REPUBLIC OF KENYA

MINISTRY OF TRANSPORT

DEPARTMENT OF AIR ACCIDENT INVESTIGATION

ACCIDENT REPORT COLLISION 5Y-SFE & S9-BAS

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CIVIL AIRCRAFT ACCIDENT REPORT

CAV/ACC/BAS/SFE/05

OPERATOR:	1.	748 AIR SERVICES LIMITED
	2.	TRANSAFRIK CORPORATION LTD.
AIRCRAFT:	1.	HAWKER SIDDELEY HS 748
	2.	HERCULES L382G
REGISTRATION:	1.	5Y - SFE
	2.	S9 - BAS
PLACE:		LOKICHOGGIO AIRPORT
DATE:		10TH JUNE 2005
TIME:	1.	1007 HOURS
	2.	1159 HOURS

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

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SYNOPSIS

Accident Investigation Department received information from Lokichoggio Tower that an aircraft had belly landed at the airport. As we were making arrangements to go to the scene, the Tower informed us that a second accident involving a Hercules aircraft had happened. Tower was instructed not to move the accident aircraft until the investigators arrive. We arrived at Lokichoggio the following morning, 11th June 2005, and commenced investigations. Sao Tome and Principe Civil Aviation Authority was informed of the accident to the Hercules, S9 - BAS.

748 Air Services Limited Hawker Siddeley (HS) 748 aircraft, registration 5Y-SFE, departed Lokichoggio Airport at 0540 hours for Boma, Southern Sudan. After Boma, the aircraft landed at Torit then Natinga, all in Southern Sudan, before proceeding back to Lokichoggio. The aircraft joined long final approach for landing from the west of the airfield and was given instructions to land on Runway 09. As soon as the aircraft touched down, the propellers struck the runway surface for some distance then the aircraft veered off the centerline to the left and came to a stop, some distance down the runway. The captain, the first officer and the loadmaster evacuated themselves. They were not injured. The aircraft sustained substantial damage.

After the accident, three other light aircraft, a Dornier 228, an Antonov 28 and a Cessna C208, landed safely at the airfield on Runway 27 after the HS 748 accident. Two Antonov-12 (AN12) aircraft inbound to Lokichoggio from Torit, Southern Sudan, diverted to Juba upon getting information of the runway obstruction.

Transafrik Corporation Hercules aircraft, Sao Tome registration S9 - BAS, flying for the United Nations World Food Programme, contacted Lokichoggio Tower at 1130 hours. The aircraft was returning from a food air drop at Motot, Southern Sudan. The pilot was advised to divert to Eldoret International Airport but he opted to land at Lokichoggio. The Tower cleared the Hercules to land on Runway 27 at the pilot's discretion. The aircraft made a very heavy landing short of the runway and the top centre fuselage broke. The aircraft came to a stop about one kilometer from the touchdown point. Shortly before coming to a halt, the aircraft impacted the HS 748 with its right wing tip. The captain, the first officer, the flight engineer and the two loadmasters evacuated themselves safely. The probable cause of the HS 748 accident was the failure to complete the landing checklist by the crew. Failure in cockpit monitoring and cross checking and misinterpretation of the landing gear up warning were contributory factors.

The probable cause of the Hercules accident was the captain's improper decision to land on the blocked runway at Lokichoggio Airport.

1. FACTUAL INFORMATION

1.1. ***History of the flight***

1.1.1. The HS 748

The HS 748 departed Lokichoggio Airport at 0540 hours for Boma, Southern Sudan. On board were three crew members; the captain, the first officer and the loadmaster. The aircraft had a fuel endurance of 4 hours. The flight was to leave Lokichoggio empty to Boma to pick up passengers, fly to Tirot to pick and drop, then to Natinga to drop and fly back to Lokichoggio empty. The outbound flight, with the captain flying, was uneventful. The first officer was the pilot flying (PF) for the return leg. The captain did the checklist and operated the radios. The captain stated that he called Lokichoggio on completing after take off checks and also reported when they reached West 2 (W2) (see GPS Arrival chart below). They were given instructions to land on Runway 09. Between W2 and 4 mile final, he heard another aircraft, possibly an Antonov 12 (AN-12) report overhead W2. The AN12 was about 5 miles behind the HS 748. The first officer stated that he could see the AN12. As they continued the approach, about 8 miles away, he heard another aircraft's communication about backtracking runway 09 for take off but he was comfortable with that. Tower advised them to continue with the approach. When at about 4 mile final approach, the AN-12 called the Tower and reported that it was too close to the traffic ahead and was making an orbit to the south. The Tower reportedly immediately cleared the AN-12 to land. The AN-12 gave its current position and asked the Tower to confirm clearance to land was for the HS 748. The Tower confirmed that when the HS 748 was at short final.

The captain stated that they were doing a higher than usual speed due to the AN-12 behind them. As they continued with the approach, the PF announced that they were coming in too fast and he would use flap 22. The captain told the PF to reduce power to zero torque. Immediately the warning horn came on. The first officer stated that the captain advised him that the flight fine pitch stop (FFPS) was on and told him to pull the FFPS lever. The first officer pulled the lever but the aircraft just shook and the horn continued. The captain admitted that he associated the horn with an engine over temperature warning. They did not investigate the cause of the warning further. The first officer stated that they did not complete the landing checks. If they had done below the line checklist they would have caught the gear up situation. Below the line checklist includes: landing gear, trimmers, airspeed checks, landing lights, hydraulic pressure check, brakes, and flap position.

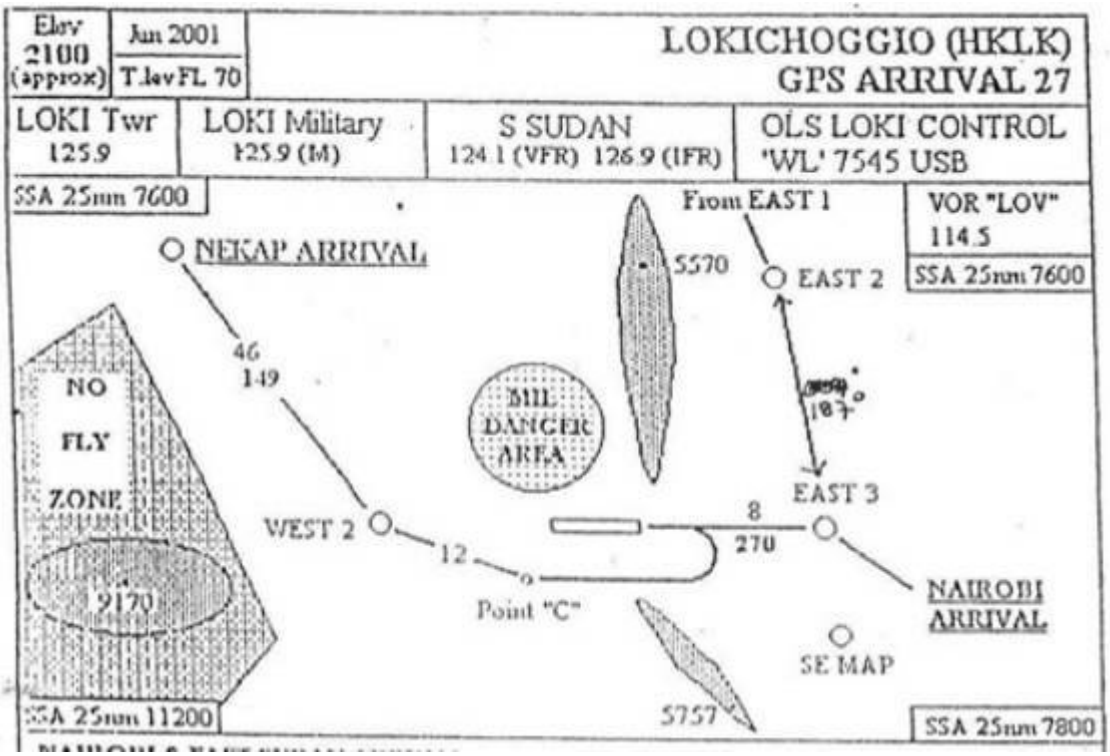
The aircraft touched down with the tail, about 583 meters from the threshold of runway 09 and immediately thereafter the propeller blades struck the runway surface. There were propeller blade marks for a distance of about 149 meters then the aircraft veered off the centerline to the left without vacating the runway. The crew evacuated themselves through the emergency exit. They sustained no injuries. The aircraft sustained substantial damage to the propellers and lower fuselage. All propeller blades were bent back. The aircraft came to rest with the right wing stretching almost halfway across the runway. Crash Fire Services rushed to the scene but were instructed not to move the aircraft until investigators arrive from Nairobi.

Three other light aircraft, a Dornier 228, an Antonov 28 and a Cessna C208, landed safely at the airfield on Runway 27 after the HS 748 accident. Two Antonov 12 (AN12) aircraft inbound to Lokichoggio from Torit, Southern Sudan, diverted to Juba upon getting information of the runway obstruction.

1.1.2. The Hercules

The Hercules departed Lokichoggio Airport at 0925 hours for Motot, Southern Sudan. On board were five crew; the captain, the first officer, the flight engineer and two loadmasters. The aircraft had three rotations planned to do aerial food drops. It had already done one early morning rotation to Pierri. This departure to Motot was the second rotation. The outbound leg was flown by the captain. The first officer was the PF on the return leg. The first officer heard other aircraft discussing the blocked runway at Lokichoggio on radio. At this time the captain was talking to Khartoum. As soon as the captain finished with Khartoum, the first officer informed him of the blocked runway. The captain then called the WFP at Lokichoggio and confirmed the information. They were advised to divert to Eldoret International Airport. They checked the charts for Eldoret and the flight engineer confirmed that they had enough fuel to divert to Eldoret. As they approached NEKAP (see GPS Arrival chart below), they heard another aircraft request Lokichoggio tower on radio if the airport was closed. Lokichoggio reportedly responded that it was open. The other aircraft then requested clearance to land and it was granted permission. At this point the captain requested Lokichoggio for permission to descend and this was granted. The captain then asked the first officer to descend to 5000 feet. During the descent, the PF requested the captain to take

over control in case they decide to land at Lokichoggio and the captain agreed.



As they got 5000 feet altitude, the PF suggested to the captain that they contact WFP Lokichoggio as they had been told to divert to Eldoret. The captain reportedly said that he would contact them after he checked the runway. Downwind to Runway 27, the captain inspected the runway. According to him, he estimated that the disabled aircraft was two thirds down Runway 27. That gave him a comfortable 1000 meters to land. He decided that they had enough runway length to land. The captain believed that, with full reverse thrust and full brakes, they could stop the aircraft at the parking for light aircraft (see the airfield diagram below). The captain stated that whenever they landed on runway 27, they would normally exit at the parking for light aircraft. The captain then talked to the Tower and was cleared to land. He was advised to carry out a long approach to Runway 27. The Tower further advised that the wind was 060°/12 knots. The captain estimated this to

be about 7 knots tail wind for the Hercules. The Hercules L382G Airplane Flight Manual (AFM) gives the maximum tailwind component approved for take-off and landing as 10 knots.

The captain did not mention whether any crew briefing was done. The purpose of the briefing is to enhance communications in the cockpit and to promote effective teamwork. The briefing should establish a mutual understanding of the specific factors appropriate for the landing. The captain determines the length and detail of the briefing.

The captain took control and stabilized the approach at 3 degree descent, full flap, speed 110 knots. The first officer reported long final Runway 27 and the Tower cleared them to land. The first officer stated that the aircraft was within its landing parameters. According to the flight engineer, the landing profile was alright all the way to touchdown. Close to the threshold of 27, the captain moved the throttles to flight idle and the aircraft suddenly dropped and impacted the ground. The captain states that he pulled back on the control column for the flare with little or no effect. The elevator was sluggish. The aircraft main landing gear slammed into the ground 16 meters short of the bitumen, bounced and the nose gear hit the bitumen one meter from the edge. At this stage the aircraft tail broke. The captain stated that he realized he had no brakes and the nose wheel steering was not very effective. He was, therefore, steering using asymmetric power. The aircraft veered left of the centerline, then right and finally came to a stop about 1000 meters from the touchdown point. Shortly before stopping, the aircraft had impacted the disabled HS 748 with its right wing tip. The aircraft stopped with the port main gear and nose gear off the runway,

adjacent to the HS 748. The fire emergency control handles were pulled. The crew evacuated themselves safely. Except for the captain, who had minor injuries, the crew suffered no injuries.

1.2. Injuries to persons

The captain of the Hercules was treated for low back pain and a cut left thumb. He believes the low back pain was not from the positive landing but from the control column which suddenly snapped forward at touchdown. He states that his thumb got jammed between the control column and the radio altimeter. There were no other injuries in the two accidents.

1.3. Damage to aircraft

The HS 748 aircraft sustained extensive lower fuselage structural damage due to scraping along the runway. All propeller blades were bent back. The HS 748 was declared a total hull loss by the insurance. For the Hercules, top of the centre fuselage section broke just behind the center wing trailing edge. The starboard wing tip was ripped off. The aft fuselage lower section was damaged due to sliding on the bitumen surface of the runway. The Hercules aircraft is undergoing repair at Lokichoggio.

1.4. Other damage

None

1.5. Personnel information

The flight crews of the two aircraft involved in the accident were correctly licensed, medically fit and properly rested to perform their

duties. Both aircraft crews were familiar with operations at Lokichoggio Airport.

The HS 748 First Officer, who was the pilot flying at the time of the accident, age 40, held a valid commercial pilot licence (CPL) number YK-3080-CL with an HS 748 rating as second pilot only. The HS 748 rating was acquired in 2004. He held a first class medical certificate issued with no limitations on 24th January 2005. He had accumulated 4300 hours, of which 2800 were on the HS 748. He had flown about 57 hours in the last 28 days before the accident and his rest time had been about 13 hours. The day before the accident he had one flight that took off from Lokichoggio at 0414 hours and returned at 1319 hours. That day he went to bed around 1800 hours and got up at 0230 hours. The captain called him at 0400 hours to confirm their flight for the day.

The HS 748 first officer had not done his Crew Resource Management (CRM) training.

The HS 748 captain, age 37, held a valid air transport pilot licence (ATPL) number YK-5557-AL with an HS 748 rating. He held a first class medical certificate issued with no limitations on 7th March 2005. He had accumulated 2000 hours on the HS 748. He had flown about 65 hours in the last 28 days before the accident and his rest time had been about 12 hours.

The captain had not done his recurrent CRM training. The training has since been carried out.

The Hercules captain, who was the pilot flying at the time of the accident, age 53, held South African airline transport pilot licence number 0270040108 with Hercules ratings. He held a first class medical certificate issued with no limitations on 11 February 2005. He had accumulated 19800 hours, of which 15000 hours were in the Hercules. He had flown about 4 hours in the 24 – hour period before the accident and his rest time had been more than 13 hours. He received his pilot proficiency check ride on the Hercules on 4th May 2005. The day before the accident he had a relatively short day. He departed Lokichoggio at 0500 hours and was back by 1000 hours. He went to bed around 1800 hours. Before the accident flight, he had done an earlier air drop to Pierri and was back by 0800 hours. He was scheduled to do one more rotation for the day. The captain completed his in-house CRM recurrent training on 11th November 2004.

The Hercules first officer, age 57, held Peru airline transport pilot licence number 634 with Hercules ratings. He held a first class medical certificate issued with no limitations on 13th April 2005. He joined Transafrik Corporation in 1998. He did his pilot proficiency check ride on the Hercules on 26th May 2005. He had accumulated 14225 flying hours. The first officer completed his in-house CRM recurrent training on 15th March 2004.

1.6. Aircraft information

1.6.1. HS 748

The aircraft was a British Aerospace (Hawker Siddeley) Andover CMK1, serial number RE/748MF/174613, registration number 5Y SFE. It was issued with a certificate of registration number 1910 on 12th November 2002 and had a current certificate of airworthiness number 2039. The certificate of airworthiness was issued in the public transport category with restriction for relief work only. The aircraft was manufactured in 1967. Since new the aircraft had accumulated 14439.0 total hours including 97 hours since the last major inspection.

The aircraft was equipped with 2 Rolls Royce model 201 Dart engines, each of which had accumulated 3565.5 and 4831.8 hours respectively since last overhaul. The engines were equipped with Dowty- Rotol propellers, each of which had accumulated 2493.8 and 4118.2 hours respectively since last overhaul.
The HS 748 was last weighed on 23rd May 2005. The basic weight was 28005.04 pounds.

1.6.2. Hercules L382G

The aircraft was a Hercules model L382-28C, serial number 4472, Sao Tome registration number S9 BAS. The aircraft was manufactured in 1972. The aircraft had a current certificate of maintenance issued on 23rd May 2005 after a B3 inspection. Since new the aircraft had accumulated 51 888.3 total hours including 482.07 hours since the last C4 (3000 hours) inspection. During the C4 inspection, fuselage structural inspection is required as per Service Bulletins 382-53-50/51/53/57/61. The C4 inspection was done at Seman, Peru in February 2005. According to the aircraft technical log, the service

bulletins were complied with and no cracks were detected in the fuselage structure.

The aircraft was equipped with 4 Allison 501-D22A gas turbine engines, each of which had accumulated 5839, 7792, 6666 and 9346 hours respectively since last overhaul. The engines were equipped with Hamilton Standard propellers, each of which had accumulated 4327, 2410, 7037 and 701 hours respectively since last overhaul.

The Hercules was last weighed on 3rd February 2005. The basic weight was 75058 pounds and centre of gravity 18.36% of Mean Aerodynamic Cord (MAC).

The fuselage group consists of the nose radome, forward fuselage section, the center fuselage section, and the aft fuselage section joined together at production breaks at fuselage stations 93, 245, and 737 to form one assembly. The center section wing and wheel well fairing are integral with the center section fuselage. The center fuselage section consists of the skin and structure between fuselage stations 245 and 737 less the center wing structure between fuselage stations 517 and 597.

1.7. Meteorological information

At 1007 hours, Visual Meteorological conditions (VMC) existed with a horizontal visibility of 10 km, wind velocity at 90 degrees at 10 knots, temperature at 35 degrees Celsius and a QNH 1015hPA.

At 1159 hours, Visual Meteorological conditions (VMC) existed with a horizontal visibility of 10 km, wind velocity at 60 degrees at 7 knots, temperature at 36 degrees Celsius and a QNH 1015hPA.

The captain stated that although the Tower did not advise him of any gusty wind conditions, he had noticed some light turbulence and some dust devils, which are common in the area, moving along the dirt road to the runway. No other source has confirmed this information.

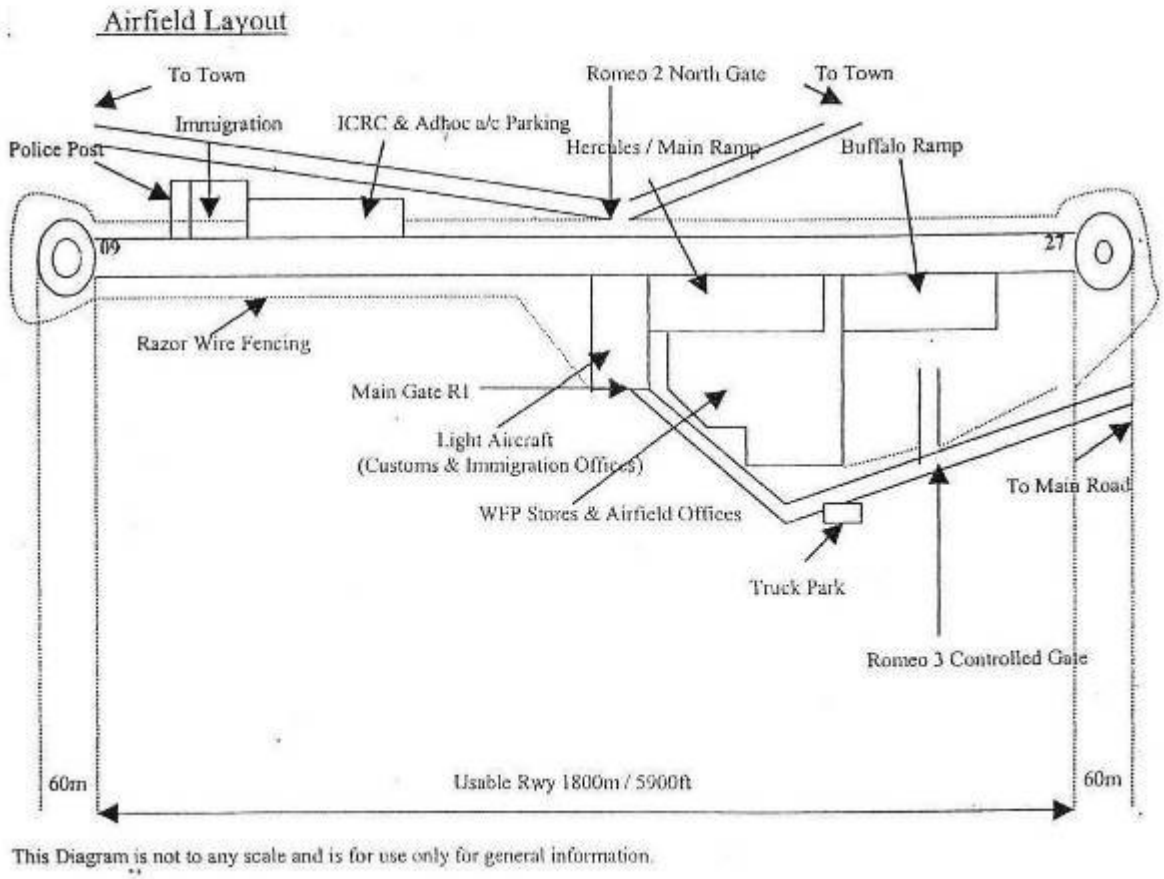
1.8. Aids to navigation

Not applicable.

1.9. Communications

There were no communication difficulties.

1.10. Aerodrome information



Lokichoggio Airport elevation is 2100 feet. It has one useable tarmac runway, 09/27, which is 1800 meters long and 25 meters wide. It also has a Control Tower and standard aerodrome equipment. The airport's geographical location is: Runway 09 position: N 04° 12.15′ E 034° 20.24′; Runway 27 position: N 04° 12.13′ E 034° 21.22′. Both crashed aircraft came to rest on the airfield at geographical location: N 04° 12.246′ E 034° 20.847′.

A 60 meter turn-around area is located at both ends of the runway. On Runway 27, the area east of this turn-around area is comprised of grassland. The aircraft main landing gear touched down in this grass area about 16 meters from the end of the runway. The grass area has an appreciable downward slope. The Hercules L382G Airplane Flight

Manual (AFM) gives the maximum runway slope for take-off and landing as plus or minus 2 percent.

Aerodrome Closure

After the second accident, the airfield was closed for all aircraft operations. ATC reported that this decision was made after consultation with Kenya Civil Aviation Authority (KCAA), Kenya Airports Authority (KAA) and the Chief Inspector of Air Accidents.

ICAO standards and recommended practices require that in the event of an accident or significant incident, the airport should be closed immediately. The airport should not be reopened until ATC has ensured that: (1) aircraft operating areas are secure; (2) aircraft movement areas that are to be reopened have been properly inspected; and (3) adequate aircraft rescue and fire fighting protection is available for aircraft operations.

The opening or closure of an airfield, or portion thereof, is the responsibility of the airport operator (KAA). However, in the fast developing dynamics that occur immediately after an accident or incident, the KAA may not be in the best position to assess the situation, and it may be beneficial to establish procedures with KCAA which gives the authority for closing the airfield under defined circumstances and guidelines to air traffic controllers. This can be accomplished through a Letter of Agreement between KAA and KCAA. Such procedures must provide safeguards to ensure that airport operations are continued or resumed only after it is determined that there will be no adverse effect on persons or property on the airfield

and that appropriate level of fire coverage is available. In addition, operations should resume only after it can be ascertained that the accident event does no pose a hazard to the resumption of airfield operations.

1.11. Flight recorders

The HS 748 was required to have a Flight Data Recorder (FDR) but none was fitted. Both the FDR and Cockpit Voice Recorder (CVR) were removed from the Hercules aircraft but the analysis was not done since enough information was available from the crew and witness statements to enable us carry out the investigation.

1.12. Wreckage and impact information

1.12.1. The HS 748

The lower fuselage was badly damaged by the impact and sliding on the bitumen. The propeller blades were bent back and slightly twisted showing that the engines were under power on landing. The bottom leading edge of the fin had a dent where it was struck by the right wing tip of the Hercules. After the accident, the landing gear selector was observed to be in the "UP" position.

1.12.2. The Hercules

Top of the centre fuselage section broke at fuselage station 737. The starboard wing tip was ripped off. The aft fuselage lower section was damaged due to sliding on the bitumen surface of the runway. The radio altimeter and the turn and slip indicator were smashed. The captain reported that, on touchdown, the control column snapped

forward and his left thumb was trapped between it and the radio altimeter.

1.13. Medical and pathological information

Alcohol and toxicological examination of the crew blood samples revealed no evidence of alcohol or drugs of abuse.

1.14. Fire

There was no fire involved in both accidents.

1.15. Survival aspects

The accidents were survivable. All the crew in both accidents evacuated themselves safely. The captain of the Hercules was treated for low back pain and a cut left thumb. He believes the low back pain was not from the positive landing but from the control column which suddenly snapped forward at touchdown. He states that his thumb got jammed between the control column and the radio altimeter.

1.16. Tests and research

A review of the American Federal Aviation Administration (FAA) Air Safety Reporting Service (ASRS) database indicates that 100 landing gear incidents have been reported each year for the past five years. Ninety-six unintentional wheels-up landings were reported in 2003.

Two factors, distraction and preoccupation, are common to most of the gear up incidents reported to ASRS. In the usual scenario, a distraction occurs at the time when the gear would normally be lowered and the pilot then becomes preoccupied with the approach and landing. Traffic is often cited as a distraction in gear up landings.

Lowering the landing gear should always be considered a two-part process. Putting the gear handle down and confirming a down and locked indication.

More recently, distractions were identified by the FAA as a significant contributing factor to checklist errors. During a review of 300 randomly selected ASRS incident reports, the FAA identified 61 occurrences of failure to monitor and cross check flight deck activity, misuse or failure to use checklists, and missed or overlooked items on the checklist following distraction or interruption. Analysis of the reports revealed that a high number of occurrences occurred when the crew were nearing the end of the work day or were rushing to meet a scheduled departure time.

Approach and Landing Information

Calculations were made using the performance charts in the Hercules (L382G) Airplane Flight Manual and the following parameters:

Airport Elevation	-	2100 feet
Wind	-	060˚/10 knots
Landing Weight	-	93718 pounds
Ambient temperature	-	36˚ C

The calculations determined that the landing field length required for the Hercules aircraft, taking into account the aircraft weight, runway elevation, and ambient temperature was 4375 feet/ 1346 meters for scheduled stops and 3600 feet/ 1107 meters for alternate stops. The landing distance required is the distance required to land from 50 feet. It is obtained by multiplying the measured stopping distances, obtained under ideal conditions during aircraft certification testing, by a safety factor. Several other factors affect landing distance, but are not specifically factored into performance charts. These include runway surface conditions, aircraft component condition, and pilot technique. The safety factor is designed to compensate for real-world variations in runway surface, component condition and pilot technique.

The aircraft maximum (structural) landing weight was determined to be 135000 pounds. The aircraft's landing weight was 93718 pounds.

The landing reference speed (V_{REF}) at 50 feet was calculated to be 104 knots.

1.17. Organizational and management information

748 Air Services Limited had a current Air Operator's Certificate (AOC) number 118B for the public transport of mail, cargo and passengers. The last AOC renewal inspection was done in November 2004 and there were no adverse comments relevant to this accident.

Transafrik Corporation is based in Luanda, Angola. It holds a Kenyan AOC number 142 to operate the Hercules L382G for cargo and mail. Safety oversight is provided by Sao Tome and Principe under a Memorandum of Understanding (MOU) signed with Kenya Civil Aviation Authority (KCAA). Pilot remuneration scheme includes a productivity/flying allowance where one is paid according to how much they fly.

1.18. Additional information

The Standard Operating Procedures (SOP) of the operator for the HS 748 aircraft was found in the Operations Manual as Chapter 3, with the effective date as 20th July 2005. The procedures relating to the checklist were as follows:

3.2.1 Checklist

It is the pilot-in-command's responsibility to ensure that the appropriate checklist for each phase of flight is used. Pilots will use the challenge and response method when using checklists. This will ensure a high degree of safety during normal and emergency procedures by maximizing crew coordination.

Where two pilots are required, the division of duties is as follows:

FLYING PILOT (FP)

This pilot will be responsible for the actual flying of the aircraft. He will have control of the aircraft and call for the appropriate checklist and configuration changes when required.

NON-FLYING PILOT (NFP)

This pilot will be responsible for the monitoring of the Flying Pilot, reading aloud of the appropriate checklist in the challenge and response manner, changing the aircraft configuration when it is called for and tuning and identifying radios and navigation aids when required.

CALLOUT PROCEDURES

It is important that standard operating procedures be followed and normal navigation accomplished. Any intentional deviation from standard procedures must be made known by the flying pilot and acknowledged by the non-flying pilot.

The Operations Manual gives the minimum crew rest time as 9 hours 15 minutes.

The Standard Operating Procedures (SOP L382) of the operator for the Hercules (L382) aircraft were found in the General Operations Manual with the effective date as 21st July 2000. The procedures relating to landing were as follows:

Note Maintain the proper attitude during approach to touchdown and avoid any tendency to drive for the end of the runway.

2. *Cross the threshold at the charted V_{REF} speed, reducing thrust as the aircraft begins to enter ground effect. Reduce to flight idle upon runway touchdown.*

LANDING

A. *Accomplish the "Landing Checklist" when on final approach.*

B. *Aircraft handling during the final approach can affect the total stopping distance. Do not touchdown near the end of the runway. Aiming at the touchdown point 1000 feet from the end of the runway will still provide sufficient distance to bring the aircraft to a stop. Landing short of the runway can have even more serious consequences than overrunning the end at low speed. V_{REF} speed should be closely observed. If the aircraft is allowed to cross the threshold at higher than V_{REF} speed, floating just off the runway surface will result and may use a large portion of the remaining runway. Do not allow the aircraft to float to bleed off speed.*

C. *The height of the aircraft over the runway has a significant effect upon total landing distance. For example, for every 10 feet the aircraft is above the normal height at the runway threshold, the landing distance increases 2.5%.*

D. *Of equal importance is the threshold speed, V_{REF}. For example, a landing speed equal to V_{REF} + 10 knots will increase the landing distance more than 1500 feet.*

E. *Normal glide path should be maintained on all approaches. The flatter the approach, the more total landing distance will be required.*

F. *Be prepared to make an early decision to go around rather than touchdown very far beyond the thousand foot aim point. The following are the most important facts affecting the landing:*

    1. *Aim for a touchdown about 1000 feet from the end of the hard surface runway. On the recommended glideslope path (three degrees); 50 foot height over the end of the runway. It is important not to land long and even more important not to land short of the runway.*

    2. *Extreme care should be taken to maintain safe airspeed in extremely gusty conditions*

1.18.1. Crew Resource Management Training

The Flight Safety Foundation Approach and Landing Accident Reduction (ALAR) Task Force found that failure in Crew Resource Management (CRM) (i.e. flight crew coordination, cross check and back up) was a causal factor in many approach and landing accidents and serious incidents worldwide. Because CRM is a key factor in flight crew performance, it has a role, to some degree, in most aircraft incidents and accidents.

Risks associated with complacency (for example; when operating at a familiar airport) or with overconfidence (for example resulting from a high level of experience with the aircraft) are CRM factors that have been identified as contributing to approach and landing accidents.

The HS 748 first officer had not done his CRM training. The captain had not done his recurrent CRM training. The training has since been carried out.

The Transafrik General Operations Manual states that *Crew Resource Management training will be provided to flight crew members together with initial training. Recurrent crew resource management training will be conducted at the discretion of the Flight Operations Manager.*

The training will include personality profiles, developing leadership skills, effective communication, decision making, poor judgment chains, self management skills, attitudes, self

image, handling stress, responsibility, conflict resolution, prioritizing situational awareness and interface between man and machine.

All the Hercules flight crew had done their CRM training in house.

1.19. New investigation techniques

None required and none were used.

2. ANALYSIS

2.1. HS 748

The captain of the HS 748 was operating the radios on the return leg. Between W2 and 4 mile final he heard another aircraft, possibly an Antonov 12 (AN12), report overhead W2. That would put the AN12 about 5 miles behind the HS 748. The first officer stated that he could see the AN12. This would indicate that he was monitoring the AN12 and that he was concerned about its position just behind them. As they continued the approach he heard another aircraft backtracking 09 for take off but he was comfortable with that. The Tower advised them to continue with the approach. Later the AN12 called the Tower and reported that it was too close to the traffic ahead and was making an orbit to the south. The Tower immediately cleared the AN12 to land. The AN12 gave its current position and asked the Tower to confirm clearance to land was for the HS 748. The Tower confirmed that the clearance was for the HS 748. It is possible that the pilots were distracted due to the radio communications between the Tower and the incoming AN12 aircraft and failed to lower the landing gear. After getting the clearance to land, they became preoccupied with the flap setting and the speed. They felt they were coming in too fast and were discussing which flaps to use. When the captain told the first officer to reduce power to zero torque and the landing gear up warning sounded, they thought it was an engine over temperature

warning. Even at this late stage they did not confirm that they had three greens. As pointed out above, the usual scenario is that a distraction occurs at the time when the landing gear would normally be lowered and the pilot then becomes preoccupied with the approach and landing. The captain was preoccupied with the radio while the first officer was concerned about the traffic behind them. The first officer did not put the gear handle down and the captain did not confirm a down and locked indication. There was no cross checking and coordination in the cockpit. This is the type of situation crew resource management training is supposed to address.

2.2. The Hercules

Runway Closure

The Hercules captain was advised to divert to Eldoret. He asked ATC whether the runway was closed as a result of the obstruction and was reportedly told that it was open. Other large aircraft had diverted to Juba on learning about the accident at Lokichoggio. The ones that had landed before the Hercules were light aircraft that were comfortable with using the remaining runway length. ICAO standards and recommended practices require that in the event of an accident or significant incident, the airport should be closed immediately. Operations should resume only after it can be ascertained that the accident event does no pose a hazard to the resumption of airfield operations. The decision by the ATC not to close the airport after the first accident, gave the impression that the Hercules could land there at the captain's discretion. This led to the decision to land the aircraft there and hence the accident.

The Decision to land

After the captain was advised to divert to Eldoret, there was good teamwork between him, the first officer, and the flight engineer in

deciding if they had all they needed to make it to Eldoret. However, the decision to land at Lokichoggio seems to have been taken by the captain alone without consulting the other flight crew. The first officer had to remind him that they have been advised to go to Eldoret and if the decision is to land then maybe he should talk to the company officials on the ground at Lokichoggio. The captain seemed not interested in this and said he would talk to them later. There is also no evidence that crew briefing was done during the approach. The captain was determined to land at Lokichoggio, possibly because he had another rotation to do that day. The request by the first officer to the captain to take control in case they land at Lokichoggio would indicate that he (the first officer) was not comfortable with the decision.

The Landing Distance

The HS 748 belly landed 543 meters from runway 09 threshold. It slid on the bitumen a further 149 meters before veering off to the left. This gives a total of 692 meters. Considering that the available runway length is 1800 meters, this leaves only 1108 meters. This is the maximum length that would be available to an aircraft landing on runway 27. Therefore, the Hercules had less than 1108 meters to land. Computations made using the AFM charts give us a landing field length of 1346 meters for scheduled stops and 1107 meters for alternate stops. From this it would seem that the pilot did not have enough length to land at Lokichoggio (scheduled stop). He stated several times that he was quite comfortable with the available runway length and even

mentioned that there was an additional 60 meters (the turning area) at the beginning of the runway. This would indicate that he intended to touchdown right at the beginning of runway 27. This is in contravention of the Hercules L382G SOP.

The captain has stated that the aircraft suddenly dropped when he brought the throttles to flight idle. Both the first officer and the flight engineer have stated that the landing parameters of the aircraft were alright and they were coming in smoothly until the captain reduced power. The Hercules L382G SOP *advises the pilot to maintain the proper attitude during approach to touchdown and avoid any tendency to drive for the end of the runway. Cross the threshold at the charted* V_{REF} *speed, reducing thrust as the aircraft begins to enter ground effect. Reduce to flight idle upon runway touchdown.* The action by the captain was deliberate. It would appear that he reduced power at this stage because he wanted to touch down at the beginning of the runway. Unfortunately he miscalculated and brought down the aircraft 16 meters short of the runway.

The comments of the captain indicate that a windshear might have caused the abrupt drop of the aircraft. However, no evidence that the aircraft encountered a windshear was found. The surface winds reported by the Tower never exceeded 10 knots.

3. CONCLUSIONS

3.1. Findings

3.1.1. HS 748 crew landed with the gear up.

3.1.2. HS 748 crew did not go through the landing checklist.

3.1.3. The crew of the HS 748 did not check to see that they had 3 greens.

3.1.4. HS 748 was not fitted with a flight data recorder (FDR).

3.1.5. A warning (the horn) sounded when the crew of the HS 748 reduced speed.

3.1.6. The crew of the HS 748 thought the horn was due to engine over heat.

3.1.7. Lokichoggio ATC did not close the runway after the HS 748 accident.

3.1.8. The Hercules crew was advised by Tower to divert to Eldoret Airport.

3.1.9. The captain of the Hercules opted to land on the remaining runway.

3.1.10. The decision to land was made by the captain alone.

3.1.11. The Hercules struck the ground 16 meters before the beginning of Runway 27.

3.1.12. Both aircraft were extensively damaged.

3.2. Probable cause

3.2.1. The probable cause of the HS 748 accident was the failure to complete the landing checklist by the crew. Failure in cockpit monitoring and cross checking and misinterpretation of the landing gear up warning were contributory factors.

3.2.2. The probable cause of the Hercules accident was the captain's improper decision to land on the blocked runway at Lokichoggio Airport.

4. SAFETY RECOMMENDATIONS

4.1. It is recommended that the KCAA introduces a requirement for operators to carry out crew resource management (CRM) training as part of their normal pilot training in line with current international practice.

4.2. It is recommended that KCAA issue clear guidelines on airport/runway closure for use by controllers (ATC).

Peter M Wakahia
CHIEF INSPECTOR OF ACCIDENTS

5. APPENDIX


Accident aircraft
Hercules Main
landing gear marks
2005 6 11

The HS 748 Landing Gear Selector in the UP position