AIRCRAFT ACCIDENT INVESTIGATION BUREAU

FINAL INVESTIGATION REPORT
ON SERIOUS INCIDENT
TO M/s AIR INDIA
A-319 AIRCRAFT VT-SCL
AT MUMBAI
ON 12.04.2013

GOVERNMENT OF INDIA
MINISTRY OF CIVIL AVIATION
AIRCRAFT ACCIDENT INVESTIGATION BUREAU
NEW DELHI INDIA

AAIB (India) Report No. : 2013-ACC-03

File No. AV.15020/03/2013-AAIB

Published on: 06.09.2016

FINAL INVESTIGATION REPORT ON SERIOUS INCIDENT TO M/S AIR INDIA LTD. A 319 AIRCRAFT VT-SCL AT MUMBAI ON 12/04/2013

1.	Aircraft Type Nationality Registration	A-319 Indian VT-SCL
2.	Owner/ Operator	M/s Orange Limited /M/s Air India
3.	Pilot – in –Command	ATPL Holder
4.	Extent of injuries	Nil
5.	Co-Pilot	ATPL Holder
6.	Extent of injuries	Nil
7.	Passengers on Board	81
8.	Extent of injuries	Nil
9.	Place of Incident	Mumbai Airport
10	Date of Incident	12.04.2013
11	Time of Incident	0136 hrs. UTC (Approx)
12	Last point of Departure	Abu Dhabi
13	Point of intended landing	Mumbai Airport
14	Type of operation	Schedule
15	Phase of operation	Landing
16	Type of incident	Landing without ATC clearance

SYNOPSIS :

Government of India vide notification no. AV.15018/21/2013-DG ordered investigation of the serious incident to Airbus A-319 aircraft VT–SCL on 12/04/2013, belonging to M/s Air India by a Committee of Inquiry. The intimation of the serious incident was provided to ICAO and BEA France as per the requirements of ICAO Annexure 13.

Prior to the landing of subject aircraft, two Jeeps were carrying out inspection of runway 09/27 as instructed by ATC due suspected bird strike. On seeing the subject aircraft at short finals, the jeeps vacated the runway of their own though by the same time ATC also instructed the jeeps to vacate the runway. The aircraft thereafter landed safely. The incident occurred in day light conditions. All the timings in the report are in IST (UTC + 5.30 hrs.) unless otherwise mentioned.

The probable cause of the serious incident has been given as follows:

- After being handed over to tower, the flight crew did not communicate with the ATC on any of the frequencies and continued to land whereas it was instructed to go around by the tower due ongoing runway inspection.
- Fatigue on the part of flight crew contributed to the error.

The Committee has also given the following safety recommendations to obviate such incidents in future:

- DGCA may develop a fatigue risk management policy under Safety Management System, wherein operators may be asked to:
    - Implement processes and procedures for evaluating information on fatigue-related incidents and evaluating their effects.
    - Develop procedures for reporting, investigating, and recording incidents in which fatigue was a factor.
    - Formalize education/awareness training programs.
    - Create a crew fatigue-reporting mechanism with associated feedback for monitoring fatigue levels.
- AAI may lay special emphasis on the RCF procedures when aircraft is on final approach track, during the refresher course.
- Safety assessment of risk associated with runway inspection with two jeeps be carried out by the aerodrome operator in consultation with AAI.

1.1 HISTORY OF THE FLIGHT

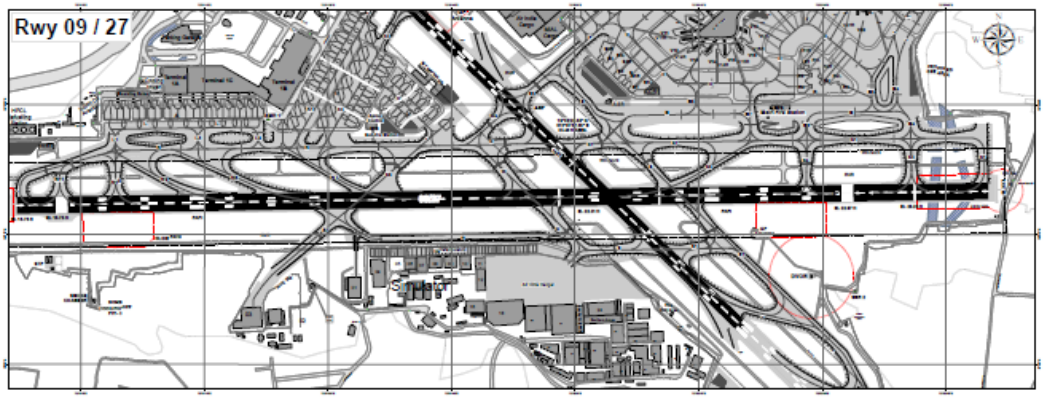
On 12/04/2013, a scheduled flight operating from Mumbai to London (Heathrow) reported suspected bird hit during takeoff from runway 27. The flight, however, reported all operations as normal. As per ground control, at about 0703 IST, Follow Me (FM-1 and FM-2) jeeps of Mumbai International Airport Limited (MIAL) commenced inspection of runway 09/27 as instructed by ATC due suspected bird strike. After obtaining positive clearance from ATC FM-1 entered runway 27 via taxiway N-9 & FM-2 entered runway via N-3. FM–1 found one dead bird on runway near intersection and after removing the same continued with the runway inspection.

After crossing runway intersection, FM-1observed an aircraft at short finals for runway 27 and instructed FM-2 on company RT (161.825 mhz) to vacate the runway immediately. Both the jeeps vacated runway 27 via taxiway N-5 at 0706 hrs IST and made a runway vacation report to ATC on RT (121.9 mhz).

With reference to this suspected bird hit, another scheduled flight operating Shamshabad to Mumbai was advised to go around due runway inspection. The subject flight operated by Airbus A-319 aircraft, from Abu Dhabi to Mumbai was at approx 08 to 10 miles (at 07:01:34 hrs) from Mumbai. The radar instructed the flight to contact tower which was acknowledged. After this there was no response or contact made by the aircraft. This was the aircraft sighted by the two jeeps as mentioned above. Tower between 070329 hrs and 070354 hrs made several go around calls to the aircraft but there was no reply. Soon after, the aircraft landed safely on runway 27. There was no injury to passenger or crew. There was no damage to the aircraft or fire.

As per the Co-pilot of the flight, they were cleared for approach by the approach radar and have changed from Approach Radar (119.30 Mhz) to Tower (118.10 Mhz) frequency. The Co-pilot was performing the duty of pilot flying (PF) and the commander was performing pilot monitoring (PM) duties. As per both the crew members the PM was trying to establish the contact with tower

CSIA Runways & Taxiways



frequency but was unsuccessful. The aircraft was in landing configuration and about 900 feet they spotted two jeeps near N5. The crew further stated that commander has briefed Co-pilot that in case the two jeeps do not clear the runway they will abort approach by the decision altitude of 230 feet and carry out go around. When the aircraft was at 500 feet AGL and as the jeeps had cleared the runway via N5, they continued approach and landed on RWY 27. There was no visual warning signal from the ATC to carry out a go around.

The Co-pilot further added that they followed communication failure procedure specific to Mumbai airport i.e. continue the approach and land if visual.

There was no snag reported on the sectors BOM-AUH and AUH–BOM. After landing the crew established contact with ground frequency 121.90 Mhz and continued taxi to bay V17R as instructed by ATC. The crew has also stated that as transmission and reception on ground frequency was fine they had not made any technical log entry and the same was mentioned in Flight Safety Report.

The Co-pilot has stated that during approach the commander was repeatedly trying to establish communication with the tower but he could not establish contact. All the time there was a lot of disturbance and garbling on the frequency. As per the co-pilot he does not remember whether the commander has tried to call on another frequency or relayed through any other aircraft.

When enquired why standard operating RCF (Radio Communication Failure) procedure was not followed by squawking 7600 or making blank call or switching to the emergency frequency, the Co-pilot has replied that they tried to establish contact on 118.1 Mhz and there was a disturbance on the frequency so they did not squawk 7600. He further stated that they realized very late that it was a complete radio failure and therefore could not complete standard Operating RCF procedure. They were also distracted by the jeeps on the runway.

After landing (121.9 Mhz) controller asked the crew the reason for landing without clearance, to which the crew explained the situation as of communication failure. After completing the shut down checklist the captain contacted the ATC officer and explained the communication failure issue of tower frequency and the subsequent decision to land considering various factors. The ATC officer collected his mobile number and assured him that he will get back after discussing it with his supervisors. At 1800 hrs IST the Flight Safety Report (FSR) was filed by the commander. The commander missed to mention in the PDR of the aircraft about the communication failure and did not meet the AME. The aircraft was not checked for any communication problem immediately after the incident and cleared for next sector operation as the FSR was raised only at 1800 hrs. IST by the crew. Alternately no snag was reported during the subsequent operations.

As the incident was not reported immediately after completion of this Abu Dhabi- Mumbai sector, CVR was not removed before commencement of next sector.

1.2 INJURIES TO PERSONS

INJURIES	CREW	PASSENGERS	OTHERS
FATAL	Nil	Nil	Nil
SERIOUS	Nil	Nil	Nil
NONE	07	81	

1.3 **DAMAGE TO AIRCRAFT**

Nil

1.4 **OTHER DAMAGE:**

Nil

1.5 **PERSONNEL INFORMATION:**

1.5.1 PILOT IN COMMAND:

An ATP licence holder and a check pilot on A-320 aircraft with around 8000 hrs of flying experience was performing duties as “Pilot Monitoring”. His ATP Licence and other qualifications i.e. PPC/IR, CAT III operations, FRTO, ETOPS were valid at the time of incident. His class I medical was also valid. His last route check was carried out on 01.02.2013 on Mumbai-Mangalore-Mumbai sector and was found satisfactory.

He was acting as check pilot for last 04 years.

1.5.2 CO-PILOT:

An ATPL holder with around 2800 hrs of flying experience was carrying out the duties of “Pilot Flying”. His ATP Licence and other qualifications i.e. PPC/IR, FRTO, ETOPS were valid at the time of incident. His class I medical was also valid. His last PPC/IR was carried out on 06.04.2013 and was found satisfactory. His last route check was carried out on 27.11.2012 on Mumbai-Dubai-Mumbai sector and was found satisfactory.

1.6 AIRCRAFT INFORMATION:

Certificate of Registration	3827/2
Date of Registration	17/10/2008
Serial Number	3551
Year of Manufacture	2008
Engines	Two - CFM56-5B6/3

Certificate of Airworthiness	5036
Validity	Valid
Passenger Capacity	122

1.7 METEOROLOGICAL INFORMATION:

The following are the extracts from relevant METARs of the date of incident:

Time (UTC)	Wind Dir	Speed (kts)	Visibility (Km)	Clouds	QNH	Trend
0110	080	04	3.5	FEW 020 SCT 100	1009	NOSIG
0140	100	03	03	SCT 100	1009	NOSIG

1.8 AIDS TO NAVIGATION:

Aerodrome is equipped with Instrument Landing System for runway 09, 27 and 14 and DVOR is co-located with DME and VOR. Surveillance Radar approach procedures are available on 09, 27 and 14 ends of the runways with published missed approached procedures. Radar Vectoring was available.

Minimum Sector Altitude for sector (340 ° - 200 °) is 2400 ft up to 12 nm and 3700 ft from 12nm to 25nm and for sector (200 ° - 340 °) is 2600 ft up to 25 nm. SID, STAR and Radar Vectoring Facilities as published were available.

All the runways are equipped with PAPI lights with 3 degree glide path. Rwy 27, 14 and 32 end PAPI lighting system is available on left while for Rwy 09 PAPI lighting system is available on right.

1.9 COMMUNICATIONS:

There was no difficulty felt by the crew in communicating with ATC Radar. At 01:30:25 hrs., Radar (119.3 Mhz) instructed IC 944 to change over to Tower (118.1 Mhz). Commander has acknowledged changing over the frequency to tower. The Crew had however not made any transmission for more than 4

minutes prior to touch down. The crew have not tried to call on VHF set to clarify with the tower about the presence of the jeeps. The crew had also not received the tower instructions to go around.

For more than 04 minutes, there is no PTT pressed from the cockpit of the flight. There was no call outs either from the ATC or from the crew of the flight during this time period by switching either to the previous selected frequency or any other frequency in view of sighting the jeeps on the runway.

1.10 AERODROME INFORMATION:

Mumbai International Airport Limited is operated by M/s GVK. Airport has two cross runway 09/27 and 14/32 with ARP location 190530 N 0725158 E and elevation of 37 feet from mean sea level. Rwy 27 is 3190 m, Rwy 09 is 3050 m, Rwy 14 is 2774m and Rwy 32 is 2823 m in lengths.

Airport is equipped with ATS communication facilities .Mumbai is Class 'D' airspace with vertical limits from surface to FL 70 and lateral limits of 40 nm from DVOR, VFR/IFR operations and traffic separation are permitted. Aerodrome is equipped with facilities like fueling, Cargo-handling, Hangar space and Repair facilities for visiting aircraft. Aerodrome is equipped with Category 10 type of fire fighting facilities. Pushback facility is available. SID, STAR and Radar Vectoring Facilities as published are available. All the runways are equipped with PAPI lights with 3 degree glide path. Meteorological Information can be availed for 24 hours.

As per the agreement between Airport Authority of India (AAI) and Mumbai International Airport Private Limited (MIAL), AAI shall at all times (including twenty-four hours each day), in accordance with the relevant standards prescribed in the relevant ICAO Annexes and Documents and at its own cost:

i. Provide the CNS/ATM Services.
ii. Maintain the AAI Equipment including carrying out periodic flight calibration of the AAI Equipment and other tests:

iii. Upgrade the AAI Equipment from time to time (a) as a minimum to comply with the relevant provision contained in the relevant ICAO Annexes and Documents; and (b) as a result of the expansion/up gradation of the Airport:

iv. ……

Further as per the agreement, in order to ensure smooth and efficient rendering of AAI Services, the parties hereby undertake and agree to set up a co-ordination committee (the “Co-ordination committee”) consisting of (i) the JVC Representative; (ii) the AAI Representative; and (iii) the Representative of other agencies, as required from time to time.

1.11 FLIGHT RECORDERS:

The CVR and SSFDR were installed on the aircraft. As the flight crew has not entered any snag in the Pilot Defect Report, the aircraft was released for further flying without removal of CVR. The SSFDR data was available.

1.12 WRECKAGE AND IMPACT INFORMATION:

There was no damage to the aircraft.

1.13 MEDICAL AND PATHOLOGICAL INFORMATION:

The crew had undergone preflight medical checks while departing from Mumbai. As the incident was not reported immediately, no medical or pathological checks were carried out for the involved crew.

1.14 FIRE:

There was no fire.

1.15 SURVIVAL ASPECTS:

The incident was survivable.

1.16 TESTS AND RESEARCH:

Nil

1.17 ORGANIZATIONAL AND MANAGEMENT INFORMATION:

The aircraft is operated by a scheduled airline. It operates flights on domestic and international sectors. The Company is headed by CMD and is assisted by a team of professionals heading each department.

The airport is owned by Mumbai International Airport Limited and the ATC services are provided by Airports Authority of India. Both these organisations have Memorandum of Understanding between them regarding the services to be provided at the airport. Safety and surveillance equipments/ services on the airport are provided by MIAL.

1.18 ADDITIONAL INFORMATION:

(A) **GENERAL**

As per para 5.2.2- establishment and assurance of communications (Annex 10- aeronautical telecommunications), “During flight, aircraft stations shall maintain watch as required by the appropriate Authority and shall not cease watch, except for reasons of safety, without informing the aeronautical station(s) concerned. Further it requires that the aircraft shall continually guard the VHF emergency frequency 121.5 MHz.

As per Doc 4444 an aircraft equipped with an SSR transponder is expected to operate the transponder on Mode A Code 7600 to indicate that it has experienced air-ground communication failure. The information contained in ICAO Documents is appropriately reflected in the DGCA CAR on the subject.

AAI has published Manual of Air Traffic Services- part I. Para 15.6 of the Manual deals with the ATC Contingencies. Following are the relevant portions of the paragraph.

15.6.1.1.1 ATC contingencies related to communications, i.e. circumstances preventing a controller from communication with aircraft under control, may be caused by either a failure of ground radio equipment, a failure of airborne equipment, or by the control frequency being inadvertently blocked by an aircraft transmitter. The duration of such events may be for prolonged periods and appropriate action to ensure that the safety of aircraft is not affected should therefore be taken immediately.

15.6.1.2 Ground radio failure

15.6.1.2.1 In the event of complete failure of the ground radio equipment used for ATC, the controller shall :

a) Where aircraft are required to keep a listening watch on the emergency frequency 121.5 MHz, attempt to establish radio communications on that frequency;
b) Without delay inform all adjacent control positions or ATC units, as applicable, of the failure;
c) Appraise such positions or units of the current traffic situations;
d) …….

(B) **Mumbai International Airport Limited (MIAL) & AAI**

MIAL had formulated a procedure for carrying out runway inspection on tower frequency 118.1 MHz at CSIA. The same was forwarded to DGCA for approval. DGCA had examined the proposal and made the following observations:

1. As the procedure pertains to inspection of active runway on which the operational control lies with ATC, SCARS must be prepared by AAI

and the hazard identification/mitigation must be submitted after examination by AAI CHQ.

2. The safety assessment must have wider participation including Scheduled and General Aviation operators as well as Tower controller who have a key role to play in the procedure.
3. In the event of RCF with Jeep, the arrivals may be considered for a go-around until there is confirmed vacation report by jeep along with the runway fitness for operation report.
4. The procedure of switching ON/OFF the runway lights by tower to indicate vacation of runway by jeep in the event of RCF may be recorded and therefore could be difficult to establish the responsibility of action in case of incident/accident investigation.
5. In the event of two jeeps transmitting on tower frequency, VHF congestion cannot be ruled out and changes of inadvertent blockage of urgent air to ground transmission are twice as high as with one jeep.

(C) **Coordination between Air Traffic Control and Apron Control**

In order to conduct smooth efficient and safe operation of aircraft movement at Mumbai, process between air traffic control and apron control has been made. Following are the relevant extract of the process.

4. COORDINATION PROCEDURE BETWEEN ATC AND APRON CONTROL DURING RWY TAKING/HANDING OVER.

4.1 Apron Control taking over from Aerodrome control/Ground Control

4.1.1 RWY taking over from Ad Control/Ground Control to Apron Control may be necessitated due to scheduled planned work services, maintenance requirement or inspection purpose.

4.1.2 Such taking/handing over shall take place on ground RT frequency (121.900 MHz) or other designated frequency which is available with Apron Control and ‘Follow Me’, with time check by ATC.

4.1.3 Prior coordination shall be made between Apron Control and ATC before taking over of the RWY.

4.2 Handing over from Apron control to Aerodrome control/Ground Control

4.2.1 Apron control shall handover the RWY after checking the AGL serviceability, ensuring that all men, material and vehicles are clear off RWY and RWY is checked and found fit for operations. (Except during Ad-hoc inspection when the RWY is required to be handed over back to Aerodrome control/ground Control after an inspection, like in case of bird, hit, FOD check etc.)

4.2.2 Handing over to Aerodrome control/Ground Control will be done on Ground RT frequency and simultaneously a time check from Aerodrome Control/Ground will be obtained on same RT frequency.

As per the SOP on runway inspection on tower frequency dated 21/11/2012, Ad-hoc inspection are carried out on an “as-and-when required” basis. Ad-hoc Runway inspection shall be carried out if there is any reported FOD, after a Suspected Bird Hit, Suspected tyre burst or Wheel failure, after a Heavy Landing, after an abandoned take-off, after landing of a full emergency aircraft, during and after the rain, or on advice of ATC.

Ad-hoc Runway inspection may be carried out on ‘SMC’ or ‘TWR’ frequency as per advice of ATC.

The Vehicles used for conducting a Runway inspection are fully equipped and fitted with 02 numbers Two-Way VHF sets tuned to surface Movement control frequency 121.90 MHz for communicating and Tower Frequency 118.10 MHz respectively. These instruments shall be used for maintaining a listening watch throughout the period of inspection.

The SOP further gives the procedure for runway inspection. As per this in the event of an RT communication failure ATC shall switch ON and OFF the Runway edge lights thrice in quick succession to indicate requirement of a

quick Runway vacation. The vehicle on seeing such visual indication shall immediately vacate the Runway and should position the vehicle in direct line of sight of ATC, facing the Control Tower. Therefore, the vehicle should be stationary and the head lights should be flashed thrice to indicate Runway vacation. The vehicle shall remain stationary till the time he has assistance in terms of a follow me vehicle (FM-2, FM-3 etc) with a two way communication with ATC. After completion of Runway inspection the serviceability of Runway shall be intimated to the ATC.

(D) **Airline Operator**

As per Chapter 5 of OPERATIONS MANUAL of the airline :

5.0 RADIO LISTENING WATCH

An aircraft shall not be flown on IFR flight within controlled airspace unless a continuous listening watch is maintained on the appropriate VHF radio frequency. A two way communication be established with the appropriate air traffic control unit. It is the responsibility of the commander to ensure that at least one crew member continuously monitors the appropriate ATC frequency at all times. One VHF communication set should be tuned to the Emergency Guard Frequency 121.5 MHz and a continuous listening watch maintained.

5.2 RESPONSIBILITY FOR R/T / RADIO LISTENING WATCH

In the normal course of flight, the First Officer shall be responsible for operating the R/T. However, this does not restrict the Commander from carrying out the R/T. Monitoring of the R/T is the responsibility of both the Pilots. During the flight, in order to maintain two-way communication/continuous Radio listening watch, one of the pilots must be at his station all the time.

5.3 MONITORING OF EMERGENCY FREQUENCY 121.5 MHZ

Communication channel no.3 for Airbus aircraft should imperatively be tuned to emergency frequency 121.5 MHZ and monitored during all phases of flight. Any monitoring of air to air frequency 123.45 MHZ / company VHF frequency should be done on communication channel no. 2 for Airbus.

5.4 COMMUNICATION LOSS WITH AIRCRAFT IN FLIGHT

On investigation of many communication loss incidents with aircraft, it has been found that in a number of cases it was found that this happened due to the Pilot's accidentally changing the frequency to a previous pre-set frequency, instead of that allocated by ATC. In other cases, it was found that the Pilots had switched off the cockpit speaker, due to various reasons, Some causes are enumerated below:

i) Captain making a P.A. announcement and First Officer monitoring R/T on headset with cockpit speakers turned off. On completion of this action, both Pilots have removed the headset but forgotten to turn the speakers on.

ii) First Officer monitoring the weather on another frequency on headset with the cockpit speaker turned off or volume reduced to minimum. On completion of this action, headset was removed and speaker status remained off/volume at minimum.

iii) Pilots have missed the call by ATC to change frequency and remained on the earlier frequency and gone out of range. Crew are therefore advised to be extremely cautious when any cockpit speaker has been switched off or the volume turned down for any reasons. Whenever the cockpit speaker is switched off or volume turned down, the pilots must announce clearly on headset "speaker switched OFF". Whilst removing the headset announce, "speaker switched ON headset removed".

Whenever frequency change is advised by ATC, change to the new frequency but maintain the old frequency on the standby, till

communication is established on the new frequency. In addition to this, if no conversion is heard on R/T for a reasonable period of time, crew must investigate and if everything seems OK, a call should be given to ATC for a Radio check.

(E) **Relevant timeline**

Time in UTC	Form	To	Transmission
012715	ASRA	AIC 944	Position 23 Miles from TCH DWN
012828	ASRA	AIC 944	Turn right heading 230 to intercept localizer RWY 27
012838	ASRA	AIC944	At 15 ILS DME descend to 2900 ft, cleared for ILS approach RWY27
013025	ASRA	AIC 944	Speed 160 kts contact TWR 118.1
013028	AIC 944	ASRA	Namaskar Sir AIC 944
013202	TWR	AIC 944	AIC 944 Mumbai TWR
013342	TWR	AIC 944	AIC 944 Mumbai TWR
013349	TWR	AIC 944	AIC 944 Mumbai Twr
013358	TWR (intercom)	ASRA	Abhi RWY inspection chal raha hai
013407	TWR	AIC 944	Aic 944 Mumbai TWR
013423	TWR	AIC 944	AIC 944 Go Around AIC 944 How do you read me
013427	Unknown	TWR	Sir, they are not reading you ask vehicle to vacate RWY please.
013430	TWR	AIC 944	Roger, AIC 944 Go Around MAM, Due RWY inspection is going ON and continue on RWY heading
013439	Unknown	TWR	Sir Air India not Going round they are landing ask the vehicle to vacate.
013540	AIC 944	SMC	Grd AIC 944
013551	SMC	AIC 944	AIC 944 Go ahead

1.19 **USEFUL OR EFFECTIVE INVESTIGATION TECHNIQUES:**

Nil

2 ANALYSIS

2.1 Serviceability of the aircraft

The Aircraft was serviceable and there was no snag reported during or after the flight. The crew has not entered any snag in the post flight documents. There was no maintenance action pending prior to the take off. All mandatory modifications were carried out.

There was no failure message regarding communication system in post Flight Report (PFR). The detailed inspection of communication equipment was carried out at Kolkata as per special call out. No failures/ fault were found in communication equipment of subject Aircraft.

The serviceability of the Aircraft is not a factor to the Incident.

2.2 Weather

The weather at the time of incident was fine with visibility of 3.5 kms and has not contributed to the incident.

2.3 Role of SMC

Lot of birds was reported on the runway by a scheduled flight short of touch down into Mumbai. Subsequently take off clearance was given to another scheduled aircraft by tower which reported suspected bird hit on takeoff through approach departure frequency 129.9 Mhz. SMC controller was asked to carry out the runway inspection from N9 to N6 at 1:32:21hrs(UTC). One scheduled aircraft which was ahead of the subject incident flight was asked to go around due to runway inspection in progress. Follow me vehicle 1 was asked to enter via N9 by SMC controller at approx. 1:32hrs (UTC) and follow me vehicle 2 (FM 2) was asked to enter via N3 at approx. 1.33(UTC).

The Runway inspection by the two follow me vehicles was in progress when the subject aircraft was approaching the runway 27. At 1:34:40hrs (UTC), the SMC controller gave instructions to vehicles for vacating the runway. By that

time the vehicles had already vacated the runway as they have seen the aircraft coming to land.

2.4 Handling RCF

In the preceding point no. 1.18, details of the RCF procedures and the actions required to be carried out by the pilot, ATC and SMC are elaborated alongwith the scenario existing at the time of present occurrence.

The PM who was doing RT Communications has stated that, “In radar control area at about 10 miles the ATC (119.3 Mhz) told us “Cleared for ILS approach R/w 27 and change over to tower 118.1 Mhz”, at no point during changeover did he mention that the runway is being closed for whichever reason. We configured the aircraft for landing and completed the landing checklist. As we were fatigued and since we were operating in WOCL, I do not remember or recollect if I had contacted the ATC (118.1 Mhz Tower Frequency) also we did not receive any instructions from ATC on 118.1 Mhz or emergency frequency (121.5 Mhz). Also the reception was highly garbled.”

After parking the Aircraft at the bay, Captain contacted ATC on phone and as per him, he informed that they had not received/ heard any instruction from ATC regarding runway being closed and further if the runway was unsafe the ATC should have given us visual instructions as per procedure (Red Flashing Lights or Red Pyrotechnic Lights) as per ICAO Doc 4444 procedure’. He further clarified that though he is responsible to handle all communications and for changing frequencies to next controller, but the copilot may also change the frequency and carry out the R/T. VHF 1 was used for establishing contacts after facing communication failure and VHF 2 was not used.

The PF has clarified that, as the controller on 119.30 Mhz cleared them for approach. They continued approach on ILS and decided to discontinue the approach at DA of 230’ for ILS 27 or if ATC gives visual signal or warning. As the runway was clear of obstruction and there were no signals or warning from the ATC they completed the landing. When enquired why standard RCF

procedure was not followed by the squawking 7600 or making blank call or switching to the emergency frequency, the first officer has replied that they tried to establish contact on 118.1 Mhz and there was a disturbance on the frequency so they did not squawk 7600. As it was very late to realize that it was a complete radio failure they could not complete standard procedure for RCF. They were also distracted by the jeeps on the runway.

The PF has also informed that, we landed only because the jeeps had vacated & because of fatigue our alertness was not 100%. The said flight BOM-AUH-BOM is a midnight departure and arrival is around 07.00 am, which is complete sleep deprivation & upsetting the circadian rhythm.

In the present case there are two different possibilities resulting in failure of two way communication between the aircraft and ATC. In the first case, the commander after acknowledging the changing over of frequency to that of tower but failed to do so. As a result the audible trigger has not alerted the crew and 119.3 Mhz remained on VHF 1. The other possibility could have been that after acknowledging the changing over the frequency to tower, the crew changes it to some other frequency and not 118.1 Mhz as a result of which, the crew has not received the go around instructions from the tower. From the evidences available, it seems that the first possibility is most probable. Nothing untoward happened in the present case but there was definitely unsafe situation. The following were the opportunities available as per the RCF procedure which could have arrested the unsafe situation.

1. The tower controller could have handed over the flight back to the radar frequency once the aircraft was not responding on the tower frequency.
2. The tower controller could have selected emergency frequency for communicating once the aircraft was not responding to the repeated calls on the tower frequency.
3. The crew was totally unaware of the situation and there was no communication between the aircraft and Ground stations during the critical period of final approach and landing. Any of the crew could have taken

appropriate RCF action once there was no communication with the ground stations.

4. ATC could have asked the jeeps to vacate the runway much earlier. (though there was discussion on intercom between ASRA and Tower)
5. Once it was established that the aircraft was not responding on the tower frequency, a co-ordinated attempt between the ATC controllers could have been made to contact the aircraft on the radar frequency.

2.5 Pilot handling of the aircraft

2.5.1 CRM

As the occurrence was not immediately reported nor any entries in the log book made about the propounded RCF, the CVR could not be removed after the occurrence for investigation purposes. The PM has mentioned in his statement that though he was responsible to handle all communications and for changing frequencies as per the communication with the ATC controller, but the copilot may also change the frequency and do the R/T.

The PF was carrying out flying under supervision and had earlier undergone check for supervised take off and landings. PM was authorized to impart supervised take off and landings to the PF. PF has clarified that he was busy in configuring the aircraft after 180 knots and in the process might have missed the R/T communication which happens at times if the pilot flying is busy in instruments/ flying. He has also stated that he at around 1000 feet asked PM that if they were cleared to land and the reply of PM was in affirmative. They then discussed about the jeeps on the runway and on observing that these were moving away they continued landing. In his belief, he thought that since the commander has changed over to tower frequency, tower should instruct them to go around if there would be any need. As per the PF, on landing & vacating the runway the PM did realize that they were not on 118.10 Mhz but still maintaining 119.30 Mhz.

In the absence of any recording of the conversation and relying on the above statements & the sequence of events, it can be seen that there was breakdown of CRM in the cockpit during the critical phase of flight. Excessive fatigue of the cockpit crew, discussed in the following paragraph might have contributed to this lack of desired level of airmanship and loss of situational awareness.

2.5.2 FDTL and Fatigue

Both the crew members have expressed & maintained throughout the investigation that they were fatigued and flew in the Window of Circadian Low (WoCL). The crew has further quoted fatigue as one of the reason for whatever omissions (established) have occurred during the critical phase of flight and thereafter on the part of crew.

The human biorhythm goes through different cycles throughout the day. “Sleep pressure”, or the need for sleep, expresses itself at different levels depending on the time of day. There are times when a person can hardly sleep at all and if they do, then the sleep provides a substandard quality of recuperation. On the other hand, there are also times – in particularly between two and six in the morning – in which the urge to sleep is especially strong. And the restorative effects are also much better if one sleeps during this period. This time period at night is referred to as the Window of Circadian Low (WOCL).

The flights operated by the crew were

FROM	DEPARTURE	TO	ARRIVAL	FLIGHT TIME
VABB	0000 hrs.	OMAA	0320 hrs.	3:20 hrs.
OMAA	0405 hrs.	VABB	0715 hrs.	3:10 hrs.

For the above flight sectors the Flight Duty Time calculation works out to be around 08:30 hrs. The flight was operated as per the FDTL requirements in

the CAR on the subject at that time and it is evident that requisite rest was provided to the crew. Landing without a clearance in the present case did not result into any untoward incident but had potential for the dire consequences as hazardous situation certainly existed.

The issue required deeper analysis as historically we can see that a big percentage of accidents or serious incidents had crew fatigue as one of the contributory factors. In order to provide a preventive recommendation, the Committee carried out review of the actions being taken by various regulatory authorities on the subject.

There are two aspects to the issue:

1. How the rest period is being used by the pilots.
2. Making of regulations on the FDTL for pilots and its implementation.

The scientific study of fatigue and sleep has progressed enormously in the past 50 years or so. In particular much has been learnt about sleep requirements, human performance during sustained operations and fatigue counter-measures which have direct impact on policy matters governing FDTL/ crew rest requirements etc. Human Factors Effectiveness Directorate of US Air Force Research Laboratory had earlier carried out an exhaustive search of archives, reports, databases and publications to locate research data that described the activities of off-duty pilots as they prepare for night (or long duration) flights. This extensive review however did not reveal information appropriate for predicting pilot sleep from the time of their flight.

It is a well established fact that fatigued individuals are more prone to fixations, low situational awareness and poor decision making. In aviation this aspect has a greatest significance and it is the responsibility of both the air carrier and the crew himself to prevent fatigue. For this, in addition to the FDTL regulatory requirements by having normal roster, one has to take into consideration other factors such as weather, air traffic, the health of each

pilot, and above all other personal circumstances that may affect a pilot's performance. The Civil Aviation Authorities world over have recommended that air carriers include training on how to avoid fatigue as part of their crew resource management training programs.

In this regard the main pertinent question is that how crewmembers use their off-duty time to prepare for duty. The available documents mainly discuss at length such topics as cognitive impairment resulting from fatigue, techniques to combat fatigue, the importance of sleep in reducing the likelihood of human error, techniques for improving and increasing the amount of rest that aircrew members receive, and real-world events that are attributable to fatigue. Similarly enough is known about the importance of the proper amount of sleep prior to periods of significant cognitive demand and long-duration cognitive performance, but there is scarcely a document that describes crew off-duty behaviors, and how they prepare for duty. In some articles, there are vague references to what pilots and crew may have done the night before flight and in other documents, there are general discussions of job-related activities that prevent a good night's sleep, such as ground support activities that are often required for operations. There is also mention of social activities associated with an exciting layover that contribute to the crewmembers' lack of sleep.

Further in some of the accident reports, one has information concerning what crewmembers may have done in their off-duty time prior to flight duty. This information is anecdotal in nature. There is no use of giving any findings or observation for preventing similar occurrences in future just on the basis of this subjective information. Further no useful recommendation can be made using the data based on serious incidents or accidents as the data is biased in the sense that crewmembers represented are those involved in actual incidents only. We cannot say what the vast majority of crewmembers did who are not involved in incidents. Similarly those cases are also not documented where the omissions due to fatigue have not resulted into incidents.

Still, world over efforts are being made to use fatigue data to predict the likely time of sleep for the Fatigue Avoidance Scheduling Tool (FAST) that can then predict crew performance.

Secondly aviation regulators have attempted to control or eliminate fatigue in operational settings through the use of FDTL regulations. It is amply clear that these regulations are “necessary but not sufficient” to manage in an effective manner the complex nature of fatigue in real-world operational settings. These regulatory authorities continually confront with the gap between fatigue as a significant safety issue and having data to address policy issues or provide specific solutions in their efforts to address fatigue risks through regulation.

ICAO Annex 6 Part I lays down the standards and recommended practices for management of fatigue for flight and cabin crew members. These standards require every State to establish prescriptive regulations for the management of fatigue which include flight time, flight duty periods, duty period and rest period limitations. DGCA in this regard has issued a CAR on FDTL wherein it is required that the Operator, for the purpose of managing its fatigue related safety risks, is required to establish the above mentioned limitations that are within the prescriptive fatigue management regulations.

Even in India in the past there have been occurrences where it was found that fatigue was one of the contributory factors. Barring the above time limits, there are no other advisory or mandatory instructions/ regulations from the DGCA regarding imparting awareness or training by the operator to their crew on how to be vigilant and avoid operations under fatigue. Even ICAO is contemplating to introduce this aspect in Annex 19 under the State Safety Programme and Safety Management System.

In this regard following is being mandated on scheduled operators by various regulators:

- Crew be imparted training on how to have a balanced approach in managing fatigue when there are operations with schedules during different hours of the day (night).
- Safety personnel and others be provided with an overview of how to incorporate the collection and analysis of fatigue related data for roistering, safety investigations etc. Operators can have Fatigue Risk Management System (FRMS) incorporated under the Safety Management System.
- All involved in the operations be educated about how to balance between fatigue management from a scientific perspective, with other demands, such as lifestyle preferences. One example can be that operators may ensure that pilots who are rostered for flying duties are not disturbed by phone or otherwise for some hours prior to his reporting time at the airport. Many operators worldwide have this in their procedures.

Even otherwise ICAO is contemplating amendments to Annex 6 (Fatigue management). It suggests that an operator in order to manage fatigue-related safety risks should have as a minimum:

a) incorporate scientific principles and knowledge within the FRMS:
b) identify fatigue-related safety hazards and the resulting risks on an ongoing basis;
c) ensure that remedial actions, necessary to effectively mitigate the risks associated with the hazards, are implemented promptly;
d) provide for continuous monitoring and regular assessment of the mitigation of fatigue risks achieved by such actions; and
e) provide for continuous improvement to the overall performance of the FRMS.

Essentially the above constitutes essential components intended to provide structure and guidance to ensure that Fatigue Risk Management (FRM) is implemented effectively and that regulatory oversight is accomplished in a reliable and verifiable manner.

2.6 Circumstances leading to the incident

The SSFDR data of flight AI-994 of 12-04-2013 indicated that the crew was in contact with ATC (Approach) till an altitude of 3000 ft. which corresponds to approximately 10 miles from touchdown. At this point the flight was changed from approach radar to tower frequency. From this point onwards crew have not made any transmission to the tower. (The next transmission was made after the Aircraft landed at Mumbai on ground frequency)

The crew at about 900 feet spotted two jeeps near N5 and as per them decided that in case the jeeps do not clear the runway they will abort approach by the decision altitude of 230 feet and carry out go around. Since when the aircraft was at 500 feet AGL, the jeeps had cleared the runway by N5, the aircraft landed on RWY 27. There was no visual warning signal from the ATC to carry out a go around.

The approach radar controller had cleared AI-944 for ILS approach and as per the “SOP for Mumbai airport (Jeppesen chart) in case of communication failure if Aircraft is cleared for approach it is expected to continue and land, if visual or -------”.

It was likely that air traffic controller assumed that a loss of communications would probably result in a go-around while pilots were expecting that they will land if they were able. These disparities probably lead to conflict between the thought process of controller and the pilot, thereby resulting in the incident.

3 CONCLUSIONS:

3.1 Findings:

1. The aircraft was having valid Certificate of Registration and valid Certificate of Airworthiness. All mandatory modifications were carried out.
2. The Aircraft was serviceable and there was no snag reported during or after the flight.

3. The crew had not entered any snag in the post flight documents. There was no maintenance action pending prior to the take off.
4. The crew had valid licences with endorsements. They had valid medical Certificates and have undergone pre-flight medical check prior to take off from Mumbai.
5. The flight was operated as per the FDTL requirements in the CAR on the subject at that time. Adequate rest was also provided to the crew.
6. PM (commander) was authorized to impart supervised take off and landings to the PF (First Officer). The PF was carrying out flying under supervision and had undergone check for supervised take off and landings.
7. No adverse report of malfunction was received regarding any navigation aids including landing aid i.e. ILS RWY 27. ATM automation system and A-SMGCS were working normal.
8. Frequencies-Approach (DEP)-127.9 MHz, Approach (ARR)-119.3 MHz, Tower-118.1 MHz and SMC-121.9 MHz were working normal.
9. No adverse report was received regarding aerodrome, its facilities and condition of landing area at the time of incident.
10. The SMC controller was holding rating for Aerodrome Control Tower since 26/08/2011 and had attended Annual Refresher course on 19/03/2013.
11. The Tower controller was holding rating for Aerodrome Control Tower since 12/11/2011 and had attended Annual Refresher course on 19/03/2013.
12. The crew had operated two sector return flight (VABB- OMAA-VABB) with scheduled take off from Mumbai at 0000 hrs. and with final arrival in Mumbai at 0715 hrs. The flight covered whole period of window of circadian low.
13. The sector VABB-OMAA and the flight from OMAA to VABB till approach were uneventful.
14. Weather at the time of incident was fine with visibility of 3.5 kms.
15. A scheduled flight reported suspected bird hit on takeoff through approach departure frequency (129.9 Mhz).
16. Runway inspection was initiated by SMC controller from N9 to N6 as advised by ATC. Follow me vehicle 1 was asked to enter via N9 by SMC

controller at approx. 1:32hrs (UTC) and follow me vehicle 2 was asked to enter via N3 at approx. 1.33(UTC).

17. A scheduled flight ahead of the subject incident flight was asked to go around due to runway inspection in progress. The aircraft followed the instructions.

18. The Runway inspection by the two follow me vehicles was in progress when the subject aircraft was approaching runway 27.

19. At 01:28:38 UTC, the aircraft was instructed “At 15 ILS DME descend to 2900 feet” and was cleared for ILS approach runway 27. These instructions were read back by AIC 944.

20. At 01:32:02 UTC, tower gave a call out to AIC 944 to which there was no response from AIC 944. At that time the flight was at 6.7 NM and 2100 feet with a speed of 184 knots.

21. Tower again gave call outs at 01:33:42 UTC, at 01:33:49 UTC and 01:34:07 UTC without any response.

22. Again at 01:34:23 UTC again there was a call out from tower, “AIC 944 Go around AIC 944, how do you read me”. There was no response from the aircraft which was at 1 NM and at 500 feet (height). At this point of time FM2 was on the runway.

23. SMC on instructions of ATC advised the vehicles for vacating the runway. By that time the vehicles had already vacated the runway as they saw the aircraft coming to land.

24. As per the crew at about 900 feet, they spotted two jeeps near N5 and under the belief that they had landing clearance decided that in case the jeeps do not clear the runway they will abort approach by the decision altitude of 230 feet and carry out go around. Since when the aircraft was at 500 feet AGL, the jeeps had cleared the runway by N5, they landed on RWY 27. There was no visual warning signal from the ATC to carry out a go around.

25. The flight was operated as per the FDTL requirements in the CAR on the subject at that time and it is evident that requisite rest was provided to the crew.

26. Both the crew members have flown in Window of Circadian Low (WoCL) and have maintained throughout the investigation that they were fatigued.

Fatigue is one of the reasons for whatever omissions (established) have occurred during the critical phase of flight on the part of crew.

27. The crew possibly failed to switch over from radar frequency to tower frequency though this action was confirmed on RT to Radar. Neither the aircraft had asked for landing clearance nor was it cleared to land by the ATC on any of the working frequencies.

28. Both the Aerodrome Controllers were conversant with the Radio Communication failure Procedures for en-route phase of the flight but were not aware of Radio Communication failure Procedures of aircraft on final approach track.

29. There was no runway inspection procedure with two jeeps for CSIA Mumbai.

3.2 Probable cause of the serious incident

- After being handed over to tower, the flight crew did not communicate with the ATC on any of the frequencies and continued to land whereas it was instructed to go around by the tower due ongoing runway inspection.
- Fatigue on the part of flight crew contributed to the error.

4. SAFETY RECOMMENDATIONS

1. DGCA may develop a fatigue risk management policy under Safety Management System, wherein operators may be asked to:
    - Implement processes and procedures for evaluating information on fatigue-related incidents and evaluating their effects.
    - Develop procedures for reporting, investigating, and recording incidents in which fatigue was a factor.
    - Formalize education/awareness training programs.
    - Create a crew fatigue-reporting mechanism with associated feedback for monitoring fatigue levels.
2. AAI may lay special emphasis on the RCF procedures when aircraft is on final approach track, during the refresher course.

3. Safety assessment of risk associated with runway inspection with two jeeps be carried out by the aerodrome operator in consultation with AAI.

30/4/2016

R.S. Passi, Chairman
Committee of Inquiry

N.S. Dagar, Member
Committee of Inquiry

Capt. Nitin Anand, Member
Committee of Inquiry

DATE 30-04-2016
PLACE NEW DELHI