



AIR ACCIDENT/INCIDENT INVESTIGATION COMMISSION

هيئة التحقيق بالواقعة الخطرة لطائرة شركة طيران الجزيرة

وفق القرار رقم 3886 / 2017

SERIOUS INCIDENT - FINAL REPORT

Aircraft Mid-Air Collision with The Cable of a Tethered Military Balloon

Operator:	Jazeera Airways
Make and Model:	Airbus A320-214
Flight Number:	J9-787
Nationality and Registration:	State of Kuwait, 9K-CAK
Place:	Kuwait International Airport
State of Occurrence:	State of Kuwait
Date of Occurrence:	27 August 2017

OCCURRENCE BRIEF

AAIS case No.:	AIFN/Special
Operator:	Jazeera Airways
Aircraft make and model:	Airbus A320-214
Registration mark:	9K-CAK (State of Kuwait)
Flight Number:	J9-787
MSN:	4162
Number and type of engines:	Two, CFM56-5
Date and time (UTC):	27 August 2017, 1317 UTC
Place:	State of Kuwait
Category:	Transport (Passenger)
Persons on-board:	142
Injuries:	None

INVESTIGATION OBJECTIVE

This Investigation is performed pursuant to article (5) of the *Kuwait Accident Investigation Regulations* promulgated by Decree 37 of 1960, and decision number 3886/ 2017, concerning forming commission for aircraft accident investigation.

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 Airbus A320-214 aircraft, registration 9K-CAK, and was notified to the Directorate General of Civil Aviation (DGCA), of the State of Kuwait.

After the initial/on-site investigation phase, the occurrence was classified as a 'serious incident'.

An investigation team was formed in line with the *Annex 13* to Chicago Convention, where the State of Kuwait has an obligation to institute an investigation as being the State of Occurrence, Registry, and the Operator.

The scope of the investigation into this serious incident is limited to the events leading up to the occurrence; no in-depth analysis of non-contributing factors was undertaken.

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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 serious incident
(Commander) – the commander of the serious incident flight
(Controller) – the Approach controller on duty
(Copilot) – the copilot of the serious incident flight
(Incident) – this investigated serious incident
(Investigation) - the investigation into this serious incident
(Operator) – Jazeera Airways
(Report) – this serious incident investigation Final Report
(Supervisor) – the acting Approach supervisor.
2. Unless otherwise mentioned, all times in this Report are 24-hour clock in Coordinated Universal Time (UTC), (Kuwait local time is plus 3 hours).

SYNOPSIS

On 27 August 2017, an Airbus A320-214 Aircraft, registration mark 9K-CAK, operated by Jazeera Airways, departed King Khaled International Airport (OERK) on scheduled flight number JZR787 to Kuwait International Airport (OKBK). There were a total of 142 person's on-board comprising two flight crew, four cabin crew, and 136 passengers.

On approach, the Approach Controller changed the approach sequence of the track to place JZR787 as number three where number two was given to a flight that requested priority landing and medical assistance upon arrival. JZR787 was instructed to stop its descent at 5,000 ft and proceed to position Initial Approach Fix (IAF) IVETA and hold.

After giving instruction for JZR787 to hold at IVETA, the Approach Controller started coordination with Tower and Ground Control for the medical request of the preceding flight. The flight crew of JZR787 did not receive further details of the holding information instructions (i.e. direction and heading) from the Controller prior to reaching the IAF IVETA.

As JZR787 was flying on a track of 332 to IAF IVETA, and had selected to hold over there, the Commander, who was the Pilot Monitoring (PM), made an entry on the Multi-function Control and Display Unit (MCDU) to set up a holding pattern at IVETA that was different from what he read back to the Controller. When the aircraft arrived at IVETA, it turned left for a parallel entry to the holding point, and after some 52 seconds from commencing the left turn, the Aircraft entered a restricted area and collided with the cable of an active operating tethered military radar balloon.

The right engine inlet cowl sustained damage due to the collision and the tethering cable of the military balloon was severed allowing the balloon to fly freely towards the sea.

The Investigation concluded that the causes of the serious incident were:

- (a) The Aircraft entered the restricted area where the balloon was tethered without crew awareness about restrictions.
- (b) The flight crew reported to Approach that the Aircraft will enter a right hand Turn holding pattern east of IVETA. The Pilot Monitoring (the Commander) intentionally entered a track of 062 right hand turn for the hold instead of the approach track of the aircraft IVETA 332 on the multi-function control and display unit (MCDU). This caused the aircraft to turn left over IVETA to execute a parallel entry.
- (c) The Approach Controller was distracted from closely monitoring the radar screen and thus from instructing JZR787 to avoid the restricted area when it started turning west of IAF IVETA.

The Report contains **13** Safety Recommendations addressed to the Operator, Kuwait ATC Management, and the Directorate General of Civil Aviation (DGCA) of the State of Kuwait.

ABBREVIATIONS

AAIS	Air Accident Investigation Sector
ACS	Approach control surveillance
AOC	Air operator certificate
APS	Approach procedure surveillance
ARC	Airworthiness review certificate
ATC	Air traffic control
ATPL	Airline Transport Pilot license
CPL	Commercial pilot license
CRM	Crew resource management
DGCA	Directorate General of Civil Aviation of the State of Kuwait
EAT	Estimated approach time
ft	Feet
GPS	Global positioning system
IAF	Initial approach fix
ICAO	International Civil Aviation Organization
KCASR	Kuwait Civil Aviation Safety Regulations
Kt	Knot
MCDU	Multi-function control and display unit
NM	Nautical miles
NOTAM	Notices to airmen
PM	Pilot Monitoring
SID	Standard instrument departure
SMS	Safety management system
SOP	Standard operating procedure
STAR	Standard arrival
TMA	Terminal approach area
UTC	Coordinated universal time

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1. FACTUAL INFORMATION

1.1 History of the Flight

On 27 August 2017, an Airbus A320-214 Aircraft, registration mark 9K-CAK, operated by Jazeera Airways, departed King Khaled International Airport (OERK) on scheduled flight number JZR787 to Kuwait International Airport (OKBK). There were a total of 142 persons on-board comprising two flight crew, four cabin crew, and 136 passengers.

As flight JZR787 approached Kuwait, it was vectored by air traffic control (ATC) for an instrument landing system (ILS) approach to runway 15R on an early right hand downwind and cleared to descend to 4,000 ft. and proceed SODAB – IAF IVETA – DATAR as number two in sequence following flight RJA640 which was 14 nautical miles (NM) ahead of JZR787 on the same track.

Flight JZR125 was number three in a different traffic sequence vectored for an ILS approach to runway 15R with an early left downwind proceeding to position PASIL. JZR125 was 22 NM behind JZR787.

Flight JZR125 requested priority landing and medical assistance upon contact with ATC due to a passenger who was suffering from chest pain. The Approach Controller, under the supervision of the ATC acting Supervisor, changed the approach sequence to place JZR787 as number three and JZR125 as number two by instructing JZR787 to stop its descent at 5,000 ft and proceed to position Initial Approach Fix (IAF) IVETA and hold.

Approach Controller cleared JZR787 from almost 15 NM direct to IAF IVETA. The ATC recording revealed that the Captain, as Pilot Monitoring (PM), had advised ATC that JZR787 was holding to the east, whereas he meant holding to the west according to his statement to the Investigation.

Approach Controller started coordination with Tower and Ground Control for the medical assistance for flight JZR125 after giving the instruction to JZR787 to hold at IVETA. However JZR787 did not receive details of the holding pattern (i.e. direction and inbound course) from the Controller prior to reaching the waypoint IAF IVETA.

As JZR787 was inbound on a track of 332 to IAF IVETA, and had selected to hold over IAF IVETA, the multi-function control and display unit (MCDU) gave the option of holding to the south-east on the present inbound course of 332 and a standard right turn onto an outbound course of 152. This would have brought JZR787 to the hold in the south-east sector and clear of a restricted area (OK R08). The Captain decided to hold west in the west sector of IAF IVETA and he inserted an inbound course of 062 with a right turn. Based on such input, the Flight Management Guidance System (FMGS) of the aircraft computed a parallel entry procedure for the aircraft to start the holding pattern. This placed JZR787 too close to the restricted area.

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As JZR787 turned left for a parallel entry, some 52 seconds after the time that the Aircraft had commenced a left turn, the Aircraft entered the restricted area where an active operating tethered military balloon radar was hovering using a suspended reinforced cable.

When he noted that JZR787 entered the restricted area, the Controller instructed the crew to turn left heading 060 but the crew read back a heading 080 and then flew the 080 heading. The Controller did not correct the read back. The Controller then instructed the crew to fly a heading of 020 and to descend to 3,000 ft, and to confirm that they had the balloon in sight.

The Controller informed the military ATC that JZR787 had entered the restricted area. The military ATC then brought the existence of the balloon at 12,000 ft. to the attention of the Controller. The crew replied that they did not have the balloon in sight due to low visibility. JZR787 was then instructed to descend to 2,400 ft.

The crew later contacted the Controller and informed him that they “Have some kind of turbulence suddenly could be that we [they] hit the balloon.” The Controller replied “Roger disregard it is away from you now turn right heading 120.”

Mohalab Radar (military ATC) informed Approach that the tethering cable of the military balloon had been severed by the aircraft making contact with the cable and the balloon flew freely towards the sea.

There was no report from the Pilots indicating JZR787 flight characteristics were abnormal in any way. No action was taken by the Controller to indicate that he believed that the Aircraft could have been in an emergency situation. No emergency phase was declared, and no notification was provided to the fire services to state that the Aircraft had collided with the balloon cable.

1.2 Injuries to Persons

There were no injuries because of the Incident. Table 1 shows details about the numbers of the people on-board.

Table 1. Injuries to persons						
Injuries	Flight Crew	Cabin Crew	Other Crew Onboard	Passengers	Total Onboard	Others
Fatal	0	0	0	0	0	0
Serious	0	0	0	0	0	0
Minor	0	0	0	0	0	0
None	2	4	0	136	142	0
TOTAL	2	4	0	136	142	0

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1.3 Damage to Aircraft

The Aircraft sustained damage and fractures to the right engine inlet and fan cowling. Two fractures for about one meter in the inlet cowl, and about 10 centimeters in the fan cowling.(Figure 1).



Figure 1. Engine inlet cowl damage

1.4 Other Damage

The reinforced cable of the tethered military balloon was cut and the balloon was liberated. The cable fell onto a motorway and the balloon was carried by the wind towards the sea where it was recovered damaged.

1.5 Personnel Information

1.5.1 Flight crew information

The flight crew consisted of the Commander (as Pilot Monitoring 'PM') and the Copilot (as Pilot Flying 'PF'). Table 2 illustrates the qualifications of both flight crewmembers.

Table 2. Flight crew data		
	Commander	Copilot
Age	50	38
Type of license	ATPL	ATPL
Valid to	8 May 2027	1 May 2026
Rating	A320 SIM JZR 32-8	A320 SIM JZR 32-8
Total flying time (hours)	11,835	6,310
Total on this type (hours)	5,044	2,074
Total last 90 days (hours)	292	159
Total on type the last 28 days	91.37	66
Total on type last 7 days (hours)	25.58	37
Last recurrent safety and emergency procedure training	20 April 2017	20 March 2017
Last proficiency check	21 August 2015	09 April 2014
Last line check	14 May 2017	11 May 2017
Medical class	Class 1	Class 1
Valid to	6 April 2018	13 March 2018
Medical limitation	Nil	VDL ¹

¹ VDL: Shall wear corrective lenses and carry a spare set of spectacles

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1.5.2 The Approach Controller

The Controller joined ATC in mid-2010, and held an ATC license, with area control and approach ratings, Approach Control Surveillance (ACS) and Approach Procedure (APS) rating, since October 2015. The Controller possessed an English language proficiency (ELP) level 5 valid until September 2018, and class 3 medical certificate valid until July 2019.

The Controller had taken 33-days annual leave during the period from 26 June to 28 July 2017. He was due to undergo a proficiency check during his leave period but no record was available to show that the proficiency check was carried out.

1.5.3 Acting Supervisor

The Supervisor joined ATC in November 1994, and at the time of the Incident he held a valid ATC license with ACS and APS ratings. The Supervisor possessed an ELP level 5 valid until January 2021, with class 3 medical certificate valid until July 2021.

The Supervisor was acting as a shift supervisor in the APS sector. The Investigation was not provided with any documentation to show that he had undergone training to carry out a supervisory role. There was no formal system of delegation within Kuwait ATC allowing a supervisor to act as a watch supervisor.

1.6 Aircraft Information

1.6.1 General

The Aircraft data is given in table 3.

Table 3. Aircraft data	
Manufacturer:	Airbus Industry
Model:	A320-214
Manufacturer serial number:	4162
Date of manufacture:	10 December 2009
Nationality and registration mark:	Kuwait, 9K-CAK
Name of the Operator:	Jazeera Airways
Certificate of airworthiness	
Number:	DGCA Form No. 25
Issue date:	11 January 2010
Valid to:	1 year as airworthiness review certificate (ARC) valid to 10 January 2018
Certificate of registration	
Number:	DGCA/1280
Issue date:	10 August 2016
Valid to:	No expiry date
Date of delivery	12 January 2010
Time since new (flight hours):	24,410:31
Last inspection and date:	10 July 2017
Engines:	CFM56-5
Maximum take-off weight (MTOW):	78 tons

1.6.2 Maintenance

According to the Aircraft technical logs, there were no reported significant technical defects prior to the Incident,

1.7 Meteorological Information

Table 4 shows the METAR at Kuwait International Airport for the period 1200 to 1400 UTC of the day of the Incident. No significant weather was contained in the METAR.

Table 4. METAR, 27 August 2017, 1200 to 1400 UTC
METAR/SPECI from OKBK, Kuwait International airport (Kuwait).
METAR OKBK 271400Z 13012KT 5000 -HZ SKC 38/28 Q0998 NOSIG
METAR OKBK 271300Z 12013KT 6000 SKC 39/25 Q0998 NOSIG
METAR OKBK 271200Z 12015KT 6000 SKC 39/25 Q0998 NOSIG

1.8 Aids to Navigation

During site visit to the Approach operations room, it was observed that the display radar vector map at the controllers' radar position contained two military restricted areas (OKAS and OKAJ). It was also noted that position IAF IVETA fell inside the OKAS restricted area. Both restricted areas overlapped in the OKBK Terminal Approach Area (TMA).

Through discussion it was also noted that the controllers were vectoring traffic coming from the south and south-west inside both restricted areas for landings on runway 15R. Unlike the Kuwait aeronautical information publication (AIP), some operator's Jeppesen charts given to the crew did not depict the restricted area. (Figure 2).

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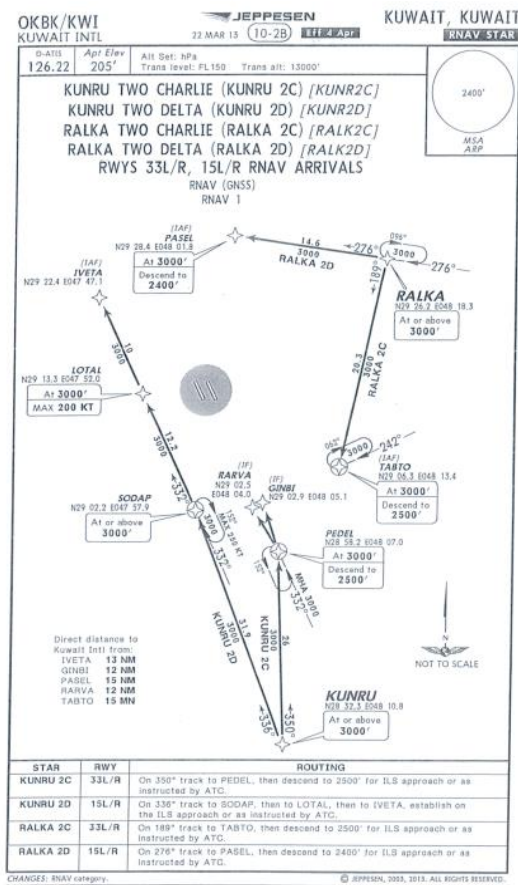


Figure 2. Comparison between Jeppesen and AIP approach charts

1.8.1 Flight Management and Guidance System (FMGS)

The FMGS consists of computers to provide navigation and guidance command to maintain the aircraft flight profile in accordance with the database information or the pilot input data. The pilot can select via the interface the “Multi-function Control and Display Unit (MCDU)” by keying on alphanumeric pad to program or modify flight routes including holding patterns to set up the FMGS for the aircraft to fly. In the case of inserting a holding pattern, the crew member could select a Holding Pattern that is in the database or insert the inbound magnetic track and direction of turn based on a fix or waypoint.

The FMGS offers three types of entry into holding patterns namely Direct, Teardrop or Parallel Entry. An extract from the Flight Crew Operating Manual is indicated below for illustration. The holding patterns would follow the international standards to be a right hand turn holding pattern.

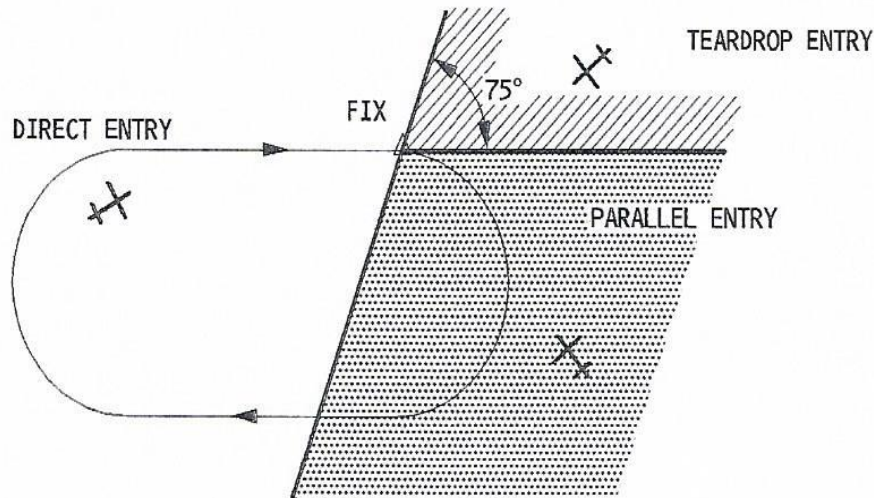
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At the time of the occurrence, the pilot inserted an inbound course to IVETA to be 062 and a right hand turn in the holding pattern. The FMGS computed the entry to be a parallel entry as depicted in the extract below.

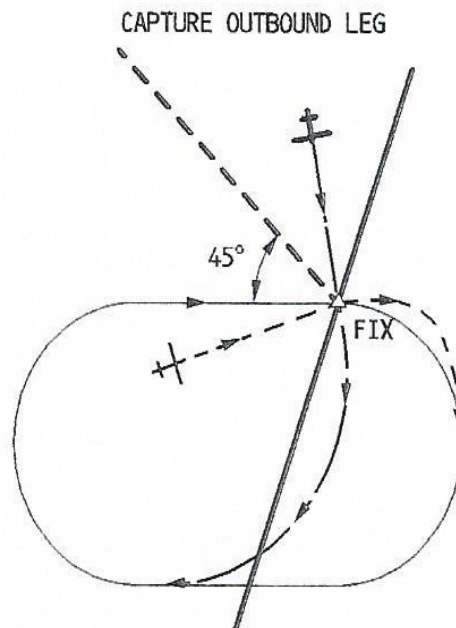
HOLDING PATTERN ENTRIES

The FMGS offers three types of entry into holding patterns :

1. Direct entry
2. Teardrop entry
3. Parallel entry

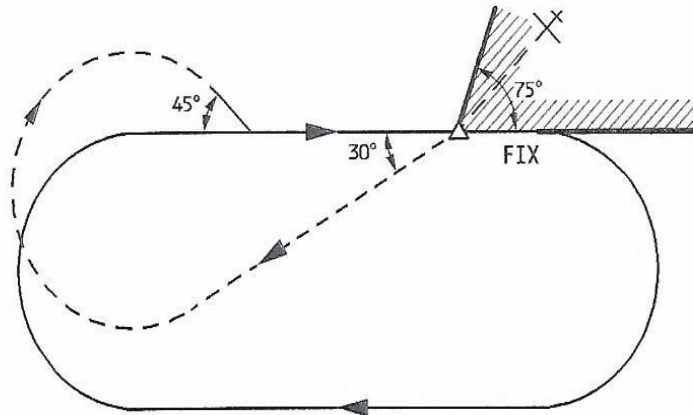


1. The direct entry

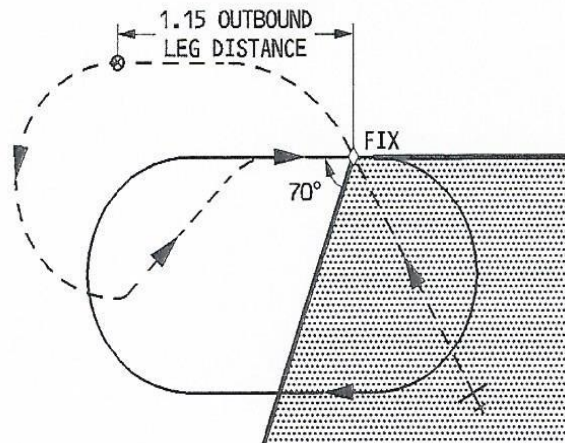


Extract from FCOM - Direct Entry

2. The teardrop entry

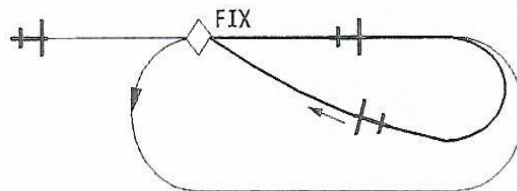


3. The parallel entry



Note: If the leg the aircraft is flying toward the holding fix is on a "limit" between a teardrop entry and a parallel entry, the FMGEC may compute and display either of the two entries. The pilot should keep this in mind and not assume that the FMGC is malfunctioning.

If the flight plan leg toward the hold entry fix is on a course that is the reciprocal of the inbound course of the holding pattern, the aircraft will fly a parallel entry.



Extract from FCOM – Teardrop and Parallel Entry

1.9 Communications

On the day of the Incident, the Controller was using a handset rather than a headset for communication with flights, as no headset was available.

A review of the ATC audio recording for the Incident flight showed that the Controller employed non-standard phraseology consistently during communications with the Tower and with Ground Control.

Communications between Approach and the Aircraft lacked information necessary to establish proper holding over IAF IVETA. Approach voice recording indicated that the Controller was giving higher priority and concentration to communications with JZR125, than he applied to JZR787.

During the time of the Incident, all controllers in the operations room were using handsets instead of the standard headsets which caused the operations room to be noisy.

1.10 Aerodrome Information

Kuwait International Airport (OKBK), was a certificated aerodrome under the Kuwait Civil Aviation Safety Regulations (KCASR).

The airport was equipped with two runways: runway 33/15R and 33/15L measuring 3,400 meters in length and 60 meters in width.

The runways can accommodate simultaneous landings and takeoffs.

1.11 Flight Recorders

Both the Digital Flight Data Recorder (DFDR) and the Cockpit Voice Recorder (CVR) were offloaded from the Aircraft and forwarded to the flight recorders downloading entity. Visual inspection of the recorders did not reveal any damage.

The Investigation found that the CVR had been over written and contained no recorded information related to the Incident. The DFDR was downloaded and all necessary parameters were appropriately recorded and used for the Investigation.

1.12 Wreckage and Impact Information

The Aircraft was intact.

The military balloon tethering cable was cut and fell onto a nearby motorway. The balloon was carried by the wind to the sea and was subsequently located.

1.13 Medical and Pathological Information

No medical or pathological investigation was conducted because of this Incident.

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1.14 Fire

There was no sign of fire.

1.15 Survival Aspects

There were no injuries to the passengers or crew.

1.16 Tests and Research

A simulator trial was carried out to simulate the circumstances of the flight with the aircraft flying on a track of 332 with autopilot engaged and proceeding to IVETA. Based on the information obtained during the investigation, a right turn holding pattern with an inbound course of 062 was inserted via the MCDU in the FMGS to simulate the action taken by the pilot. The information displayed to both pilots on the navigation display in their primary field of view was as below.



Presentation to the pilots for the entry procedure for right turn holding pattern at IVETA with an inbound course of 062 as computed by FMGS.

1.17 Organizational and Management Information

1.17.1 The Operator

Jazeera Airways operates under an Air Operator Certificate (AOC) issued by the Directorate General of Civil Aviation (DGCA) of the State of Kuwait.

The Operator has a fleet of 11 Airbus A320 aircraft. The DGCA Aviation Safety Department carry out safety oversight on all activities of the operator.

1.17.2 Kuwait Air Traffic Control (ATC) Management

Kuwait ATC Management operates under KCASR, Part 11.

Air traffic services are divided into three parts:

1. Area control service
2. Approach control service
3. Aerodrome control service.

Management of the ATC is under the Director of Air Navigation Services as the service provider who would apply to the Director of Aviation Safety Department (ASD) for all necessary approval.

1.17.2.1 Manual of Air Traffic Services (MATS)

The MATS contains all instructions and procedures for ATS controller to follow. An extract of the MATS is attached below for reference. Para 4.4.2.3.3 and 4.4.2.3.4 specifically required the duty controller to provide inbound magnetic track to the holding fix and direction of turns.

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M.A.T.S. STATE OF KUWAIT M.A.T.S.
APPROACH AND AREA CONTROL PROCEDURES

4.4.2 HOLDING INSTRUCTIONS

4.4.2.1 When instructing an aircraft to hold, the time at which an aircraft is permitted to continue its flight or may expect a further clearance shall be given in addition to the holding level.

4.4.2.2 Additional holding instructions shall be issued if **one** of the following conditions prevails :

4.4.2.2.1 The aircraft has to follow a holding procedure other than the published one; or

4.4.2.2.2 the pilot reports that he is not familiar with the published holding procedure; or

4.4.2.2.3 the aircraft is required to hold over a point for which no holding procedure is published.

4.4.2.3 When issuing additional holding instructions, the following items shall be mentioned :

4.4.2.3.1 Holding fix;

4.4.2.3.2 Holding level;

4.4.2.3.3 Inbound magnetic track to the holding fix;

4.4.2.3.4 Direction of turns;

4.4.2.3.5 Time along outbound leg or distance values, if necessary;

4.4.2.3.6 Additional instructions, if necessary.

4.4.3 PROCEDURES FOR THE CHANGE OF FLIGHT RULES

4.4.3.1 Aircraft on flight plans specifying that the initial portion of the flight will be uncontrolled, and that the subsequent portion of the flight will be subject to ATC by an ACC after the control area of origin, shall be advised to contact the ACC in whose area controlled flight will be commenced for the clearance.

4.4.3.2 Change of flight rules from IFR to VFR :

4.4.3.2.1 Flights for which a Y flight plan has been filed shall be cleared to the point where the IFR portion terminates.

1.17.3 ASD Safety Oversight of ATC services

The DGCA/ASD is the authority in the State of Kuwait responsible for promulgating regulations and carrying out oversight functions related to Kuwait ATC.

In July 2017, the DGCA/ASD conducted an audit of Kuwait ATC. The audit was performed by external auditors from another civil aviation authority in the region. The audit results were provided to the DGCA/ASD.

There were eight non-compliance audit findings which were categorized as level one and level two.

In accordance with the requirements of DGCA, Level One findings should be resolved as soon as possible and Level Two findings shall be resolved within 30 days. No documented corrective action related to the above audit findings were provided to the Investigation.

1.18 Additional Information

There was no other information relevant to the circumstances leading up to the Incident.

1.19 Useful or Effective Investigation Techniques

The Investigation was conducted in accordance with the Kuwait Accident Investigation Regulations promulgated by decree 37 of 1960, and decision number 3886/2017 concerning forming commission for aircraft accident investigation, and in accordance with the Standards and Recommended Practices of Annex 13 to Chicago Convention.

2. ANALYSIS

2.1 General

The Investigation collected data from various sources for the purpose of determining the causes and contributing factors that led to the Incident.

This analysis covers the issues of required safety briefing, the operations, human factors, and the Kuwait Civil Aviation Safety Regulations (KCASR).

This part of the Report elaborates the circumstances of every investigation aspect related 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 Flight Crew Performance

JZR787 was cleared direct to IAF IVETA and to hold there. There was no published holding procedure for IAF IVETA. The flight crew had not requested holding instructions from ATC relative to the hold entry such as the inbound radial to IVETA, left or right turn, and estimated approach time.

According to the Commander's statement, Approach Controller cleared JZR787 from almost 15 nautical miles (NM) direct to IAF IVETA and hold. The Commander advised the Controller that JZR787 would hold to the east. The Controller relied on the Commander's statement without requesting verification.

In the absence of any holding instructions, the Commander (who was Pilot Monitoring 'PM') inserted on the multi-function control and display unit (MCDU), an inbound course of 062 and a right turn. Based on the existing track when the aircraft was flying on a track of 332, the FMGS would have computed a parallel join holding pattern. The aircraft would be holding to the west of IVETA instead of what the commander advised of holding to the east. The Copilot (who was Pilot Flying 'PF') stated that he noticed the Commander's entry on the MCDU, and figured out the mismatch between the Commander's action on the MCDU and his stated advice to Approach. The Copilot did not comment to the Commander in relation to the MCDU entry since by now the entry procedure had been computed to be a parallel join with a left turn over IVETA to start the joining procedure. This information would have been displayed to both pilots on the Navigation Display immediately in front of their primary field of view. Not knowing the presence of a Restricted Area in the vicinity of IVETA, it was highly likely that both pilots were content with the FMGS computed parallel entry procedure with a left turn over IVETA.

However, according to the Copilot's statement, during the approach of JZR787 to IAF IVETA, the intention of the Copilot (who was PF), and his understanding of the ATC clearance, was to proceed and hold over IAF IVETA on the present inbound course of 332 with a left turn.

A holding to the south of IVETA with a left turn might possibly have averted the occurrence. Had the Copilot (PF) discussed with the Commander the scenario, it might be possible a query would have arisen and that the crew would have requested further instructions from the Controller.

With reference to the Commander's statement, as JZR787 approached IAF IVETA, the Commander inserted the hold over IAF IVETA with an inbound course of 062 and a right turn. The Copilot saw the hold on the NAV display as it had been entered by the Commander. What he saw was different from what he expected to see. According to the Copilot's statement, he was planning to hold on the present inbound course to IAF IVETA which was 332 with a left turn. The flight crew felt no threat and assumed Approach Controller clearance with pilot discretion to hold over position IAF IVETA, due to insufficient information on the Jeppesen Kuwait STAR chart, therefore the Copilot did not inform the Commander of his intentions and his expectation of the planned entry into the hold, and what the Commander inserted into the MCDU.

During the interview, the Commander explained that his choice of an inbound magnetic track of 062 was to follow the traffic pattern and make the aircraft ready to leave the holding pattern to join the right base for RWY 15R. The Commander further opined that he was reluctant to insert an inbound magnetic track of 332 to hold at IVETA with a right turn (i.e. holding to the south of IVETA) because the right hand turn could put the aircraft close to the extended centerline of RWY 15R. Based on an inbound magnetic track of 062, a right turn holding pattern at IVETA with the aircraft approaching for a parallel join, it appeared that both pilots were content with the FMGS computed entry.

As per the Operator's standard operating procedure (SOP), the Copilot (PF) should brief the Commander (PM) on his intentions and request the Commander to insert the hold over IAF IVETA into the MCDU. Both flight crew should adhere to and follow the Operator's SOP and task sharing and monitoring. The PF should be assertive and exercise good crew resource management (CRM).

The Investigation believes that communications between the flight crew members, and between the flight crew and Approach, was insufficient to confirm a common understanding, and to establish a common mental model, of the existing situation and planned actions. The Controller did not pass the necessary information as required by the procedures, the flight crew did not cross check with Approach to verify all aspects of holding at IAF IVETA. The flight crewmembers did not establish a high level of situational awareness.

As JZR787 turned left for the parallel entry to hold at IAF IVETA, Approach gave JZR787 a further left turn heading of 060 and then 020. During the turn, the crew felt what they described as "turbulence". It was only when Approach asked JZR787 to confirm if they had a balloon in sight (where they replied

negative), that the crew linked the “turbulence” to a possible collision with the balloon.

The flight crew advised Approach that they suspected that a collision with the balloon had occurred. Approach replied “roger” and advised the crew to disregard his question since the balloon was not near the Aircraft.

According to the flight crew, they had checked the cockpit for any abnormal indications and had found none. The flight crew could have taken an extra safety step by asking the cabin crew to check outside and report anything unusual to them. (A cabin crew member entered the cockpit after landing to show the Captain a media clip that a passenger had taken of the damaged flight engine).

However at a time when all parameters were normal and that the aircraft was approaching final to land at RWY 15R, it would not be unreasonable for the pilots to assume all things were normal for the landing.

The CVR lacked recorded voice for the crew which also could not enable the Investigation to measure the crew fatigue from their voice, but the Investigation, from the circumstantial evidence, believes that’s there was no fatigue issue behind the crew performance.

2.3 The Operator’s Manuals

2.3.1 Operations Manual

Kuwait AIP standard arrival chart instrument and approach chart – ICAO RNAV (GNSS) STARs RWY 15L-15R & RNAV ILS DME RWY 15R, showed the restricted area in close proximity with the IAF IVETA. If traffic holding on the west sector of IAF IVETA after one and a half minute at the holding speed of maximum 200 kts, on outbound heading, an aircraft would cross a distance of about five nautical miles and would enter the restricted area.

The restricted area in charts distributed to the crew was neither illustrated in the Operator’s Jeppesen RNAV STARs charts, nor was it included in the Jeppesen Approach chart. RNAV ILS RWY 15R showed the small part of the restricted area without publishing the height for the area. Accordingly, the flight information that was provided to the crew in the brief package lack critical information concerning the restricted area.

The Operator did not carry out a crosscheck between the Jeppesen charts and its relevant standard arrival chart in the Kuwait AIP. The Operator did not notice this mismatch between the two documents. Therefore, insufficient or obsolete information was provided to the crew, with no preventive measures in place.

The Operator’s Jeppesen chart STARs, SID and Approach shall highlight the restricted, prohibited, and danger areas and the height as described in the AIP STARs, SID and Approach charts, for flight crew situation awareness and to enhance safety.

The Operator's briefing package notice to airmen (NOTAM) or company NOTAM should highlight the restricted area and the presence of military tethered balloon activity in vicinity of IAF IVETA and also it is not illustrated on the Operator's Jeppesen RNAV STARs charts.

2.3.2 The Operator's safety management system (SMS)

The Operator did not exercise a safety risk assessment, through the SMS, to identify these hazards. Once the mitigation has been approved and implemented, any associated impact on safety performance provides feedback to the Organization's safety assurance process. This is necessary to ensure integrity, efficiency, and effectiveness of the defenses under the operational conditions.

The Operator's manuals did not highlight the shortage of information in the Jeppesen manual. There was also no report submitted by the crew to highlight this deficiency.

In the SOP, the crew normally refer to Jeppesen rather than to AIP. The Jeppesen is a handy manual to the crew and is more pilot-oriented.

The Operator's quality management system should include all planned and systematic actions necessary to provide confidence that all operations are conducted in accordance with all applicable requirements, and SOP, therefore quality inspection should be carried out where the primary purpose is to observe a particular event/action/document etc., in order to verify whether established operational procedures and requirements are followed during the accomplishment of that event and whether the required standard is achieved.

2.4 Air Traffic Control (ATC)

At the time JZR125 requested priority to land, the distance between JZR787 and JZR125 was more than 22 NM which would normally allow JZR787 to land as number two ahead of JZR125 without causing any delay for JZR125. The Investigation determined that Controller instructed JZR787 for holding over IAF IVETA without counting the distance and time for both flights to make an uneventful landing and avoiding JZR787 for holding.

The Controller did not pass the necessary information to JZR787 for entering a non-published hold, as required by local procedures.

It took about a minute for the Aircraft to enter the restricted area after the initiation of the left turn. The Investigation believes that the Controller had sufficient time to turn JZR787 back to the right to avoid the restricted area, provided that he was actively monitoring the radar and was not distracted by coordination function with Ground Control for providing assistance to JZR125. This coordination would be more appropriately performed by a supervisor or assistant, rather than the active controller. This requires appropriate procedure to be in place.

The Investigation could not determine whether the exceedance of the Controller's proficiency check, from due date had contributed to his insufficient traffic monitoring or not.

On the ATC equipment side, the display radar vector map on the Controller's radar position was not updated to show the map of all positions in consistency with the AIP chart. There was also no sufficient procedure to guide the Controller in vectoring departure and arrival traffic around the restricted area which was very close to the TMA.

The Investigation reviewed the Kuwait ATC Management records and could not find a safety risk assessment document to the risk of the restricted area (OK R08) close proximity to runway 15. The Investigation believes that should a proper safety risk assessment be initiated, it would be highly probable that the hazard of entering the restricted area during any aircraft holding for any reason, is identified and its risk controls measures are developed.

Accordingly, the Investigation recommends that Kuwait ATC Management perform an exercise of risk assessment for close proximity of the restricted area to runway 15. This exercise may then be applied to other operational areas where the ATC safety management may highlight hazards, analyze the risk, and then take appropriate controls.

The military ATC was not aware of JZR787 entering the restricted area until the Approach Controller called and informed them about the situation, only then did the military advice Kuwait ATC radar to alert the JZR787 crew to the existence of the balloon in the restricted area, at 12,000 ft.

2.5 The Oversight of the Directorate General of Civil Aviation (DGCA)

The findings of the audit that was carried out on Kuwait ATC Management was not addressed appropriately. At least the level one findings (concerning the safety and quality management systems) should have been addressed by Kuwait ATC Management and appropriate corrective action been planned. No document of corrective actions to the audit findings was provided to the Investigation.

Normally, effective SMS helps the organization management monitor its performance through mechanism beginning from reporting system, hazard identification, risk assessment, and risk control measures. If the organization is backed up by effective safety management system, the organization will have an opportunity to identify latent hazards and take corrective actions.

Had the Controller alerted the crew to their mistake in commencing a left turn instead of right turn it could have prevented the Aircraft from entering the restricted area. According to ICAO *Document 4444 – Air Traffic Management:*

“The Radar display may be used to provide radar vectoring to arriving aircraft for the purpose of establishing an expeditious and efficient approach sequence, provide radar vectoring to arriving aircraft for the purpose of establishing an expeditious and efficient approach sequence and maintain radar monitoring of air traffic where tolerances regarding such matters as adherence to track, speed or time have been prescribed by the appropriate ATS authority, deviations are not considered significant until such tolerances are exceeded.”

These functions of the radar display were not practiced by the Controller when the crew reported about their intention to inbound IAF IVETA by mentioning right turn but starting a left turn. The Investigation believes that by referring to the radar screen, the Controller could have realized the aircraft trajectory and corrected it.

The proximity of the restricted area was not taken into consideration by Kuwait ATC Management in terms of risk assessment had deprived Kuwait ATC Management from identifying the need for the controllers training in that phase of flight for handling the traffic in that area.

What also added to the Controller’s insufficient situational awareness was the distraction caused by his involvement in the emergency handling of the other aircraft. Such involvement could have been limited if the supervisor assumes his role appropriately. This task sharing could have been clearer, provided it is well documented by procedure laid down in the ATS unit manual, and sufficient training is given to the controllers and supervisor. The Investigation believes that the task sharing between the Controller and the Supervisor was implemented inappropriately and the Supervisor was not competent enough to establish the task sharing and relieve the Controller from managing the medical emergency and focus on managing the traffic.

The Controller was alerted by the military ATC only when the Aircraft had already entered the restricted area. Identifying the mistake was less likely than required because there was not in place coordination procedures through mutual written agreement between the civil and military ATS units. The Investigation believes that this agreement should consider the risk that stems from the proximity of the restricted area with the approach waypoint (IAF IVEAT).

3. CONCLUSIONS

3.1 General

From the evidence available, the following findings, causes and contributing factors were identified 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 the 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 requirements of the Kuwait Civil Aviation Safety Regulations (KCASR).
- (b) The Aircraft was airworthy when dispatched for the flight.
- (c) The Aircraft sustained damage to the right engine inlet cowling and fan cowling because of the collision with the balloon cable.

3.2.2 Findings relevant to the flight crew

- (a) The flight crewmembers were licensed and qualified for the flight in accordance with the requirements of the KCASR.
- (b) The flight crew did not request holding instructions from ATC.
- (c) The Commander (pilot monitoring 'PM') informed Approach of his intention to hold to the east, but did not follow through with those intentions without informing ATC of the changes.
- (d) The communications of the Commander with Approach were not in accordance with standard ICAO phraseology for radio communication.

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- (e) The Commander did not brief the Copilot (pilot flying 'PF') of his intentions for the inbound course.
- (f) The CRM was not of a sufficiently high standard in terms of planned actions and task sharing.
- (g) The flight crew did not alert Approach of any level of emergency declaration after the Aircraft collision with the balloon.

3.2.3 Findings relevant to the flight operations

- (a) The Operator's route briefings manual and Jeppesen RNAV STARs charts did not include sufficient information for the crew about restricted, danger, and prohibited areas and their published heights.
- (b) The Jeppesen approach chart RNAV ILS RWY 15R showed the danger and prohibited areas and small part of the restricted area without the published height for each area.
- (c) No safety risk assessment was carried out by the Operator to assess the possibility of an aircraft entering the restricted area which was in close proximity to runway 15.
- (d) The Operators' operations manual, did not include sufficient information regarding holding procedures.

3.2.4 Findings relevant to ATC

- (a) The Approach Controller did not follow the local procedure to issue the radial and direction of turn when instructed the Aircraft to hold over non-standard holding position or over fix point. (Include a copy of the instruction from the ATC manual about the requirement to issue instruction on "Inbound radial and turn direction" for a Holding Pattern.)
- (b) The distance between JZR787 and JZR125 was sufficient to allow the JZR787 to land ahead of JZR125 without instructing the JZR787 to hold over non-published holding point.
- (c) Kuwait ATC Management had no procedure in place for controllers to handle traffic of aircraft declaring medical emergency. No procedures existed for controllers in terms who is responsible to coordinate with Ground Control if needed.
- (d) No clear written procedure outlining interaction between ATC and airport Ground Control for information/service exchange. and responsibility for coordination
- (e) The Controller was distracted from monitoring the radar screen and had not instructed JZR787 to avoid the restricted area when it started turning west of IAF IVETA.
- (f) The Controller did not correct the crew error when the Pilot Monitoring read back the heading 060 instead of the Approach instructed 080 heading.

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- (g) There was no sufficient task coordination in the ATC for supporting the Ground Control in handling the medical emergency landing.
- (h) Although the Controller knew that JZR787 had collided with the tether cable of the balloon, he did not take action to initiate local emergency.
- (i) Kuwait ATC Management had no system in place for performing simulator emergency training exercises on regular basis for all controllers.
- (j) The annual proficiency check conducted for the Controller was not sufficient as it consisted of only practical check without written, oral, emergency simulator exercise, and random tape review to check Controller's phraseology standard.
- (k) The Controller was away on annual leave for consecutive 33 days during which the proficiency check was due but was not conducted upon his return prior to performing his operational duties.
- (l) Kuwait ATC Management had no system in place to ensure that controllers use standard ICAO phraseology.
- (m) The audio-video recording system was unserviceable for about three years prior to the date of Incident. This hindered the Investigation from drawing a sequence of events timeline.
- (n) Kuwait ATC Management allowed all controllers in the operation room to use handset instead of headset in all communications.
- (o) Kuwait ATC Management did not ensure that the acting Supervisor was competent to assume ATC supervisor role.
- (p) Kuwait ATC Management does not ensure documentation is maintained and up-to-date. The AIP chart in the operation room, the quick file reference, ATC operation manual, the emergency manual plan, and all documentations manuals provided to controllers were not up to date.
- (q) The restricted area was erroneously entered by previous flights with no reports submitted by controllers to the management. The Investigation believes that the Incident reporting did not comply with the safety management systems (SMS) required by the KCASR, Part 19.
- (r) The radar monitors were not updated to display maps for all positions that are compatible with the AIP chart.
- (s) Two radio communication in Arabic between Approach and military ATC took place but were not recorded by ATC audio recording system. These communications took place when the JZR787 entered the restricted area, where the military alerted the controller to instruct JZR787 to evacuate the restricted area due to presence of the balloon at 12,000 ft.
- (t) There were no corrective actions submitted by the Kuwait ATC Management to the Investigation based on the last audit that was conducted one month before the Incident.

- (u) Kuwait ATC Management did not develop procedures to guide the controllers when vectoring departure/arrival traffic around the restricted area as it is very close to the TMA. In addition, no safety risk assessment performed for the location of the restricted area and the close proximity to runway 15.

3.2.5 Findings relevant to the Directorate General of Civil Aviation (DGCA)

- (a) The DGCA carried out an audit on the Kuwait ATC Management one month before the Incident, and an audit report was submitted to Kuwait ATC Management. There was no corrective action plan submitted to the DGCA.
- (b) The DGCA oversight on the Kuwait ATC publication and documentation was not effective to assure that the in-place AIP chart, quick file reference, the ATC operation manual, the emergency plan manual, and hand-outs provided to the controllers are reviewed and updated regularly.
- (c) The DGCA did not follow the system in place to monitor corrective actions against findings raised by its oversight system.
- (d) The DGCA have not performed the regulatory oversight activity to ensure implementation of the SMS.

3.3 Causes

The Investigation determines that the causes of the Aircraft mid-air collision with the balloon were:

- (a) The Aircraft entered the restricted area where the balloon was tethered without crew awareness about flying in that area.
- (b) The flight crew reported to Approach that the Aircraft will hold east of IVETA, they instead entered the hold with an inbound track of 062 that placed the aircraft to the west of IVETA.
- (c) The insufficient crew resource management prevented the PF (the Copilot) from attracting the attention of the PM to his error of entering conflicting command on the MCDU.
- (d) The Approach Controller was distracted from monitoring the radar screen and to instruct JZR787 to avoid the restricted area when it started turning west of IAF IVETA.

3.4 Contributing Factors to the Incident

The Investigation identifies the following contributing factors to the Incident:

- (a) The radar monitors were not updated to display maps for all positions that are compatible with the AIP chart. The lack of restricted areas in these monitors prevented the Approach Controller from addressing the erroneous entry to the restricted area and to take the necessary preventive action.
- (b) The DGCA oversight did not effectively assure that the Quality and Safety Systems in Kuwait ATC Management are efficient.

4. SAFETY RECOMMENDATIONS

4.1 General

The safety recommendations listed in this Report are proposed according to Standard 6.8 of Annex 13 to the Convention on International Civil Aviation, and are based on the conclusions listed in Part 3 of this Report.

4.2 Final Report Safety Recommendations

The Investigation recommends that:

4.2.1 Jazeera Airways

Safety Recommendation-01/2018

Ensure proper implementation of Crew Resource Management training and procedures.

Safety Recommendation-02/2018

Operator should review and update continuously the route briefing manual, and coordinate with Jeppesen to review the RNAV charts for depicting the restricted area (OK R08), danger area (OK D04), and prohibited area (OK P01), associated with the published height for each area. The resulting change of the manuals should be in conformity with the updated Kuwait aeronautical information publication (AIP).

Safety Recommendation-03/2018

The operator should ensure adequate information dissemination system to the flight crew concerning the critical information that shall be contained in the Operator's briefing package. The existence of the military tethered balloon activity near IAF IVETA is an example of this critical information.

Safety Recommendation-04/2018

The operator should establish hazard register and carry out safety risk assessment exercise. This exercise should be properly documented and necessary information be disseminated to the crew. An example of hazard that should be registered is the close proximity of the restricted area to runway 15.

Safety Recommendation-05/2018

The operator should provide crew training on the different Holding Pattern entry procedures as computed by the MCDU.

4.2.2 Kuwait ATC Management

Safety Recommendation-06/2018

ATC Management should ensure that the simulator training of the controllers follows the local procedure in issuing holding instructions and prioritization of landing, listen carefully to the crew read-back, and effectively monitor the radar screen for any aircraft unplanned maneuver. Example: Assign an aircraft for a holding position and monitor the movement of the aircraft.

Safety Recommendation-07/2018

ATC Management should ensure proper coordination between controllers and supervisors in case of an emergency situation. The role of the supervisor is to relieve the active controller and take control for mitigating distraction that may downgrade the controller's performance.

Safety Recommendation-08/2018

ATC Management should establish an equipment management system that considers equipment reliability and evolving need for new equipment.

An example of equipment that is necessary to be monitored by the system is the audio-video recording system which introduces a primary source of data in case of an incident / accident.

Another example is updating radar screens with the current maps in consistent with AIP.

Safety Recommendation-09/2018

Establish written and clear procedures governing all communications and coordination between Civilian ATC and Military ATC at Mohalab to include air traffic coordination and radio communication phraseology.

Safety Recommendation-10/2018

ATC Management should ensure the establishment and proper implementation of the quality and safety systems in terms of documenting oversight findings, process for corrective action(s), conduct risk assessment before determining the corrective action(s), and do the necessary change management.

In addition to the DGCA oversight, Kuwait ATC Management should ensure continuous periodic audits, quality reporting, findings, and well-assessed corrective action(s).

Safety Recommendation-11/2018

ATC Management should ensure the development of a procedure for assigning controllers for Supervisor duty and give necessary training for assuring his/her competency for this role.

Safety Recommendation-12/2018

ATC Management should ensure the development of a procedure for assuring that all controllers use ICAO standard phraseology in all communication/coordination including, but not limited to, communications with military.

4.2.3 The Directorate General of Civil Aviation (DGCA) of the State of Kuwait

Safety Recommendation-13/2018

Enhance its oversight system to contain provisions for the DGCA to record audits and inspection's findings, assess the corrective actions submitted by the auditee, follow up the implementation of the corrective actions, and update the finding records accordingly.