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FINAL INCIDENT REPORT 5Y-SIB 04.01.2015

FOKKER 27-50
JOMO KENYATTA INTERNATIONAL AIRPORT
NAIROBI

CIVIL AIRCRAFT FINAL ACCIDENT REPORT

5Y-SIB

OPERATOR : SKYWARD EXPRESS LTD

OWNER : SKYWARD EXPRESS LTD

AIRCRAFT : FOKKER 50

MANUFACTURER/YEAR : FOKKER AIRCRAFT B.V

YEAR OF MANUFACTURER : 25/10/1989

REGISTRATION : 5Y-SIB

TYPE OF FLIGHT : CARGO

DATE : 04JANUARY, 2015

PLACE : HKJK, KENYA

TIME : 0802 HOURS

All times given in this report is Coordinated Universal Time (UTC) East African Local Time is
UTC plus 3 hours

OBJECTIVE

This report contains factual information which has been determined up to the time of publication. The information in this report is published to inform the aviation industry and the public of the general circumstances of accidents, serious incidents and incidents.

This investigation has been carried out in accordance with *The Kenya Civil Aviation (Aircraft Accident and Incident Investigation) Regulations, 2013 and Annex 13 to the ICAO Convention on International Civil Aviation.*

The objective of the investigation of an accident or incident under these Regulations shall be the prevention of accidents and incidents. It shall not be the purpose of such an investigation to apportion blame or liability.

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ABBREVIATIONS

AAID	-	Air Accident Investigation Department
AD	-	Aerodrome
AIP	-	Aeronautical Information Publication
ARP	-	Aerodrome Reference Point
ATC	-	Air Traffic Services
ATPL	-	Airline Transport Pilot License
CPL	-	Commercial Pilot License
CVR	-	Cockpit Voice Recorder
FDR	-	Flight Data Recorder
GFS	-	Ground Flight Safety

HKJK	-	Jomo Kenyatta International Airport
HKNW	-	Wilson Airport
HKWJ	-	Wajir International Airport
ICAO	-	International Civil Aviation Organization
KAA	-	Kenya Airports Authority
KAF	-	Kenya Air force
KAPU	-	Kenya Airport Police Unit
KCAA	-	Kenya Civil Aviation Authority
LG	-	Landing Gear
MLG	-	Main Landing Gear
MS	-	Marabou Stork
NLG	-	Nose Leading Gear
PABX	-	Private Automatic Branch telephone Exchange
PALS	-	Precision Approach Landing Systems
QNH	-	Altimeter setting related to sea level
RFFS	-	Rescue and Fire Fighting Services
SALS	-	Simple Approach Landing Systems
UAE	-	United Arab Emirates
USA	-	United States of America
WGS	-	World Geodetic System (1984)

SYNOPSIS

The report describes the 4th January 2015 aircraft accident involving gear-up landing of Skyward International Ltd Fokker 27-50 cargo flight registration 5Y-SIB at Jomo Kenyatta International Airport (HKJK) after the left main landing gear failed to lower during landing at its intended destination at Wilson airport (HKNW). The aircraft was substantially damaged and all the ten persons onboard (4 crews and 6 passengers) evacuated the aircraft unaided and with no injuries.

The report discusses the accident flight, KCAA guidance on bird/wildlife hazard management, Wajir bird/wildlife hazard management program, KCAA guidance on the removal of disabled aircraft, HKJK emergence response and aircraft recovery. The report also discusses analysis of the investigation, findings, probable cause and safety recommendations.

The investigation findings revealed that the aircraft had taken-off from Wajir (HKWJ) at 0540 and immediately after take-off it experienced a bird strike. There was no other incident during the flight until downwind Wilson airport when the left main landing gear light indicated unsafe. The crew requested HKNW air traffic services (ATC) for more time in the circuit while trouble-shooting problem. It took more than one hour while trouble-shooting to lower then left main landing gear (LMG) without success. Eventually, the crew declared an emergency elected to do a gear-up landing and diverted the flight to Jomo Kenyatta International Airport (HKJK). The probable cause of the accident was the failure of the left MLG to during landing due to a bird strike which disabled proper functioning of the mechanical system that controls the opening and closing the door to the left MLG.

1. FACTUAL INFORMATION

1.1. History of the Flight

On 4 January 2015, about 0840 local time, a Fokker 27-50 a cargo flight, registration 5Y-SIB, operated by Skyward Express Ltd, experienced a gear-up landing at Jomo Kenyatta International Airport (HKJK). The flight had diverted to HKJK due to a mechanical malfunction of the landing gear. Visual meteorological conditions prevailed and the airplane was on an IFR flight plan. None of the ten persons on board were injured. The airplane was substantially damaged and there was no fire. The flight originated at Wajir (HKWJ) and the original destination was Nairobi-Wilson Airport (HKNW).

During the departure from HKWJ, the flight sustained a bird-strike. After taking steps to confirm any aircraft system malfunction the aircraft systems were still operable and the flight crew elected to continue the flight. The flight en route was without any incident. While in the traffic pattern at Wilson, the landing gear was activated to extend and it resulted in an unsafe indication for the left main gear. During the period of about an hour while circling overhead the airport, the flight crew attempted to resolve the anomaly but they were unsuccessful. It prompted the crew to declare an emergency after they had confirmed that the left main landing gear was locked up in the air position and was not lowering. After declaring an emergency, the crew carried out an extensive consultation with the air traffic services and the company ground personnel and elected to divert the flight to Jomo Kenyatta International Airport (HKJK). The crew made a successful gear-up landing at Jomo Kenyatta International Airport (HKJK) runway 06 with no injury to those onboard the flight however the aircraft sustained substantial damage. The aircraft got disabled after landing and blocked both runways for more than four hours as the airport authorities struggled to remove it to pave way for other operations.

According to the report obtained from post-accident interview with the flight crew at 0540 the aircraft took-off at Wajir (HKWJ) on runway 15 and immediately after take-off on passing 200ft at a speed of $V_{ref} + 10$ Knots the crew noticed a flock of birds and tried to evade them. While increasing the aircraft rate of climb they felt like a thud (hitting something). After clearing the flock they inspected the instruments and confirmed all aircraft systems were functioning satisfactorily. They then proceeded with their flight as intended.

According to the air traffic control (ATC) transcript obtained from Wilson control tower upon entering Wilson aerodrome traffic circuit at 0641:41 the crew requested ATC to join downwind runway 07 and was immediately cleared. After five minutes (0646:50) the crew requested ATC to extend downwind and at 0648:03 the crew confirms to the ATC that they are checking the undercarriage.

At 0654:08 the crew confirms to the ATC that they have an emergency on the left main landing gear and they have checked it is locked up in the air position. The crew requested for more time to trouble-shoot the problem and requested ATC to brief their company about the problem.

At 0731:07 the crew confirmed to HKNW air traffic service unit that they are ready to do gear-up landing and they would prefer HKJK instead of HKNW. They are then cleared for HKJK to join left base runway 06. 30 seconds later the crew changes their intention to go to HKJK and confirms to HKNW ATC that they would do a gear-up landing at HKNW and requests for more time.

At 0749:31 the crew consults with their company through HKNW ATC and agrees to carry out the gear-up landing at HKJK and the flight was cleared to proceed to HKJK. At 0802 the crew made a successful gear-up landing on runway 06 at HKJK.



Figure 1:A photograph showing the disabled aircraft on the runway after gear-up landing

1.2 Injuries to Persons

Table 1: Injury chart

Injuries	Crew	Passenger	Others	Total
Fatal	0	0	0	0
Serious	0	0	0	0
Minor/none	4	6	0	10
Total	4	6	0	10

1.3 Damage to Aircraft

Substantially damaged

1.4 Other Damages

None

1.5 Personnel Information:

1.5.1 Captain

The captain was 54 years old and had a valid Airline Transport Pilot Licence issued on 4th July 2014 expiring on 6th January 2015 with a total of 17000 flying hours. He had a total of 1200 hours on FK27-50. He held a first class KCAA medical certificate with limitation on corrective "lens correction".

The captain started his career in flying in 1985 with KAF where he flew Buffalo DHC-5D, Dornier Do28D-2 and Bulldog S100/127. He obtained CPL in 1995 and later obtained ATPL in 2001. He left the military in 1996 and joined Blue Bird Aviation Ltd where he flew Let 410A and Let410 UVP and Dash 8 aircraft. On 21st November 2003 he sat his first TTR on F27-50 and failed and on November 2004 he sat TTR on F27-50 and passed. He held a valid ATPL issued on 04-07-14 and which was due to expire on 06-07-15 with type rating on Let 410, LET 410 UVP E9 & E20, Fokker 50, Fokker F100 and DHC 8. The Captain joined Skyward Express in January 2012 and by the time of the accident he had a total of 1700 flying hours.

1.5.2 First Officer

The first officer was 29 years old and had a valid Airline Transport Pilot License issued on 25th April 2014 expiring on 31st May 2015 with a total of 4143 hours. He had a total of 200 hours on the type. He held a valid first class medical certificate with no limitation. He was type rated on

BE1900, BE300 and F27-50. The First Officer had recently (16th November 2014) attended and successfully completed EASA Multi-Pilot Type Rating Course on the Fokker 50 airplane.

1.6 Aircraft Information

1.6.1. General

According to record obtained from KCAA the aircraft type Fokker 50 version 27 serial number 20167 was constructed on 25th October 1989 by Fokker Aircraft B.V. Further information indicates that it was registered in Malaysia where it was being operated before it came to Kenya. It got registered in Kenya on 21st August 2013 with registration mark 5Y-SIB under the ownership of Skyward International Ltd. It later changed ownership and on 22 September 2014 after it was acquired by Skyward Express Ltd with the same registration mark. It was issued with a certificate of airworthiness on 5th September 2014 which was valid until 4th September 2015. According to the flight operations manual the Fokker 50 aircraft requires a minimum of two pilots and two in-flight attendants for compliance requirements if the passenger seating capacity is over 50 and one in-flight attendant for passenger seating capacity less than 50.

1.6.2 Landing Gear Operation

1.6.2.1 General

The landing gear (LG) consists of a forward retracting nose gear and two rearward retracting main gears. Doors enclose the landing gear bays. The LG is retracted and extended hydraulically. In the event of a hydraulic system failure the landing gear can be lowered by gravity.

1.6.2.2 Main Landing Gear Control and Operation

The main landing gear is kept in retracted position by hydraulic pressure. In case of pressure loss, the main gears are held in retracted position by mechanical up locks. The main gear doors open and close mechanically by the main gear struts. When the main gears extended will lock

mechanically. The hydraulic operation is controlled by a two position (UP or DOWN) LG selector located at the center main instrument panel. The electrically controlled LG selector valve directs hydraulic pressure accordingly. On the ground UP selector is prevented by a selector lock. This lock will be released automatically as soon as the aircraft is airborne. In the event of an automatic lock release failure, the lock can be released by depressing the LOCK OVERRIDE button.



Figure 2: A photograph showing an engineer pulling the left MG down

The ALTERNATE LG selector is located at the RH aft side of the pedestal and has to be pulled upward to select alternate down. Operation of this lever releases the up locks of main gear and nose gear doors and dumps the hydraulic pressure of landing gear and nose wheel steering operation. Thus making the LG extend by gravity and lock by spring force.

1.7.Meteorological Information

The weather observed and recorded for HKJK at 0802 was as follows; Winds 060° at 8knts; Visibility was greater than 10km; Clouds few at 3000ft; Temperature was 28°C; Dew point 9°C; QNH 1016 mb.

1.8 Aids to Navigation

No problem with any navigational aid was reported.

1.9 Communication

No technical communication problem was reported by the flight crew or any of the air traffic controllers who handled the accident flight.

1.10 Aerodrome Information

1.10.1 Wajir International Airport (Departure Aerodrome)

Wajir airport is managed and operated by Kenya Airports Authority (KAA) and is located at N 01°43'59.4'' E 040°05'29.5'' with an altitude of 770ft above mean sea level in Wajir County in northern Kenya. It has one runway which is 2.7km length and 25 metres wide. It has two runways orientation namely 15 and 33 with asphalt/concrete surface. It normally handles both commercial and military aviation activities and its provided with air traffic services. Records obtained indicated that the airport has not been certified by KCAA as required.

1.10.1.1 Wajir Bird/Wildlife Hazard Management Program

Wajir airport had not implemented bird/wildlife hazard management program by the time of the accident even the investigation obtained a draft copy.

1.10.1.2 Major bird/wildlife attractants sites at Wajir airport

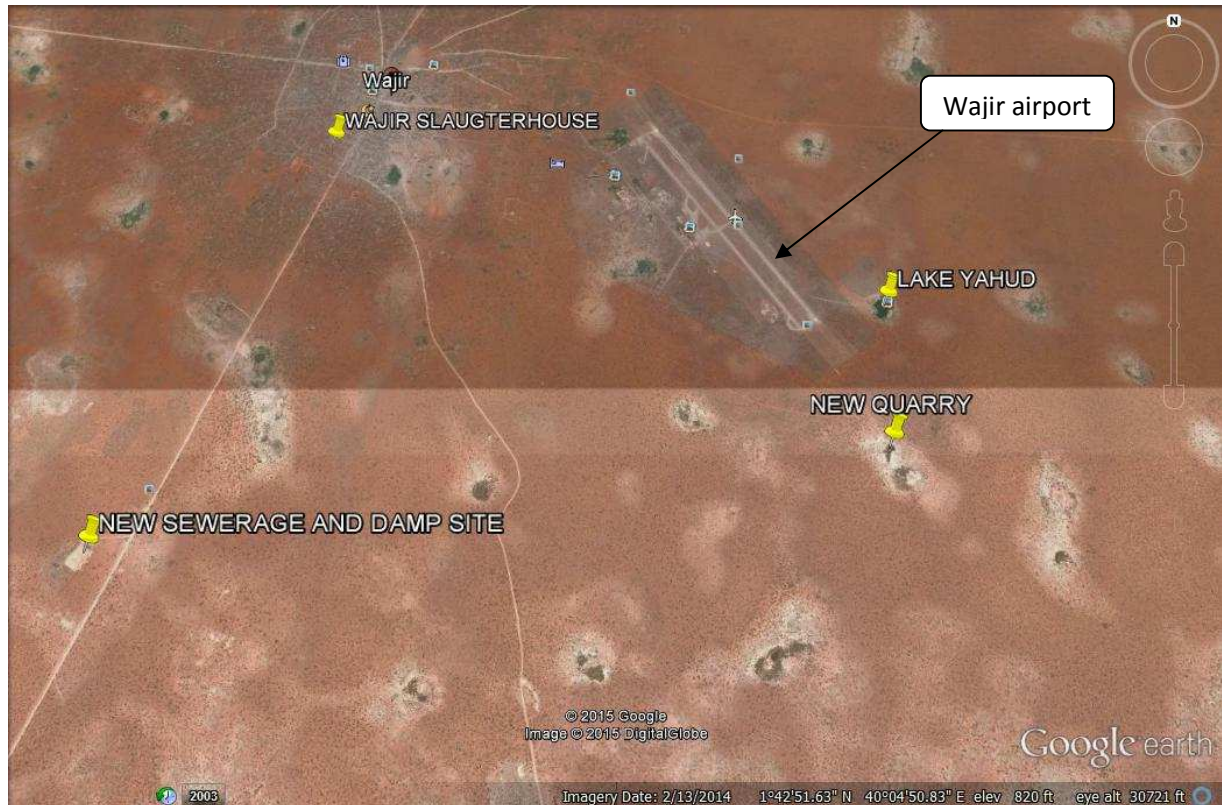


Figure 3: Google map showing Wajir aerodrome and its environs

The above Google map shows major bird/wildlife attractants around Wajir airport. Major Attractants are Wajir slaughterhouse, Lake Yahud, New quarry, new co-located sewerage and damping site. There are also other attractants within the airport such as swamp water mash, grass and bushes. All the attractants sites fall less than 7km radius from the aerodrome reference point (ARP). Lake Yahud is the nearest at 1.67km from ARP and less than 0.66km from end of runway 15.

Like all animals birds need water and food to survive. Though they can extract moisture from their food, most birds drink water every day. Birds also use water for bathing to clean their feathers, cool their bodies and remove parasites and therefore a dependable water supply is attractive.



Figure 4: A photograph showing a flock of birds feeding at Wajir slaughterhouse

1.10.1.3 ATC Procedures at Wajir

Information obtained in the AIP, AD section 2-3 specified that all aircraft departing runway 15 and proceeding to the west are to maintain runway heading until passing 3000ft amsl. All aircraft departing runway 33 and proceeding to the west are to maintain runway heading until passing 3000ft amsl. All inbound traffic from west and intending to land runway 15 are to route over Waghala airstrip before joining final not below 3000ft amsl. All inbound traffic from west and intending to land on runway 33 are to join final not below 3000ft amsl. The AIP, AD section 2-4 also provides a caution on the chart **“Loose chips on the runway and presence of animals and birds on the maneuvering area”**

1.10.2 Jomo Kenyatta International Airport (Destination Aerodrome)

Jomo Kenyatta International Airport (HKJK) is the country's main international airport operated by Kenya Airports Authority located in Nairobi County. It is certified by KCAA and it had a valid certificate for operation issued on 1st July 2014 and expiring on 30th June 2015. It has a bitumen runway surface length 4117m and width 45m located at WGS co ordinates S 01°19'09.2'' E 036°55'39.9'' with an elevation of 5330ft agl. It has PAPI lights on both runway 06 and 24. Runway 06 has Precision Approach Landing Systems (PALS) and runway 24 has Simple Approach Landing Light Systems (SALS).

1.10.2.1 HKJK plan for the Removal of Disabled Aircraft

Information obtained in HKJK aerodrome certification manual indicated that the plan for removal of disabled aircraft was part of the aerodrome manual. However a copy of the plan obtained revealed no official approval by KCAA had been obtained even though the aerodrome was certified. A copy of the certificate indicated the certificate was issued on 1st July 2014 and was due to expire on 30th June 2015. Secondly information relating to HKJK capability for the

removal of disabled aircraft had not been published in the Kenya AIP. The AIP, AD section 2-9 indicated that the plan for the removal of disabled aircraft was yet to be notified.

Further details on the plan contained information on KAA policy on safety, purpose and scope for the removal of disabled aircraft at HKJK, responsibility for recovery of the disabled aircraft, list of companies and equipment available. It also contains information on responsibility of key personnel involved, procedures for the removal of a large aircraft, list of equipment, facilities and agencies involved including their personnel and experts.

1.11 Flight Recorders

1.11.1 Cockpit Voice Data Recorder

The aircraft was equipped with Fairchild Model A100 Solid-State Cockpit Voice Recorder (CVR). The CVR was taken to United Arab Emirates (U.A.E) General Civil Aviation Authority laboratory for readout and evaluation. There was no significant data extracted from the CVR during readout that was consistent with the flight as it was not functional.



Figure 5: A photograph showing the Cockpit Voice Recorder

1.11.2 Flight Data Recorder

The aircraft was equipped with a Honeywell model 980-4700 solid-state FDR. Just like the VCR the FDR was also taken to United Arab Emirates (U.A.E) General Civil Aviation Authority laboratory for a readout and evaluation. The raw data was extracted but could not be analyzed at the laboratory because of lack of Data Frame Layout documentation. The raw data extracted was sent to Netherlands for evaluation. The result was sent back to AAID with six parameters of aircraft flight information for the entire accident flight.



Figure 6: A photograph showing Flight Data Recorder

1.12 Wreckage and Impact Information

1.12.1 Structural Damage

The first evidence of ground impact was located 200m from threshold runway 06 along the runway centerline. The aircraft rolled on its belly leaving a trail of fuselage fairing and broken pieces of the main fuselage along its track. The wreckage was found 950m from threshold runway 06 near taxiway F. The main wreckage consisted all parts of the aircraft structure including the landing gear which was still in up position. Figure 7 shows the main wreckage and fire foam sprayed by RFF response unit.

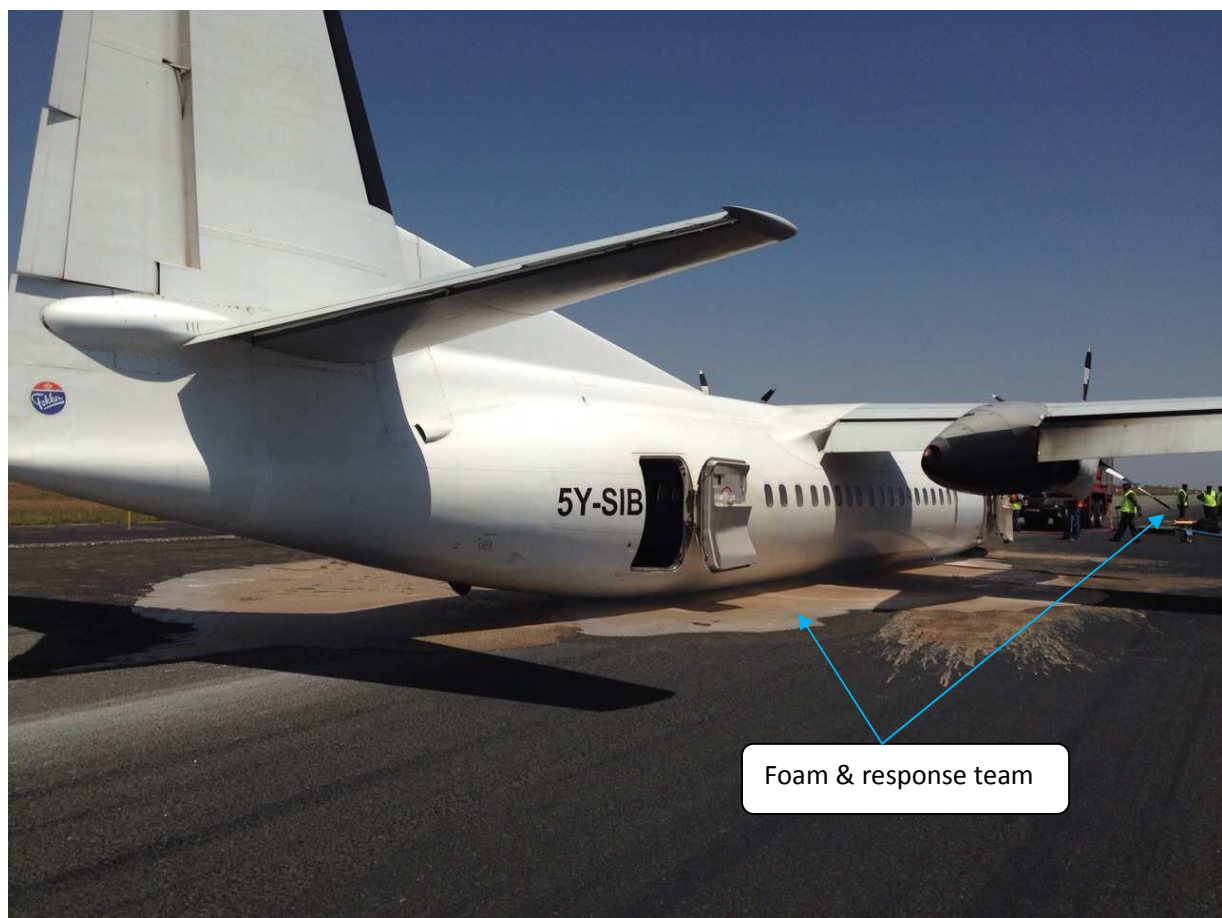


Figure 7: A photograph showing the wreckage of the aircraft on the runway

1.12.2 Main Landing Gear

The left Main Landing Gear (MLG) was found still up position and the carcass of MSwedged onto the door of the left main landing gear. There was a dent to the door of the left MLG with scattered stain of blood from the bird's carcass. A close examination revealed that one the struts

that mechanically aid the closing and opening of the door of the left MLG was broken (See figure 10 below).



Figure 8: A photograph showing an engineer removing the bird's Caracas from the left MLG



Figure 9: A photograph showing damage on the door to the left MLG

The right MLG was on gear-up and remained intact. All components on the right MLG were also found intact and attached to the main gear assembly. The nose landing gear (NLG) was also on gear-up position and intact. All components of the NLG were found intact and attached to the gear assembly.

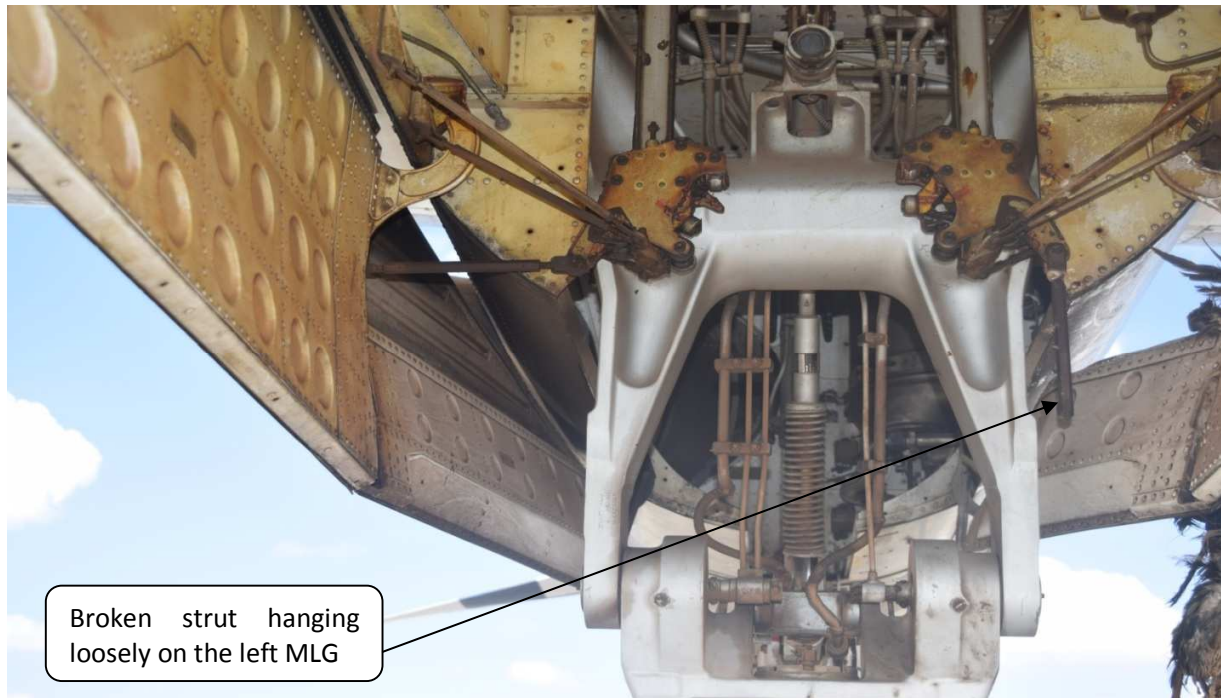


Figure 10: A photograph showing the left MLG with a broken strut

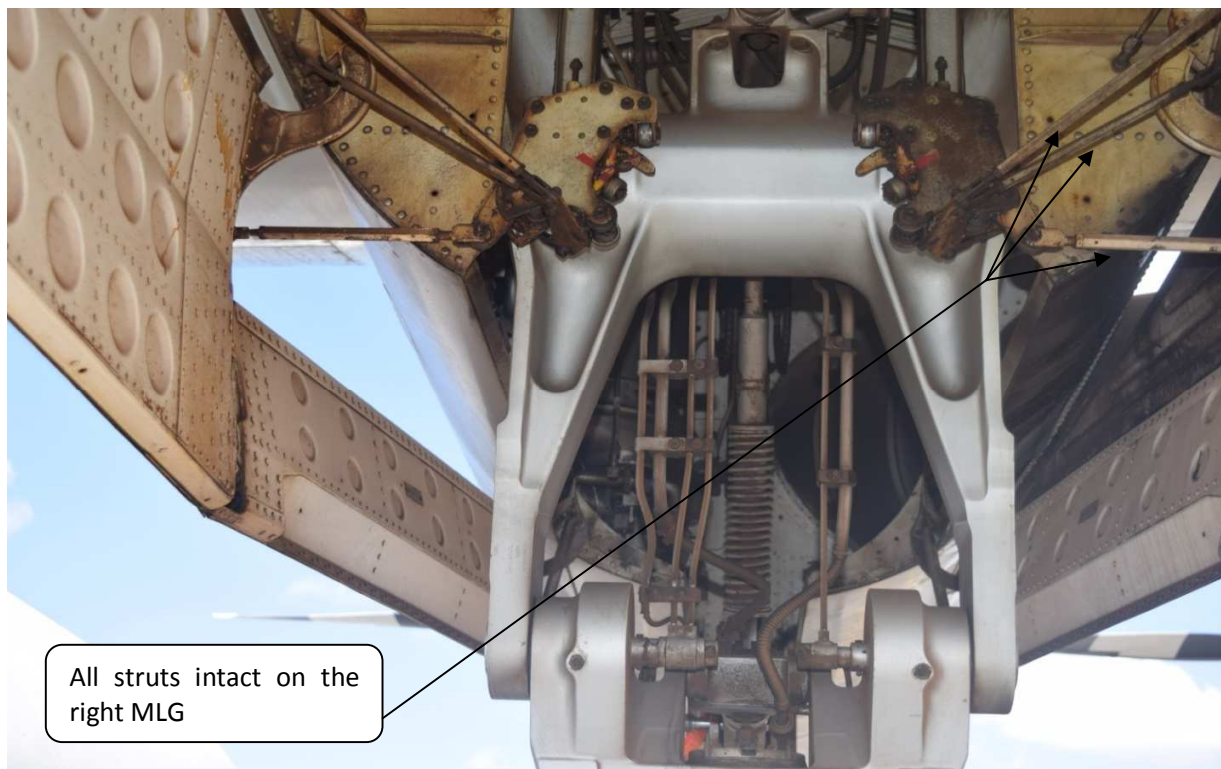


Figure 11: A photograph showing the right MLG with all the struts intact and in position

1.13 Medical and Pathological Information

Not applicable

1.14 Fire

There was no fire after the crash.

1.15 Survival Aspects

1.15.1. Emergency exits

The aircraft was equipped with four entries and exits doors. The passenger door on the forward LH side, the cargo door on the forward RH, the cargo door on the aft RH and the gallery service door on the LH. All the doors can be opened and closed from inside or outside. All the doors opens on the sideways except the passenger door on the forward LH. The passenger door on the forward LH is equipped with an integral stairway and two handrails and it opens downwards. When unlocked the door opens under its own weight.

1.15.2 Evacuation of Crew and Passengers

According to the report from the First Officer all the passengers on flight had been briefed and prepared for the belly landing. Immediately after the aircraft came to a stop the passenger door on the forward LH side could not open due to its position and contact with the ground and therefore the In-flight attendant opened the aft RH cargo door and the flight engineer opened the gallery service door on the LH. The First Officer opened the forward RH side cargo door just behind the flight deck for evacuation. The first Officer supervised the evacuation of all passengers as the Captain switched off all the electric instruments. The flight engineer also disconnected the aircraft battery. After securing the aircraft flight crew also evacuated the aircraft but did not close the doors. After all had evacuated the aircraft and just outside the aircraft, the fire vehicles arrived and sprayed the aircraft with foam. They were then joined by

other emergency responders who assisted them and later transferred them to the terminal building by bus.

1.15.3. Emergency Response

At first the emergency response was activated at 0654 at HKNW when the crew declared an emergency. HKNW was put on standby for emergency landing and same information was relayed to HKJK approach radar and Kenya Airport Police Unit (KAPU) head office based at HKJK.

At 0731 KAPU commandant responded with a vehicle to HKNW to join other emergency response team. As the crew prepared for gear-up landing at Wilson they changed the decision and preferred to land at HKJK however the decision was again rescinded almost immediately. Then there was confusion at 0750 about which aerodrome between HKNW and HKJK to do gear-up landing. However after thorough consultation between the crew and the company officials it was agreed that the crew land at HKJK. The crew was then directed to proceed to HKJK.

At 0759 HKJK Rescue and Fire Fighting Services Unit (RFFS) was alerted and three (3) foam vehicles was deployed along the runway. At 11:00 information about emergency landing at HKJK was relayed to HKJK Port Health, HKJK GFS and HKJK PABX office. GFS responded by diverting all calls from PABX to GFS and informed all the airline agents including the airside bus drivers.

At 11:02 HKJK security was alerted and they immediately responded by opening gate no. 13 and alerted all other security staff. After landing the RFF vehicles responded and dispensed foam on the aircraft and all the persons onboard evacuated and taken to the terminal building using KAA bus.

1.15.4 Recovery for the Disabled Aircraft

The recovery process started 81 minutes after the aircraft had landed and got disabled on the runway. The exercise involved engineers from Skyward Express, Kenya Airways, HKJK RFF and airport security. Initially the recovery team experienced a number of challenges including lack of manpower to lift the recovery kit, poor coordination among the responding agencies and lack of knowledge on the use of the recovery kit. The recovery used KQ lifting crane, KAA pneumatic weight lifting bags and the operators jack planes. Use of air bags and jacking the plane by its nose. Several methods was used until the aircraft was lifted at around 15:50 and wheels released after which it was towed to parking taxiway M. The runway was opened at 1620 after it was cleaned off all loose debris from the aircraft and the runway surface.

1.16. Tests and Research.

Nil

1.17. Organizational and Management Information

1.17.1 KCAA Guidance on Airport Bird/Wildlife Hazard Management

Part VII of Kenya Civil Aviation Authority (Aerodrome) Regulations 2013 section 64 and 65 require an operator to establish procedures to deal with danger posed to aircraft by the presence of wildlife in the vicinity of aerodrome. The operator shall establish a wildlife management plan which shall be approved by the authority to form part of the aerodrome manual. An operator shall take practical measures to control the wildlife habitat at or near aerodromes and to disperse birds which are potential hazard to aircraft operations. The operator shall carry out an ongoing evaluation of the wildlife hazard by competent personnel

1.17.2. Wajir Bird/Wildlife Hazard Management Program

As indicated in section 1.10.1 and 1.10.1.2 above

The obtained draft copy of Wajir bird/wildlife hazard management program indicated that it was developed on 1st August 2014. However by the time of the accident the program had not been approved by Kenya Civil Aviation Authority (KCAA) and had not been implemented by Kenya Airport Authority (KAA)Wajir as required. Details of the program provided an overview and objective of Wajir bird/wildlife management program. It also provided information on the aircraft type and nature of operations including a summary of key bird/wildlife hazard at Wajir airport. The program provided wildlife hazard assessment, the available bird/wildlife hazard management measures and the techniques to be used to scare bird/wildlife. Information on best practices for habitat management around the airport including bird/wildlife attractants at the airport was also included. The program provided information on personnel training, communication, role and responsibilities of key personnel on bird/wildlife control.

1.17.3 KCAA Guidance for the Removal of Disabled Aircraft

According to Kenya Civil Aviation Authority Aerodrome regulations section 100 requires that an operator shall put in place a plan for the removal of disabled aircraft from the movement area or adjacent area to it. The plan shall be based on characteristics of the type of aircraft operation. It shall include a list of equipment and personnel for that purpose, procedures for the removal of the disabled aircraft, arrangement for rapid receipt of the recovery equipment kits from other aerodromes and the name of the coordinator designated to implement the plan

1.18 Additional Information.

1.18.1 ICAO Guidance on Airport Wildlife Hazard Management

ICAO Doc 9137 Part 3 Section 3.3 requires airport operators to develop, implement and demonstrate an effective bird/wildlife strike and wildlife control program at the airport which is commensurate to the size

and level of complexity. This includes the appointment of bird/wildlife coordinator who is responsible and accountable for its bird/wildlife hazard control policy and personnel engaged in bird/wildlife hazard control. ICAO Doc. 9137 Part 3 Section 4 describes the organization of airport bird/wildlife strike control program. It provides details on the structure and scope of an airport bird/wildlife strike control program.

1.18.2 ICAO requirements for Removal of Disabled Aircraft

ICAO Annex 14 Vol. 1 specifies that each aerodrome must draw up a comprehensive plan for the removal of a disabled aircraft on or adjacent to the aircraft movement area and a coordinator designated to implement the plan when necessary. Additionally, the plan should include a list of equipment and personnel responsible, a list of nominated agents acting on behalf of each operator at the aerodrome and statements of the airlines arrangement for use of pooled specialist equipment and a list of local contractors able to supply heavy equipment on hire.

Furthermore, aerodrome operators are required to provide the aeronautical information service office with information on their capability for removal of disabled aircraft. This may be expressed in terms of the largest aircraft the aerodrome is equipped to remove.

1.19 Useful or Effective Investigation Techniques

Not applicable

2. ANALYSIS

2.1 General

The flight crew were properly certificated and qualified under KCAA regulations. There was no evidence of preexisting medical or physical condition that might have adversely affected the flight crew performance during the accident flight. The aircraft was equipped and maintained in accordance with KCAA regulations. There was no significant weather that day which would adversely affect the accident flight.

During take-off the crew experienced a bird strike which they did not envisage would cause danger to their flight until when on final downwind at Wilson airport. This happened because

immediately after the strike they checked all the flight control systems and noticed normal function. They therefore elected to continue with the flight and did not inform the air traffic control unit at Wajir or at destination. After detecting unsafe signal on the left MLG on arrival at Wilson airport circuit the flight crew made several attempts to extend the left MLG without any success. After extensive consultation with air traffic control unit and the company, the flight crew elected to carry out a gear-up landing at HKJK instead of HKNW. A successful gear-up landing was eventually executed at HKJK and there were no injuries to persons onboard however the aircraft sustained substantial damage.

2.2 Wajir International Airport

2.2.1. Bird/wildlife Control Program

By the time of the accident HKWJ had not been certificated by KCAA and had not implemented bird/wildlife control program as required by KCAA Aerodrome regulations Part VII section 64 and 65. The investigation however obtained a draft copy of the proposed bird/wildlife control program prepared by the aerodrome management. A close examination on the detail of the proposed program revealed that it did not adopt best practices for aerodrome bird/wildlife control as specified by ICAO Doc. 9137 Part 3 section 4 and 9 to include an inventory of all bird attractant sites within 13 km radius of the ARP. The investigation noted that the program only considered an area extending up to 8 km radius of the ARP instead of 13 km.

2.2.2 ATC Procedures

The ATC procedures for Wajir aerodrome provided just a warning on the presence of birds and there was no other procedure to supplement the warning on the charts to circumvent and reduce the danger posed by birds.

2.3 HKJK Plan for the Removal of Disabled Aircraft

Information obtained revealed that the plan for removal of disabled aircraft was part of HKJK aerodrome manual however the plan had not been approved by KCAA even though the HKJK had an aerodrome certificate. Additionally the plan had not been published in the AIP to provide information relating to HKJK capability for the removal of disabled aircraft as specified by ICAO Annex 14 Vol. 1 section 2.10.

2.4. Flight Recorders

The CVR was not functional since there was no significant data extracted during read-out that was consistent with the accident flight.

The raw data was extracted from the FDR and an evaluation on the data obtained six parameters relating with the accident flight. The parameters were however obtained after the raw data obtained was sent to Netherlands for evaluation because U.A.E GCAA laboratory relevant software for the analysis.

2.5. Wreckage and Impact Information

The aircraft stopped a distance of 750 m after first impact with the ground. There was extensive damage on its lower fuselage (belly) as it left a trail of broken pieces from the fuselage. The passenger door on the forward LH failed to open because of its contact on the ground owing to its structural position on the aircraft. There was also a dent on the door to the left MLG and one broken strut that mechanically aids the closing and opening of the door of the left MLG.

2.6. Fire

There was of fire after aircraft impact

2.7.Survival Aspects

2.7.1. Evacuation of Passengers and Crew

Despite the fact that the forward LH passenger door could not open as required all the passengers and crew were evacuated.

2.7.2. Emergency Response

Initially there was confusion between HKJK and HKNW on the intended aerodrome for gear-up landing from the crew. Secondly there was effective communication between the crew and the air traffic control on the events preceding the emergency landing. However there was lack of proper coordination for emergency response by HKJK fire and rescue service team to respond on the accident flight because the fire and rescue unit was alerted at 0759 and the impact was at 0802 just three minutes prior to impact and yet the crew had declared an emergency more than 30 minutes earlier.

2.7.3. Removal of Disabled Aircraft

Generally, the process for recovery of the disabled aircraft took more than one hour to start. Secondly there was lack of effective equipment and adequate trained personnel for the removal of the disabled at HKJK.

2.8 KCAA

KCAA as a regulator has established regulations for on management of bird/wildlife hazard at aerodromes. KCAA aerodrome regulations section 64 and 65 requires all aerodrome operators to establish suitable program on prevention of bird strikes including procedures for monitoring the presence of birds at aerodrome.

While KCAA has also established regulations (Aerodrome regulation 100) for aerodrome operator to establish a plan for the removal of disabled aircraft on the aerodrome, KCAA on its part did not ensure that HKJK plan for the removal of disabled aircraft was appropriately approved before an aerodrome certificate was issued.

3. CONCLUSIONS

3.1 Findings

- 3.1.1. HKJK had a valid certificate issued by KCAA.
- 3.1.2. Wajir airport had not been certificated as required by KCAA regulations.
- 3.1.3. Even though HKJK had a plan for the removal of disabled aircraft as required, there was no evidence to show if the plan had been approved by KCAA.
- 3.1.4. Information relating to HKJK capability for the removal of disabled aircraft in the AIP as specified by ICAO Annex 14 Vol. 1 section 2.10 was missing.
- 3.1.5. Both the Captain and First Officer were properly certificated and licensed to operate the Aircraft as per KCAA regulations
- 3.1.6. The accident aircraft was properly equipped, dispatched and maintained however the Cockpit Voice Data Recorder installed on the aircraft was not functional during the read-out.
- 3.1.7. There was no significant weather that would have adversely affected the flight.
- 3.1.8. Wajir aerodrome had not implemented bird/wildlife hazard management program as required by KCAA.
- 3.1.9. The drafted copy of Wajir bird/wildlife hazard management program recognized the existence of several bird/wildlife attractants in the vicinity of the aerodrome within a radius of 8km (see section 2.10) instead of the 13km as specified by ICAO Doc.9137 Part 3 section 4.7.2
- 3.1.10. There was a warning statement on the presence of bird/wildlife included on Wajir aircraft departure/arrival chart however there are no any ATC procedures developed to supplement safe flight operations at Wajir.

- 3.1.11. There was effective communication and coordination between the flight crew and ATC during the accident flight.
- 3.1.12. The FDR could not be analyzed at U.A.E General Civil Aviation Authority laboratory due to lack of information on Data Frame Layout documentation.
- 3.1.13. The installed CVR for the aircraft was not serviceable as it did not have any data relevant to the accident flight.
- 3.1.14. After experiencing the bird strike the crew did not inform the ATC about the incident.
- 3.1.15. There was no effective warning on the presence of birds from the ATC at HKWJ and no procedure provided on sharing information with other flight carries operating within the vicinity of the airport on the presence of birds.
- 3.1.16. There was no proper coordination for emergency response by HKJK fire and rescue services considering that the unit received information three minutes prior to impact and yet the crew had declared an emergency more than 30 minutes before. The response therefore did not meet the 3 minutes response specified by ICAO Annex 14 Section 9.2.27.

3.2 Probable Cause

The cause of the accident was the failure of the left Main Landing Gear,MLGto extendduring landing due to a bird strike which disabled proper functioning of the mechanical system that controls the opening and closingthe door to theleft MLG.

4. SAFETY RECOMMENDATIONS

- 4.1. Since Wajir International Airport was not certified by KCAA as required it is recommended that:

KCAA ensure that all airport used for international operations are certified as per the Specification of ICAO Annex 14 Section 1.4.1and procedures contained in the airport

part of the safety management system(SMS).The AAID recommends that KCAA certify all certification manual relating to bird/wildlife control are developed and implemented as

Airports used for international operations as per the Specifications contained in both the ICAO Annex 14 Section 1.4.1 and procedures in the airport certification manual relating to bird/wildlife Control are developed and implemented as part of the safety management system (SMS)

- 4.2 Since information on the CVR installed in the aircraft could not be obtained due to equipment malfunction it is recommended that:

KCAA develop technical guidance material for monitoring flight data recorders to ensure their serviceability at all times during operations.

- 4.3 Since Data Frame Layout and FDR calibrations documents could not readily be obtained during FDR read-out at U.A.E it is recommended that:

KCAA to ensure air operators provide Data Frame Layout and FDR calibration documents to be availed to AAID for aircraft accident investigation when required.

- 4.4. While investigation on HKJK established that the aerodrome was certified and had a valid certificate from KCAA, its plan for the removal of disabled aircraft had not been approved. Secondly, information on the aerodrome capability for the removal of disabled aircraft had not been published in the AIP as specified by ICAO Annex 14 Vol. 1 section 2.10. Therefore the investigation recommends that:

KCAA revises the certification process for HKJK as specified in 4.1 above and to ensure that procedures contained in the airport certification manual relating to the plan for removal of disabled aircraft is approved and the capability for removal of disabled aircraft published in the AIP.

- 4.5. Since there was confusion during the initial emergency declaration on whether the aircraft would make a gear-up landing at HKJK or HKNW which led to some agencies

such as KAPU respond to HKNW instead of waiting for the flight at HKJK and information reaching RFFS 3 minutes to touch-down it is recommended that:

KAA revises its emergency response procedures to ensure effective communication and coordination of all responding agencies.

- 4.5 Since the draft copy of KAA HKWJ bird/wildlife hazard management program only covered an area 8km from ARP instead of up to 13km as specified by ICAO Doc. 9137 Part 3 section 4.7.2 it is recommended that:

KAA revise WHP section 2.10 to cover areas off-airport up to 13km radius on ARP to include major bird attractant sites such as Wajir slaughterhouse and the damping site.

- 4.4. It was noted that the process of recovery of a disabled on the runway was complex exercise that requires involvement special procedures including multipart leveling and lifting. Some of these procedures can be dangerous and safety precautions must take precedence over all constraints. It is therefore recommended that KAA in consultation with major airline operators such as KQ train and equip a team of personnel to acquire relevant skills on the removal of disabled aircraft.

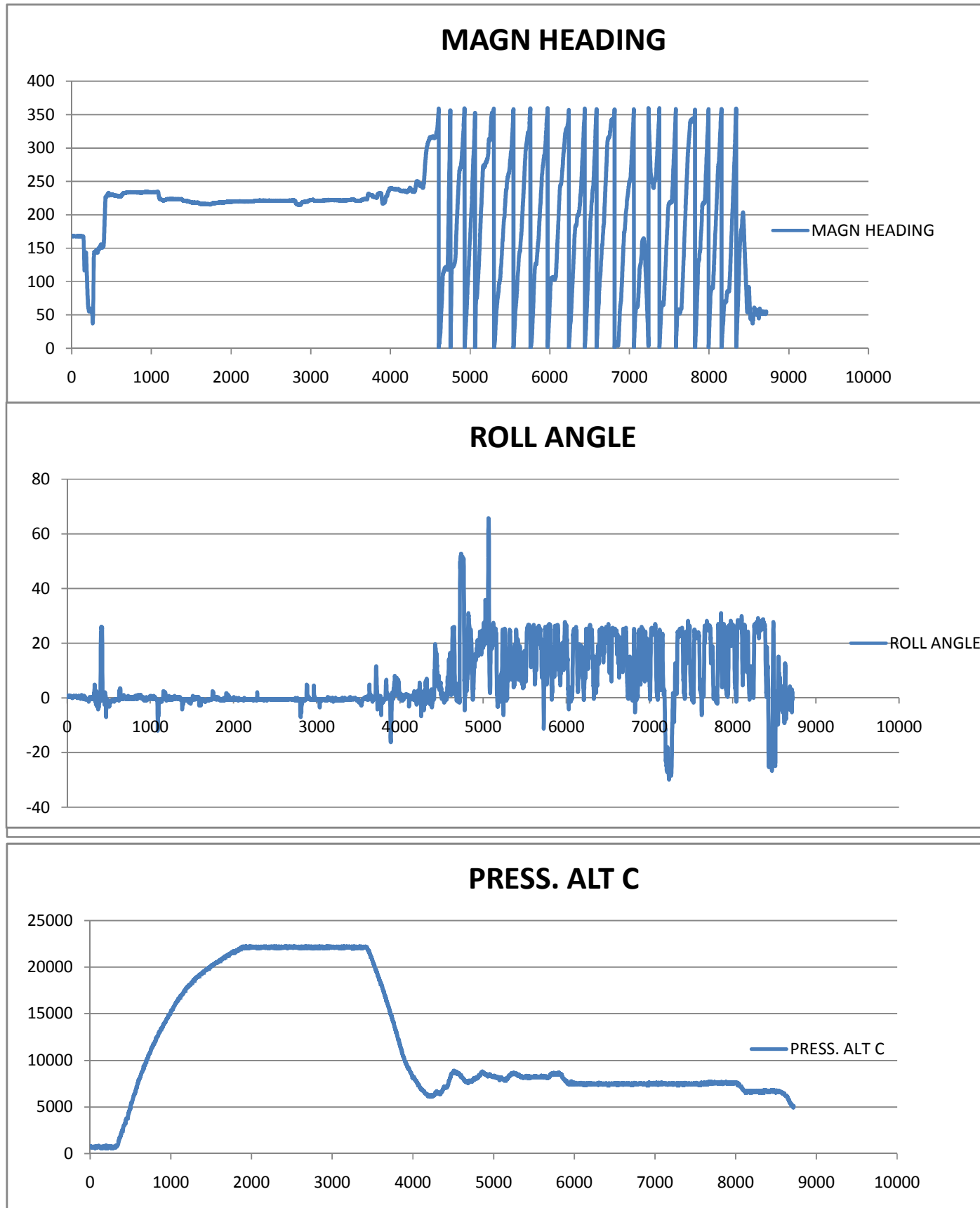
- 4.5 While the investigation noted that both ICAO Doc. 9137 Part 1 Chapter 15 and FAA Advisory Circular No. 150/500-4 withdraw their recommendation on the procedures for foaming the runway during emergency operation, the investigation recommends that:

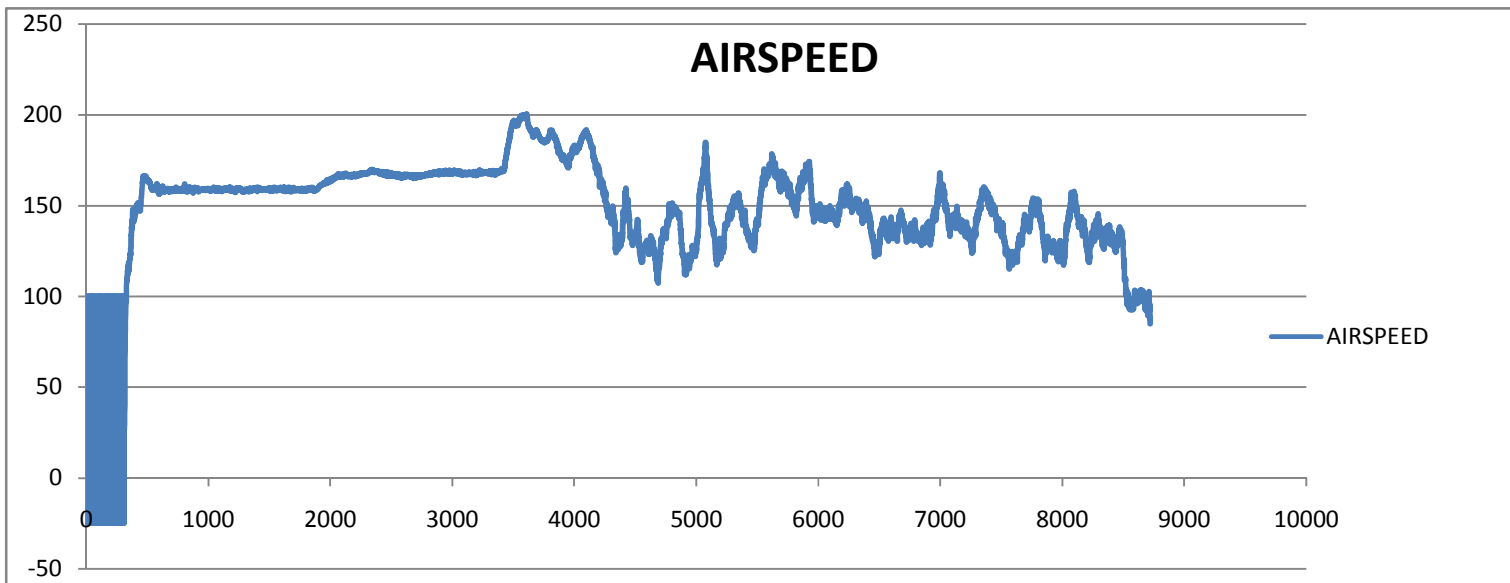
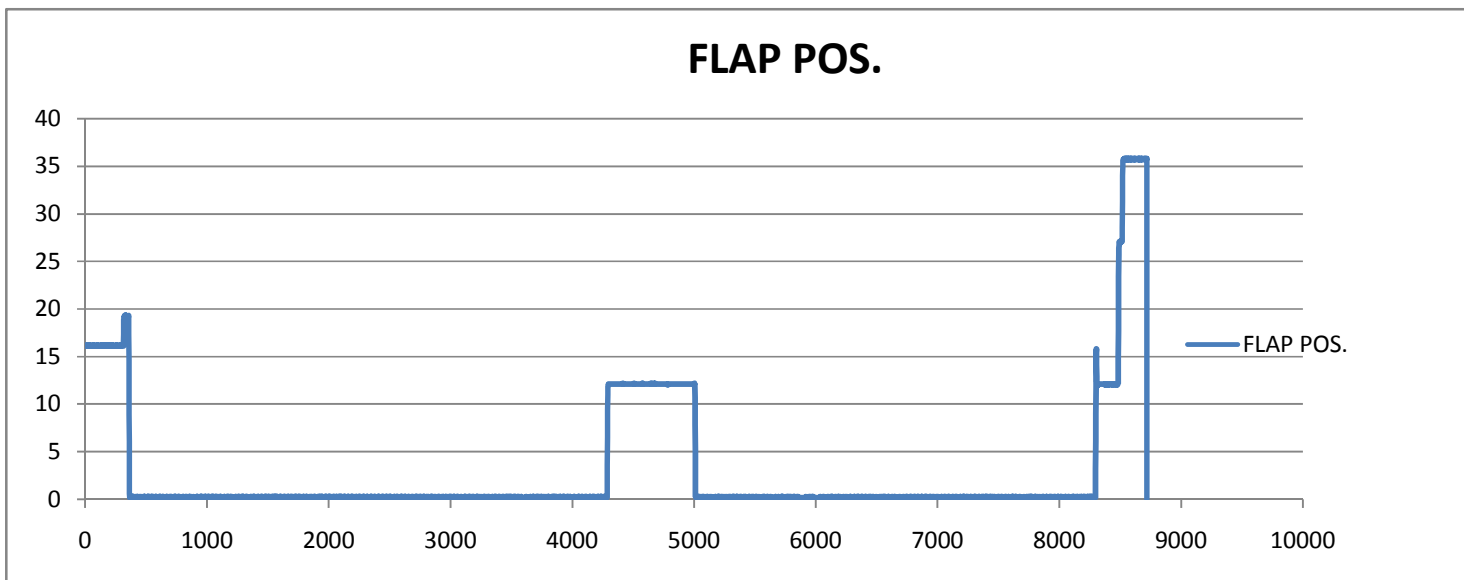
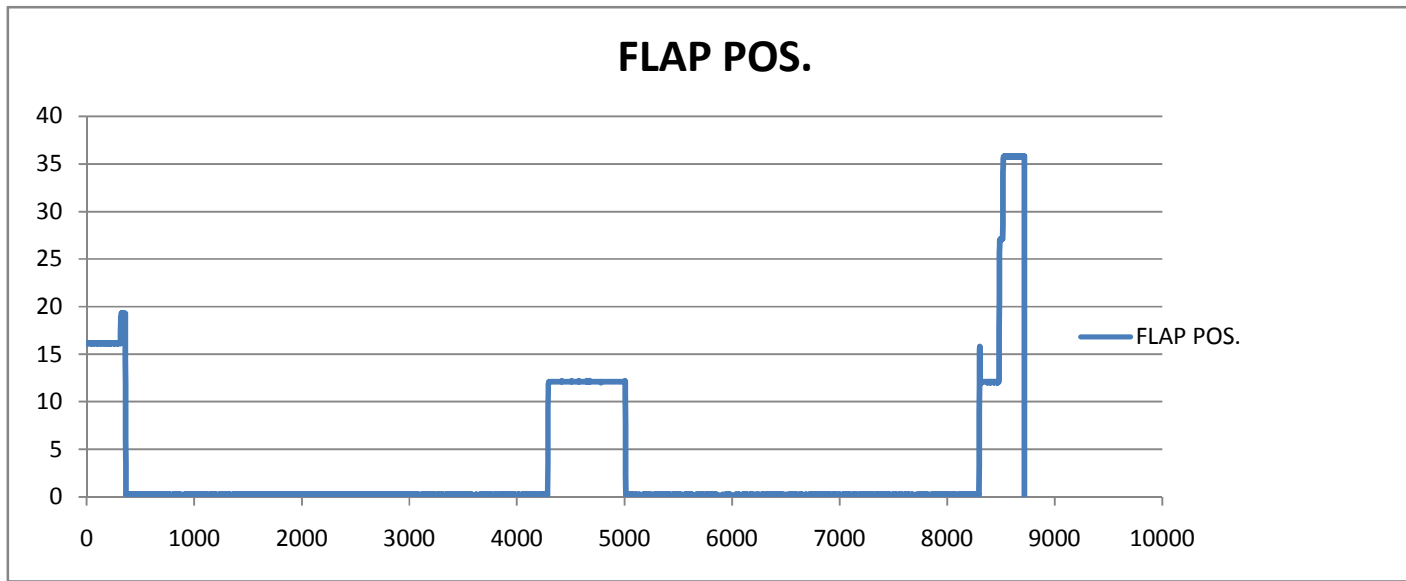
More research should be carried out to establish new techniques on how to assist aircraft on emergency landing such as the accident flight in order to minimize the damage and injury to aircraft and occupants onboard.

- 4.6 HKWJ should explore the need to acquire new predictive and real-time bird avoidance systems such as avian radar to supplement the bird control hazard management programs at the airport.

APPENDICES

APPENDIX A: FDR READ-OUT





APPENDIX B: ATC VOICE RECORDER TRANSCRIPT

VOICE TRANSCRIPT ON 5Y-SIB FK50 EMERGENCY LANDING AT JKIA ON 04-01-2015 AT 0641Z

TIME(UTC)	STATION TX	STATION RX	INTELLIGENCE
0641:25	5YSIB	TOWER	WILSON MORNING FIVE YANKEE SIERRA INDIA BRAVO
0641:28	TOWER	5YSIB	FIVE YANKEE SIERRA INDIA BRAVO MORNING GO A HEAD
0641:31	5YSIB	TOWER	WE ARE FROM WAJIR WITH TEN ON BOARD, ALONG THE NORTH EAST, AND SILOS WILL BE ZERO SIX FOUR SEVEN. REQUEST JOINING FOR WILSON
0641:41	TOWER	5YSIB	ROGER THAT, CALL AGAIN RELEASED FOR RIGHT HAND DOWNWIND ZERO SEVEN QNH ONE ZERO TWO ONE WINDS ARE CALM.
0641:47	5YSIB	TOWER	CLEARED FOR RIGHT DOWNWIND ZERO SEVEN ONE ZERO TWO ONE SIERRA INDIA BRAVO

0641:49	5YSIB	TOWER	SIRRA INDIA BRAVO IS JOINING RIGHT DOWNWIND ZERO SEVEN
0644:54	TOWER	5YSIB	ROGER NEXT REPORT TURNING FINAL RUNWAY ZERO SEVEN
0644:57	5YSIB	TOWER	WILL CALL TURNING FINAL
0644:59	TOWER	5YSIB	TRAFFIC IS A CARAVAN ROLLING ONE FOUR TURNING RIGHT
0645:02	5YSIB	TOWER	COPIED THE TRAFFIC
0646:50	5YSIB	TOWER	SIERRA INDIA BRAVO EXTENDING DOWNWIND
0647:53	TOWR	5YSIB	AND SIERRA INDIA BRAVO ANY PROBLEM, I CAN SEE YOU ARE TAKING VERY LONG TO TURN AND YOU SEEM TO BE A BEAM THE MONASTRY
0647:03	5YSIB	TOWER	WE ARE CHECKING ON OUR UNDERCARRIAGE JUST STANDBY
0648:07	TOWER	5YSIB	ROGER THAT AND REPORT WHEN READY FOR AN ATTEMPT OR PROBABLY TO FLY OVERHEAD WE WILL ALSO CHECK IF THEY ARE DOWN
0648:18	5YSIB	TOWER	ROGER

0649:08	TOWER	5YSIB	SIERRA INDIA BRAVO JUST CONFIRM YOU COMING IN FOR AN ATTEMPT TO OR MAKE UP TO CHECK IT UP FOR YOU?
0649:14	5YSIB	TOWER	NEGATIVE WE WILL REQUIRE ABOUT TEN MINUTES ON THE, AROUND NGONG, AROUND NGONG TO CHECK ON OUR UNDERCARRIAGE
0649:27	TOWER	5YSIB	ROGER REPORT WHEN READY TO COME UP FOR AN ATTEMPT
0649:31	5YSIB	TOWER	WILCO.
0654:04	5YSIB	TOWER	WILSON SIERRA INDIA BRAVO
0654:06	5YSIB	TOWER	SIERRA INDIA BRAVO GO A HEAD
0654:08	TOWER	5YSIB	YAA WE HAVE AN EMERGENCY, OUR LEFT MAIN GEAR IS NOT LOWERING AND WE HAVE CHECKED IT IS LOCKED UP IN THE AIR POSITION. WE ARE DECLARING AN EMERGENCY ON THE, FOR THE UNDERCARRIAGE.
0654:26	TOWER	5YSIB	ROGER, THAT EMERGENCY DECLARED AND REPORT WHEN YOU ARE READY TO ATTEMPT A LANDING
0653:33	5YSIB	TOWR	ROGER WE WILL STILL NEED FOR

			ANOTHER TEN MINUTES FLYING TO LOWER THE UNDERCARRIAGE THEN WE WILL CALL READY FOR AN ATTEMPT.
0654:43	TOWER	5YSIB	ROGER
0654:49	5YSIB	TOWER	CAN YOU PLEASE BRIEF THE COMPANY, OUR COMPANY
0654:49	TOWER	5YSIB	WILCO, WE ARE DOING THAT
0702:06	TOWER	5YSIB	FIVE YANKEE SIERRA INDIA BRAVO FROM TOWER
0702:18	5YSIB	TOWER	GO A HEAD TOWER FOR SIERRA INDIA BRAVO
0702:22	TOWER	5YSIB	WE ARE JUST REQUESTING FOR YOUR FUEL ENDURANCE ONLY.
0702:26	5YSIB	TOWER	WE HAVE NOW ONE HOUR
0702:30	TOWER	5YSIB	ROGER NEXT REPORT READY FOR THE ATTEMPT
0702:33	5YSIB	TOWER	WILCO.
0731:03	5YSIB	TOWER	AND WILSON SIERRA INDIA BRAVO
0731:05	TOWER	5YSIB	FIVE YANKEE SIERRA INDIA GO AHEAD
0731:07	5YSIB	TOWER	OKAY, WE ARE NOW COMMITTED TO DO A BELLY LANDING AND WE

			PREFER TO GO TO NAIROBI JOMO.
0731:16	TOWER	5YSIB	COPIED STANDBY REJOINING
0731:23	5YSIB	TOWER	OKAY AND PLEASE EXPEDITE WE ARE COMING UP TO OUR LIMIT
0731:38	5YSIB	TOWER	AND WILSON SIERRA INDIA BRAVO
0731:40	TOWER	5YSIB	SIERRA INDIA BRAVO YOU ARE CLEARED TO JOIN LEFT BASE RUNWAY ZERO SIX AND YOU ARE CLEARED TO JOIN NOW
0731:44	5YSIB	TOWER	OKAY DISREGARD JOMO WE WILL DO IT IN WILSON.
0731:51	TOWER	5YSIB	OKAY CONTINUE APPROACH NUMBER ONE ON FINAL
0731:54	5YSIB	TOWER	OKAY FINAL RUNWAY ZERO SEVEN SIERRA INDIA BRAVO
0731:57	TOWER	5YSIB	CORRECT AND I HAVE YOU VISUAL WIND NOW ZERO SIX ZERO ONE ZERO KNOTS CLEARED TO LAND RUNWAY ZERO SEVEN
0732:01	5YSIB	TOWER	OKAY TO LAND ON ZERO SEVEN SIERRA INDIA BRAVO
0732:14	5YSIB	TOWER	TOWER SIERRA INDIA BRAVO
0732:16	TOWER	5YSIB	FIVE YANKEE SIERA INDIA BRAVO

0732:17	5YSIB	TOWER	GIVE US FIVE MINUTES TO COMMUNICATE WITH THE COMPANY
0732:20	TOWER	5YSIB	ROGER THAT, JUST CONFIRM TO US THAT THE GEAR THAT HAS A PROBLEM IS THE STARBOARD MAIN GEAR?
0732:30	5YSIB	TOWER	AFFIRM IT IS THE MAIN GEAR
0732:33	TOWER	5YSIB	AND YOUR STARBOARD ONE?
0732:37	5YSIB	TOWER	IT'S THE PORT, PORT, PORT MAIN GEAR, PORT MAIN GEAR.
0732:42	TOWER	5YSIB	YAA WE COPIED THAT
0749:26	TOWER	5YSIB	FIVE YANKEE SIERRA INDIA BRAVO FROM WILSON
0749:28	5YSIB	TOWER	GO A HEAD
0749:31	TOWER	5YSIB	YAA WE WOULD ADVISE THAT YOU TALK TO THE COMPANY ON THIS FREQUENCY. HE IS RIGHT HERE
0749:35	5YSIB	TOWER	OKAY GO
0749:37	COMPANY	5YSIB	ALI
0749:41	COMPANY	5YSIB	YAA EE NATAKA MUENDE JOMO, BUT WE ARE TRYING TO, YOU CAN FLY FOR ANOTHER TWENTY MINUTES?
0749:47	5YSIB	COMPANY	WE ARE APPROACHING THE MINIMUM

			KABISA, WE ARE JUST TRYING TO REDUCE THE FUEL LOAD, OR YOU ARE SAYING WE GO JOMO?
0749:52	COMPANY	5YSIB	EE I THINK JOMO IS A BETTER RUNWAY TERMS OF NANII, ITA ACHIEVE NANII, SO IT IS A BETTER RUNWAY.
0749:58	5YSIB	COMPANY	OKAY SAWA
0749:59	COMPANY	5YSIB	NA BETTER FACILITY SO I WILL ADVISE YOU SHORTLY SO WE ARE TALKING WE ARE COORDINATING WITH TOWER HAPA VILE MTAPATIWA PRIORITY.
0750:05	5YSIB	COMPANY	OKAY SAWA
0750:12	5YSIB	COMPANY	WACHA BASI WE GET IN TOUCH WITH JOMO AT THE MOMENT
0750:16	TOWER	5YSIB	ROGER
0750:22	5YSIB	TOWER	JUST ADVISE WE ARE SPEAKING TO TOWER
0750:24	TOWER	5YSIB	ROGER THAT
0751:26	TOWER	5YSIB	THE FIVE YANKEE SIERRA INDIA BRAVO
0751:30	5YSIB	TOWER	GO AHEAD

0751:32	TOWER	5YSIB	TRAFFIC NOW IS A BOEING SEVEN EIGHT EIGHT AND A DREAMLINER, SHE SHOULD BE AROUND TEN MILES FROM FINAL RUNWAY ZERO SIX TO LAND JOMO KENYATTA, ABLE TO MAKE IT BEHIND THAT PLANE?
0751:41	5YSIB	TOWER	OKAY WE GOT TRAFFIC ON TCAS, WE WILL , WE ARE ABLE TO MAKE IT BEHIND
0751:48	TOWER	5YSIB	ROGER THAT, AND PROBABLY HOLD OVERHEAD WILSON AND UPON SIGHTING PROCEED BEHIND THAT PLANE FOR FINAL RUNWAY ZERO SIX JOMO
0751:55	5YSIB	TOWER	OKAY WE HAVE THE TRAFFIC IN SIGHT, AND POSITION BEHIND SIERRA INDIA BRAVO
0751:58	COMPANY	5YSIB	ALI
0752:01	5YSIB	COMPANY	SEMA
0752:02	COMPANY	5YSIB	YAA BEFORE TOUCH DOWN TO, ZIMA BOTH ENGINES
0752:06	5YSIB	COMPANY	OKAY SIR, WE WILL DO THAT AS PER THE CHECKLIST

0752:09	5YSIB	COMPANY	THANK YOU
0752:16	TOWER	5YSIB	AND SIERA INDIA BRAVO YOU GOT THE DREAMLINER IN SIGHT NOW SHE IS AROUND EIGHT MILES FROM TOUCH DOWN
0752:20	5YSIB	TOWER	IN SIGHT
0752:21	TOWER	5YSIB	ROGER THAT, CONTACT JOMO TOWER NOW ON ONE ONE EIGHT ECIMAL SEVEN.
0752:26	5YSIB	TOWER	OKAY WE WILL SWITCH TO TOWER THANK YOU
0752:29	TOWER	5YSIB	WISHING YOU A VERY SAFE LANDING
0752:21	5YSIB	TOWER	THANK YOU