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الهيئة العامة للطيران المدني
GENERAL CIVIL AVIATION AUTHORITY

Air Accident Investigation Sector

Incident

- Final Report -

AAIS Case N°: AIFN/0011/2014

Runway Confusion

Operator: Badr Airlines
Type: Ilyushin IL-76TD
Registration: ST-BDN
Place of Occurrence: Sharjah International Airport
State of Occurrence: United Arab Emirates
Date of Occurrence: 29 June 2014



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Air Accident Investigation Sector
General Civil Aviation Authority
The United Arab Emirates

Incident Brief

GCAA AAI Report No.:	AIFN/0011/2014
Operator:	Badr Airlines
Aircraft Type and Registration:	Ilyushin IL-76TD, ST-BDN
MSN	1023413443
No. and Type of Engines:	Four, D-30 KP-2 turbofan engines
Date and Time (UTC):	29 June 2014, 0323
Location:	Sharjah International Airport
Type of Flight:	Cargo
Persons On-board:	6
Injuries:	None

Investigation Objective

This Investigation is limited to the aspects related to the approach and landing preparation; no in-depth analysis of non-contributing factors was undertaken.

This Investigation is performed pursuant to the UAE Federal Act No. 20 of 1991, promulgating the Civil Aviation Law, Chapter VII, Aircraft Accidents, Article 48. It is in compliance with the UAE Civil Aviation Regulations, Part VI, Chapter 3, in conformity with *Annex 13 to the Convention on International Civil Aviation* and in adherence to the *Air Accidents and Incidents Investigation Manual*.

The sole objective of this Investigation is to prevent aircraft accidents and incidents. It is not the purpose of this activity to apportion blame or liability.

Investigation Process

The occurrence involved an Ilyushin IL-76TD cargo Aircraft, registration ST-BDN, and was notified to the General Civil Aviation Authority (GCAA) by phone call to the Duty Investigator (DI) Hotline Number +971 50 641 4667.

After the Initial/On-Site Investigation phase, the occurrence was classified as an 'Incident'.

An Investigation Team was formed in line with the ICAO Annex 13 obligations of the United Arab Emirates (UAE) being the State of Occurrence.



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Notes:

- ¹ Whenever the following words are mentioned in this Report with the first letter Capitalized, it shall mean:
- (Aircraft)- the aircraft involved in this Incident.
 - (Airport)- Sharjah International Airport.
 - (Airport Authority)- Sharjah Civil Aviation Department which is the operator of the Airport and a holder of Air Traffic Services (ATS) Certificate issued by the General Civil Aviation Authority under Part VIII- *Air Navigation Regulations*, of the Civil Aviation Regulations (CARs) of the United Arab Emirates. The Certificate is effective as of 27 March 2013.
 - (Controller)- the duty air traffic control officer (DATCO) of Sharjah Airport Tower
 - (Investigation)- the investigation into this Incident
 - (Incident)- this investigated Incident
 - (Tower)- the tower of Sharjah International Airport
 - (Report)- this Incident Investigation Report
 - (ATS Provider)- SERCO, the provider of air traffic services in Sharjah.
- ² Unless otherwise mentioned, all times in this Report are 24-hour clock in Coordinated Universal Time (UTC), (UAE Local Time minus 4).
- ³ Photos used in the text of this Report are taken from different sources and are adjusted from the original for the sole purpose to improve clarity of the Report. Modifications to images used in this Report are limited to cropping, magnification, file compression, or enhancement of color, brightness, contrast or insertion of text boxes, arrows or lines.

Abbreviations and Definitions

ADC	Aerodrome control(ler)
AGL	Above ground level
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
AIS	Aeronautical Information Supplement
ANS	Air navigation services
AOC	Air Operator Certificate
ATCA	Air traffic control assistant
ATCO	Air traffic control officer
ATIS	Automatic Terminal Information Service
ATPL	Airline Transport Pilot
ATS	Air Traffic Service
CoA	Certificate of Airworthiness
CoR	Certificate of Registration
CVR	Cockpit Voice Recorder
DATCO	Duty air traffic control officer
DI	Duty Investigator
FDR	Flight Data Recorder
ft	Feet (distance unit)
GCAA	General Civil Aviation Authority of the United Arab Emirates
GMC	Ground Movement Control(ler)
hPa	Hectopascal (Pressure unit. 1 hPa = 100 Pa),
ICAO	The International Civil Aviation Organization
IFR	Instrument Flight Rules
kts	Knot(s) (airspeed/wind speed unit)
LoA	Letter of Agreement
MHz	Mega Hertz (Frequency unit)
MSN	Manufacturer Serial Number
N°	Number
NM	Nautical mile (distance unit)



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NOTAM	Notice to Airmen
PAPI	Precision Approach Path Indicator
PF	Pilot Flying
PH	Pilot Handling
PM	Pilot Monitoring
QNH	Barometric pressure adjusted to sea level
RH	Right hand
UAE	The United Arab Emirates
UTC	Coordinated Universal Time
VFR	Visual Flight Rules



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Synopsis

On 29 June 2014, a Badr Airlines Ilyushin IL-76TD, registration mark ST-BDN, operated flight BDR7625 from Khartoum, Sudan, to Sharjah, the United Arab Emirates. There were four flight crewmembers, one ground engineer, and one loadmaster onboard. On the approach to Sharjah, a 'go-around' was flown as the Aircraft had been aligned to carry out an approach to a runway which was still under construction instead of to the active runway 30.

The BDR7625 crew had requested a visual approach from Dubai Arrival Air Traffic Control (ATC Approach) who confirmed the request and instructed the crew to descend to 2,000 ft and to report ready for visual. When BDR7625 was abeam Sharjah Airport, the Approach Controller instructed the crew to report the field in-sight, ready for a visual approach. BDR7625 confirmed the instruction correctly.

At approximately 8 miles, BDR7625 was transferred from Dubai Approach to Sharjah Tower. At approximately 0319, BDR7625 contacted Sharjah Tower for the first time stating that the aircraft was approximately six miles from the runway. The Tower replied giving the QNH, surface wind as calm, and cleared BDR7625 to land on runway 30. The Tower also gave instructions to vacate runway 30 via taxiway Bravo. The instructions were read back correctly by the crew.

BDR7625 continued the final approach until shortly before the beginning of the inactive new runway. When the Aircraft was at a late point in the approach, the captain realized, by observing the cross marks painted on the runway, that the runway was not in operation.

The construction workers who were assigned to perform work on the beginning of the new runway rapidly vacated the area when they observed the Aircraft approaching the wrong runway at low level of approximately 50 ft, and at a distance of approximately 0.3 miles from the threshold. As the Aircraft passed over construction equipment on the new runway one piece of construction equipment weighing about one ton was moved by the jetblast.

The Investigation concluded that the causes of the runway confusion at late approach stage Incident were: the inability of the flight crew to identify the correct landing surface; the crew had followed an incorrect airport chart contained in the Jeppesen Airway Manual that was not yet effective on the date of the Incident; the inadequate dispatch briefing which did not provide sufficient information and draw attention to a temporary revised page in the Jeppesen Airway Manual; the insufficient CRM among the flight crewmembers; and the confusing Aeronautical Information Circular (AIC) statement and Jeppesen runway information which improperly depicted a chart that reflected the future runway configuration.

Contributing factors to the Incident were: the insufficient visual observation of the BDR7625 approach by the Tower Controller; the lack of information provided by the Approach Controller to the Tower Controller that BDR7625 was flying a visual approach and was entering his control area; and the insufficient testing and training provided to the Tower Controller to enable him to differentiate as to which runway an aircraft was aligned with.

In this Final Report, five safety recommendations are addressed to the Operator, four to Sharjah International Airport Authority, one to Dubai Air Navigation Services, and one to the Jeppesen Company.



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1. Factual Information

1.1 History of the Flight

On 29 June 2014, a Badr Airlines Ilyushin IL-76TD, registration mark ST-BDN, operated flight BDR7625 from Khartoum, Sudan to Sharjah, the United Arab Emirates. There were four flight crewmembers, one ground engineer, and one loadmaster onboard. On the approach to Sharjah, a 'go-around' was flown as the Aircraft had been aligned to carry out an approach to a runway that was still under construction, instead of to the active runway 30.

BDR7625 was instructed by Dubai Arrival Air Traffic Control (ATC Approach) to descend to an altitude of 6,000 feet (ft) and maintain that altitude. Some minutes later, ATC informed BDR7625 to descend further to 2,000 ft and report ready for visual.

When BDR7625 was abeam Sharjah Airport, the Approach Controller instructed the crew to report the field in-sight, ready for a visual approach. BDR7625 confirmed the instruction correctly.

The captain requested that the throttles be retarded to idle and the flight engineer complied. Shortly thereafter, a question was raised by the navigator when he stated: "Looking for the runway." and that they would report later. The captain directed the same concern to the co-pilot asking him whether he had the runway in-sight or not. The co-pilot stated that he could not see the runway.

The navigator called: "Descending to 3,000 ft.", and the captain called for a speed reduction to 200 knots (kt) and extension of the landing gear.

At approximately 0313, the Approach Controller informed BDR7625 to turn right heading 210 for base, and the navigator acknowledged this instruction correctly. Later, the navigator stated: "Lateral 9.1 to old runway around 270 meters runway nearer." The captain called for 210 straight, and the navigator announced runway in-sight. The speed at this time was about 200 kt. The navigator called for a one mile turn onto final.

The Approach Controller instructed BDR7625 to turn right heading 280, and the instruction was read back correctly by the navigator. At approximately 0318, the navigator announced the turn to final and the captain confirmed. The navigator contacted the Approach Controller informing him that BDR7625 was established on the approach for runway 30. The Approach Controller acknowledged the call and asked whether the flight was area navigation (RNAV) or visual. The navigator replied that BDR7625 was visual. The Approach Controller directed BDR7625 to contact Sharjah Tower at 118.6 MHz. This instruction was read back correctly by the navigator.

At approximately 8 miles, BDR7625 was transferred from Dubai Approach to Sharjah Tower.

Before contacting the Tower, the navigator called the attention of the captain: "To the left." and called the distance as: "Eleven." The captain called for the slats and flaps to be set at 25 and 30, respectively, and the throttles to be retarded to idle. The navigator continued calling out the distance to go: 10, 8.5, 7, and asked the co-pilot to watch for the runway in-sight. The co-pilot acknowledged that the runway was straight on course, whereas the navigator stated: "To the left."



At approximately 0319, BDR7625 contacted Sharjah Tower for the first time stating that the aircraft was about six miles from the runway, and providing the number of persons on-board. The Tower replied giving the QNH, surface wind as calm, and cleared BDR7625 to land on runway 30. The Tower also gave instructions to vacate runway 30 via taxiway Bravo. The instructions were read back correctly by the crew.

The navigator requested the captain to descend and the captain acknowledged. The navigator commented that the 'black' is the new runway and the captain confirmed that information. There was an element of stress in the captain's voice. The captain asked about the exit assigned for vacating the runway and the co-pilot advised that it was Bravo. Later, the captain informed the crew that he had the Bravo 7 high-speed taxiway in sight. The co-pilot, navigator, and captain agreed that the high-speed taxiway Bravo related to the old runway (runway 30).

At 0320:12, another aircraft called the Tower requesting departure clearance. The Tower gave conditional clearance for that aircraft to proceed to runway 30 via taxiway Golf and to line up and await the BDR7625 on a one and a half mile final. The crew of the other aircraft acknowledged the Tower instructions correctly.

While communication between the Sharjah Tower and Dubai Departure was ongoing, and at 0321:00, a voice was heard on the ATC recorder coming from, most probably, the departing aircraft whose crew called twice: "Wrong runway.". Three seconds later, the same comment was heard on the ATC recorder with another voice that, most probably, came from another departing aircraft crewmember.

BDR7625 continued its final approach until shortly before the beginning of the inactive new runway. When the Aircraft was at a late point in the final approach, the captain realized, by observing the cross marks painted on the runway that the runway the aircraft was about to land on, was not in operation.

The construction workers who were assigned to perform work on the beginning of the new runway rapidly vacated the area when they observed the Aircraft approaching the wrong runway at a low level of approximately 50 ft, and at a short distance of about 0.3 miles from the threshold. As the Aircraft commenced its go-around the jetblast moved one piece of construction equipment which weighed about one ton.

At 0321:08, BDR7625 called Sharjah Tower declaring a 'go-around' while the Tower Controller was still on the telephone with Dubai Departure Control arranging the departure of the other two aircraft.

At 0321:16, the Tower Controller called BDR7625 giving instructions to continue on runway heading and maintain an altitude of 2,000 ft.

The crew did not provide a reason to the Tower Controller for the 'go-around'. The crew switched frequency to Dubai Departure Control in order to establish a new approach.

Dubai Departure instructed BDR7625 to climb to 3,000 ft on runway heading and the controller enquired as to the reason for the 'go-around'. The navigator replied that they had flown the approach to the wrong runway.

During the climb, the crew discussed the approach to the wrong runway for several seconds. The co-pilot commented that the Tower Controller had instructed BDR7625 to vacate via taxiway Bravo, not to land on Bravo. The captain asked twice: "According to documents we

had to land on which [runway], according to it new runway is the active, isn't it? They did not tell us [where] to land..." The navigator commented that: "It says temporary construction work." The captain queried: "What temporary, I didn't understand." and again queried as to which runway BDR7625 should have landed on. The navigator answered that they will confirm and the co-pilot stated: "On the left runway and vacate via Bravo."

The captain said that there was a yellow light where the navigator commented that the light was simply temporary and the co-pilot commented that the new runway red light was illuminated and he thought the light was located on the threshold. The captain added that temporary works were being carried out and according to Notice to Airmen (NOTAM) it appeared that the new runway was not serviceable yet. The co-pilot disagreed with the comment of the navigator and said: "No, it is serviceable."

At approximately 0331, Dubai Approach contacted BDR7625 and instructed a right turn, heading 210, and to confirm whether BDR7625 was visual. The navigator replied that BDR7625 was ready for a visual approach. The Approach Controller instructed BDR7625 to report runway in-sight, which was acknowledged by the navigator correctly.

The navigator contacted the Approach Controller informing him that BDR7625 was ready for the final approach to runway 30 at Sharjah. The Approach Controller instructed BDR7625 to turn right heading 300, and to descend to 2,000 ft.

At approximately 0333, the navigator reported runway in-sight. After a short discussion, the captain asked: "Which runway now?" and the co-pilot answered: "Now old."

Later on, the Approach Controller contacted BDR7625 and asked if the runway was in-sight, and the navigator confirmed runway in-sight. The Approach Controller instructed BDR7625 to continue the visual approach and contact Sharjah Tower at 118.6 Mhz. The navigator read back the instructions correctly.

Prior to contacting the Tower, the captain was still unsure as to which runway was assigned for landing. Later, the navigator informed the Tower that the runway was in-sight and BDR7625 was ready to land. The Tower advised the wind direction and speed and verified that BDR7625 was cleared to land on runway 30. At this time, the captain was still unsure as to which runway was for landing. Accordingly, the navigator called the Tower requesting confirmation that the left runway was the old runway and the Tower replied: "Runway is dry." At that time, the co-pilot observed the approach lights were illuminated and he advised the captain to follow them.

At approximately 0340, BDR7625 landed safely on runway 30 and taxied uneventfully to the assigned stand.

1.2 Injuries to Persons

Table 1. Injuries to persons						
Injuries	Flight Crew	Cabin Crew	Other Crew On-board	Passengers	Total On-board	Others
Fatal	0	0	0	0	0	0
Serious	0	0	0	0	0	0
Minor	0	0	0	0	0	0
None	4	0	2	0	6	0
TOTAL	4	0	2	0	6	0

There were no injuries to persons as a result of this occurrence.

1.3 Damage to Aircraft

The Aircraft was undamaged.

1.4 Other Damage

There was no other damage as a result of the occurrence.

1.5 Personnel Information

1.5.1 Flight Crew General Information

The flight crew comprised: the captain, co-pilot, flight engineer and navigator. Table 2 illustrates the qualifications of all flight crewmembers.

1.5.2 The Captain

Crewmember	Captain	Co-pilot	Flight Engineer	Navigator
Age	45	48	49	48
Gender	Male	Male	Male	Male
Date joining the operator	March 2011	January 2009	November 2004	February 2007
Type of license	ATPL	ATPL	Flight Engineer	Navigator
Valid to	20 September 2014	10 September 2014	24 September 2014	12 September 2014
Validation by the State of Registry	30 June 2014	2 July 2014	30 June 2014	15 December 2013
Issuing State	Ukraine	Ukraine	Ukraine	Ukraine
Medical class	Class 1, 20 September 2014	Class 1, 10 September 2014	Class 1, 24 September 2014	Class 1, 12 September 2014
Valid to	One	one	One	one
Total last 90 days	49 hours	49 hours	49 hours	49 hours
Total last 7 days	5 hours	5 hours	5 hours	5 hours
Total on type last 90 days	49 hours	49 hours	49 hours	49 hours

The captain stated that his first flight to Sharjah was in 1995. He resumed flying on type to Sharjah in December 2013 and continued until the Incident flight. The last flight prior to the Incident was performed about 10 weeks before the Incident date. The navigator, co-pilot, and flight engineer also operated that same flight prior to the Incident flight.

1.5.3 Sharjah Tower Controller

On the day of the Incident, the Tower was operated by two Air Traffic Control Officers, (ATCO) and one Air Traffic Control Assistant (ATCA).

One of the two ATCOs was on-duty (DATCO) occupying the Aerodrome Control (ADC) and Ground Movement Control (GMC) simultaneously. The other ATCO was on his break sitting on an armchair, located to the back of the control stations.



The ATCA was stationed at the air traffic control administrative desk located to the right of the DATCO.

The records of the male, 40-year old DATCO, showed that he joined Sharjah ATC in October 2013. The Controller went into on-the-job (OJT) training for about one month. He completed his COC on 3 December 2013, completing currency requirements on 20 May 2013, and his most recent training was on Visual Meteorological Condition (VMC) departures on 20 June 2014.

The DATCO held an Air Traffic Control License issued by the GCAA, in accordance with the UAE Civil Aviation Regulations (CAR) Part VIII, Subpart 4, A.2.10, on 24 October 2011.

The Rating was 'Aerodrome Control', and no limitations were included in the license.

The DATCO's Language Proficiency was Level 5 and the required re-issue date of his license was 7 April 2016.

The DATCO's Medical Certificate was Class III.

A review of the DATCO's June 2014 monthly roster showed that he worked the morning shift (0530-1330 LT) on the day of the Incident, and had worked the same shift the day before. He was off-duty before the morning-shift on both days.

1.6 Aircraft Information

1.6.1 General

Table 3 shows general data related to the Aircraft.

Table 3. Aircraft data	
Manufacturer:	Ilyushin
Model:	IL-76TD
MSN:	1023413443
Date of manufacture:	30 September 1992
Nationality and registration mark:	Sudanese, ST-BDN
Name of the owner:	Badr Airlines
Name of the operator:	Badr Airlines
Certificate of Registration (CoR)	
Number:	SPL/160
Issuing Authority:	Civil Aviation Authority, Sudan
Issuance date:	25 October 2008
Valid to:	Open
Certificate of Airworthiness (CoA)	
Number:	AWP/COA/0233/2008
Issuing Authority:	Civil Aviation Authority, Sudan
Issuance date:	16 February 2008
Valid to:	29 June 2014
Total hours since new:	As of the date of the Incident: 11,064 hours



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Total cycles since new:	As of the date of the Incident: 3226 cycles
Last inspection type, date and hours/cycles:	φ- 1 Base Maintenance, on 10 April 2014, at 11,018 hours/3,205 cycles
Total hours since last inspection:	45
Total cycles since last inspection:	21 cycles
Engines:	Four Turbofan, D-30 KP-2 Engines are not relevant to this Incident
Maximum Takeoff Weight	190,000 kg
Maximum Landing Weight	151,500 kg
Zero Fuel Weight	138,000 kg

According to the records provided to the Investigation, there were no reported significant Aircraft technical defects prior to the Incident. Neither was there any mechanical anomaly prior to takeoff.

1.7 Meteorological Information

At the time of the Incident, the weather was clear, wind speed 2 kt from 90 degrees, temperature 34 °C, dew point 25 °C, and QNH 1004 hpa.

The prevailing meteorological conditions were not a factor in the occurrence.

On 29 June September 2014, Sharjah sunrise and sunset were at 0531 and 1913 LT, respectively. The day length was 13 hours, 42 minutes, and 13 seconds.

BDR7625 was a 'Daylight' flight.

1.8 Aids to Navigation

Approach service to Sharjah Airport is performed by the Dubai Approach sector in Dubai Air Navigation Services (DANS).

Sharjah Airport is equipped with a Tower control that directs aircraft from ground to takeoff, and from landing to ground, by ground movement control (GMC) and aerodrome control (ADC) positions. The two positions can be carried out by a single person, using two radio frequencies, during light traffic.

The controller(s) manage(s) the ground and airborne traffic visually from the visual control room.

Due to the proximity of Dubai and Sharjah aerodromes, when a pilot requests a visual approach, the aircraft shall be retained on the radar frequency until there is no doubt that the aircraft is positioning for the coordinated airfield.

Sharjah Tower was not equipped with a facility to control traffic by secondary surveillance radar (SSR). The only available aid was a radar display, which was not used for control purposes, and was only intended for information purposes, and to improve the controllers' situational awareness. At the time of the Incident, the display showed a single approach line to the old runway and the radar return was so close to the approach line that a general look at the screen did not clearly reveal whether an aircraft was correctly aligned. It

required a careful and close look to see whether an aircraft was aligned or offset.

1.9 Communications

Communications between the Approach and Tower units usually take place by telephone.

Communications between an aircraft and Dubai Approach takes place on the 124.9 MHz radio frequency, and the communications between an aircraft and the Tower GMC and ADC take place on the 121.875 and 118.6 MHz frequencies, respectively.

All communications between the Approach and Tower units and the crew were recorded by ground based automatic voice recording equipment for the time that the flight was on the control frequency. The quality of the aircraft recorded transmissions was good.

The relevant extract from the transcript of Sharjah Tower and the crew is shown in table 4.

According to the Tower Controller, there was a noticeable difference in the clarity of the initial communications during the first landing attempt, while communications became deficient following the 'go-around'. During the final approach, the crewmembers attempts to express themselves in English were difficult to understand, except for the standard ATC phraseology.

During the construction period, the Tower to construction contractor communication was usually accomplished on the 118.6 MHz Tower frequency. During the Incident flight, the entire communication was heard by the flight crew

Table 4. ATC Transcript extract

Time	Station	R/T
0318:58	BDR7625	Sharjah Tower good morning BRAVO DELTA ROMEO SEVEN SIX TWO FIVE six miles on final runway three zero information x-ray with you we are six
0319:09	TWR	BRAVO DELTA ROMEO SEVEN SIX TWO FIVE Sharjah Tower good morning Q N H is one zero zero three surface wind is calm runway three zero clear to land
03 19:17	BDR7625	Clear to land runway three zero BRAVO DELTA ROMEO SEVEN SIX TWO FIVE
03 19:21	TWR	Afirm' and vacate via bravo
0319:23	BDR7625	vacate via bravo, BRAVO DELTA ROMEO SEVEN SIX TWO FIVE
03 20:12	ABY556	Tower good morning Arabia five five six ah ready on sequence
0320:16	TWR	Arabia five five six Tower roger behind the ilyushin seventy six on a one and a half mile final runway three zero via golf line up and wait behind
0320:26	ABY556	Line up and wait behind the landing traffic Arabia five five six
03 20:46	DEP	Standby Sharjah
0320:56	DEP	go ahead Sharjah
0320:58	TWR L	Hi Arabia five five six via DARAX
0321:00	Un1	WRONG RUNWAY WRONG RUNWAY
0321:01	DEP	Arabia five five six via DARAX released
0321:03	Un2	WRONG RUNWAY
0321:03	TWR L	Thanks also Arabia five one three also DARAX
0321:04	DEP	Okay a minimum of four minutes between them
0321:08	TWR L	SAY AGAIN sorry
0321:08	BDR7625	BRAVO DELTA ROMEO SEVEN SIX TWO FIVE go around
0321:10	DEP	minimum of four minutes between them please
0321:21	TWR L	Four minutes okay
0321:16	TWR	BRAVO DELTA ROMEO SEVEN three SIX FIVE copied going around continue



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		runway heading maintain altitude two thousand feet
0321:24	BDR7625	Continue climbing two thousand BRAVO DELTA ROMEO SEVEN SIX TWO FIVE
0326:09	TWR L	Sharjah
0326:10	DEP	BRAVO DELTA ROMEO SEVEN SIX TWO FIVE was mumbling something about something on the runway. But just confirm you did not send him around?
0326:19	TWR L	No he went around BY HIMSELF
0326:20	DEP	Okay alright We'll put him behind Arabia four three six kay

1.10 Aerodrome Information

1.10.1 General data

Sharjah International Airport is a GCAA certificated aerodrome under the UAE Civil Aviation Regulations (CARs) Part IX.

The Airport is operated by Sharjah Department of Civil Aviation (DCA) and Sharjah Airport Authority (SAA). The Airport serves passengers and cargo operations.

The (24° 19' 45" N 055° 30' 58" E) Airport is equipped with an Instrument Landing System (ILS), Cat I which was not in use during the BDR7625 approach.

On the day of the Incident, the Airport was equipped with a single active runway 12/30. The runway was paved with asphalt and was categorized as CAT I. Another parallel runway was under construction. The new runway was to the north of the active runway and the runways were approximately 250 meters apart (centerline to centerline).

The runway construction work commenced at the beginning of 2013 and was planned to be completed on 15 September 2014.

The Airport Authority is responsible for air traffic services at Sharjah Airport and holds an Air Traffic Services (ATS) Certificate issued by the GCAA and effective as of 27 March 2013.

1.10.2 New runway project safety plan and risk assessment

Paragraph 4.20- *Managing Unsafe Conditions*, in CAR Part X, Amendment 2, dated 1 January 2006, requires an aerodrome operator to develop a safety plan for all development/maintenance works on the aerodrome. In addition, closure markings and un-serviceability lights shall be displayed on a runway or taxiway, or portion thereof, which is closed to the use of aircraft.

Based on the risk analysis, prepared by the Airport Authority on 16 March 2014, hazard under item N° 25 was listed in the hazard register as "Aircraft making approach to the wrong runway." The risk of that hazard was assessed as low-probability and severe-impact risk. The risk reduction was planned to be accomplished by taking the following actions:

- Painting large white crosses on the closed runway;
- Issuing a NOTAM to warn pilots;
- Testing to assist ATC with differentiating between aircraft making approach to the wrong runway; and
- Advising ATC to keep additional watch for wrong runway approach.

Resulting from the risk assessment plan, white crosses were painted on the surface of the new runway, and one lighted cross sign was positioned several meters before the threshold (figure 1).



Figure 1. Lit cross mark positioned before the new runway threshold marks

According to CAR Part VIII, paragraph 3.4.6- *Aerodrome Works Safety*, the safety plan shall contain a synopsis of the procedures for planning and carrying out works safely, on, or in the vicinity of the movement area, or those areas that may extend above the obstacle limitation surfaces. The plan shall include the following:

"(a) Description of the methodology used for the development of a safety plan, including the development of checklists, and the control of contractors working airside;

(b) Description of the methodology used for implementing a works safety plan including use of works notification systems and work authority permits;

(c) Description of the procedures used for closing off and reopening areas for aircraft use, and the formal acceptance of work areas, prior to returning them to serviceability on a daily basis;

(d) Description of the supervision arrangements for early detection of deviations from intended practices or procedures or systems, if applicable;

(e) Arrangement for communicating with the air traffic services unit and/or apron management service unit during the progress of such works;

(f) The names, telephone numbers, and roles of the persons responsible for planning and implementing aerodrome works safety plans, including telephone numbers to contact those persons during and after work hours."



1.10.3 NOTAMS, AIP, AIS, AIC and Jeppesen update

Several NOTAMs were issued by the Airport providing information relevant to the new runway. The most recent NOTAM (No. A0525/14) was issued in May 2014 and contained information relevant to a new under-construction runway, 250 meters north of runway 12/30. The following statement was mentioned in the NOTAM:

"PILOTS ARE CAUTIONED TO POSITIVELY IDENTIFY LDG RWY [identify the landing runway]."

AIC 03/2014, effective as of 11 May 2014, was published: "To inform operators that the New Runway at Sharjah International Airport is in the construction phase." The AIC contained a caution that stated: "During the construction period and prior to opening Pilots are cautioned to correctly identify the runway in use. This is particularly important at later stages of construction when full markings may be available in readiness for completion and/or the lighting system may be under test - Until opening the new runway is marked with standard white crosses to indicate a closed runway."

A Jeppesen temporary revision, page 10-8 (figure 2a), was issued on 30 May 2014, to caution pilots to correctly identify the runway in use. The page referred to as 'Temporary Construction Works' contained a chart depicting the active runway and the new runway. A caution was also mentioned below the chart stating that:

"During the construction period and prior to opening Pilots are cautioned to correctly identify the RWY [runway] in use. This is particularly important at later stages of construction when full markings may be available in readiness for completion and/or the lighting system may be under test. Until opening the new RWY is marked with standard white crosses to indicate a closed RWY."

The chart depicted the future appearance of the aerodrome by showing the new runway as a black solid line, whereas the active runway was designated as taxiway Bravo, and depicted in a faint grey color. The linking taxiways were also depicted in faint grey. The chart did not show the active high-speed taxiway Bravo that connects the end of the active runway 30 to the parallel active taxiway Alpha. The high-speed taxiway Bravo was the one that was cleared by the Tower Controller for BDR7625 to use to vacate the active runway 30. Figure 2b shows the Sharjah Airport chart that was current on the day of the Incident and should have been used by the crew.

According to the known standards, changes to Jeppesen pages are usually made by Jeppesen Company based on aeronautical information published on the GCAA website. Communication with Jeppesen Company revealed that the purpose of the creation and issuance of page 10-8 was to provide the cautionary nature of the information described in the AIC 03/2014 during airport and runway construction. The Temporary Construction Works Chart was created according to Jeppesen Temporary (airport) Construction Information Charting Specifications.

According to GCAA procedures, a form to request aeronautical information changes is limited to NOTAMs. This form is usually completed by an airport and forwarded to Air Navigation Service (ANS) of the GCAA. There are no specific forms for AIP, AIS, or AIC changes.

The procedure does not require the acceptance of changes by ANS in every case. The criteria for acceptance relate to the extent of the changes, and whether a change approval is



required by the Civil Aviation Regulations. In all cases, acceptance is made through traditional modes of correspondence, with no specific endorsement by the responsible department in the GCAA.

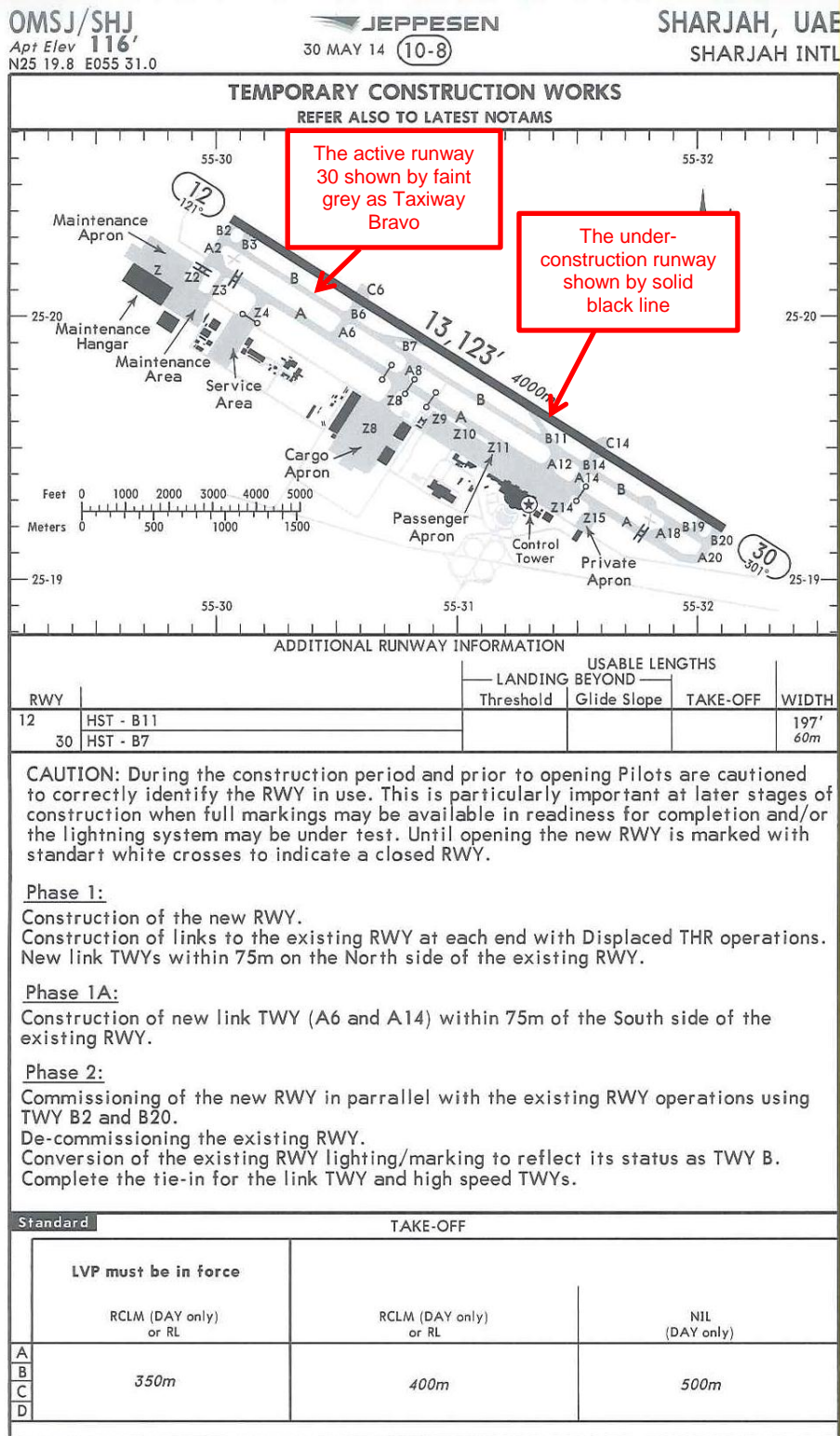


Figure 2a. Jeppesen temporary revision

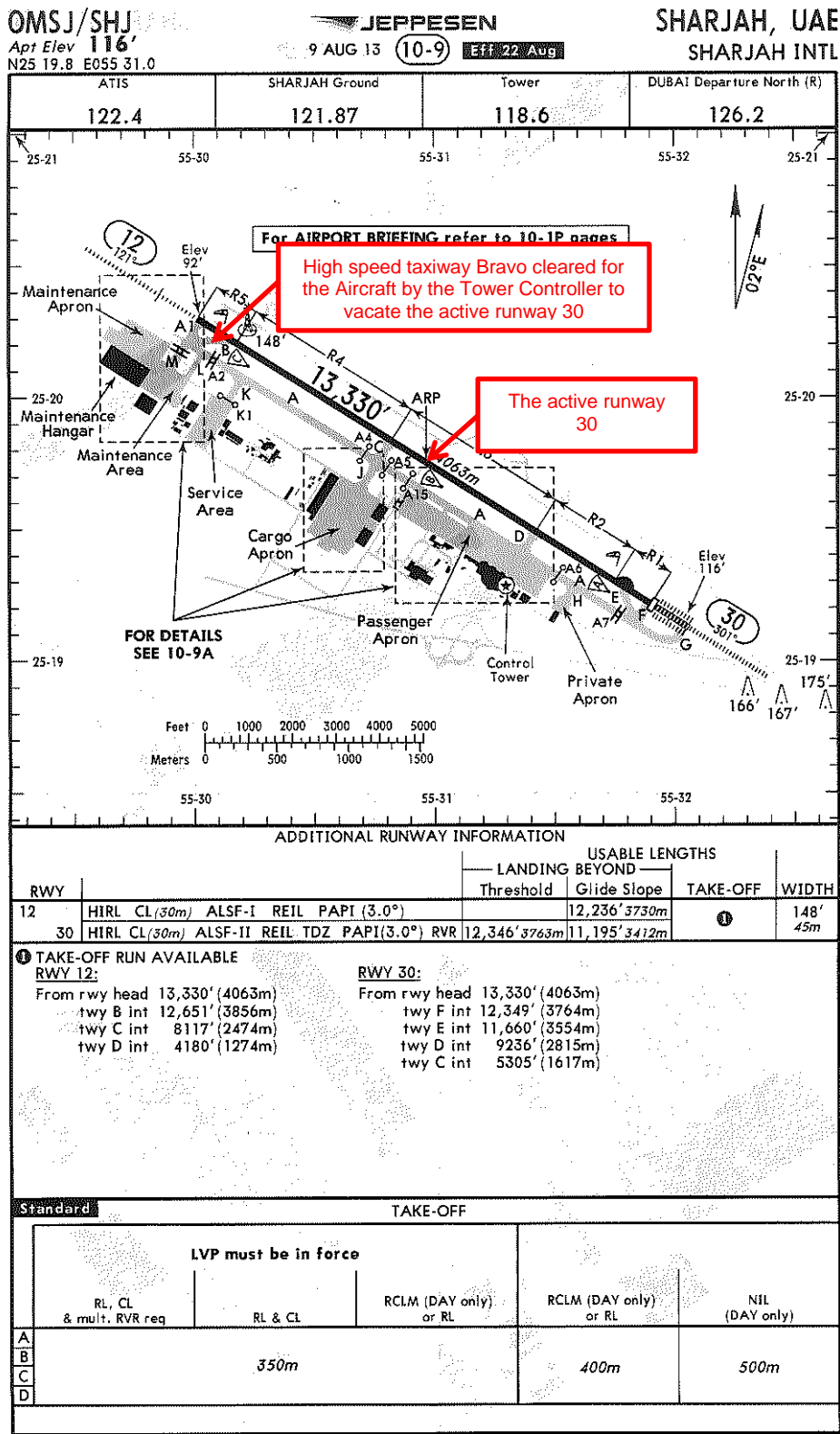


Figure 2b. The current Sharjah Airport chart depicting the active runway

1.11 Flight Recorders

Both flight recorders were removed from the Aircraft and forwarded to the AAIS flight recorder download facility.

Visual inspection of the flight recorders did not reveal any damage.

The CVR was downloaded and contained a clear record of communications. A transcript was made and formed a good source of information that assisted the Investigation to assess the performance of the flight crew, as well as the Approach and Tower controllers.

The Investigation did not consult the FDR data since the recorded parameters were irrelevant to the occurrence.

1.12 Wreckage and Impact Information

The Aircraft was undamaged.

1.13 Medical and Pathological Information

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

1.14 Fire

There were no signs of fire.

1.15 Survival Aspects

None of the crewmembers sustained any injury.

1.16 Tests and Researches

For the purpose of examining the environment of the Tower, the Investigation visited the Tower and determined the following:

- (a) The view of the active runway 30 thresholds and approaches was good. The Tower observation windows contain a large pillar which somewhat obstructed the ATCO's view, but the ATCO's view was not overly restricted.

From the Tower controllers' perspective, it should not have been excessively difficult to assess that an aircraft was approaching the incorrect runway, although this cannot be stated definitively since the Investigation did not have the opportunity to observe an aircraft approaching to runway 30. The difficulty in assessing the approach of an aircraft relates to the oblique angle of view, and the fact that the approaches are only 250 meters apart (figure 3).



Figure 3. The ATCO position looking towards 30



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- (b) At the time of the event, the radar display, which was not used for control purposes, but rather for information and to improve the controllers' situational awareness, displayed a single approach line to the active runway. The Investigation viewed an aircraft approaching runway 12, and the return was so close to the approach line that a general look did not clearly reveal whether the aircraft was correctly aligned. It took careful and close observation to see whether the aircraft was aligned on the correct approach or offset.
- (c) The ergonomics of the control position appeared to be good. All equipment was at hand, and easily seen and/or accessible for use when required. The lighting panel was a touch screen and easy to use. Preset selections, based on day/night and visibility/ cloud conditions, were available. All circuits were easily selectable manually.

On the day of the visit, the ATCO selected the preset that switched on only the Precision approach path indicator (PAPI). The ATCO could easily select all other circuits such as runway and approach lighting manually.
- (d) The ATCO seating position gave a good view of the runway 30 approach with the minor limitation of the thick window pillar.

1.17 Organizational and Management Information

1.17.1 The Operator's organizational structure

Badr Airlines is a cargo operator certificated under the Sudan Civil Aviation Regulations (SUCAR)- 6 Volume VII; Air Navigation Regulations (ANR) Part "VIII", volumes 2 and 3- *Commercial Air Transport Operator*.

The organization structure of the Operator is shown in figure 4.

The Operator did not have a standalone safety management unit within its structure, and operational safety was afforded by the Flight Safety and Operations Director.

1.17.2 The Operator's dispatch and flight preparation

The on-duty dispatcher for the Incident flight stated that the Airport chart was inserted in the Jeppesen Airway Manual two days before the flight, and during the crew briefing, he did not mention the runway under construction. He verified with the crew that the charts were up to date.

Amendments to the Jeppesen Airway Manual were usually delivered to the Operator by mail and then transferred to the Operations Department where the Office Manager was responsible for the insertion of the amendments.

The dispatcher also stated that he ascertained that the Jeppesen Airway Manual onboard was up to date on the day of departure but the captain stated that his intention was to land on runway 30L¹ and that all documents showed runway 30L was active since 30 May 2014.

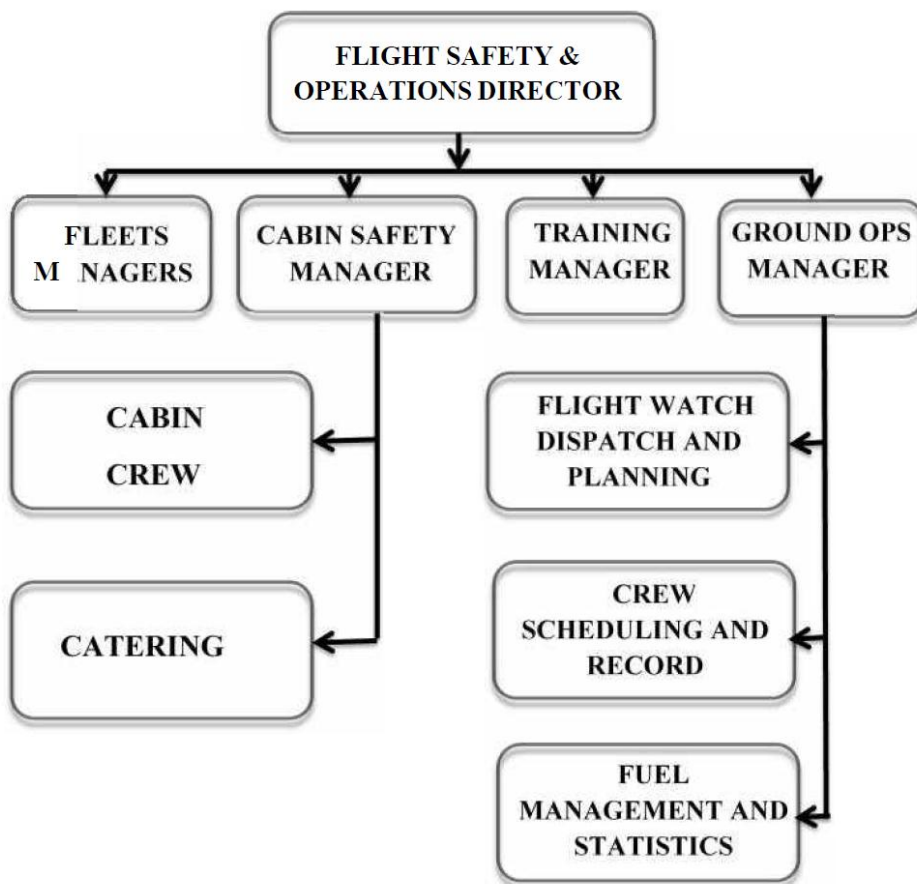


Figure 4. Operator's organizational structure

¹ Runway 30L as perceived by the crew and the dispatcher after reviewing the temporary revision of the Jeppesen (page 108- Temporary Construction Works).



1.17.3 Sharjah ANS organization structure

The Sharjah *Air Navigation Services/Air Traffic Services Organization Exposition, Version 1.4*, contained the duties and responsibilities of various positions in the ATS Provider's structure for Sharjah ATS (figure 5).

Among the positions included were the Head of Safety & Quality (HS&Q), the ATC Supervisor, and the ATCO.

According to the *Exposition*, the main purpose of the HS&Q job was to investigate all ATC related incidents at Sharjah Airport and to implement measures to avoid such occurrences. In addition, the HS&Q was responsible for ensuring that: "A robust Safety Management System (SMS PRO) is maintained in Sharjah ANS."

Among the key responsibilities of the HS&Q were: To build and maintain a non-punitive reporting culture amongst management and staff; to manage all Safety Management System (SMS PRO) functions in the Airport's ANS; to review the overall performance of the ATS (ANS), specifically by monitoring the performance of the Airport in relation to its identified target levels of safety; and to communicate with the DCA as required in relation to incidents which have occurred at the Airport.

The main purpose of the Tower Supervisor job is to maintain a safe, orderly, and expeditious flow of air traffic, preventing collisions between aircraft in the air, and also between aircraft on the maneuvering area and the aprons, and assisting in preventing collisions between aircraft and obstructions on the maneuvering area. Also, notify appropriate organizations regarding any reportable incidents such as aircraft in need of search and rescue, and assist such organizations as required.

The main purpose of the ATCO's job is to maintain a safe, orderly, and expeditious flow of air traffic, preventing collisions between aircraft in the air and also between aircraft upon the maneuvering area and the aprons, and assisting in preventing collisions between aircraft and obstructions on the maneuvering area. In addition, to notify appropriate organizations regarding any reportable incidents such as aircraft in need of search and rescue, and assist such organizations as required.

Among the ATCO's responsibilities were to: Follow and comply with the company and DCA SMS PRO; organize and control of air traffic flying in, approaching, departing and flying in the vicinity of the Control Zone (CTR); issuing information and instructions to aircraft; prioritizing ATC workload according to safety requirements and airport requirements; and the identification and reporting of safety risks in accordance with the Safety Management System.

The purpose of the ATCA job is to provide general assistance to the DATCO to ensure that aircraft receive a safe, expeditious, and effective service.

Among the ATCA's responsibilities were to: assist DATCO when requested, especially during emergencies and low visibility operations; liaise with other operational departments and coordinate with other ATS units; obtain information to meet the need for pre-flight information service and in-flight information service; and deal with external enquiries.

The structure of the ATS Provider gave a direct reporting line from the Manager of ATS, to the Assistant Director of Operations, which is managerial position in the Airport Authority.

In the same structure, the HS&Q reports to the Head of Operations who reports to the Manager of ATS. The HS&Q is a managerial position within the ATS Provider.

In addition to his management position, the HS&Q was included in the Tower roster and served as a current ATCO.

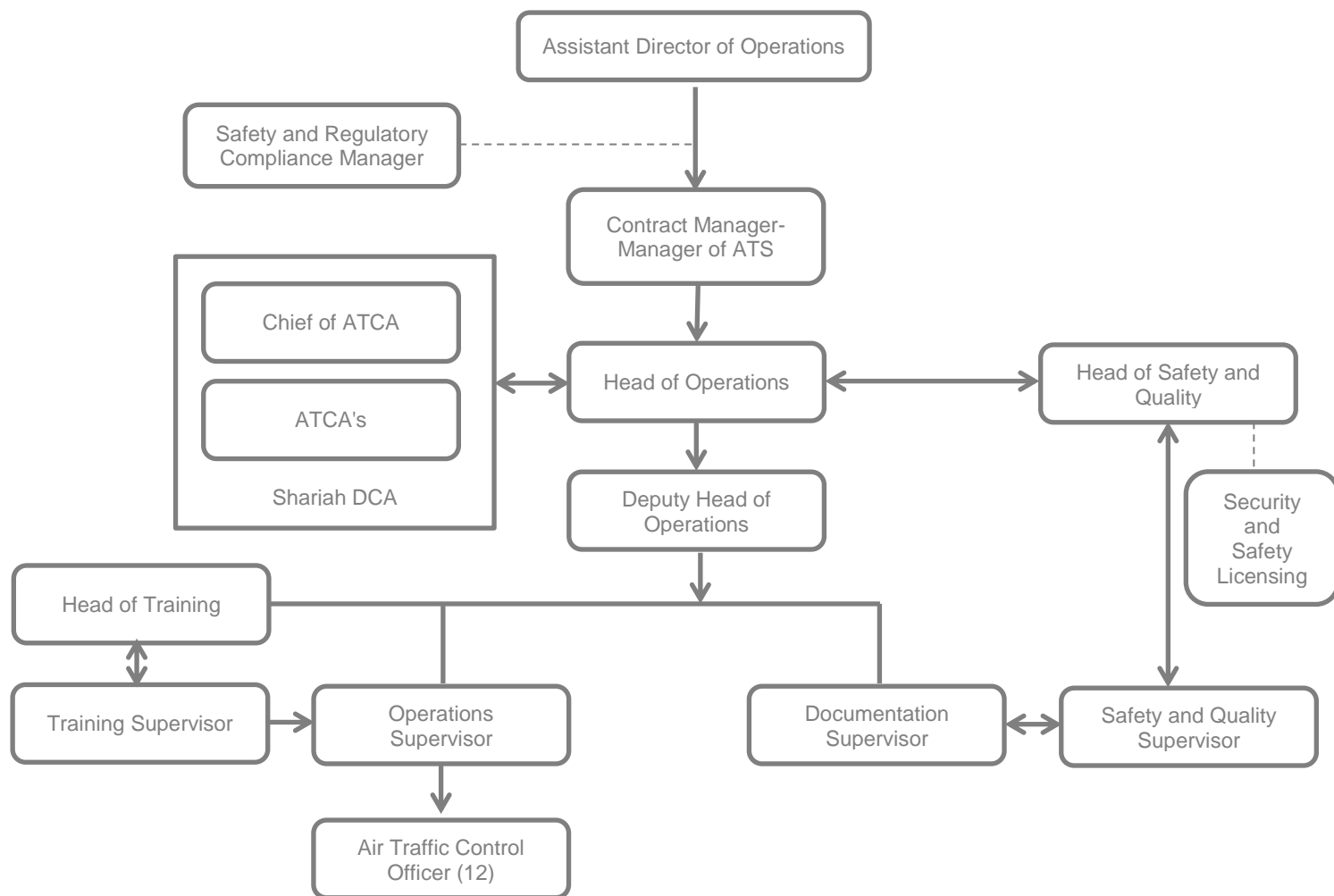


Figure 5. ATS Provider organizational structure

1.17.4 The Sharjah Airport Control Tower

Sharjah Air Traffic Services (ATS) is contracted to a Provider (private company) through a signed contract.

The company is required by the terms of the contract to supply air traffic controllers suitable to the size and nature of airport operations.

The responsibility for control of aircraft approaching and departing from Sharjah Airport is assumed by Dubai ATC Approach (Arrival)/Departure, through a letter of agreement (LOA) signed between both parties.



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The ATS Tower policy requires three persons to man the Tower: Two ATCOs and one ATCA. One of the ATCOs shall be a supervisor who has full authority to manage the shift according to the prevailing situation.

The policy allows one ATCO to perform the functions of GMC and ADC except in workload peaks, which are usually in the early mornings and evenings. The controllers' positions are logged by using software called Time on Position (TOP).

There must be a minimum of two ATCOs present in the Tower at all times. The second ATCO is available to assist when traffic levels require. He can either assume responsibility for GMC, or act as a coordinator handling telephone communication.

There are two positions where the “spare” ATCO may sit. One is at a computer station, where his back would be to the runway 30 approach, and, being at the back of the Tower, his view of the traffic would be severely restricted. The second position is an armchair, where he can relax. The armchair is low, and when seated there, the view of the runway 30 approach (which is the general direction of view from that position) is very limited, the seated position being so low that the view is obstructed by desks. If the person sits up, there would be a better view of the runway 30 approach area, but the view would still be limited.

The ATCA position usually faces the runway 30 approach. ATCA is tasked to perform various computer-based systems, and he therefore cannot concentrate his attention of the traffic. In addition, ATCA is neither trained on, nor required to monitor traffic, and has no input in those terms. ATCAs has no function in regard to traffic control; his/her tasks are essentially administrative.

On the day of the Incident, the Tower was manned by the morning shift whose duty time was scheduled between 0530 and 1330 LT. During that shift, the GMC and ADC Tower positions were combined together. The division of work was decided to be as follows:

- From 0530 to 0730 LT- ATCO 2
- From 0730 to 1130 LT- ATCO 1
- From 1130 to 1330 LT- ATCO 2

The Tower roster was normally based on a 10-day cycle: 6 days working 6 hours daily, followed by 4 days off-duty.

In the preceding 7-days, the Tower Controller roster was, in sequence, as follows:

Night, night, rest/off-day, off-day, night, off-day, off-day and morning. By calculating the various shifts within the last 7 days, the Controller would have had 48 hours rest in a total of 168 calendar hours in the 7 days.

In his statement, the Controller stated that in case assistance from the standby controller (ATCO 2) is required, the ATCO 2 would be called by name. On the day of the Incident, the Controller did not ask the standby ATCO 2 for assistance, nor did he deem it necessary.

The Controller used the radio and telephone communication by inserting the speaker into his left ear, telephone microphone and radio speaker are all directed to the left ear of the Controller.

The Controller interpretation of the DATCO role was that he/she is responsible for control and communication with all aircraft and vehicles, and phone call coordination regarding



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tactical control of aircraft. A DATCO is also required to attend to other phone calls regarding the passing of other supplementary information, which are not directed to the ATCA such as slot times, flow control, and airport agencies.

According to the Controller, ATCA is responsible for flight plans, flight process strips, logging aircraft movements, and liaising with other ATS units and airport agencies that do not affect the tactical control of the aircraft. A standby controller, while on a break, is always available to assist either the DATCO or the ATCA should the ATCO positions need to be split into GMC and ADC, or if phone call coordination proves excessive for the DATCO or ATCA. Unless a designated supervisor is rostered on-duty, either ATCO may act as supervisor, although usually the senior ATCO will do so.

The Controller stated that the key factor determining whether to request the assistance of the standby ATCO is the volume and/or complexity of the traffic. When either becomes excessive, the split between Ground and Tower positions may be required. Splitting may also be required if phone calls remain unanswered.

The definition of the workload to the Controller was the traffic volume and complexity, emergency, or contingency situations, and phone call coordination. A combination of these can prove very time-consuming and demanding.

The Controller stated that, due to haze, he did not see BDR7625 until approximately three miles on final approach to runway 30. The Controller added that the Aircraft appeared high on approach and not obviously lined-up with the incorrect runway 30 due to both runways being so close together.

When asked about the Tower workplace environment, the Controller answered: "I am comfortable working with my colleagues. However, the physical environment is dirty, damaged and often uncomfortable to work [in] if the A/C [air conditioning] is not [working] properly." The Controller's statement was supported by a post-Incident GCAA audit level 2 finding which revealed that: "The permanent tower has ongoing issues including roof leaks, cracked windows and damaged seals, inadequate air conditioning, flooring issues and possibly other [issues]. Window replacement is fundamental to the anticipated Tower refurbishment, as the present state allows penetration of dust and condensation, resulting in reduced visibility from the Tower. Assurance is required that refurbishment will address all issues associated with the current state of the Tower."

According to the finding, the workplace conditions were contrary to the requirements of the UAE Civil Aviation Regulations (CAR) Part VIII, Subpart 4- *Air Traffic Control Organizations*, CAR 4.10(b) which states: "Working conditions shall meet established levels for temperature, humidity, ventilation, noise and ambient lighting, and do not adversely affect controller performance."

According to the Airport's *Local Area Traffic Instructions (LATSI)*, section 3, the ADC, on frequency 118.6 MHz, is normally responsible for operations on the runway and for aircraft flying within the area of responsibility of the aerodrome control tower, whereas the GMC, on frequency 121.875 MHz, is normally responsible for traffic on the maneuvering area with the exception of the runways.

The ADC is responsible for receiving coordination from Dubai for arrivals and training flights and managing traffic in the circuit, whether VFR or IFR.



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1.17.5 The Contract between the Airport Authority and the ATS Provider

A contract was signed between the Airport Authority and the ATS Provider on 23 March 2014.

According to the contract, the ATS Provider undertook to provide services to the satisfaction of the Airport Authority and in accordance with the requirements of the contract and: "Any other programs, work procedures and rules, method statements and special conditions that may be agreed between the parties from time to time in accordance with [the contract]."

The ATS Provider committed to perform other obligations: "In a timely, efficient, proper, and workmanlike manner using reasonable care, skill, and diligence; using a sufficient number of suitably trained, qualified, skilled and experienced staff; and in accordance with good industry practice and reasonable directions of the Department [Airport Authority]."

The contract contained a clause related to key performance indicators (KPIs) which called for deductions from the payments to the ATS Provider where targets related to certain safety aspects are not achieved. Among the safety targets, one KPI referred to 'go-arounds'. This KPI was determined to be the number of 'go-arounds', which would be measured against one defined target, which was "0 [zero] 'go-arounds' in a month."

The baseline² for the 'go-around' aspect was agreed as two 'go-arounds' per month. Three thresholds: 1st, 2nd, 3rd, levels were indicated in the contract. The thresholds were defined as 2, 4 and 5 'go-arounds' per month, respectively. According to the contract, deductions are related to the baseline, threshold and weights. For 'go-arounds', the weight was identified to be 15%.

In Schedule 1 to the contract- *Service Level Agreement (SLA)*, the ATS Provider committed to perform operations safely and efficiently to good industry standards and in compliance with the standards and recommended practices, and procedures.

The contract obliged the ATS Provider to provide the following personnel:

- One Contract Manager
- One Manager Air Traffic Services
- One Head of Operations
- One Head of Safety

² The Baseline is defined in the contract as: "The minimum acceptable level of service before deductions occur."
Baseline 0% was defined as: "If the baseline performance is achieved as per the Baseline definition then no deduction will be made."

The Threshold (1st, 2nd, and 3rd) is defined in the contract as: "The first [second/third] level at which Performance Deductions will occur The criteria for the threshold are defined in absolute terms to ensure clarity around the measurement of performance."



- One Head of Training
- Four Tower Watch Supervisors
- Twelve Air Traffic Controllers

In addition, the contract required the ATS Provider, if it deemed necessary, to provide further staffing to perform the services, with no additional charge to the Airport Authority.

The air traffic control services were to be covered for round the clock operations, and were the responsibility of the ATS Provider. The obligations included Aerodrome Control (Ground Movement Control and Air Positions), SMS PRO and ROSI incident investigation analysis, full compliance with GCAA requirements, ICAO Standards and Recommended Practices and conformity with corrective actions resulting from GCAA audit findings.

In the *Service Availability* section, the SLA stated that "The Services will be provided in accordance with the availability and restrictions specified below [in a table]." The table contained a list of services: "Aerodrome Control (Air) and Aerodrome Control (GMC) with 24/7, 100% un-restricted service availability".

In the *Service Reporting* section, the ATS Provider is required to submit to the Airport Authority (Safety and Regulation Compliance Manager) a monthly SLA monitoring report (ATC and AIS), and a daily ATC report that contains ATC related issues and incidents.

The contract gave the right to the Airport Authority to conduct inspections of the ATS Provider's organization, and anything related to such operations.

In the Monthly KPI Report, submitted by the ATS Provider to the Airport Authority for the month of the Incident (June 2014), the KPI related to 'go-arounds' was discussed through correspondence between the Airport Authority and the ATS Provider. The ATS Provider stated that the BDR7625 Incident should not be attributed to ATC and that the pilot on a visual approach is solely responsible for ensuring a safe landing, and: "For whatever reason, it is determined that the 'go-around' was attributable to ATC there will not be any deductions from [the ATS Provider's] payment."

1.17.6 Safety Management System (SMS)

The UAE CAR Part VIII, Subpart 4, CAR 4.41- *Safety Management System (SMS) Requirements*, requires the Airport Authority, as a holder of ATS Certificate, to establish an SMS acceptable to the GCAA and as a minimum complies with the requirements of CAR Part X- *Safety Management System Requirements*.

CAR 4.41(b) requires that the SMS clearly define lines of safety accountability throughout the ATS organization, including a direct responsibility for safety on the part of senior management.

CAR Part X, Section 6- *Organizational Structure and Responsibilities*, requires that an organization structure contain a safety management postholder to be the member of management who shall be the responsible focal point for the development and maintenance of an effective safety management system. Among other responsibilities, the safety management postholder shall report to the accountable manager on the performance of the SMS and on any need for improvement. The organization shall have sufficient appropriately qualified staff for the planned tasks and activities related to safety management.



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The ATS Provider operated a partial SMS which was administered by the HQ&S, and owned by the Manager ATS. The only part of the SMS that had been implemented was the 'Reporting' module. Details of incidents were entered into software system called 'SMS PRO'.

The interaction between the Airport Authority and the ATS Provider was planned to be accomplished by the ATS Provider's Contract Manager ATS, who was intended to have direct contact with the Airport Authority. The Head of Operations within the ATS Provider's structure was also liaising between the Airport Authority and ATC.

The HQ&S, Training, and Deputy Head of Operations usually attended frequent meetings with the Airport Authority. Direct communication, outside of these meetings, was limited. Most of the correspondence between the entities was among higher management personnel.

The ATS Provider operated an incident reporting system, which had three components. In addition to the 'SMS PRO', the GCAA 'ROSI' system, and the ATS Provider's 'Assure' system were used. It was mandatory to report incidents to SMS PRO and ROSI. Serious incidents, and ATC errors, were reported into the 'Assure' system.

The last audit of the ATS Provider conducted by the GCAA, after the Incident date, revealed that the ATS Provider's SMS was under development, and needed to be aligned with the policies of the Airport Authority, who shall own and operate the SMS as an ATS Certificate holder, in order to avoid conflicting philosophies. The ATS Provider's safety policy was clearly visible to all employees; however there was no visibility of the Airport Authority safety policy. A review was required to ensure that the ATS Provider's safety policy was in accordance with that of the Airport Authority.

1.17.7 Letter of Agreement (LOA) for control transfer between the Approach and the Tower ATS units

During his interview, the Tower Controller stated that: "It is not required to ask the crew if they get the runway in-sight as a requisite to grant a landing clearance."

The Tower Controller added that in case the landing is going to be performed visually, a prior coordination with the Approach shall be accomplished, but in the case of BDR7625 no such coordination was achieved. The Controller added that: "The Tower neither received a notification regarding [a] visual approach from Dubai [Approach] nor did he hear from the pilot that he was in [a] visual approach. The flight transfer between Dubai Approach and Sharjah Tower was done without any communication between the two controllers, as the procedure does not require such communication."

The Approach Controller placed BDR7625 under the DMATS monitoring. He verified the reported position as received from the crew, and then transferred the traffic to the Tower. Thereafter, there was no communication between Dubai Approach and Sharjah Tower.

Dubai Approach delegated authority to Sharjah Tower to issue clearances, provided that a Standard Departure clearance is issued to all Instrument Flight Rules (IFR) departures, with the exception of those in non-standard departures, and that all clearances or instructions are read back or acknowledged in a manner to clearly indicate that they have been understood and will be complied with.

For arrivals, the transfer of control was agreed between the two ATS units as having been accomplished when Dubai Approach established inbound flights on final approach outside



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6 NM on the localizer or inbound track, unless otherwise coordinated. Transfer of communication was to take place no later than 5 NM from touchdown, unless otherwise coordinated. The transfer of control was to take place at 4 NM from touchdown in visual meteorological conditions (VMC) and at touchdown when Sharjah Airport is operating in instrument meteorological conditions (IMC).

Traffic on a visual approach shall be instructed to maintain 1,500 ft, until established on final approach. Dubai Approach may issue a visual approach clearance to traffic inbound to Sharjah with no prior coordination, provided that transfer of communication takes place when the inbound aircraft is above 2,000 ft, and provided that the Sharjah circuit is not active. Sharjah ATC shall advise Dubai ATC when the circuit is active.

1.18 Additional Information

1.18.1 ICAO Standards and Recommended Practices

ICAO Document 4444 defines the ATS as: "A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service)."

The Document defines the 'transferring' unit/controller as the unit/controller in the process of transferring and receiving the responsibility for providing air traffic control service to an aircraft to the next air traffic control unit/air traffic controller along the route of flight. Transferring usually occurs at the "transfer of control point" which is a defined point located along the flight path of an aircraft, at which the responsibility for providing air traffic control service to the aircraft is transferred from one control unit or control position to the next.

The Document states that the unit's 'capacity assessment' depends on the level and type of ATS provided; the structural complexity of the control area, the control sector or the aerodrome concerned; the controller workload, including control and coordination tasks to be performed; the types of communications, navigation and surveillance systems in use, their degree of technical reliability and availability as well as the availability of backup systems and/or procedures; availability of ATC systems providing controller support and alert functions; and any other factor or element deemed relevant to controller workload. However, the ATS should enhance the ATC capacity by periodical review of ATS capacities in relation to traffic demand; and provide for flexible use of airspace in order to improve the efficiency of operations and increase capacity.

In the "transfer of control" agreements, the Document states that transferring units should have procedures providing for a flexible use of airspace that specify conditions for transfer of the airspace to/from the ATC units concerned.

Specifically, paragraph 4.3.2.1 of the Document mentions, that in agreements between a unit providing aerodrome control service and a unit providing approach control service, and except for flights which are provided with aerodrome control service only; the control of arriving and departing controlled flights shall be divided between units providing aerodrome control service and units providing approach control service in that for:

"*Arriving aircraft.* Control of an arriving aircraft shall be transferred from the unit providing approach control service to the unit providing aerodrome control service when the aircraft:

- a) is in the vicinity of the aerodrome, and

- 1) it is considered that approach and landing will be completed in visual reference to the ground, or
 - 2) has reached uninterrupted visual meteorological conditions, or
- b) is at a prescribed point or level, or
 - c) has landed."

The operational aspects shall be safeguarded by an incident reporting system to facilitate the collection of information on actual or potential safety hazards or deficiencies, including route structures, procedures, communications, navigation and surveillance systems and other safety significant systems and equipment, as well as controller workloads.

Aerodrome control service

Aerodrome control service shall be provided by an aerodrome control tower. The ATS unit shall designate the area of responsibility for each air traffic control (ATC) unit and, when applicable, for individual control sectors within an ATC unit. Where there is more than one ATC working position within a unit or sector, the duties and responsibilities of the individual working positions shall be defined.

Functions of aerodrome control towers

The Document states:

"7.1.1.2 Aerodrome controllers shall maintain a continuous watch on all flight operations on and in the vicinity of an aerodrome as well as vehicles and personnel on the maneuvering area. Watch shall be maintained by visual observation, augmented in low visibility conditions by an ATS surveillance system when available. Traffic shall be controlled in accordance with the procedures set forth herein and all applicable traffic rules specified by the appropriate ATS authority. If there are other aerodromes within a control zone, traffic at all aerodromes within such a zone shall be coordinated so that traffic circuits do not conflict.

7.1.1.3 The functions of an aerodrome control tower may be performed by different control or working positions, such as:

- a) aerodrome controller, normally responsible for operations on the runway and aircraft flying within the area of responsibility of the aerodrome control tower;
- b) ground controller, normally responsible for traffic on the maneuvering area with the exception of runways;
- c) clearance delivery position, normally responsible for delivery of start-up and ATC clearances to departing IFR flights."

Essential information on aerodrome conditions

The Document requires that essential information on aerodrome conditions shall include information relating to construction or maintenance work on, or immediately adjacent to, the movement area.

This information shall be given to every aircraft, except when it is known that the aircraft already has received all or part of the information from other sources. The information shall be



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given in sufficient time for the aircraft to make proper use of it, and the hazards shall be identified as distinctly as possible. Other sources include NOTAM, Automatic Terminal Information Service (ATIS) broadcasts, and the display of suitable signals.

Transfer of control

The Document states:

"10.1.1.1 The coordination and transfer of control of a flight between successive ATC units and control sectors shall be effected by a dialogue comprising the following stages:

- a) notification of the flight in order to prepare for coordination, as necessary;
- b) coordination of conditions of transfer of control by the transferring ATC unit;
- c) coordination, if necessary, and acceptance of conditions of transfer of control by the accepting ATC unit; and
- d) the transfer of control to the accepting ATC unit or control sector.

10.1.2.2.1 The responsibility for the control of an aircraft shall be transferred from the ATC unit to the next unit at the time of crossing the common control area boundary as determined by the unit having control of the aircraft or at such other point or time as has been agreed between the two units.

10.1.2.2.2 Where specified in letters of agreement between the ATC units concerned, and when transferring an aircraft, the transferring unit shall notify the accepting unit that the aircraft is in position to be transferred, and specify that the responsibility for control should be assumed by the accepting unit forthwith at the time of crossing the control boundary or other transfer control point specified in letters of agreement between the ATC units or at such other point or time coordinated between the two units."

Transfer of communication

The Document states:

"10.1.2.4.1 Except when separation minima specified in 8.7.3 are being applied, the transfer of air-ground communications of an aircraft from the transferring to the accepting ATC unit shall be made five minutes before the time at which the aircraft is estimated to reach the common control area boundary, unless otherwise agreed between the two ATC units concerned.

10.1.2.4.2 When separation minima specified in 8.7.3 are being applied at the time of transfer of control, the transfer of air-ground communications of an aircraft from the transferring to the accepting ATC unit shall be made immediately after the accepting ATC unit has agreed to assume control.

10.1.2.4.3 The accepting ATC unit shall normally not be required to notify the transferring unit that radio and/or data communication has been established with the aircraft being transferred and that control of the aircraft has been assumed, unless otherwise specified by agreement between the ATC units concerned. The accepting ATC unit shall notify the transferring unit in the event that communication with the aircraft is not established as expected."

Coordination between a unit providing approach and a unit providing aerodrome control service

The Document states:



"10.1.4.1.1 A unit providing approach control service shall retain control of arriving aircraft until such aircraft have been transferred to the aerodrome control tower and are in communication with the aerodrome control tower. Letters of agreement or local instructions, appropriate to the airspace structure, terrain, meteorological conditions and ATS facilities available, shall establish rules for the transfer of arriving aircraft.

10.1.4.1.2 A unit providing approach control service may authorize an aerodrome control tower to release an aircraft for take-off subject to the discretion of the aerodrome control tower with respect to arriving aircraft.

10.1.4.2.1 An aerodrome control tower shall keep the unit providing approach control service promptly advised of pertinent data on relevant controlled traffic such as:

.....

d) information concerning missed approaches;"

Coordination and transfer data

The Document states:

"11.3.7.8 The transfer of control shall be either explicit or, by agreement between the two units concerned, implicit, i.e. no communication need be exchanged between the transferring and accepting units.

11.3.7.13 When control of the transferred aircraft has been assumed, the accepting unit shall complete the transfer of control dialogue by communicating assumption of control to the transferring unit, unless special arrangements have been made between the units concerned."

Phraseologies

The Document contains the following standard phraseology for approach transfer of control:

"12.4.2.5.7 COMPLETION OF APPROACH

- a) REPORT VISUAL;
- b) REPORT RUNWAY [LIGHTS] IN SIGHT;
- c) APPROACH COMPLETED [CONTACT (*unit*)].

12.4.2.5.8 MISSED APPROACH

- a) CONTINUE VISUALLY OR GO AROUND [*missed approach instructions*];
- b) GO AROUND IMMEDIATELY [*missed approach instructions*] (*reason*);
- c) ARE YOU GOING AROUND?;
- d) IF GOING AROUND (*appropriate instructions*);
- e) GOING AROUND [*pilot transmission*]."

1.18.2 Operational Memo and Supplementary Instruction

On the day of the Incident, and immediately after the Incident occurred, an Operational Memo (OM) was issued by the ATS Provider, referring to the Incident and requesting the



ATCOs to act in an extremely safety conscious manner because of the new runway project, and to be vigilant and proactive in order to prevent any serious incidents.

Some items mentioned in the OM were:

1. Make sure that the blinds in the visual control room (VCR) do not limit the view on final approach.
2. Use the second window on the radar display, zoomed in as close as possible, to confirm the aircraft is lined up for the correct runway.
3. During daylight, switch ON all lights on 100% to serve as a visual aid to pilots.
4. When doubt exists as to whether an aircraft is lined up for the correct runway, ATC can confirm with the pilot as to whether the PAPIs are visual.

A Supplementary Instruction (SI) was issued on the day following the Incident requesting that the runway lights remain ON continuously, including sequence flashing lights, in order to emphasize the runway in use.

1.18.3 Other Occurrences and related SMS investigations

The GCAA incident reporting system (ROSI) contained reported incidents relevant to the new runway construction. The following is a selection of these ROSI reported incidents:

- On 29 June 2014, for the Incident BDR7625 flight, the Tower ATC ROSI report relevant to the Incident flight stated: "[At] 0323Z [UTC], BDR7625 executes 'go-around' final approach RWY [runway] 30 due to unstable [unstabilized] approach. 0337Z: BDR7625 QAL runway 30. Pilot apologizes for being confused by RWY [runway] PAPI lights on final approach. Shortly afterwards, Vehicle "work 1" advises by telephone that the aircraft BDR7625 was aligned with the new runway on final approach, implying that it went around for that reason.

The ATS Provider's investigation concluded that the Aircraft went around at approximately a mile and half from final and 500 ft above ground level (AGL). The pilot was using a published Jeppesen chart dated 30 May 2014. The chart indicated that the new runway was operational.

Four recommendations were mentioned in the ATS Provider's investigation report: keeping the runway lights switched on during the day; the DATCO to check meticulously each aircraft position on final; ILS approach is preferred; and incorrect charts should not be used.

- On 10 July 2014, at 0555 UTC, when an aircraft was approximately 02 NM final approach, the aircraft was aligned with the under-construction runway. Accordingly, the controller instructed the aircraft to 'go-around'. The aircraft landed safely at 0607.

The ATS Provider's investigation concluded that: the DATCO followed the correct procedure; the pilot was using a Jeppesen chart that was misleading; the lights on the active runway were ON, but the aircraft still aligned with the north (incorrect) runway.

No recommendations were mentioned in the ATS Provider's investigation report but the report indicated that Supplementary and Temporary Instructions were issued to



amend procedures to avoid runway confusion and the Jeppesen chart has been removed from circulation.

- On 16 September 2014, at 1256 UTC, on approach to Sharjah Airport, full length was requested due runway works and taxiway availability. This was accepted and acknowledged by ATC. While taxiing to the end to vacate the runway via exit Alpha 1, the crew saw two large trucks maneuvering into the stopway area while the aircraft was still on the runway.

There was no ATS Provider's investigation report submitted to the Investigation.

1.19 Useful or Effective Investigation Techniques

No new investigation techniques were used during this Investigation.



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2. Analysis

2.1 Introduction

A review of accident and incident investigation literature shows that 'misidentification' of runways by pilots can be a significant factor in many kinds of accidents: collision is the most significant of these.

The Investigation into this Incident collected data from various sources for the purpose of determining the causes and contributing factors.

This 'Analysis' discusses the issues of pre-departure dispatch brief, crew confusion and crew resource management (CRM), visual watch of aircraft flying a visual approach, new runway safety risk assessment, issued aeronautical information, the contract between the Airport Authority and the ATS Provider, and the Safety Management System (SMS) in the Airport's air navigation service.

This Section of the Report explains the contribution of every investigation aspect to the Incident. The 'Analysis' also contains safety issues that may not be contributory to the Incident but are significant in adversely affecting safety.

2.2 Dispatch Brief

In general, and according to the Operator's procedure, Jeppesen Airway Manual changes are usually delivered to the Operator via normal mail, and then they are transferred to the Operations Department where the Office Manager is responsible for the insertion of the revised pages and for entering the applicable revision number in the Jeppesen folder.

During the dispatcher's brief to the crew, the Jeppesen Airway Manual contained page 10-8, *Temporary Construction Works*, dated 30 May 2014, the temporary revision to the Sharjah Airport chart. . The revision of the Jeppesen Airway Manual had gone through the Operator's pre-defined procedure and had been inserted with the latest revision of the Airport's chart in its proper place in the folder, two weeks before the flight.

The insertion of the temporary revision page did not prompt the dispatcher to draw the attention of the crew to the fact that the depicted runway chart was for the future situation after the new runway project was finalized and that this chart was not yet effective. The dispatcher did not also draw the attention of the crew to the fact that the active runway was the one which would be insight to south of the under-construction runway, and that there was a single runway at the destination.

According to the captain, he checked the revised runway information page in the Jeppesen Airway Manual before the flight, and the dispatcher did not mention anything regarding that page.

The revision date (30 May 2014) of Jeppesen Page 10-8 was later than the last flight that the captain had flown to Sharjah Airport (about 10 weeks before 29 June 2014). Although the work on the runway had started long before the chart temporary revision date, and the captain had made the last flight before the Incident flight normally, the Investigation determined that the captain perceived, mistakenly, that the active runway would be the one shown in page 10-8 as a solid black line. The captain did not note the fact that page 10-8 was not yet effective, and was reflecting the situation as it would exist in the future.



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The captain stated that his intention was to land on runway 30L, and that all documents indicated that runway 30L had been active since 30 May 2014. The Investigation believes that the dispatch brief was not sufficient to ensure that the crew would refer to the current airport chart, instead of the not yet applicable chart on page 10-8. In addition, the crew cockpit brief was not completed properly to identify that the right (northern) runway was still under construction.

2.3 Crew Confusion and Crew Resource Management (CRM)

Runway confusion involves a single aircraft, and is used to describe the error when an aircraft makes "Unintentional use of the wrong runway, or a taxiway, for landing or takeoff. Positive Runway Identification is usually described as the unequivocal association of a runway with its correct identity prior to landing on it."³

The Aircraft continued losing height after the 'go-around' was initiated until it was approximately 0.3 NM from the threshold and at a height above ground level (AGL) of approximately 50 ft. The jetblast from the engines caused a construction compressor weighing approximately one ton to move.

During his interview, the captain stated that he saw two runways in-sight and he asked Dubai Approach about that but the latter did not communicate with him.

In his explanation of the confusion, the captain stated that the cross mark on the runway was not clear to him, and that the sunlight reflection had caused him to become confused.

The Tower Controller instructed BDR7625 to vacate the runway via exit Bravo. The captain had spent some time in discussion with the other crewmembers on how to reach and take that exit. On that time, the crew was referring to the not yet applicable page 10-8 that showed several exits designated as Bravo, but no Bravo 1 connecting the under-construction runway depicted in black with the parallel taxiway designated as Bravo. The captain had mistakenly perceived one of the exits as Bravo 1.

The CVR revealed that the captain became fixated on the right (northern) runway, which he used to land on, and, up to his perception, there were no other clues that the runway was not operational. The light cross sign and white cross marks were not observed by him. Page 10-8 of the Jeppesen Airway Manual supported the confusion by showing the future appearance of several Bravo intersections with the new runway; showing the under-construction runway more noticeably by a solid black line in comparison to the fainter depiction in gray of the active runway 30; and by showing the designation of the active runway 30 as taxiway Bravo. The caution mentioned below the chart was not sufficient to alert the crew to the fact that the chart depicted a future configuration which would be effective at a later date.

³ Reference: www.skybrary.com



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The human brain usually focuses on the most highlighted and noticeable shapes when scanning any graphic, and the conscious part of the brain is usually stimulated by bigger, wider, more visible, tangible shapes, etc. The perception of the human brain is always affected by stimuli, and the reaction of a person is usually based on his perception resulting from observation of the stimuli.

In addition to the captain, none of the flight crew was aware that the Aircraft was aligning with the wrong runway. The crew revealed that neither the cross light sign, nor the cross marks, were clearly visible to them, and that they could only see the cross light sign when the Aircraft had reached one mile from the threshold, when the captain announced the 'go-around'.

The Investigation believes that there was an inadequate attempt to positively identify the correct runway due to diminished alertness by the crew. CRM was not effectively implemented on the flight deck for effective cross checking by the co-pilot who was the pilot monitoring (PM).

Although the Controller's visual reference was not restricted regarding the two similarly orientated paved surfaces, the Investigation believes that the ATC safety barriers were insufficient to prevent confusion contributing to an approach to the wrong runway. The visual watch by the Tower Controller of the final approach of BDR7625 was not sufficient, particularly considering the physical layout of the runways and the possibility of confusion for pilots flying a visual approach. The Investigation believes that the combination of the physical layout of the runways, and the fact that a visual approach was being flown, required maximum alertness on the part of the Controller to ensure safety. There were no other ATC defending factors to prevent confusion by, for instance, highlighting the operational runway by illuminating its lights.

2.4 Visual Watch of Visual Landing Aircraft, and New Runway Risk Assessment

In visual landings, pilots have the main responsibility for landing the aircraft safely, but controllers also have an important role, as the last line of defense, in preventing misaligned aircraft from carrying out unsafe landings.

ICAO Document 4444 requires aerodrome controllers to maintain a continuous watch on all flight operations, on and in the vicinity of an aerodrome, as well as vehicles and personnel on the maneuvering area. Watch shall be maintained by visual observation, augmented in low visibility conditions by an ATS surveillance system, when available.

According to the Document, the functions of an aerodrome control tower may be performed by different control or working positions, such as: aerodrome controller, normally responsible for operations on the runway and aircraft flying within the area of responsibility of the aerodrome control tower; ground controller, normally responsible for traffic on the maneuvering area with the exception of runways; or clearance delivery position, normally responsible for delivery of start-up and ATC clearances to departing IFR flights.

The Tower Controller was not advised by the Approach Controller that the landing of BDR7625 would be performed visually. The omission in passing that critical information did not alert the Tower Controller to the fact that the Aircraft would require his visual watch.

The Investigation's assessment of the Controller's visibility from the Tower could not be precisely checked and the ability of a controller to determine which runway an aircraft is aligned with could not be exactly determined. The short distance between the two runways (250 meters), may not enable a controller to differentiate between them unless an initial triggering

factor is conveyed to the controller by any source such as a message received from an Approach controller or information is received from the crew. In addition, the available Tower radar display was unable to determine which runway an aircraft was aligned with.

The Investigation believes that the subsequent incident, which occurred on 10 July 2014, indicates that a Tower controller can discover an approach to the incorrect runway, provided that the controller has been previously alerted that the aircraft is carrying out a visual approach, even if the line of sight to the runways forms a small acute angle (figure 6).

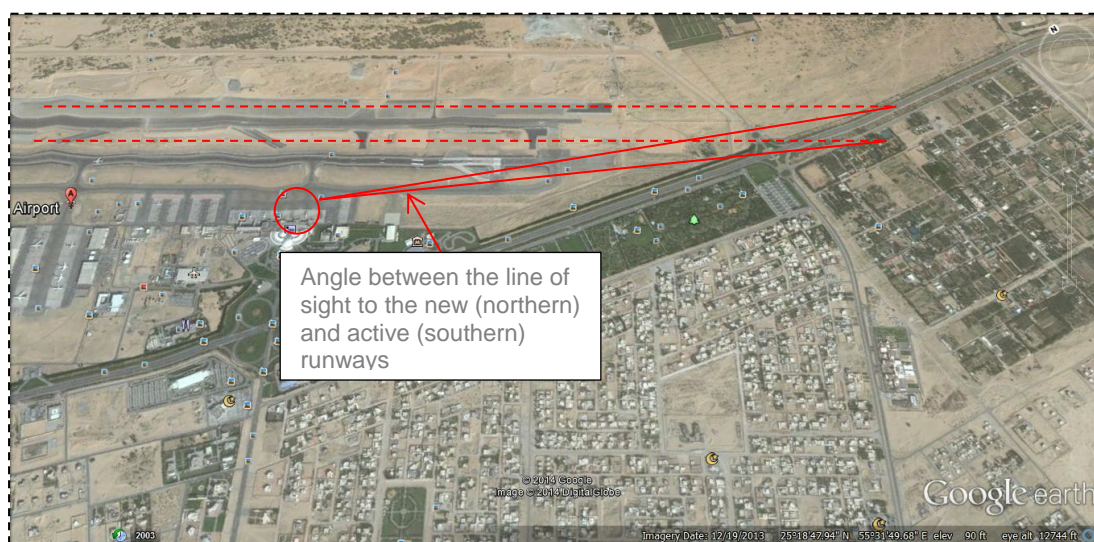


Figure 6. Line of sight from the Tower to the two runways

During the final approach of BDR7625, and at the moment the Aircraft appeared in his line of sight, the Controller was on the telephone coordinating the departure of two aircraft with Dubai Departure.

The time from the first contact with the Tower until the captain declared a 'go-around' was slightly more than two minutes (from 0318:58 to 0321:08), within which about one minute (from 0320:12 to 0321:08) was consumed by departure coordination.

Thereafter, the Tower Controller had no contact with the Aircraft until 0321:16 when he gave the 'go-around' instruction to "continue runway heading and maintain an altitude of 2,000 ft."

Eight seconds elapsed between the crew 'go-around' announcement and the Tower Controller's reaction. In that critical time period, the Controller's attention was fixated on coordinating the departing aircraft, which deprived him from hearing the two 'wrong runway' alerts that were transmitted, most probably, by the two departing aircraft crews (at 0321:00 and 0321:03).

"Monitoring traffic is a critical and complex activity, involving scanning and searching for static and dynamic information from a number of sources, such as a situation display, flight data display, or directly, as in the case of tower controllers. Some scanning methods and strategies are known to be particularly effective, and can be supported via training.

Scanning performance is affected by many internal factors, such as expectations (e.g. about an aircraft's flight path), and external factors, such as display design (e.g. font size). With



a thorough consideration of such human factors in design and training, scanning performance can be optimized.

Maintaining attention is a crucial issue in the work of the controller. The controller always needs to divide his attention through reasonable 'time-sharing', therefore the controller needs to ensure that tasks do not interfere with each other (e.g. monitoring traffic and checking a written procedure). "Sustaining attention over long periods when there may be little traffic is difficult, and the controller must ensure that regular scanning is maintained during periods of focused attention. Distractions, fatigue, health and personal factors can all affect attention and must be managed carefully."⁴

No evidence was discovered to indicate that the Tower Controller was affected by fatigue. In addition, the Tower Controller's workload was evaluated as being normal and the GMC and ADC positions could safely be assumed by one person. The Investigation believes that the lack of adequate information available to the Tower Controller, in that he was not made aware that BDR7625 was carrying out a visual approach, and his inadequate training in the change of the Airport layout did not enable the Tower Controller to provide effective (or you could use appropriate) assistance to the crew during the approach.

The ATS Provider's approach to the new runway project safety case was not comprehensive, as it did not focus on human performance. Human factor aspects were not considered appropriately, either in terms of understanding of the changes to the system, and their context, or in determining the possible effects of the changes on task performance. There was no evidence to the Investigation that, prior to the appearance of the new runway in the sight of a landing aircraft's crew, an observational study had been conducted to collect pre-operational data on controller performance. This data would have focused on workload, situational awareness, and teamwork.

Although it could not be determined whether the Tower workplace environment had an adverse effect on the performance of the Tower Controller, the Investigation believes that the Tower environment, as stated by the Controller and supported by the post-Incident GCAA audit, was below the requirements of the UAE Civil Aviation Regulations (CAR), Part VIII, Subpart 4, CAR 4.10(b), which could negatively affect and downgrade the performance of the controllers.

2.5 Aeronautical Information

The flight crew navigator updated the Jeppesen runway information page two weeks prior to the Incident flight. There was no issue with the update of the Jeppesen Airway Manual, but drawing the attention of the crew to the fact that two runways would appear in-sight during the approach, was not sufficiently emphasized during the dispatch brief.

⁴ Reference: Human Performance in Air Traffic Management Safety, A White Paper, EUROCONTROL/FAA Action Plan 15 Safety, September 2010.



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The Operator's existent operational safety management system did not manage the changed situation at Sharjah in a manner that could have mitigated the hazard of aircraft approaching an in-active runway. That the crew is responsible for managing such a changed situation, without the issue being considered through the use of an appropriate safety mechanism, was not a comprehensive operational approach that would give appropriate consideration to safety.

Regarding the Airport's published information, a proper NOTAM was issued in good time, but AIC 03/2014, issued by the Airport Authority, and effective as of 11 May 2014 for the purpose of including the new runway, was made in a manner that added to the confusion when Jeppesen entered the AIC information into the new Jeppesen runway information page dated 30 May 2014.

The Investigation believes that, although the AIC contained a written caution that formed the main source for Jeppesen page 10-8, the AIC caution statement was vulnerable to misunderstanding and could, in itself, contribute to runway confusion. Jeppesen page 10-8 added more to the confusion by containing the same AIC statement, but adding to it a runway chart that portrayed a future situation with a special highlight on the runway under construction, but not yet in use, and applying a taxiway designation to the active runway.

2.6 The Contract between the Airport Authority and the ATS Provider and the Safety Management in Sharjah ANS

The contract between the Airport Authority and the ATS Provider was signed in March 2014. The main aim of the contract was to provide ATS to the satisfaction of the Airport Authority.

The structure of the ATS Provider gave a direct reporting line from the Manager of ATS, who holds an ATS Provider managerial position, to the Assistant Director of Operations, who holds a managerial position in the Airport Authority.

In the same structure, the Head of Safety and Quality (HS&Q), a managerial position within the ATS Provider, reports to the Manager of ATS.

In addition to the responsibilities of his position, the HS&Q was included in the Tower's roster, and served as a current ATCO.

From the aspect of safety functions, a number of safety events had occurred within a period of time prior to and post the occurrence of the Incident. These incidents were not properly investigated and consequently no remedial actions were implemented. The Investigation reviewed the unit's investigation reports on the subject cases and could not find remedial actions related to any root causes such as human factors, environment, safety risk assessments or adequate procedures.

On the contrary, the conclusions of the unit's investigations either directed responsibility for the incidents to the flight crew, or were phrased in language designed to relieve the controllers of responsibility. The Investigation believes that the lack of a GCAA accepted SMS was the main cause of the insufficient internal investigations, and the consequent lack of appropriate remedial actions.



In addition, at the time of the Incident, the HS&Q had not attended appropriate accident/incident investigation training. Following the Incident, the HS&Q did attend a course on the subject.

From the chain of command aspect, the Investigation believes that the ATS Provider's direct vertical reporting line between the safety position and the operations postholder in the ATS Provider's structure could constitute a conflict of interest, although this was not proven to the Investigation. The safety position should be independent of the ATS executive management, and should report to the highest management level.

For the Airport Authority, there was no position within the management structure dedicated to ANS functions. The Airport Authority's GCAA accepted SMS, according to CARs Part VIII and Part X, was fragmented between the Airport Authority and the ATS Provider. The only clear link between both SMS was the reporting software tool. The partial safety management components that were in place within the Airport Authority were delegated to the ATS Provider without appropriate oversight being exercised by the Airport Authority, as required by the signed contract.

The Investigation believes that the Airport Authority had a passive role in the ANS activity, which did not assure that the bank of safety data that is necessary for the operation of an SMS would be sustained by the Airport Authority in case the contract with the ATS Provider is terminated for any reason.

The fragmented SMS elements, and the vague assignment of responsibilities, created a gap in the joint SMS, since a proper SMS system had not been established by the Airport Authority to bridge any gap created by a sudden termination of the ATS Provider contract.

One of the main key performance indicators (KPI) mentioned in the Service Level Agreement (SLA) was the 'go-around' KPI which was agreed by the two parties to be considered punitive, if the number of 'go-arounds' exceeded a specified target. In aviation literature, a 'go-around' is: "Performed for safety reasons, e.g. failure to acquire/loss of the required visual reference for a landing, a sudden change in wind velocity detrimental to continuing an approach, evidence or advice of a runway incursion or where an approach is unstabilised. One of the largest contributing factors to fatal accidents overall, and to all runway excursion accidents, is the failure to successfully execute a 'go-around' and/or a failure to make a timely decision to 'go-around'. However, the 'go-around' maneuver itself, and subsequent flight management, will introduce new risks."⁵

A 'go-around' is a consequence of different causes. It is a recovery action in case a safe landing is not expected to be achieved. A 'go-around' should be reported in precise words that accurately describe the cause behind it. Remedial actions should be directed to rectify the causes, rather than rectifying the consequences, unless the 'go-around' is not practiced

⁵ Reference: www.skybrary.aero



according to the standards and procedure. When reporting 'go-arounds', pilots and controllers should be accurate in describing what happened and should specify the landing environment.

The Investigation believes that the existence of the 'go-around' KPI in the contract between the Airport Authority and the ATS Provider is a source of hazard that may discourage controllers from reporting 'go-arounds', or from describing the 'go-around' accurately, or to assign responsibility to the flight crew for its execution.

It is probable that the Tower Controller had simplified the ROSI report of the Incident 'go-around' in order to avoid responsibility. Shortly after the initiation of the 'go-around', the Aircraft reached approximately 50 ft height AGL as stated by the crew, witnessed by the runway construction workers, and evidenced by the movement of the one-ton compressor. The actual observed height of the aircraft was approximately one tenth of the height stated in the Tower Controller's report.

Aviation accident historical literature contains fatal accidents caused by crews continuing unsafe approaches because of the concern of the pilots that they would be blamed for a 'go-around'.

3. Conclusions

3.1 General

From the evidence available, the following findings, causes and contributing factors were made with respect to this Incident. These shall not be read as apportioning blame or liability to any particular organization or individual.

To serve the objective of this Investigation, the following sections are included in the conclusions heading:

- **Findings-** are statements of all significant conditions, events or circumstances in this Incident. The findings are significant steps in this Incident sequence but they are not always causal or indicate deficiencies.
- **Causes-** are actions, omissions, events, conditions, or a combination thereof, which led to this Incident.
- **Contributing factors-** are actions, omissions, events, conditions, or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of this Incident occurring, or mitigated the severity of the consequences of the Incident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil or criminal liability.

3.2 Findings

3.2.1 Findings relevant to the Aircraft

- (a) The Aircraft was certified, equipped and maintained in accordance with the existing requirements of the Sudan Air Navigation Regulations.
- (b) The Aircraft was certified as being airworthy when dispatched for the flight.
- (c) There was no evidence of any defect or malfunction of the Aircraft that could have contributed to the Incident.

3.2.2 Findings relevant to the crew

- (a) The flight crew were licensed and qualified for the flight in accordance with existing Sudan Air Navigation Regulations.
- (b) The flight crew were medically fit and adequately rested to operate the flight.
- (c) The flight crew complement was adequate to operate the flight, and composed as per the Sudan Air Navigation Regulations and the Operator's standard operating procedures (SOP).
- (d) The flight crew's most recent flight to Sharjah Airport was about 10 weeks before the Incident flight.
- (e) The captain's actions and statements indicated that he was not familiar with the new runway construction at Sharjah.

3.2.3 Findings relevant to the flight operation

- (a) The flight was conducted in accordance with the procedures in the Operator's *Operations Manual*.
- (b) The dispatch brief was not sufficient to draw the attention of the crew to the new runway layout.
- (c) The approach was visual in visual meteorological conditions (VMC).
- (d) The alertness levels of the captain, the co-pilot and navigator, and their shared mental model of the new runway layout, were adversely affected by improper crew resource management (CRM).
- (e) The flight crew cockpit brief was not completed properly and did not identify that the right hand, new (northern) runway was still under construction.

3.2.4 Findings relevant to the Operator

- (a) The operator did not have in place a Safety Management System accepted by the Sudan General Civil Aviation Authority.
- (b) The crew resource management did not promote good flight deck synergy.

3.2.5 Findings relevant to the air traffic services and airport facilities

- (a) The Approach and Tower Controllers were properly licensed, medically fit and correctly rated to provide the service.
- (b) There was no proof that proper testing/training had been provided to the Tower Controller as was required by the risk assessment plan issued by the Airport Authority for the runway construction project.
- (c) The Tower Controller was coordinating the departure of two aircraft during the final approach of BDR7625 and after the 'go-around'. Therefore, he was unaware that BDR7625 was aligning with the incorrect runway, and he also did not hear the two warnings transmitted by the flight crews of the two departing aircraft.
- (d) The Approach Controller did not inform the Tower Controller that the Aircraft was flying a visual approach.
- (e) The Tower Controller did not appropriately divide his scanning and attention to his workload. He devoted most of his time to the two departing aircraft and not enough to the Aircraft carrying out a visual approach.
- (f) Although the line of sight to both runways from the Tower was at an acute angle, the Tower Controller could have discovered that BDR7625 was aligning with the wrong runway, had he been made aware by the Approach Controller that the Aircraft was flying a visual approach.
- (g) The Tower Controller's visual reference was not restricted on the two similar orientation paved surfaces, but the visual watch carried out by the Controller of the Aircraft during its final approach was insufficient.
- (h) The lights of the active runway were OFF during the first landing attempt and then switched to ON for the second landing.

- (i) The rest break requirements were adequate and the Tower Controller was not affected by fatigue.
- (j) During the period of the Incident, the roles of the GMC and ADC could be assumed by one controller if the complexity of traffic was light to moderate.
- (k) The ATS Provider's new runway safety case did not comprehensively focus on human performance.
- (l) The AIC, and the subsequent Jeppesen runway information page 10-8-*Temporary Construction Works*, were vulnerable to misinterpretation.
- (m) Page 10-8 was inserted in the Jeppesen Airway Manual when there was no need for it, since it reflected a future change.
- (n) Inadequate independence was afforded to the position of safety within the management structure of the ATS Provider organization.
- (o) The 'go-around' concept was improperly treated as a negative KPI in the service level agreement (SLA) signed between the Airport Authority and the ATS Provider
- (p) The Airport Authority organizational structure was not capable of producing independent functions of air navigation service (ANS) as a responsibility of the Airport Authority under the air traffic services (ATS) Certificate, nor did the structure have a clear mandate for oversight of the ATS functions.
- (q) The ATS part of the Airport Authority SMS was fragmented and was not integrated with the ATS Provider's partial SMS.
- (r) The Tower was equipped with an air traffic monitor from which it was difficult for a Tower controller to judge the alignment of an aircraft, unless careful and close examination was carried out by the controller.
- (s) The Tower workplace environment was below the requirements of the UAE Civil Aviation Regulations (CAR), Part VIII, Subpart 4, CAR 4.10(b).

3.3 Causes

The Air Accident Investigation Sector determines that the causes of the Runway Confusion Incident experienced by the flight crew of BDR7625 were:

- 3.3.1 The inability of the flight crew to identify the correct landing surface.
- 3.3.2 The crew had followed an airport chart in the Jeppesen Airway Manual that was not yet effective on the date of the Incident.
- 3.3.3 The insufficient CRM among the flight crewmembers.
- 3.3.4 The inadequate dispatch briefing which did not provide sufficient information and draw attention on page 10-8 of the Jeppesen Airway Manual.
- 3.3.5 The confusing Aeronautical Information Circular (AIC) statement and Jeppesen Airway Manual runway information page 10-8, which improperly depicted a chart that reflected the future situation rather than the existing situation.



3.4 Contributing Factors to the Incident

Contributing factors to the Incident were:

- 3.4.1 The insufficient visual observation of the BDR7625 approach by the Tower Controller.
- 3.4.2 The lack of information provided by the Approach Controller to the Tower Controller that BDR7625 was flying a visual approach and was entering his control area.
- 3.4.3 The insufficient testing/training provided to the Tower Controller to enable him to differentiate which runway an aircraft was aligning with.

4. Safety Recommendations

4.1 General

The safety recommendations listed in this Report are proposed according to paragraph 6.8 of *Annex 13 to the Convention on International Civil Aviation*⁶, and are based on the conclusions listed in heading 3 of this Report; the GCAA expects that all safety issues identified by the Investigation are addressed by the receiving States and organizations.

4.2 Corrective Actions taken

4.2.1 The ATS Provider

Immediately after the Incident, the ATS Provider issued an Operational Memo (OM) that required ATCOs remain/act in an extremely safety conscious way regarding the new runway project.

The OM contained initiatives to enhance the situational awareness of the ATCO such as:

- (a) Make sure that the blinds in the visual control room do not limit the view of the final approach.
- (b) Use the second window on the radar display zoomed in as close as possible to confirm that the aircraft is lined up for the correct runway.
- (c) During daylight, switch ON all lights on the operational runway at the 100% setting to serve as a visual aid to pilots.
- (d) When doubt exists, as to whether an aircraft is lined up for the correct runway, ATC can confirm with the pilot whether the Precision Approach Path Indicators (PAPI) are visual.

The OM requested the ATCOs to be vigilant and proactive in order to prevent any serious incidents.

A Supplementary Instruction (SI) was circulated to ATCOs on the day following the Incident, requesting the controllers to emphasize the runway in use, the runway lights shall remain ON 24 hours per day, including the sequence flashing lights. The OM requested the ATCOs to include the status of the lights in the handover and takeover.

⁶ Paragraph 6.8 of *Annex 13 to the Convention on International Civil Aviation* states: 'At any stage of the investigation of an accident or incident, the accident or incident investigation authority of the State conducting the investigation shall recommend in a dated transmittal correspondence to the appropriate authorities, including those in other States, any preventive action that it considers necessary to be taken promptly to enhance aviation safety'.

4.2.2 Jeppesen Company

The Jeppesen Office of Aviation Safety review of page 10-8 concluded that a better airport plan view (graphic) on page 10-8 would have utilized the “Area Under Construction” Symbolization (dashed outline) around the area where the new runway was being constructed, leaving the current/active runway intact as a solid black line and runway designation. The Jeppesen Office of Aviation Safety undertook to discuss this type of depiction and to review the relevant specifications for the Jeppesen Temporary Charts with the Jeppesen Corporate Technical Standards department for future airport Temporary Construction Information Charts.

4.3 Final Report Safety Recommendations

The Air Accident Investigation Sector recommends that:

4.3.1 The Operator, to-

Establish new policies and procedures or enhance existing policies and procedures to:

SR 10/2015

Ensure that any changes made to the aircraft on-board manuals, especially the Jeppesen Airway Manual, are appropriately conveyed to the flight crew in due time.

SR 11/2015

Enhance the dispatch system to draw the attention of the flight crew to any changes in aeronautical information. The dispatch system should ensure that the required information that is passed to the flight crew is based on a safety assessment of the changed information.

SR 12/2015

Enhance operational safety by assessing the safety impact of operational changes, and establish required procedures and flight crew training taking into consideration a risk assessment of the changes.

SR 13/2015

Enhance training in Crew Resource Management (CRM).

SR 14/2015

Enhance existing operational safety by establishing a more comprehensive Safety Management System (SMS).

4.3.2 Sharjah International Airport Authority, to-

Establish new policies and procedures, or enhance existing policies and procedures to:

SR 15/2015

Identify an air navigation service (ANS) function within the Airport Authority organization.



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SR 16/2015

Enhance the training of the air traffic controllers, especially in dealing with visual approach flights, and visual ground movement control, and in the appropriate division of scanning and attention to the visual control of departure, ground manoeuvring, and arrival of flights.

SR 17/2015

Review the current SMS in regard to fulfilling the requirements of a comprehensive SMS. The improved SMS is recommended to be totally separate from the Aerodrome SMS. The SMS should be owned by the Airport Authority, in line with the Civil Aviation Regulations requirements, and part of its function may be delegated to the ATS Provider with proper integration and oversight.

SR 18/2015

Review the contract with the ATS Provide based on safety assessments and thus eliminate, amend, or change clauses that may cause hazards in ATS operations, especially in the key performance indicators (KPI) section and more specifically related to the 'go-around' KPI.

SR 19/2015

Re-assess the Tower workplace environment and take the necessary remedy actions to comply with the requirements of the UAE Civil Aviation Regulations, Part VIII, Subpart 4, CAR 4.10(b).

4.3.3 Dubai Air Navigation Services, to-

SR 20/2015

Take the necessary measures to ensure that the Approach controllers inform the Sharjah Tower controllers of any flight cleared for a visual approach.

4.3.4 Jeppesen Company, to-

SR 21/2015

Carry out a suitable evaluation of likely pilot human factors aspects in the use of charts. This evaluation should be performed during the review of the specifications for future new and revised airport charts.

**Air Accident Investigation Sector
General Civil Aviation Authority
The United Arab Emirates**

Appendix A. A layout showing the location of the construction equipment

