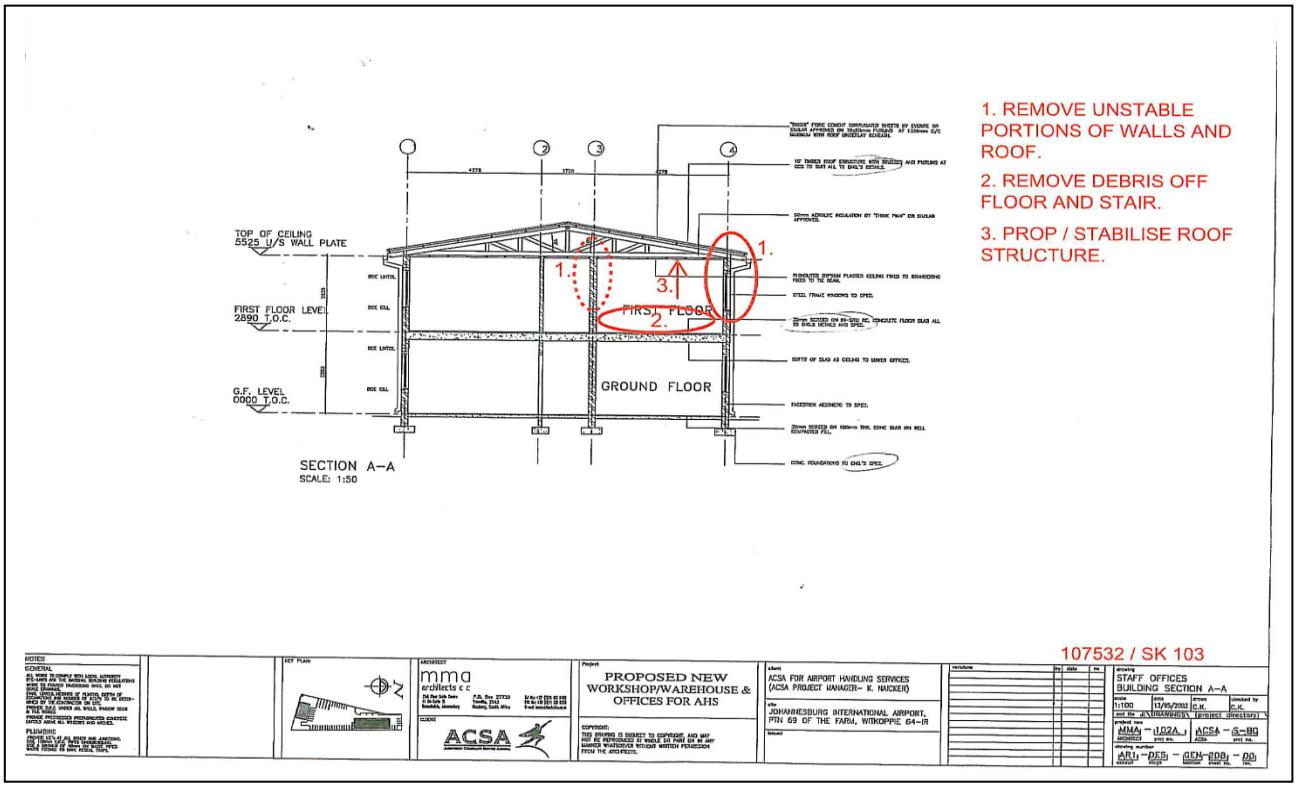
(i) Front Floor Plan



(ii) Eastern Side View



(i) Southern Side View



Appendices H

Copy of Fuel Spillage Soil Remediation Reports (Note certain areas are de-identified).

Report Ref: 25 January 2014

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PROJECT NAME	: BA Jet-Fuel Spillage: Soil Remediation	DPR NO.	: 03
PROJECT NO.	: HRS 001	DATE 25/01/2014	: Page | 1

CONTRACT FORM	: British Airways Order (Sign On)
To Client	: British Airways
E-mail Client	:
C.C.	: "
	:
Location	: Grass patch @ BidAir Building @ Taxiway M, ORTIA, Kemptonpark, Gauteng

PERSONNEL ON SITE:	DESIGNATION:	On Site	Off Site
	Project Manager	23/01/2014	25/01/2014

DRIZIT - EQUIPMENT/PLANT/STOCK REPORT

1 x TLB, 1 x transporter with trailer, 35 x 20 kg bag remediation agent, shovels, picks, rakes, 34 x jersey barriers
1 x TLB Operator, 5 x workers, 1 x Supervisor and 1 x SHE Off/1st Aider/Fire Team Member/Project Mng (Ma)

SUMMARY OPERATIONAL ACTIVITIES

From	To	Description activity
07:30	-	Contractor with crew arriving at Super South Gate waiting for escort
07:50	-	ARFF escort arrives
08:01	-	On site
08:03	08:10	Toolbox Talk, DSTI & LMRA
08:13	10:20	Mixing water with 25 liter Biokleen, washing embankment (see pictures)
08:13	11:55	TLB loosing soil to depth (part 3), plus following / digging pipe to establish perimeter
12:00	13:00	Lunch
13:08	-	Back at site
13:10		Last session of digging with TLB loosing soil to depth (part 3)
13:33	14:14	Encountered problem, depth 1.5 to 1.8 m, ground water & Jet fuel contamination next to drain.
		Using 2 x 20 kg bags remediation agent per side (see pictures). Using uncontaminated soil to fill
		trenches whilst layering with remediation agent (see pictures)
14:30	14:44	Puncture (L) front tyre TLB, replaced with spare, resuming operations
15:20	16:02	Filling of excavations complete. Levelling of soil with hand tools to previous condition and adding
		last layer of remediation agent.
15:40	16:10	Placement of erosion booms, removal of yellow jersey barriers
16:11	-	Barrier stacking complete
16:15	-	Leaving site. Site safe, clean and inspected / approved by ARFF escort
16:36	-	Exited Super South Gate

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PROJECT NO.	: HRS 001	DATE 25/01/2014	: Page | 2

OPERATIONS PLANNED FOR NEXT 24 HRS

No.	Operations planned
1	TLB digging of Part 3 of soil
2	Washing embankment with Biokleen agent
3	Installing erosion booms and leaving site in acceptable condition

OUT OF POCKETS:	QTY:
Red heavy duty gloves	5
Re-usable corded ear plugs	6
Safety glasses	6

ADDITIONAL INSTRUCTIONS RECEIVED FROM CLIENT (BA)

None thus far

POINTS OF CONSIDERATION (DRIZIT)

No.	Description
1.	Ergonomics of soil removal process
2.	Costings
3.	Exposure to hazardous waste during operations especially during breaks
4.	Time sheets and management of operational times
5.	Removal methods and storage considerations
6.	Equipment needed & used to execute the job at hand safely

REMARKS (HRS)

No.	Description
1.	Speed of operations
2.	Dehydration with subsequent re-hydration
3.	Method Statement changing due to time constraints
4.	Timekeeping off breaks (rest & rehydration)

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APPROVAL & SIGNATURE

HRS REPRESENTATIVE		CLIENT REPRESENTATIVE	
Name	**Position**	**Name**	
Louis Pretorius	Project Manager & HSE		
Signature		**Signature**	

Report Ref: 07 March 2014

HazRisk SOLUTIONS	DAILY PROGRESS REPORT (DPR)	www.hazrisk.co.za

PROJECT NAME	:	BA Jet-Fuel Spillage: Soil Remediation	DPR NO.	:	04
PROJECT NO.	:	HRS 001	DATE 07/03/2014	:	Page | 1

CONTRACT FORM	:	British Airways Order (Sign On)

To Client	:	British Airways
E-mail Client	:	
C.C.	:	
Location	:	Grass patch @ BidAir Building @ Taxiway M, ORTIA, Kemptonpark, Gauteng

PERSONNEL ON SITE:	DESIGNATION:	On Site	Off Site
	Project Manager	07/03/2014	07/03/2014

DRIZIT - EQUIPMENT/PLANT/STOCK REPORT

1 x TLB, 1 x transporter, 3 x 20 kg bag remediation agent, 1 x shovels, 2 x rakes, 40 x jersey barriers,
1 x 50 kg bag Urea and 1 x 25 kg bag MAP, 1 x TLB Operator, 2 x workers, 1 x Supervisor,
and 1 x SHE Off/1st Aider/Fire Team Member/Project Mng (Me)

SUMMARY OPERATIONAL ACTIVITIES

From	To	Description activity
07:55	-	HRS arrives at ACSA
08:05	-	Both HRS and Drizit at permit office
09:15	-	Both HRS and Drizit leaving permit office, en-route to Super South Gate
09:35	-	Arriving at SSG and parking vehicle
09:44	-	Phoning ARFF escort
09:52	-	ARFF escort arrives
09:55	-	ARFF escort realises his card cannot open gate and Security refuses to let us in
10:15	-	ARFF card re-activated and access through SSG
10:22	-	On site
10:25	10:30	Toolbox Talk, DSTI & LMRA
10:55	-	Yellow Jersey Barrier deployment complete
10:56	11:15	Sampling of previous 4 x points
11:16	11:44	Applying 3 x bags bio-remediation product, 1 x bag Urea and 1 x bag MAP on top of soil before soil is turned by TLB (See photographs)
11:45	13:58	TLB loosing soil and turning mud (Noting and smelling heavy amounts of sewage contamination)
14:00	14:22	Crew raking soil to try and level to a certain degree. Re-placement or erosion booms.
14:23	-	Packing up barriers and re-stacking
14:25	-	Informing escort to arrive to accompany us to SSG

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14:40	-	Barrier stacking complete
14:41	-	Leaving site. Site safe, clean and inspected / approved by ARFF escort
14:47	-	Exited Super South Gate

OUT OF POCKETS:	QTY:
Heavy duty gloves	2
Re-usable corded ear plugs	3
Safety glasses	3

ADDITIONAL INSTRUCTIONS RECEIVED FROM CLIENT (BA)

None thus far

POINTS OF CONSIDERATION (DRIZIT)

No.	Description
1.	Ergonomics and Methodology of soil turning
2.	Costings
3.	Exposure to hazardous waste during operations
4.	Time sheets and management of operational times
5.	Removal methods and storage considerations
6.	Equipment needed & used to execute the job at hand safely

REMARKS (HRS)

No.	Description
1.	Speed of operations
2.	Slip / Trip / Fall due to mud
3.	Method Statement changing due to imminent rain

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APPROVAL & SIGNATURE

HRS REPRESENTATIVE	
Name	Position
Louis Pretorius	Project Manager & HSE
Signature	

CLIENT REPRESENTATIVE	
Name	
Signature	

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PROJECT NAME	: BA Jet-Fuel Spillage: Soil Remediation	**DPR NO.**	: 01
PROJECT NO.	: HRS 001	**DATE 23/01/2014**	: Page | 1

CONTRACT FORM	:	**British Airways Order (Sign On)**
To Client	:	**British Airways**
E-mail Client	:	
C.C.	:	
Location	:	**Grass patch @ BidAir Building @ Taxiway M, ORTIA, Kemptonpark, Gauteng**

PERSONNEL ON SITE:	**DESIGNATION:**	**On Site**	**Off hire**
	Project Manager	23/01/2014	TBA

DRIZIT - EQUIPMENT/PLANT/STOCK REPORT

1 x TLB, 1 x transporter with trailer, 35 x 20 bag remediation agent, shovels, picks, rakes, 34 x jersey barriers

1 x TLB Operator, 5 x workers, 1 x Supervisor and 1 x SHE Off/1st Aider/Fire Team Member/Project Mng (Me)

SUMMARY OPERATIONAL ACTIVITIES

From	To	Description activity
12:40	-	HRS & Contractor with crew arriving at Super South Gate waiting for escort
12:50	-	Escort arrives but we are not allowed to enter as nobody informed security at the gate
13:01	-	(ACSA Safety Supervisor) arrives to help & assist with entry
13:55	-	Entered through super south gate en-route to site
14:02	-	Safety Talk and Daily Instruction to crew by HRS (Site Induction)
14:10	14:23	Site establishment and perimeter marked out with yellow jersey barriers
14:35	-	" arrives on site to discuss the 'no plans' issue of cables with me and
14:25	16:25	Contractor removing contaminated grass on cement bank as well as building rubble whilst TLB
		with 1 x crew digs and follows fibre-optic line to identify risk areas
15:17	-	Electrical contractor with underground cable detector arrives as per request to help &
		with detection of other possible cables. It was suspected that 11,000 V cables (x 2) were found
		within the area where we have to remediate (also not on the map viewed in Ipfi's office)
16:25	17:00	Exploration holes digging
17:00	17:05	Site made safe and neat. Inspected by and accepted by escort
17:08	-	Leaving site en-route to super south gate

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OPERATIONS PLANNED FOR NEXT 24 HRS

No.	Operations planned
1	Manual digging to find clean soil around pipes
2	TLB to start with loosening ground to depths of exploration holes
3	Filling of IBC with water and flushing agent to flush drain system

OUT OF POCKETS:	**QTY:**
Red heavy duty gloves	5
Re-usable corded ear plugs	6
Safety glasses	6

ADDITIONAL INSTRUCTIONS RECEIVED FROM CLIENT (BA)

None thus far

POINTS OF CONSIDERATION (DRIZIT)

No.	Description
1.	Ergonomics of soil removal process
2.	Costings
3.	Exposure to hazardous waste during operations especially during breaks
4.	Time sheets and management of operational times
5.	Removal methods and storage considerations
6.	Equipment needed & used to execute the job at hand safely

REMARKS (HRS)

No.	Description
1.	Speed of operations
2.	Dehydration with subsequent re-hydration
3.	Method Statement changing due to time constraints
4.	Timekeeping off breaks (rest & rehydration)
5.	
6.	
7.	

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Report Ref: 24 January 2014

HazRisk SOLUTIONS	DAILY PROGRESS REPORT (DPR)	www.hazrisk.co.za

PROJECT NAME	: BA Jet-Fuel Spillage: Soil Remediation	**DPR NO.**	: 02
PROJECT NO.	: HRS 001	**DATE 24/01/2014**	: Page | 1

CONTRACT FORM	:	**British Airways Order (Sign On)**

To Client	:	**British Airways**
E-mail Client	:	
C.C.	:	
Location	:	**Grass patch @ BidAir Building @ Taxiway M, ORTIA, Kemptonpark, Gauteng**

PERSONNEL ON SITE:	**DESIGNATION:**	**On Site**	**Off hire**
	Project Manager	23/01/2014	TBA

DRIZIT - EQUIPMENT/PLANT/STOCK REPORT

1 x TLB, 1 x transporter with trailer, 35 x 20 kg bag remediation agent, shovels, picks, rakes, 34 x jersey barriers
1 x TLB Operator, 5 x workers, 1 x Supervisor and 1 x SHE Off/1st Aider/Fire Team Member/Project Mng (Me)

SUMMARY OPERATIONAL ACTIVITIES

From	To	Description activity
07:51	-	Contractor with crew arriving at Super South Gate waiting for escort
08:15	-	ARFF escort arrives
08:21	-	On site
08:25	08:30	Toolbox Talk, DSTI & LMRA
08:30	09:14	Chicken Parade of debris in veld around area to be remediated (see pictures)
09:16	09:43	Soil sampling for lab analysis (see pictures)
09:35	10:50	TLB loosing soil to depth (part 1)
10:04	10:50	Filling 1 st IBC (1,000 liters) with water and 25 liters of Biokleen to flush drain to address any
		residual Jetfuel, (see pictures)
10:51	11:54	Adding of remediation agent. Layering (at bottom of excavation, soil, middle, soil, top). Levelling
		of soil to previous state before incident
12:00	13:00	Lunch
13:15	-	Back at site
13:25	16:10	TLB loosing soil to depth (part 2)
13:25	13:45	Crew doing another chicken parade to eliminate site of FOD
13:46	14:20	Filling 2 nd IBC (1,000 liters) with water and 25 liters of Biokleen to flush drain to address any
		residual Jetfuel, (see pictures)
15:38	15:45	visited site
16:15	-	Leaving site. Site safe, clean and inspected / approved by ARFF escort
16:25	-	Exited Super South Gate

HazRisk SOLUTIONS	DAILY PROGRESS REPORT (DPR)	www.hazrisk.co.za

PROJECT NAME	: BA Jet-Fuel Spillage: Soil Remediation	**DPR NO.**	: 02
PROJECT NO.	: HRS 001	**DATE 24/01/2014**	: Page | 2

OPERATIONS PLANNED FOR NEXT 24 HRS

No.	Operations planned
1	TLB digging of Part 3 of soil
2	Washing embankment with Biokleen agent
3	Installing erosion booms and leaving site in acceptable condition

OUT OF POCKETS:	QTY:
Red heavy duty gloves	5
Re-usable corded ear plugs	6
Safety glasses	6

ADDITIONAL INSTRUCTIONS RECEIVED FROM CLIENT (BA)

None thus far

POINTS OF CONSIDERATION (DRIZIT)

No.	Description
1.	Ergonomics of soil removal process
2.	Costings
3.	Exposure to hazardous waste during operations especially during breaks
4.	Time sheets and management of operational times
5.	Removal methods and storage considerations
6.	Equipment needed & used to execute the job at hand safely

REMARKS (HRS)

No.	Description
1.	Speed of operations
2.	Dehydration with subsequent re-hydration
3.	Method Statement changing due to time constraints
4.	Timekeeping off breaks (rest & rehydration)
5.	
6.	
7.	

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PROJECT NO.	: HRS 001	DATE 24/01/2014	: Page | 5






HazRisk SOLUTIONS	DAILY PROGRESS REPORT (DPR)	www.hazrisk.co.za

PROJECT NAME	: BA Jet-Fuel Spillage: Soil Remediation	DPR NO.	: 02
PROJECT NO.	: HRS 001	DATE 24/01/2014	: Page | 6

APPROVAL & SIGNATURE

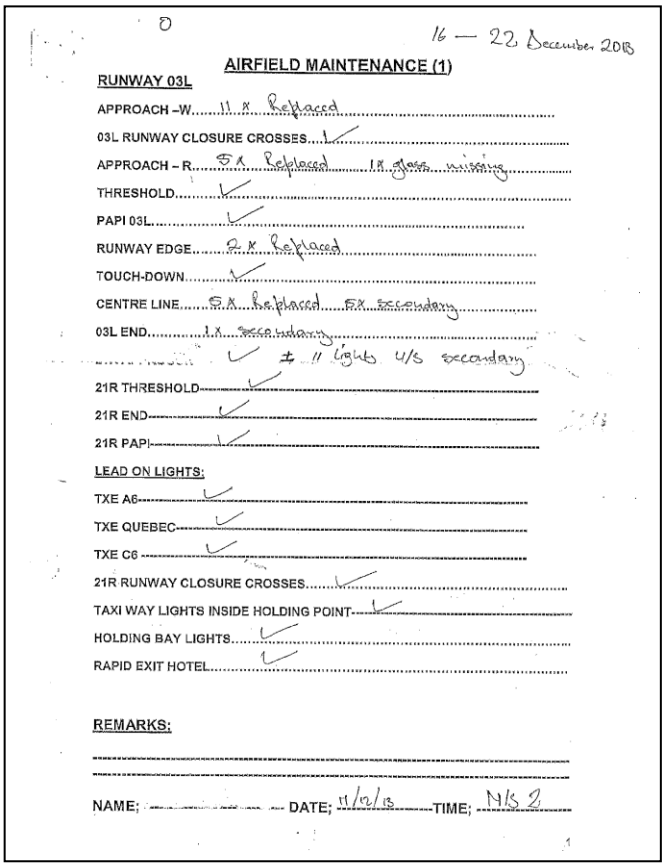
HRS REPRESENTATIVE	
Name	Position
Louis Pretorius	Project Manager & HSE
Signature	

CLIENT REPRESENTATIVE	
Name	
Signature	

Appendices I

Copies of ACSA ARFF Runway and Taxiway:

(i) Maintenance Check Sheets (Not certain areas been de-identified)



16 — 22 December 2013

AIRFIELD MAINTENANCE (1)

RUNWAY 03L

APPROACH –W..... 11 x Replaced

03L RUNWAY CLOSURE CROSSES..... ✓

APPROACH – R..... 5 x Replaced 1x glass missing

THRESHOLD..... ✓

PAPI 03L..... ✓

RUNWAY EDGE..... 2 x Replaced

TOUCH-DOWN..... ✓

CENTRE LINE..... 6 x Replaced 6x secondary

03L END..... 1 x secondary

✓ ± 11 Lights U/S secondary

21R THRESHOLD..... ✓

21R END..... ✓

21R PAPI..... ✓

LEAD ON LIGHTS:

TXE A6..... ✓

TXE QUEBEC..... ✓

TXE C6..... ✓

21R RUNWAY CLOSURE CROSSES..... ✓

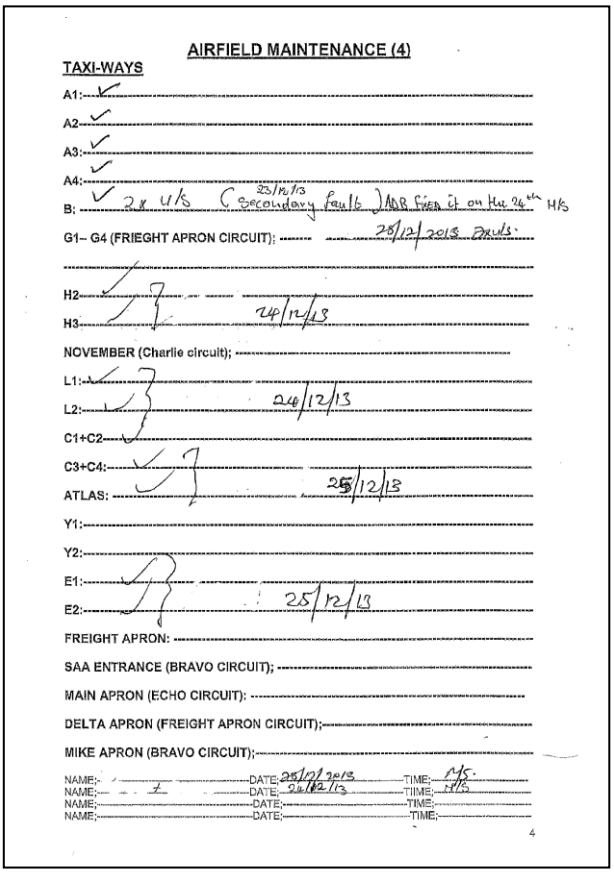
TAXI WAY LIGHTS INSIDE HOLDING POINT..... ✓

HOLDING BAY LIGHTS..... ✓

RAPID EXIT HOTEL..... ✓

REMARKS:

NAME; ..... DATE; 11/12/13 TIME; N/S 2



AIRFIELD MAINTENANCE (4)

TAXI-WAYS

A1: ✓

A2: ✓

A3: ✓

A4: ✓

B: ✓ 2 x U/S (Secondary fault) ADB fixed it on the 24th 23/12/13 H/S

G1– G4 (FRIEGHT APRON CIRCUIT): ..... 23/12/2013 Davids

H2: ✓

H3: ✓ 24/12/13

NOVEMBER (Charlie circuit);

L1: ✓

L2: ✓ 24/12/13

C1+C2: ✓

C3+C4: ✓

ATLAS: ✓ 25/12/13

Y1:

Y2:

E1: ✓

E2: ✓ 25/12/13

FREIGHT APRON:

SAA ENTRANCE (BRAVO CIRCUIT);

MAIN APRON (ECHO CIRCUIT):

DELTA APRON (FREIGHT APRON CIRCUIT);

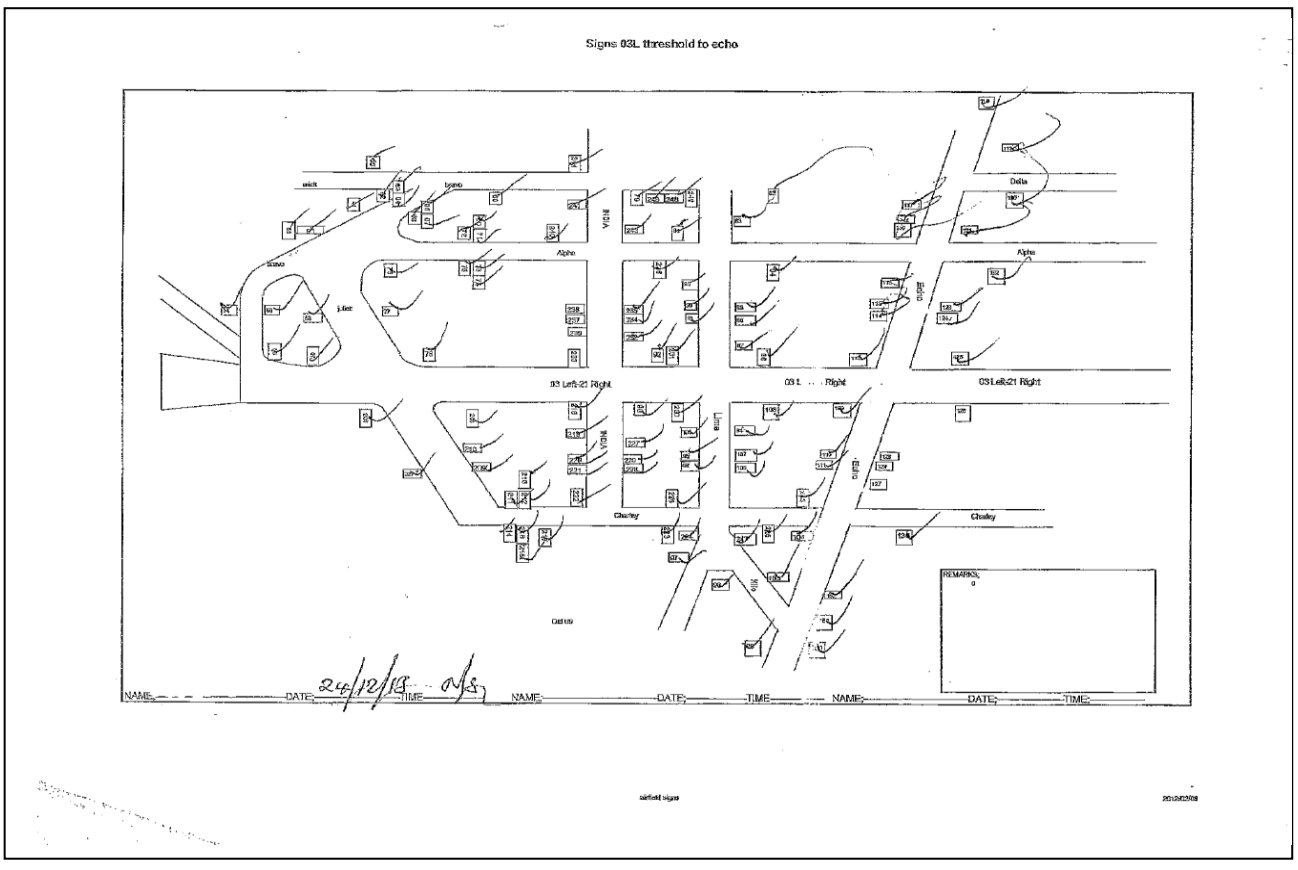
MIKE APRON (BRAVO CIRCUIT);

NAME; ..... DATE; 25/12/2013 TIME; N/S.

NAME; I DATE; 26/12/13 TIME; N/S

NAME; ..... DATE; ..... TIME; .....

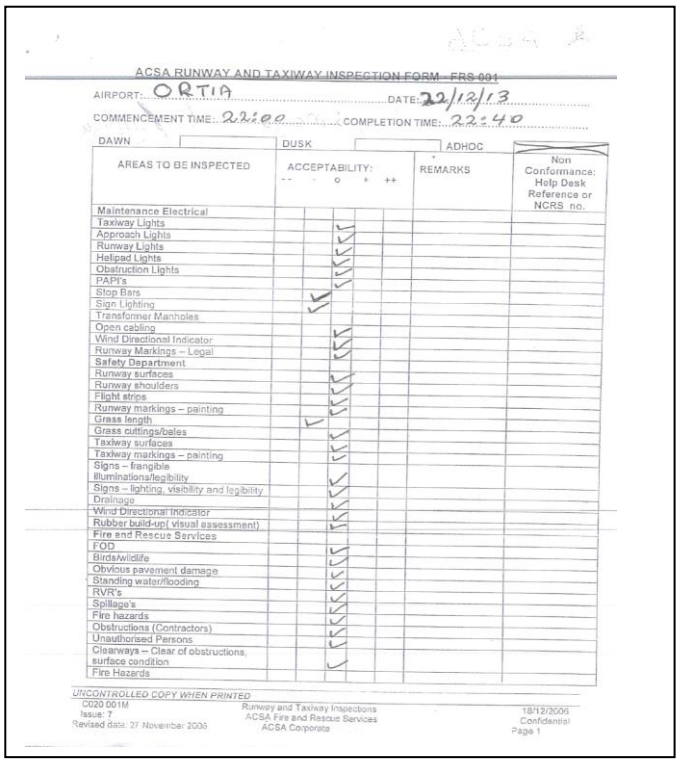
NAME; ..... DATE; ..... TIME; .....



Signs 03L threshold to echo

NAME; ..... DATE; 24/12/13 TIME; N/S NAME; ..... DATE; ..... TIME; ..... NAME; ..... DATE; ..... TIME; .....

(ii) Inspection Check Sheet (Note certain items are de-identified)



ACSA RUNWAY AND TAXIWAY INSPECTION FORM - FRS 001

AIRPORT: ORTIA DATE: 22/12/13

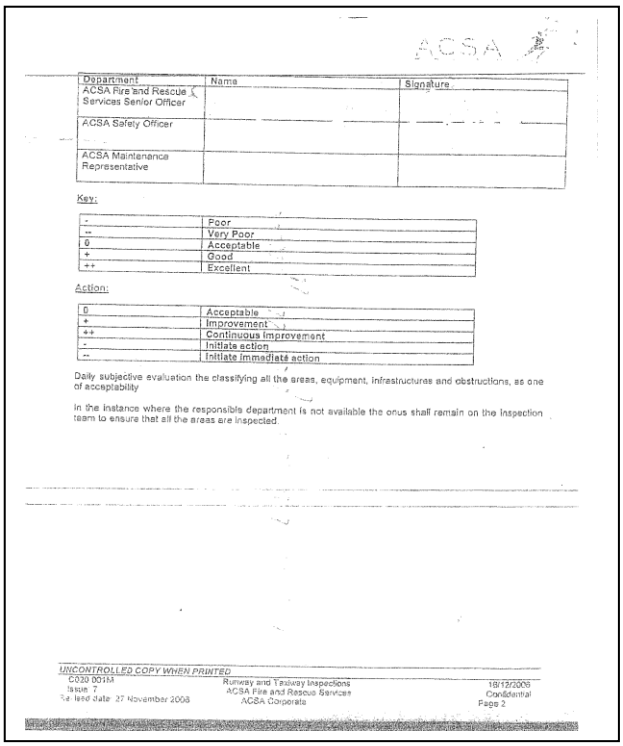
COMMENCEMENT TIME: 22:00 COMPLETION TIME: 22:40

DAWN | DUSK | ADHOC

AREAS TO BE INSPECTED	ACCEPTABILITY: -- - 0 + ++	REMARKS	Non Conformance: Help Desk Reference or NCRS no.
Maintenance Electrical			
Taxiway Lights	0		
Approach Lights	0		
Runway Lights	0		
Helipad Lights	0		
Obstruction Lights	0		
PAPI's	0		
Stop Bars	+		
Sign Lighting	+		
Transformer Manholes			
Open cabling			
Wind Directional Indicator	0		
Runway Markings – Legal	0		
Safety Department			
Runway surfaces	0		
Runway shoulders	0		
Flight strips			
Runway markings – painting	0		
Grass length	+		
Grass cuttings/bales			
Taxiway surfaces	0		
Taxiway markings – painting	0		
Signs – frangible Illuminations/legibility			
Signs – lighting, visibility and legibility	0		
Drainage	0		
Wind Directional Indicator	0		
Rubber build-up(visual assessment)	0		
Fire and Rescue Services			
FOD	0		
Birds/wildlife	0		
Obvious pavement damage	0		
Standing water/flooding	0		
RVR's	0		
Spillage's	0		
Fire hazards	0		
Obstructions (Contractors)	0		
Unauthorised Persons	0		
Clearways – Clear of obstructions, surface condition	0		
Fire Hazards	0		

UNCONTROLLED COPY WHEN PRINTED

C020 001M Issue: 7 Revised date: 27 November 2006 | Runway and Taxiway Inspections ACSA Fire and Rescue Services ACSA Corporate | 18/12/2006 Confidential Page 1



ACSA

Department	Name	Signature
ACSA Fire and Rescue Services Senior Officer		
ACSA Safety Officer		
ACSA Maintenance Representative		

Key:

-	Poor
--	Very Poor
0	Acceptable
+	Good
++	Excellent

Action:

0	Acceptable
+	Improvement
++	Continuous improvement
-	Initiate action
--	Initiate immediate action

Daily subjective evaluation the classifying all the areas, equipment, infrastructures and obstructions, as one of acceptability

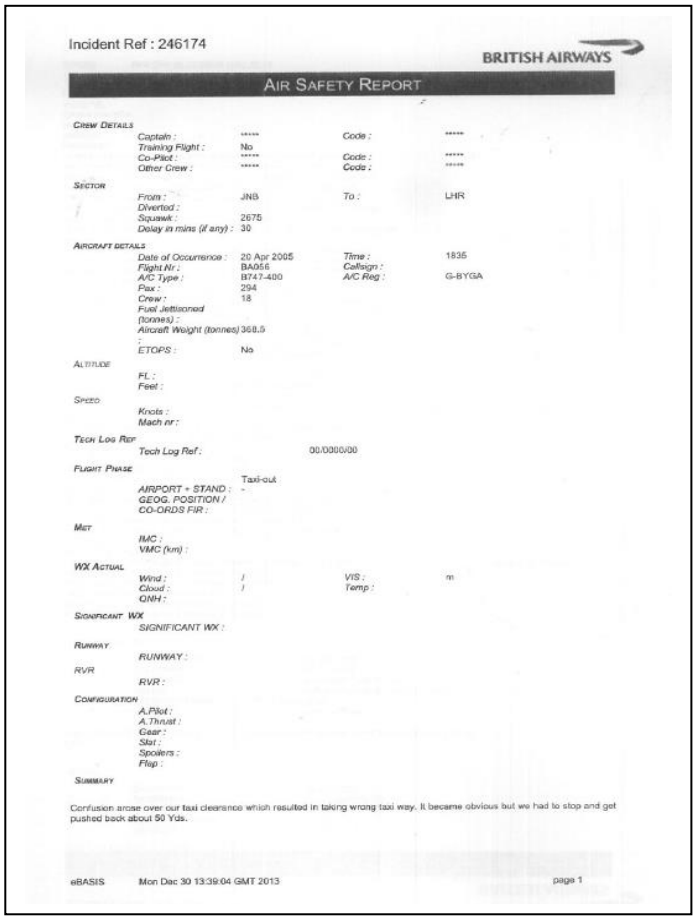
In the instance where the responsible department is not available the onus shall remain on the Inspection team to ensure that all the areas are inspected.

UNCONTROLLED COPY WHEN PRINTED

C030 001M Issue: 7 Revised date: 27 November 2006 | Runway and Taxiway Inspections ACSA Fire and Rescue Services ACSA Corporate | 18/12/2006 Confidential Page 2

Appendices J

Copy of British Airways Air Safety Report Ref: 246174 dated 20 April 2005 (De-identified)



Incident Ref : 246174

BRITISH AIRWAYS

AIR SAFETY REPORT

CREW DETAILS

Captain :	*****	Code :	*****
Training Flight :	No		
Co-Pilot :	*****	Code :	*****
Other Crew :	*****	Code :	*****

SECTOR

From :	JNB	To :	LHR
Diverted :			
Squawk :	2675		
Delay in mins (if any) :	30		

AIRCRAFT DETAILS

Date of Occurrence :	20 Apr 2005	Time :	1835
Flight Nr :	BA056	Callsign :	
A/C Type :	B747-400	A/C Reg :	G-BYGA
Pax :	294		
Crew :	18		
Fuel Jettisoned (tonnes) :			
Aircraft Weight (tonnes) :	368.5		
ETOPS :	No		

ALTITUDE

FL :
Feet :

SPEED

Knots :
Mach nr :

TECH LOG REF

Tech Log Ref : 00/0000/00

FLIGHT PHASE

Taxi-out

AIRPORT + STAND : -
GEOG. POSITION / CO-ORDS FIR :

MET

IMC :
VMC (km) :

WX ACTUAL

Wind :	/	VIS :	m
Cloud :	/	Temp :	
QNH :			

SIGNIFICANT WX

SIGNIFICANT WX :

RUNWAY

RUNWAY :

RVR

RVR :

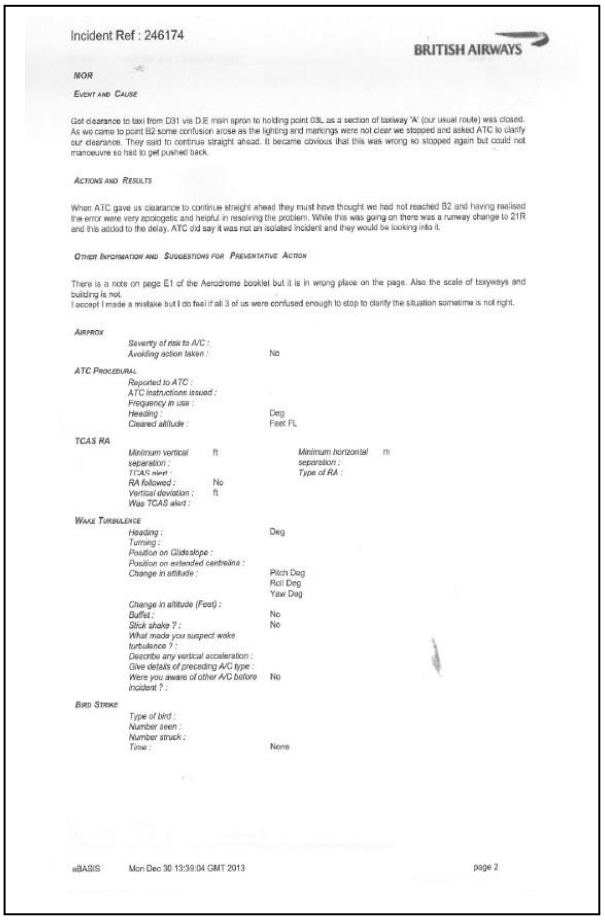
CONFIGURATION

A.Pilot :
A.Thrust :
Gear :
Slat :
Spoilers :
Flap :

SUMMARY

Confusion arose over our taxi clearance which resulted in taking wrong taxi way. It became obvious but we had to stop and get pushed back about 50 Yds.

eBASIS Mon Dec 30 13:39:04 GMT 2013 page 1



Incident Ref : 246174

BRITISH AIRWAYS

NOR

EVENT AND CAUSE

Got clearance to taxi from D31 via D,E main apron to holding point 03L as a section of taxiway 'A' (our usual route) was closed. As we came to point B2 some confusion arose as the lighting and markings were not clear we stopped and asked ATC to clarify our clearance. They said to continue straight ahead. It became obvious that this was wrong so stopped again but could not manoeuvre so had to get pushed back.

ACTIONS AND RESULTS

When ATC gave us clearance to continue straight ahead they must have thought we had not reached B2 and having realised the error were very apologetic and helpful in resolving the problem. While this was going on there was a runway change to 21R and this added to the delay. ATC did say it was not an isolated incident and they would be looking into it.

OTHER INFORMATION AND SUGGESTIONS FOR PREVENTATIVE ACTION

There is a note on page E1 of the Aerodrome booklet but it is in wrong place on the page. Also the scale of taxyways and building is not.
I accept I made a mistake but I do feel if all 3 of us were confused enough to stop to clarify the situation sometime is not right.

AIRPROX

Severity of risk to A/C :
Avoiding action taken : No

ATC PROCEDURAL

Reported to ATC :
ATC instructions issued :
Frequency in use :
Heading : Deg
Cleared altitude : Feet FL

TCAS RA

Minimum vertical separation :	ft	Minimum horizontal separation :	m
TCAS alert :		Type of RA :	
RA followed :	No		
Vertical deviation :	ft		
Was TCAS alert :			

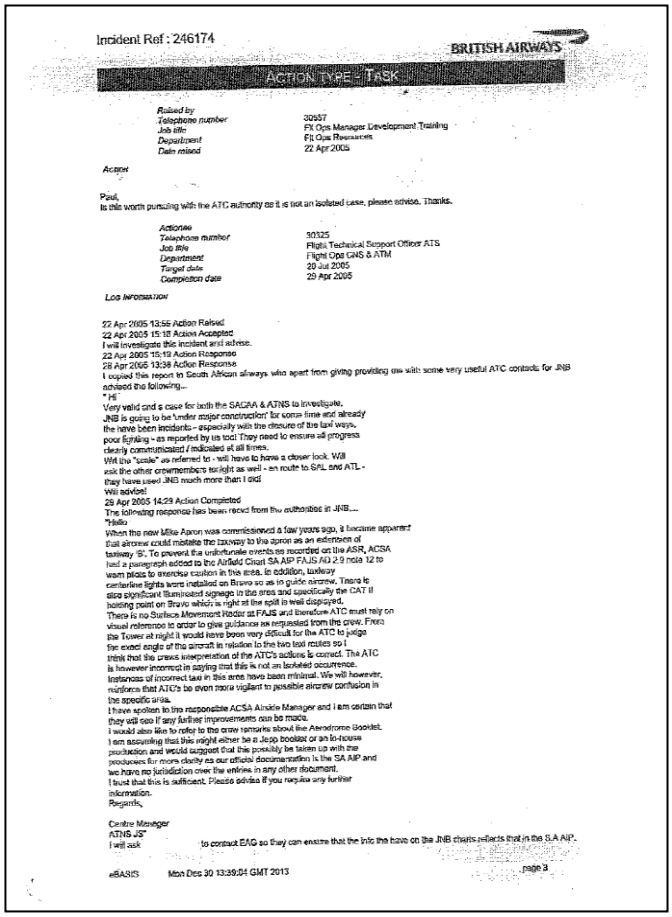
WAKE TURBULENCE

Heading : Deg
Turning :
Position on Glideslope :
Position on extended centreline :
Change in attitude : Pitch Deg
Roll Deg
Yaw Deg
Change in altitude (Feet) :
Buffet : No
Stick shake ? : No
What made you suspect wake turbulence ? :
Describe any vertical acceleration :
Give details of preceding A/C type :
Were you aware of other A/C before incident ? : No

BIRD STRIKE

Type of bird :
Number seen :
Number struck :
Time : None

eBASIS Mon Dec 30 13:39:04 GMT 2013 page 2



Incident Ref : 246174

BRITISH AIRWAYS

ACTION TYPE - TASK

Raised by
Telephone number 30557
Job title FK Ops Manager Development Training
Department FK Ops Resources
Date raised 22 Apr 2005

Action

Paul,
Is this worth pursuing with the ATC authority as it is not an isolated case, please advise. Thanks.

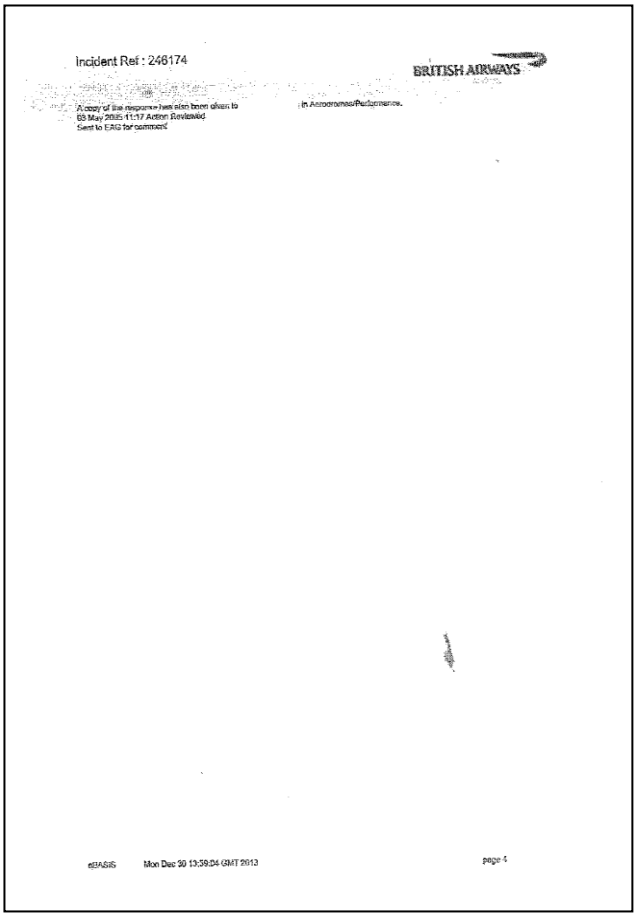
Actionee
Telephone number 30125
Job title Flight Technical Seaport Officer ATS
Department Flight Ops GNS & ATM
Target date 20 Jul 2005
Completion date 29 Apr 2005

Log Information

22 Apr 2005 13:56 Action Raised
22 Apr 2005 15:18 Action Accepted
I will investigate this incident and advise.
22 Apr 2005 15:19 Action Response
28 Apr 2005 13:38 Action Response
I copied this report to South African airways who apart from giving providing me with some very useful ATC controls for JNB
advised the following...
" Hi
Very valid and a case for both the SACAA & ATNS to investigate.
JNB is going to be under major construction for some time and already
we have been incidents - especially with the closure of the taxi ways,
poor lighting - as reported by us too! They need to ensure all progress
clearly communicated / indicated at all times.
Will the "scale" as referred to - will have to have a closer look. Will
ask the other crewmembers tonight as well - en route to SAL and ATL -
they have used JNB much more than I did!
Will advise!
28 Apr 2005 14:29 Action Completed
The following response has been raised from the authorities in JNB....
"Hello
When the new Mike Apron was commissioned a few years ago, it became apparent
that aircrew could mistake the taxiway to the apron as an extension of
taxiway 'B'. To prevent the unfortunate events as recorded on the ASR, ACSA
had a paragraph added to the Airfield Chart SA AIP FAJS AD 2.9 note 12 to
warn pilots to exercise caution in this area. In addition, taxiway
centerline lights were installed on Bravo so as to guide aircrew. There is
also significant illuminated signage in the area and specifically the CAT II
holding point on Bravo which is right at the split is well displayed.
There is no Surface Movement Radar at FAJS and therefore ATC must rely on
visual reference to order to give guidance as requested from the crew. From
the Tower at night it would have been very difficult for the ATC to judge
the exact angle of the aircraft in relation to the two taxi routes so I
think that the crews interpretation of the ATC's actions is correct. The ATC
is however incorrect in saying that this is not an isolated occurrence.
Instances of incorrect taxi in this area have been minimal. We will however,
reinforce that ATC's be even more vigilant to possible aircrew confusion in
the specific area.
I have spoken to the responsible ACSA Airside Manager and I am certain that
they will see if any further improvements can be made.
I would also like to refer to the crew remarks about the Aerodrome Booklet.
I am assuming that this might either be a Jepp booklet or an in-house
production and would suggest that this possibly be taken up with the
producers for more clarity as our official documentation is the SA AIP and
we have no jurisdiction over the entries in any other document.
I trust that this is sufficient. Please advise if you require any further
information.
Regards,

Centre Manager
ATNS JS"
I will ask to contact EAG so they can ensure that the info the have on the JNB charts reflects that in the SA AIP.

eBASIS Mon Dec 30 13:39:04 GMT 2013 page 3



Incident Ref : 246174

BRITISH AIRWAYS

A copy of the response has also been given to ... in Aerodromes/Performance.
05 May 2005 11:17 Action Reviewed
Sent to EAG for comment

eBASIS Mon Dec 30 13:39:04 GMT 2013 page 4

Appendices K

Copy of SACAA email communication to inform British Airways & Navtech of the changes/revisions (Note certain items de-identified)

From:
Sent: 15 November 2013 11:41 AM
To: 'Afri Air'; 'Air France'; 'ATNS'; 'ATNS'; 'ATNS'; 'Aviation Direct'; 'British Airways'; 'British Airways'; 'Chief Directorate: National Geo-spatial Information'; 'Comair'; 'Comair'; 'Denel'; 'DFS Frankfurt'; 'Emirates'; 'Euronautical'; Gary Newman; 'Hylton Spencer'; 'Jeppesen'; 'KLM'; 'KZN Aviation'; Lufthansa Systems Flight Nav Inc.; 'Lufthansa Systems Flight Nav Inc.'; 'Lufthansa Systems FlightNav Inc.'; 'Lufthansa Systems FlightNav Inc.'; ' '; ' '; 'Navtech'; 'Navtech'; ; 'Qantas Airways Limited'; 'Qatar Airways'; 'Qatar Airways'; 'SA Express'; 'SA Express'; 'SAA'; 'SAA'; 'SAA'; 'SAAF'; 'SITA'; 'Surveys and mapping'
Subject: South African AIP Supplements AIRAC 12 December 2013
Attachments: S102-13 Western Gliding Activities.pdf; S103-13 Charts.pdf; S104-13 REALIGNMENT AND RENAMING OF UQ3 to T122.pdf; S105_13 Letdown procedures attachment 12 DEC 2013.pdf; S105-13 LETDOWN PAGE.pdf

Dear All

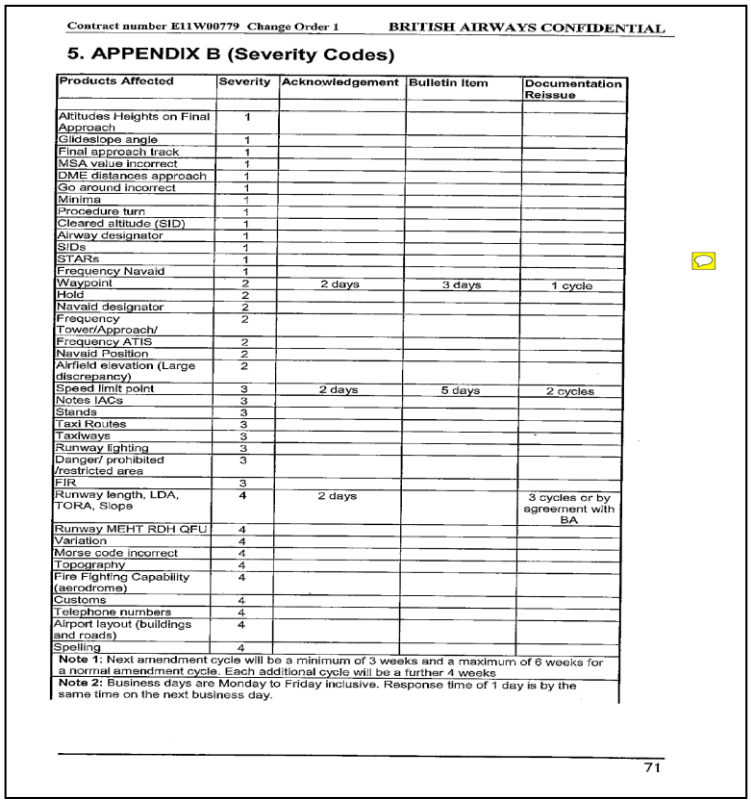
Herewith find Supplements that will be published in the 12 December 2013 AIRAC cycle. Charts will be available for download from the CAA web-site shortly.

Regards,

Senior Aeronautical Information Services Officer Air Navigation Services
Tel: 011 545 1224 | Fax: 011 545 1282 | Cell: 083 451 2645 | Email: | www.caa.co.za

Appendices L

Copy of Navtech Severity Codes Matrix



Contract number E11W00779 Change Order 1 **BRITISH AIRWAYS CONFIDENTIAL**

5. APPENDIX B (Severity Codes)

Products Affected	Severity	Acknowledgement	Bulletin Item	Documentation Reissue
Altitudes Heights on Final Approach	1			
Glideslope angle	1			
Final approach track	1			
MSA value incorrect	1			
DME distances approach	1			
Go around incorrect	1			
Minima	1			
Procedure turn	1			
Cleared altitude (SID)	1			
Airway designator	1			
SIDs	1			
STARs	1			
Frequency Navaid	1			
Waypoint	2	2 days	3 days	1 cycle
Hold	2			
Navaid designator	2			
Frequency Tower/Approach/	2			
Frequency ATIS	2			
Navaid Position	2			
Airfield elevation (Large discrepancy)	2			
Speed limit point	3	2 days	5 days	2 cycles
Notes IACs	3			
Stands	3			
Taxi Routes	3			
Taxiways	3			
Runway lighting	3			
Danger/ prohibited /restricted area	3			
FIR	3			
Runway length, LDA, TORA, Slope	4	2 days		3 cycles or by agreement with BA
Runway MEHT RDH QFU	4			
Variation	4			
Morse code incorrect	4			
Topography	4			
Fire Fighting Capability (aerodrome)	4			
Customs	4			
Telephone numbers	4			
Airport layout (buildings and roads)	4			
Spelling	4			

Note 1: Next amendment cycle will be a minimum of 3 weeks and a maximum of 6 weeks for a normal amendment cycle. Each additional cycle will be a further 4 weeks

Note 2: Business days are Monday to Friday inclusive. Response time of 1 day is by the same time on the next business day.

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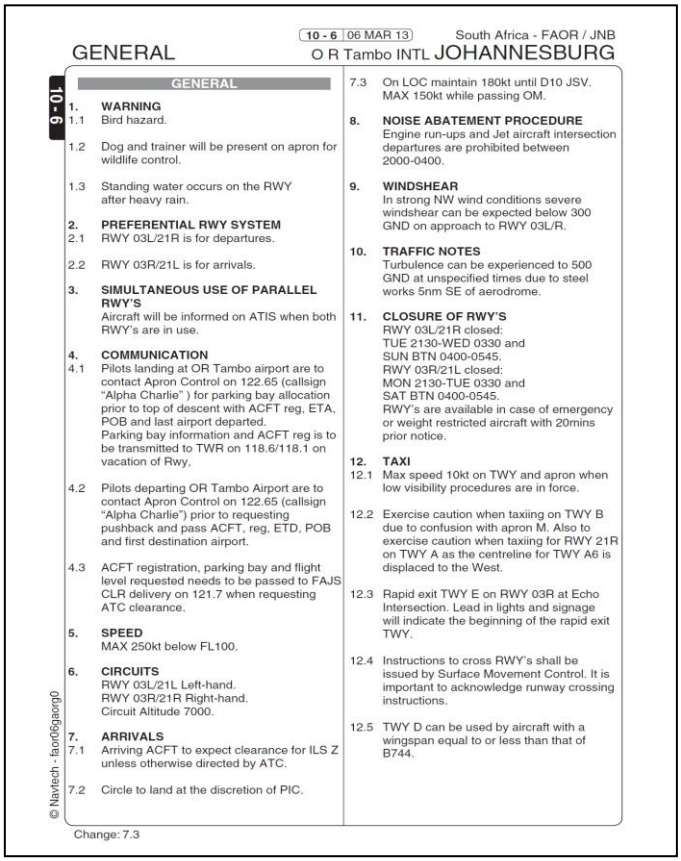
Appendices M

Copies of Navtech Charts



10 - 6 | 06 MAR 13 South Africa - FAOR / JNB

GENERAL — O R Tambo INTL JOHANNESBURG

10 - 6

GENERAL

1. **WARNING**
1.1 Bird hazard.

1.2 Dog and trainer will be present on apron for wildlife control.

1.3 Standing water occurs on the RWY after heavy rain.

2. **PREFERENTIAL RWY SYSTEM**
2.1 RWY 03L/21R is for departures.

2.2 RWY 03R/21L is for arrivals.

3. **SIMULTANEOUS USE OF PARALLEL RWY'S**
Aircraft will be informed on ATIS when both RWY's are in use.

4. **COMMUNICATION**
4.1 Pilots landing at OR Tambo airport are to contact Apron Control on 122.65 (callsign "Alpha Charlie") for parking bay allocation prior to top of descent with ACFT reg, ETA, POB and last airport departed. Parking bay information and ACFT reg is to be transmitted to TWR on 118.6/118.1 on vacation of Rwy,

4.2 Pilots departing OR Tambo Airport are to contact Apron Control on 122.65 (callsign "Alpha Charlie") prior to requesting pushback and pass ACFT, reg, ETD, POB and first destination airport.

4.3 ACFT registration, parking bay and flight level requested needs to be passed to FAJS CLR delivery on 121.7 when requesting ATC clearance.

5. **SPEED**
MAX 250kt below FL100.

6. **CIRCUITS**
RWY 03L/21L Left-hand.
RWY 03R/21R Right-hand.
Circuit Altitude 7000.

7. **ARRIVALS**
7.1 Arriving ACFT to expect clearance for ILS Z unless otherwise directed by ATC.

7.2 Circle to land at the discretion of PIC.

7.3 On LOC maintain 180kt until D10 JSV. MAX 150kt while passing OM.

8. **NOISE ABATEMENT PROCEDURE**
Engine run-ups and Jet aircraft intersection departures are prohibited between 2000-0400.

9. **WINDSHEAR**
In strong NW wind conditions severe windshear can be expected below 300 GND on approach to RWY 03L/R.

10. **TRAFFIC NOTES**
Turbulence can be experienced to 500 GND at unspecified times due to steel works 5nm SE of aerodrome.

11. **CLOSURE OF RWY'S**
RWY 03L/21R closed:
TUE 2130-WED 0330 and
SUN BTN 0400-0545.
RWY 03R/21L closed:
MON 2130-TUE 0330 and
SAT BTN 0400-0545.
RWY's are available in case of emergency or weight restricted aircraft with 20mins prior notice.

12. **TAXI**
12.1 Max speed 10kt on TWY and apron when low visibility procedures are in force.

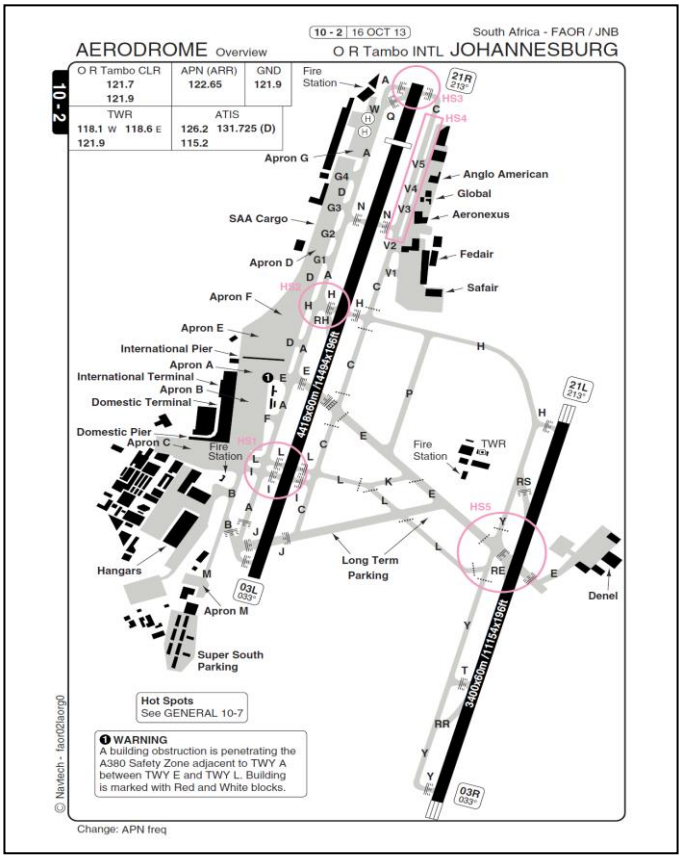
12.2 Exercise caution when taxiing on TWY B due to confusion with apron M. Also to exercise caution when taxiing for RWY 21R on TWY A as the centreline for TWY A6 is displaced to the West.

12.3 Rapid exit TWY E on RWY 03R at Echo Intersection. Lead in lights and signage will indicate the beginning of the rapid exit TWY.

12.4 Instructions to cross RWY's shall be issued by Surface Movement Control. It is important to acknowledge runway crossing instructions.

12.5 TWY D can be used by aircraft with a wingspan equal to or less than that of B744.

Change: 7.3



10 - 2 | 16 OCT 13 South Africa - FAOR / JNB

AERODROME Overview — O R Tambo INTL JOHANNESBURG

10 - 2

O R Tambo CLR	APN (ARR)	GND
121.7 121.9	122.65	121.9
TWR	ATIS	
118.1 W 118.6 E 121.9	126.2 131.725 (D) 115.2	

Apron G
Apron D
Apron F
Apron E
International Pier
Apron A
International Terminal
Apron B
Domestic Terminal
Domestic Pier
Apron C
Apron M
Hangars
Super South Parking
Long Term Parking
SAA Cargo
Anglo American
Global
Aeronexus
Fedair
Safair
Fire Station
TWR
Denel
21R 213°
21L 213°
03L 033°
03R 033°
4418x60m 14495x196ft
3400x60m 11154x196ft

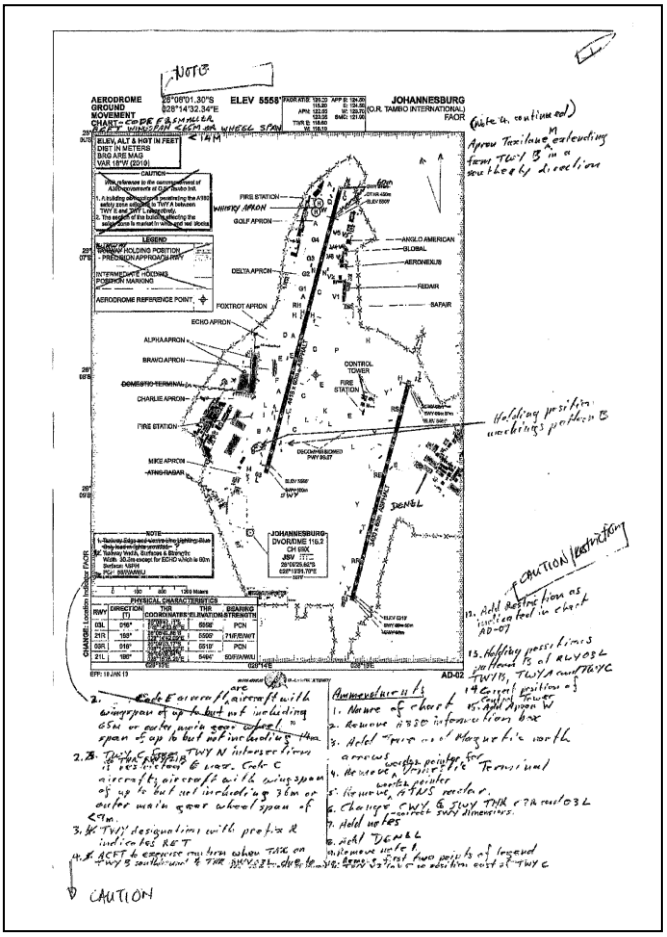
Hot Spots
See GENERAL 10-7

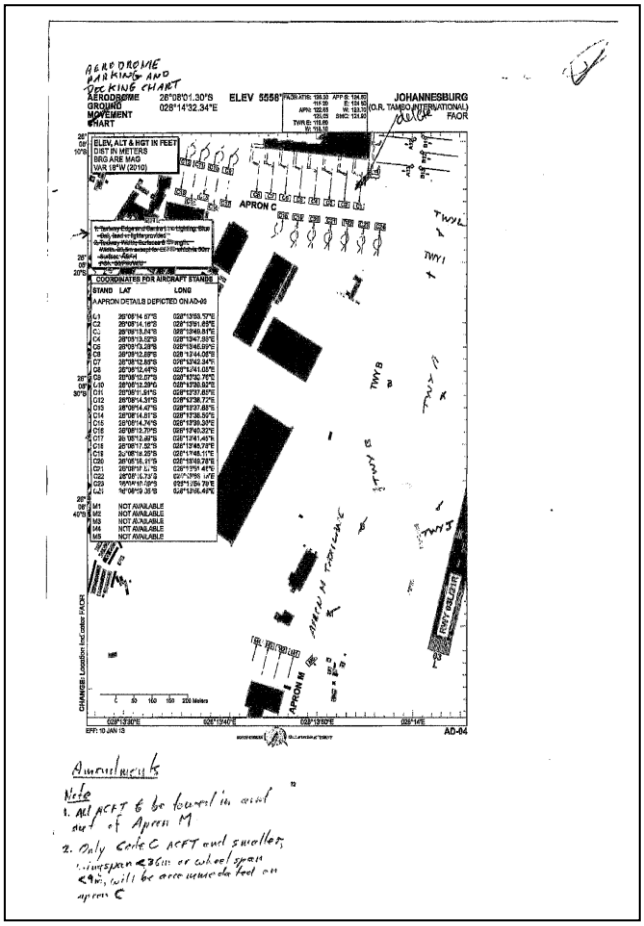
❶ **WARNING**
A building obstruction is penetrating the A380 Safety Zone adjacent to TWY A between TWY E and TWY L. Building is marked with Red and White blocks.

Change: APN freq

Appendices N

Copies of ACSA Aeronautical Information Changes/Revisions to Bravo and Mike





FAOR AD 2.9 Surface Movement Guidance And Control System And Markings

1	Use of ACFT stand ID signs, TWY guide lines and visual docking/parking guidance system of ACFT stands	5. Allocation of parking bays: - Pilots landing to contact Apron Control, call sign "ALPHA CHARLIE" on FREQ 122,65 MHz, prior to top of descent, and give the following information: Aircraft Registration, ETA, Passengers on board and last airport departed. This may be done prior to landing in VHF range. The parking bay information and aircraft registration is to be transmitted to TWR on FREQ 118.6/118.1 MHz on vacating the runway for taxi instructions. Unscheduled ACFT ARR to CTC apron office prior LDG on FREQ 122.65. Unscheduled ACFT unable to provide DEP date and time will not be accommodated on ACSA apron areas. These ACFT will be directed by TWR to the portion of old RWY 09 BTN TWY "E" and TWY "L" where they will be facilitated - Pilots departing to contact Apron Control, call sign "ALPHA CHARLIE" on FREQ 122.65 MHz, prior to requesting pushback and give the following information: Aircraft Registration, ETD, Passengers on board and first destination airport. Operators or companies may obtain this information direct from the Apron Office on telephone numbers (011) 921 6209/921 6253. 6. Pushbacks must be done according to the centreline marking on the aprons. Pushback performed off centrelines result in less than minimum clearance being achieved between wing tips. 7. Delta taxi lane behind PRKG stands D2 to D50 can be used to TAX ACFT with a wingspan equal to or less than that of B744. ACFT pushing back FM PRKG stands D2, D3 and D4 must be pushed back to face N and exit via G4 onto TWY Alpha. 8. Pilots to EXER CTN when taxiing on TWY "B" as the "M" apron extends immediately S of TWY "B" where the TWY bends at the CAT II HLDG point.

FAOR AD 2.9 Surface Movement Guidance And Control System And Markings

1	Use of ACFT stand ID signs, TWY guide lines and visual docking/parking guidance system of ACFT stands	- Pilots to EXER CTN when taxiing on the full length of TWY "B" as confusion may exist at the INT of TWY "B" and the "M" apron. -Pilots to EXER CTN when taxiing for RWY 21R on TWY "A", as the centreline at TWY A6 is diverted 10 M to the west. 9. Pilots are REQ not to exceed 10KT when transiting or TAX on any of the designated aprons when low VIS PROC are in force. 10. All operators are reminded that all flights except training and test flights conducted into and out of AD must make use of the aprons and terminals at AD as allocated by apron control. No flights may operate directly to and from hangers or hard stands unless agreed with the airport management. 11. Fully automated docking system on parking stands Alpha 1R to Alpha 13, Charlie 1 to Charlie 8 and stands E1-E13. Pilots are to ensure the following: a) The stands are clear of objects; b) Correct information is displayed on monitor - aircraft type and series. Docking instructions will be displayed on monitor, pilots to intercept centre-line and follow the azimuth guidance display. Pilots are advised that the azimuth guidance can be used from both the Captain seat (left of closing rate display) and the First Officer's seat (right of closing rate display). c) Caution to be exercised when docking at stands A4, A5 and A6 due to sunlight reflecting off the Automatic Docking panels at sunrise. Should docking INFO be impaired, contact APN Control on 122.65 MHz for assistance. 12. The Taxi-lane centreline leading into the main apron has been deviated easterly abeam parking stands B3 and B4. Pilots to follow new line when taxiing through the apron. 13. Rapid exit TWY 'E' designed for Class C ACFT. The recommended exit speed is between 45 and 50 KT. 14. No aircraft with a wing span of 52M or greater (CODE E&F) are allowed on Delta APN taxilane when aircraft with a wing span of 65M or greater (CODE F) are taxing on nothern portion of TWY A past Delta APN (From Delta APN stand D2 to D50 stands) Wingtip clearance is restricted and below ICAO recommendation. 15. No aircraft with a wing span of 52M or greater parking at stand D3A must enter and exit Delta APN via TWY G3.

FAOR AD 2.9 Surface Movement Guidance And Control System And Markings

1	Use of ACFT stand ID signs, TWY guide lines and visual docking/parking guidance system of ACFT stands	ETA, PAX on board & last AP departed. This may be done prior to LDG in VHF range. The PRKG bay INFO and ACFT REG is to be transmitted to TWR on FREQ 118.6/118.1 MHz on vacating the RWY for TAX instructions. Unscheduled ACFT ARR to CTC APN office prior LDG on FREQ 122.65 MHz.Unscheduled ACFT unable to provide DEP date & time will not be accommodated on ACSA APN areas. These ACFT will be directed by TWR to the portion of old RWY 09 BTN TWY "E" & TWY "L" where they will be facilitated - Pilots departing to CTC APN CTL, call sign "ALPHA CHARLIE" on FREQ 122.65 MHz, prior to requesting pushback & give the FLW INFO: ACFT REG, ETD, PAX on board & first destination AP. Operators or companies may obtain this INFO DCT FM the APN Office on TEL: (011) 921 6209/921 6253. 6. Pushbacks must be done according to the CL marking on the aprons. Pushback performed off CL result in less than MNMclearance being achieved BTN wing tips. 7. 'D' taxi lane behind PRKG stands 'D2' to 'D50' can be used to TAX ACFT with a wingspan equal to or less than that of B744. ACFT pushing back FM PRKG stands D2, D3 and D4 must be pushed back to face N and exit via G4 onto TWY 'A'. 8. Pilots to EXER CTN when TAX on TWY "B" as the "M" APN extends immediately S of TWY "B" where the TWY bends at the CAT II HLDG point. 9. ACFT entering APN 'A' & 'B' via TWY 'E' or ACFT XNG RWY 03L/21R on TWY 'E' in a Westerly direction to use MNM thrust required so as to avoid adverse Jet Blast effects to ACFT taking off or LDG on RWY 03L/21R. ACFT taking off or LDG on RWY 03L/21R to be aware of XNG & TAX ACFT Jet Blast when PSG TWY 'E' intersection. 10. ACFT with a Wing Span of 65M or Greater PRKG at ACFT PRKG stand 'D3A' must enter and exit 'D' APN via TWY 'G3'. When manoeuvreng on 'D' APN taxilane; Pilots to EXER CTN and remain on the taxilane CL to maintain wingtip clearance FM other PRKG ACFT. DIST FM taxilane CL to the back of ACFT stands is 42.5M. 11. No ACFT with a wing span of 52M or greater (Code 'E' and 'F') are allowed on 'D' APN taxilane when ACFT with a wing span of 65M or greater (Code 'F') are TAX on Northern portion of TWY 'A' past 'D' APN(FM 'D' APN stands 'D2'-'D50'). Wingtip clearance is restricted and BLW ICAO recommendation.

FAOR AD 2.9 Surface Movement Guidance And Control System And Markings

1	Use of ACFT stand ID signs, TWY guide lines and visual docking/parking guidance system of ACFT stands	ETA, PAX on board & last AP departed. This may be done prior to LDG in VHF range. The PRKG bay INFO and ACFT REG is to be transmitted to TWR on FREQ 118.6/118.1 MHz on vacating the RWY for TAX instructions. Unscheduled ACFT ARR to CTC APN office prior LDG on FREQ 122.65 MHz.Unscheduled ACFT unable to provide DEP date & time will not be accommodated on ACSA APN areas. These ACFT will be directed by TWR to the portion of old RWY 09 BTN TWY "E" & TWY "L" where they will be facilitated - Pilots departing to CTC APN CTL, call sign "ALPHA CHARLIE" on FREQ 122.65 MHz, prior to requesting pushback & give the FLW INFO: ACFT REG, ETD, PAX on board & first destination AP. Operators or companies may obtain this INFO DCT FM the APN Office on TEL: (011) 921 6209/921 6253. 6. Pushbacks must be done according to the CL marking on the aprons. Pushback performed off CL result in less than MNMclearance being achieved BTN wing tips. 7. 'D' taxi lane behind PRKG stands 'D2' to 'D50' can be used to TAX ACFT with a wingspan equal to or less than that of B744. ACFT pushing back FM PRKG stands D2, D3 and D4 must be pushed back to face N and exit via G4 onto TWY 'A'. 8. Pilots to EXER CTN when TAX on TWY "B" as the "M" APN extends immediately S of TWY "B" where the TWY bends at the CAT II HLDG point. 9. ACFT entering APN 'A' & 'B' via TWY 'E' or ACFT XNG RWY 03L/21R on TWY 'E' in a Westerly direction to use MNM thrust required so as to avoid adverse Jet Blast effects to ACFT taking off or LDG on RWY 03L/21R. ACFT taking off or LDG on RWY 03L/21R to be aware of XNG & TAX ACFT Jet Blast when PSG TWY 'E' intersection. 10. ACFT with a Wing Span of 65M or Greater PRKG at ACFT PRKG stand 'D3A' must enter and exit 'D' APN via TWY 'G3'. When manoeuvreng on 'D' APN taxilane; Pilots to EXER CTN and remain on the taxilane CL to maintain wingtip clearance FM other PRKG ACFT. DIST FM taxilane CL to the back of ACFT stands is 42.5M. 11. No ACFT with a wing span of 52M or greater (Code 'E' and 'F') are allowed on 'D' APN taxilane when ACFT with a wing span of 65M or greater (Code 'F') are TAX on Northern portion of TWY 'A' past 'D' APN(FM 'D' APN stands 'D2'-'D50'). Wingtip clearance is restricted and BLW ICAO recommendation.

Appendices O

Email Communications (e.g. ATNS response to question about the taxiway lights on Bravo).

From: xxxxxxxxx
Sent: 10 April 2014 12:34 PM
To: xxxxxxxxxx
Cc: xxxxxxxxxx
Subject: RE: Re: BAW34 accident

Hello xxxxxxxxxx

Find below my answers to the questions. The questions are very poorly phrased so I will interpret them as best I can and attempt to provide suitable answers.

1. What I need to find out is the question around the unserviceable green taxiway centreline lights on Bravo?.
– On the day in question, there were no green centreline taxiway lights. ACSA were busy installing and in certain circumstances replacing some centreline lights. When the night setting is selected on the mimic panel it will switch on all edge lights and centreline lights for the taxiways that are pre-programmed. So, if taxiway B has both sets of lights they will be switched on when this setting is selected. Furthermore, when taxiway B is on the edge and centreline lights follow the bend in the taxiway to the runway holding points. I have been informed that the morning following the accident you visited the scene and apparently took some photographs of the electricians working on the centreline lights. We are looking to see if there was any notam action regarding the centreline lights. If we find anything I shall forward it too you.

2. Also, taxiway Mike edge lights been switched on that night, the reason for it?.
– On the mimic panel in the visual control room there is no provision made to individually select taxiway Mike's edge lights on and off. There is however various options to switch on all the taxiway edge lights for twilight and night operations. These selections include taxiway Mike so when they are used all the taxiway lights on the airfield are set and adjusted to these pre-programmed settings. The night setting was selected and therefore taxiway Mike's edge lights were on. Taxiway M has no centreline lights, only edge lights which also include the Mike apron.

3. The rescue and fire fighting service vehicle (FTL) which carried out an inspection that night. What according to ATC records were they reporting to ATC that they are inspecting, what was the status?".
– Find below the relevant extracts from the FAOR TOWER OCCURRENCE LOG recording the events pertaining to FTL. The relevant inspection comments are in green font.

22 DECEMBER 2013 SUNDAY

TIME	ITEM	INITIALS	OPERATIONAL COMMENT
19:00z	TWR	xxxxxxxxx	Combined
20:09z	RWY	xxxxxxxxx	03R clear & serviceable
20:28z	RWY	xxxxxxxxx	03L clear & serviceable
20:43z	ACCIDENT	xxxxxxxxx	

BAW34 observed off of TXY B, towards MIKE apron. I checked with BAW34 & he advised he might have hit something.

	ACCIDENT		Crash alarm pressed after TX with BAW.
20:46z	PAN PAN	xxxxxxx	From BAW34, fire crew already at aircraft.
20:50z	FREQ	xxxxxxx	FTL & BAW34 moved to freq 118.1 MHz. FT Lead advised BAW34 to shut down engine 3 as there is a big fuel leak, BAW34 complied.

23 DECEMBER 2013

00:30z	SACAA	xxxxxxx	– FTL to place marker boards south of SAA TECH for B closure.
01:01z	Marker boards	xxxxxxx	Marker boards in place on TWY B south of SAA tech.
03:43z	NOTE	xxxxxxx	Taxiway B & MIKE apron open & serviceable – aircraft at technical.
04:01z	ALARMS	xxxxxxx	Tested & serviceable X3
04:23z	RWY 03L / 21R	xxxxxxx	Inspected, clear & serviceable.
04:37z	INSP	xxxxxxx	RWY 03R / 21L inspected, clear and serviceable.

It is my understanding that you have in your possession the ASMGCS recordings for this event which should correlate with the information above.
I hope this helps, if there is anything more then ask and I shall attempt to answer.
xxxxxxxxxxxxx
Acting MATS Johannesburg | Air Traffic Services
Johannesburg ATCC

Appendices P

Copy of ATNS Report relevant to NOTAM's

AERONAUTICAL INFORMATION SERVICE
REPUBLIC OF SOUTH AFRICA

AERONAUTICAL INFORMATION					
AERODROME		PRE-FLIGHT INFORMATION BULLETIN			
Briefing Id	O0600262	Date/Time	06FEB14 1107		
Period		22DEC13 0000 TO 22DEC13 2359			
Briefing includes **NOTAM DOCINFO**					
Subject		Purpose		Traffic	
AERODROME	FAOR				

If any irregularity in operation of NAV or COM facilities is encountered during the flight in the FAJA, FACA and FAJO FIR's, pilots are requested to notify the Aeronautical Information Management Team by filing a post flight report, via the ATNS website, www.atns.co.za, under AIM, post flight report or fax a post flight report form (AIC 40-7) to +27 11 9286514.

AIS INFORMATION

FAOR (OR TAMBO INTL (JOHANNESBURG))

NOTAM A3920/13
Q) FAJA/QMYXX/IV/NBO/A/000/999/2608S02815E005
A) FAOR **B)** 1311240410 **C)** 1401281400 EST
E) TWY CL MARKINGS AND LGT FOR RAPID EXIT TWY RS AND RAPID EXIT TWY RR WERE DESIGNED FOR ACFT TYPES WITH LONG WHEEL BASES (A340-600). ACFT EXITING RWY 03R VIA RAPID EXIT TWY RS TURNING LEFT INTO TWY Y AND ACFT EXITING RWY 21L VIA RAPID EXIT TWY RR TURNING RIGHT INTO TWY Y TO EXER CTN TO AVOID THE MAIN UNDERCARRIAGE RUNNING OFF THE TWY.

NOTAM A3919/13
Q) FAJA/QMNXX/IV/NBO/A/000/999/2608S02815E005
A) FAOR **B)** 1311240409 **C)** 1401281400 EST
E) ALL AIRCRAFT TO BE TOWED IN AND OUT OF APRON M.

NOTAM A3463/13
Q) FAJA/QMXLT/IV/M/A/000/999/2608S02815E005
A) FAOR **B)** 1310310810 **C)** 1401211000 EST
E) THE INTERMEDIATE HOLDING POSITIONS LISTED BELOW ARE NOT COMPLIANT TO CODE F (B748, A380 AND AN124) OPERATIONS ON CROSSING TAXIWAYS. AIRCRAFT USING THESE HOLDING POSITIONS MUST EXERCISE CAUTION AND HOLD AT 60M OR GREATER FROM THE CROSSING TAXIWAY WHEN GIVING WAY TO CODE F AIRCRAFT:
TWY A ON BOTH SIDE OF TWY INDIA INTERSECTION
TWY H NORTH OF TWY Y INTERSECTION
TWY P AT TWY H INTERSECTION
TWY Y AT RAPID EXIT TAXIWAY RS INTERSECTION
TWY Y SOUTH OF TWY T INTERSECTION

NOTAM A3462/13
Q) FAJA/QMRXX/IV/NBO/A/000/999/2608S02815E005
A) FAOR **B)** 1310310805 **C)** 1401211000 EST
E) RWY 03R/21L HOLDING PSN ON TWY E EAST OF THE RWY IS NOT COMPLIANT TO CODE F (A380, B747-800 AND AN124) AND ILS CAT 11 RWY OPR. ACFT USING THIS HOLDING POSITION MUST EXER CTN AND HOLD AT 115M OR GREATER FM THE RWY AT ALL TIMES.

NOTAM A3461/13
Q) FAJA/QLACS/IV/NBO/A/000/999/2608S02815E005
A) FAOR **B)** 1310310752 **C)** 1401211500 EST
E) RWY 03L APCH LGT TYPE LEN INSTL:
PALS, CAT II, 900M, WHITE CL, RED SIDE BARS LAST 270M, WHITE BARS AT 150M AND 300M FROM THR.

NOTAM A3460/13
Q) FAJA/QLACS/IV/NBO/A/000/999/2608S02815E005
A) FAOR **B)** 1310310751 **C)** 1401211500 EST
E) RWY 21L APCH LGT TYPE LEN INSTL:
PALS, CAT II, 900M, WHITE CL, RED SIDE BARS LAST 270M, WHITE BARS

AT 150M AND 300M FROM THR.

NOTAM A3459/13
Q) FAJA/QLACS/IV/NBO/A/000/999/2608S02815E005
A) FAOR **B)** 1310310750 **C)** 1401211500 EST
E) RWY 03R APCH LGT TYPE LEN INSTL:
PALS, CAT II, 900M, WHITE CL, RED SIDE BARS LAST 270M, WHITE BARS AT 150M AND 300M FROM THR.

NOTAM A3353/13
Q) FAJA/QLACS/IV/NBO/A/000/999/2608S02815E005
A) FAOR **B)** 1310241500 **C)** 1401211500 EST
E) RWY 21R PRECISION APCH RWY CAT II. APCH LGT TYPE LENGTH INSTL:
PALS, CAT II, 900M LIH, WHITE CL BARRETTE, RED SIDE ROW BARRETTE LAST 270M, WHITE CROSS BARS AT 150M AND 300M FROM THR.
(THR DISPLACED BY 450M).

NOTAM A3251/13
Q) FAJA/QMRXX/IV/NBO/A/000/999/2608S02815E005
A) FAOR **B)** 1310181029 **C)** 1401131000 EST
E) WHEN CODE F ACFT (B748, A380 AND A124) ARE OPERATING ON RWY 03L/21R THE FOLLOWING HOLDING PROCEDURES MUST BE FOLLOWED FOR THE RELEVANT RWY 03L/21R HOLDING POINTS:
-TWY E EAST OF RWY 03L/21R ACFT TO HOLD SHORT OF TWY C
-TWY H WEST OF RWY 03L/21R ACFT TO HOLD ON TWY A
-TWY Q ACFT TO HOLD ON TWY A
-TWY A ACFT TO HOLD ABEAM OF TWY Q.

NOTAM A2832/13
Q) FAJA/QFAXX/I/NBO/A/000/999/2608S02815E005
A) FAOR **B)** 1309201055 **C)** PERM
D) DLY 1800-0400
E) AFT HR BOOKING OF AD-HOC STRATEGIC AIRPORT SLOTS FOR THE CO-ORDINATED AIRPORT FAOR WILL BE FACILITATED BY THE AIM SERVICE CENTRE ON 0860 359 669, +2711 928 6517 OR +2711 928 6518.

NOTAM A1235/13
Q) FAJA/QLCCS/I/BO/A/000/999/2608S02815E005
A) FAOR **B)** 1304160759 **C)** PERM
E) RWY 21R CENTRELINE, LIGHT LENGTH, SPACING, COLOUR INTESITY:
DISPLACED THRESHOLD CAT II WHITE TO 900M FROM END,
FROM 900M TO 300M ALTERNATE WHITE AND RED,
LAST 300M RED. DISTANCE BETWEEN LIGHTS - 30M.

NOTAM A1138/13
Q) FAJA/QMAXX/IV/NBO/A/000/999/2608S02815E005
A) FAOR **B)** 1304041153 **C)** PERM
E) ACFT ENTERING APRON A AND APRON B VIA TWY E OR ACFT CROSSING RWY 03L/21R ON TWY E IN A WESTERLY DIRECTION TO USE MINIMAL THRUST REQUIRED SO AS TO AVOID ADVERSE JET BLAST EFFECTS TO ACFT TAKING OFF OR LANDING ON RWY 03L/21R. ACFT TAKING OFF OR LANDING ON RWY 03L/21R TO BE AWARE OF CROSSING AND TAXIING ACFT JET BLAST WHEN PASSING TWY E INTERSECTION.

NOTAM A0135/13

Q) FAJA/QMALT/IV/NBO/A/000/999/2608S02815E005
A) FAOR **B)** 1301100034 **C)** PERM
E) ACFT WITH A WING SPAN OF 65M OR GREATER PARKING AT ACFT PRKG STAND D3A MUST ENTER AND EXIT DELTA APN VIA TWY G3. WHEN MANOEUVRING ON DELTA APN TAXILANE PILOTS MUST EXERCISE CAUTION AND REMAIN ON THE TAXILANE CENTRELINE TO MAINTAIN WINGTIP CLEARANCE FROM OTHER PARKED ACFT. DISTANCE FROM TAXILANE CENTRELINE TO THE BACK OF AIRCRAFT STANDS IS 42,5M.

NOTAM A0133/13
Q) FAJA/QMALT/IV/NBO/A/000/999/2608S02815E005
A) FAOR **B)** 1203301814 **C)** PERM
E) NO ACFT WITH A WING SPAN OF 52M OR GREATER (CODE E AND CODE F) ARE ALLOWED ON DELTA APN TAXILANE WHEN ACFT WITH A WING SPAN OF 65M OR GREATER (CODE F) ARE TAXIING ON NORTHERN PORTION OF TWY A PAST DELTA APN (FROM DELTA APN STANDS D2 TO D50).
WINGTIP CLEARANCE IS RESTRICTED AND BELOW ICAO RECOMMENDATION.

NOTAM A4103/13
Q) FAJA/QPIXX/I/NBO/A/000/999/2608S02815E005
A) FAOR **B)** 1312031046 **C)** 1402280600 EST
E) INSTRUMENT APPROACH PROCEDURES SUSPENDED AS LISTED HEREWITH:
1. ILS W RWY 03R (EFF 10 JAN 2013) ILS-06
2. VOR Y RWY 21R (EFF 10 JAN 2013) VOR-02.

NOTAM A3868/13
Q) FAJA/QOBCE/IV/M/AE/000/056/2610S02813E005
A) FAOR **B)** 1311200852 **C)** 1402171230 EST
E) STAND 541, HUGES ROAD, JOHANNESBURG (261046S 0281323E): CRANE WITH DAY AND NIGHT MARKINGS ERECTED FROM GND-85FT AGL.
F) GND **G)** 5569FT AMSL

NOTAM A3442/13
Q) FAJA/QOBCE/IV/M/AE/000/055/2602S02815E005
A) FAOR **B)** 1310300953 **C)** 1401271230 EST
E) PRASA NERVE CENTRE, KAALFONTEIN (260217S 0281513E): CRANE (115FT AGL) WITH NIGHT MARKINGS ERECTED.
F) GND **G)** 5427FT AMSL

END OF DOCUMENT