

**SOUTH AFRICAN CIVIL AVIATION AUTHORITY
(SACAA)**

SERIOUS INCIDENT INVESTIGATION FINAL REPORT

ACCIDENT INCIDENT INVESTIGATION DIVISION (AIID)

REF: CA18/3/2/0755

**Jetstream Aircraft 4100 ZS-OMZ
Runway Excursion during Take-off from
Port Elizabeth Airport,
SOUTH AFRICA.
18 November 2009**

This Serious Incident Investigation Report is issued in the interest of Aviation Safety and to prevent any similar occurrence.



All times given in this report is Co-ordinate Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

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Jetstream Aircraft 4100 ZS-OMZ, Runway Excursion during Takeoff from Port Elizabeth Airport, SOUTH AFRICA on 18 November 2009

Prepared By

Accident Incident Investigation Division (AIID)
South African Civil Aviation Authority
Private Bag X 73,
Halfway House 1685
South Africa
www.caa.co.za

Purpose of Accident/Incident investigations

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (1997) this report is compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and not to establish legal liability.

THE SOUTH AFRICAN CIVIL AVIATION AUTHORITY

ACCIDENT & INCIDENT INVESTIGATION DIVISION (AIID)

SERIOUS INCIDENT INVESTIGATION REPORT

Jetstream Aircraft 4100 ZS-OMZ 18 November 2009 Port Elizabeth Airport SOUTH AFRICA.

Table of Contents

Executive Summary	5
1 Factual Information	6
1.1 History of the flight	6
1.2 Injuries to persons	7
1.3 Damage to aircraft	7
1.4 Other damage	7
1.5 Personnel	7
1.6 Aircraft Information	9
Airframe	9
Engines	9
Propellers	9
Weight and Balance	9
1.7 Meteorological Information	10
1.8 Aids to Navigation	10
1.9 Communications	10
1.10 Aerodrome Information	10
1.11 Flight Recorders	11
1.11.1 Cockpit Voice Recorder	11
1.11.2 Flight Data Recorder	11
1.11.3 Discussion of DFDR (See Fig 2)	11
1.12 Wreckage and Impact Information	13

1.13	Medical and Pathological Information	14
1.14	Fire	14
1.15	Survival Aspects	14
1.16	Tests and Research	15
1.17	Organization and Management	19
1.18	Additional Information	19
1.19	Useful or Effective Investigation Techniques	21
2.0	Analysis	21
3.0	Conclusions	21
3.1	Findings	21
3.2	Probable Cause/s	22
4.0	Safety Actions and Recommendations	22
5.0	Appendices	22
5.1	Appendix A	23
5.2	Appendix B	24
5.2	Appendix C	25

EXECUTIVE SUMMARY

The aircraft was scheduled to operate a domestic flight from Port Elizabeth to East London.

During the take-off run, at 70 Kts, the aircraft veered left off the runway and stopped 35m beyond the runway edge in long grass and level terrain. Although the captain applied full right rudder and aileron into the wind, he was unable to arrest the veering to the left.

After the aircraft came to a stop the aircraft was evacuated. Nobody sustained any injuries and the aircraft did not sustain any damage.

Fine weather conditions prevailed at the time of the incident and the weather did not play a role in the incident.

The runway was re-opened approximately 1 hour after the incident.

Both the captain and the 1st officer were in possession of valid licences, medical certificates and were rated on the aircraft type.

According to available records the aircraft was correctly maintained as required by the manufacturer and the regulator.

The operator was in possession of a valid Operating Certificate and the AMO was in possession of a valid AMO certificate

The investigation revealed that the Steering Control Cable was damaged during a previous installation, which resulted in wear damage to the gear inside the Steering Control Box resulting in slippage of the cable on the gear.



A view of the steering control box with the damaged control cable inserted and the outer cable casing removed to expose the damage to the cable.



A view of the gear inside the steering control box, showing the damaged Control cable (Stretch & Kink) next to it

The tiller control with the meshing gear had been in service for 5973 cycles of operation since installation on 26/04/2006. This is an on condition unit and the cable is routed through the sleeve separately. The cable was probably kinked during this installation, resulting in the wear of the meshing teeth over the next 3 years of operation.

Name of Owner/Operator : South African Airlink (Pty) Ltd
Manufacturer : Jetstream Aircraft Ltd
Model : 4100
Nationality : South Africa
Registration Marks : ZS-OMZ
Place : FAPE International
Date : 18 November 2009
Time : 1332Z

All times given in this report are Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

Purpose of the Investigation:

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (1997) this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and not to establish legal liability.

Disclaimer:

This report is given without prejudice to the rights of the CAA, which are reserved.

1. FACTUAL INFORMATION

1.1 History of Flight

- 1.1.1 On 18 November 2009, ZS-OMZ was a domestic scheduled flight from Port Elizabeth to East London, operated by SA Airlink. The occupants consisted of 3 crew members and 29 passengers.
- 1.1.2 During the take-off run at 1332Z the aircraft started veering to the left and the captain (pilot flying) was unable to arrest the loss of directional control.
- 1.1.3 The aircraft departed the runway (Rwy 08) on the left-hand side of the runway and stopped 35m beyond the runway edge in long grass and level terrain.
- 1.1.4 After the aircraft came to a stop the pilot secured the aircraft and instructed the cabin crew member to evacuate the passengers.
- 1.1.5 There were no previous snags recorded on the steering system in the flight folio or the logbooks since the cable was fitted.

1.2 Injuries to Persons

Injuries	Pilot	Crew	Pass.	Other
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-	-	-
None	2	1	29	-

1.3 Damage to Aircraft

1.3.1 The aircraft did not sustain any damage during the incident.



Fig 1: A view of the aircraft after it stopped to the left of the runway at Port Elizabeth International Aerodrome.

1.4 Other Damage

1.4.1 There was no other damage.

1.5 Personnel Information

Pilot-in-Command (Captain)

Nationality	South Africa	Gender	Male	Age	43
Licence Number	*****	Licence Type	Airline		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	Night Instrument				
Medical Expiry Date	31 March 2010				
Restrictions	Nil				
Previous Accidents	Nil				
Last CRM Course (Crew Resource Management)	15 January 2009				

Flying Experience:

Total Hours	5972.4
-------------	--------

Total Past 90 Days	196.2
Total on Type Past 90 Days	196.2
Total on Type	4724.9

Duty Times:

12 to 16 November 2009	Leave
17 November 2009	Operated flight #'s 8486 / 8487 / 8488 / 8489 Sign on 12:30 and sign off 17:35
18 November 2009	Operated flight #'s 8486 / 8487 Sign on 12:30 and sign off 15:05

Co-pilot (1st Officer)

Nationality	South Africa	Gender	Male	Age	25
Licence Number	*****	Licence Type	Airline		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	Night Instrument Instructor Gr 2 Safety				
Medical Expiry Date	31 March 2010				
Restrictions	Nil				
Previous Accidents	Nil				
Last CRM Course (Crew Resource Management)	16 April 2009				

Flying Experience:

Total Hours	2474.14
Total Past 90 Days	254.19
Total on Type Past 90 Days	192.09
Total on Type	471.28

Duty Times:

14 & 15 November 2009	Off
16 November 2009	Operated flight #'s 8791 / 8792 / 8735 / 8738 Sign on 07:30 and sign off 16:17
17 November 2009	Position JNB to PLZ to operate flight #'s 8486 / 8487/ 8488 / 8489 Sign on 10:15 and sign off 17:35
18 November 2009	Operated flight #'s 8486 / 8487 Sign on 12:30 and sign off 15:05

Maintenance engineer experience:

Experience on Type	8 Years
J41approval	Base release

1.6 Aircraft Information

Airframe:

Type	Jetstream 4100	
Serial No.	41037	
Manufacturer	Jetstream Aircraft Ltd	
Date of Manufacture	1994	
Total Airframe Hours (At time of Incident)	20227.55	
Last A-Check (Date; Hours & Cycles)	15 October 2009	20040.07 Hrs 19610 Cycles
Hours since Last A-Check	186.48	
Next A-Check (Date & Hours)	Currently in	20329.6 Hrs
Next C-Check (Date & Hours)	Progress	20465.4 Hrs
C of A (Issue Date)	21 January 2000	
C of R (Issue Date) (Present owner)	4 August 2008	
Operating Categories	Standard	

Engine 1 (L/H):

Type	Honeywell TPE 331-14HR-901H
Serial No.	P76087
Hours since New	17088.00
Hours since Overhaul 27 August 2003	3609.00

Propeller 1 (L/H):

Type	McCauley B5JFR36C1103
Serial No.	051195
Hours since New	1274.48
Hours since Overhaul	TBO not Reached

Engine 2 (R/H):

Type	Honeywell TPE 331-14GR-805H
Serial No.	P76039C
Hours since New	5908.39
Hours since Hot Section Inspection 3 June 2000	1438.57

Propeller 2 (R/H):

Type	McCauley C5JFR36C1104
Serial No.	050605
Hours since New	1908.15
Hours since Overhaul	TBO not reached

NB: There were no recorded defects on the aircraft prior to this flight.

Weight and Balance

According to available information the aircraft was loaded within the weight limitations as specified by the manufacturer and the Centre of Gravity was within the specified limitations as per the manufacturer's specifications. See Appendix "C" for diagram.

1.7 Meteorological Information

According to an official weather report from the South African Weather Service, the following weather conditions prevailed at the time of the accident:

Wind direction	114°TN	Wind speed	9Kt G12Kt	Visibility	Good
Temperature	16.2°C	Cloud cover	Scattered	Cloud base	4000 ft
Dew point	Unknown				

The weather information supplied to the crew during their take-off brief was as follows: “*surface wind one two zero degrees one five gusting twenty two knots cleared take off.*”

1.8 Aids to Navigation

1.8.1 The aircraft was equipped with standard navigation equipment as per the minimum equipment list approved by the regulator for the aircraft type. No defects were reported prior to the flight.

1.9 Communications

1.9.1 The aircraft was equipped with standard communication equipment as per the minimum equipment list approved by the regulator for the aircraft type. No defects were reported prior to the flight.

1.9.2 Communication between the aircraft (Link 488, ZS-OMZ) and the control tower at Port Elizabeth was on frequency 118.1 MHz. Apart from informing the tower that they have a problem there was no emergency declared by the crew of the incident aircraft. See Appendix “A”

1.10 Aerodrome Information

Aerodrome Location	1 NM South of Port Elizabeth	
Aerodrome Co-ordinates	S 33° 59.4' E025° 36.7'	
Aerodrome Elevation	225 ft	
Runway Designations	08/26	17/35
Runway Dimensions	1980m x 46m	1677m x 46m
Runway Used	08	
Runway Surface	Tarred	
Approach Facilities	VASIS Rwy's 08, 26, 35 VDA PEV 112.9 S 33° 59.32' E025° 36.22' N PD 372.5 S 33° 58.43' E025° 37.46' N PE 355.0 S 34° 01.36' E025° 32.08' N DS 340.0 S 33° 59.53' E025° 35.32' ILS PD Loc Rwy 26 ILS PE Loc Rwy 08	

1.10.1 The runway was closed after the aircraft departed the runway but was re-opened approximately 1 hour later after the aircraft was taxied away from the runway, back to the apron.

1.11 Flight Recorders

1.11.1 Cockpit Voice Recorder

Make	Solid State
Description	Solid State Cockpit Voice Recorder
Part Number	1602-01-03
Serial Number	255
Condition on removal	Outer Case not damaged

NB: At the time that the incident was reported, the operator was requested to instruct the crew to disarm the CVR as well as the DFDR. The DFDR was disarmed but the crew failed to disarm the CVR and as a result the information on the CVR was overwritten by the taxi of the aircraft when it was removed from the position where it stopped following the incident.

1.11.2 Digital Flight Data Recorder

Make	Fairchild F1000
Description	Solid State Flight Data Recorder
Part Number	S800-2000-00
Serial Number	00860
Condition on removal	Outer Case not damaged

1.11.3 Discussion of DFDR (See Fig 2)

1.11.3.1 For the purposes of this report, the DFDR data download was started at 16 seconds before the aircraft entered the runway.

Parameter monitored	Reading	Conclusion
Aileron	Neutral	During the period monitored here, all parameters were normal.
Rudder	10 seconds: -20°. 5 Seconds: 10°. 1 Second: Neutral	
IAS	10 Seconds: 30 Kts. 6 Seconds: Accelerates from 30 Kts to approximately 40 Kts.	
Engine RPM (L)	16 Seconds: 95% RPM	
Engine RPM (R)	16 Seconds: 95% RPM	
Engine Torque (L)	10 Seconds: 10% Torque. 6 Seconds: 20% Torque.	
Engine Torque (R)	10 Seconds: 10% Torque. 6 Seconds: 20% Torque.	

1.11.3.2 12 Seconds after the aircraft entered the runway the captain moved his hand from the tiller to the control wheel.

Parameter monitored	Reading	Conclusion
Aileron	12 seconds: -5°	The aircraft entered the runway at an IAS of 40 Kts
Rudder	12 Seconds: Neutral	

IAS	12 Seconds: Accelerates from 40 Kts to approximately 80 Kts	and immediately started the take-off run without stopping at the threshold. Up to an IAS of approximately 70 Kts all parameters were apparently normal. At an IAS of approximately 70 Kts the hand-over from the Tiller to the Control wheel takes place. It was at this point where the aircraft started veering to the left.
Engine RPM (L)	12 Seconds: Accelerates from 95% RPM to 100% RPM	
Engine RPM (R)	12 Seconds: Accelerates from 95% RPM to 100% RPM	
Engine Torque (L)	12 Seconds: Increase from 20% Torque to 100% Torque	
Engine Torque (R)	12 Seconds: Increase from 20% Torque to 100% Torque	

1.11.3.3 14 Seconds after the aircraft started veering left off the runway, the aircraft stopped.

Parameter monitored	Reading	Note
Aileron	14 Seconds: -18°	When the aircraft started veering to the left at an IAS of approximately 70 Kts, the captain immediately applied full right rudder and full right aileron into the wind, in an attempt to arrest the veering to the left.
Rudder	14 Seconds: -20°	
IAS	2 Seconds: Accelerates from 80 Kts to approximately 90 Kts. 12 Seconds: Decelerate from 90 Kts to 30 Kts.	In addition the captain reduced the engine torque on both engines to a mere 20% Torque. However, the captain was not able to arrest the veering to the left and the aircraft finally left the runway and stopped 35m from the runway edge in some grass, with the aircraft on a heading of 65°M.
Engine RPM (L)	14 Seconds: Decelerates from 100% RPM to 95% RPM	
Engine RPM (R)	14 Seconds: Decelerates from 100% RPM to 95% RPM	
Engine Torque (L)	4 Seconds: Decrease from 100% Torque to 10% Torque. 8 Seconds: Constant at 10% Torque. 2 Seconds: Increase from 10% Torque to 20% Torque	
Engine Torque (R)	4 Seconds: Decrease from 100% Torque to 10% Torque. 8 Seconds: Constant at 10% Torque. 2 Seconds: Increase from 10% Torque to 20% Torque	

1.11.3.4 16 Seconds after the aircraft stopped, the DFDR was disarmed.

Parameter monitored	Reading	Note
Aileron	12 Seconds: -20°. 2 Seconds: 5°. 4 Seconds: Neutral	After the aircraft stopped, the DFDR was disarmed but not the CVR.

Rudder	18 Seconds: -30°
IAS	18 Seconds: Decelerate from Accelerates from 30 Kts to 0 Kts
Engine RPM (L)	18 Seconds: Maintain 90% RPM
Engine RPM (R)	18 Seconds: Maintain 90% RPM
Engine Torque (L)	6 Seconds: Maintain 20% Torque. 12 Seconds: Decrease from 20% Torque to 5% Torque
Engine Torque (R)	6 Seconds: Maintain 20% Torque. 12 Seconds: Decrease from 20% Torque to 5% Torque

Note: A review of the DFDR data revealed that the flap parameters were not recorded.

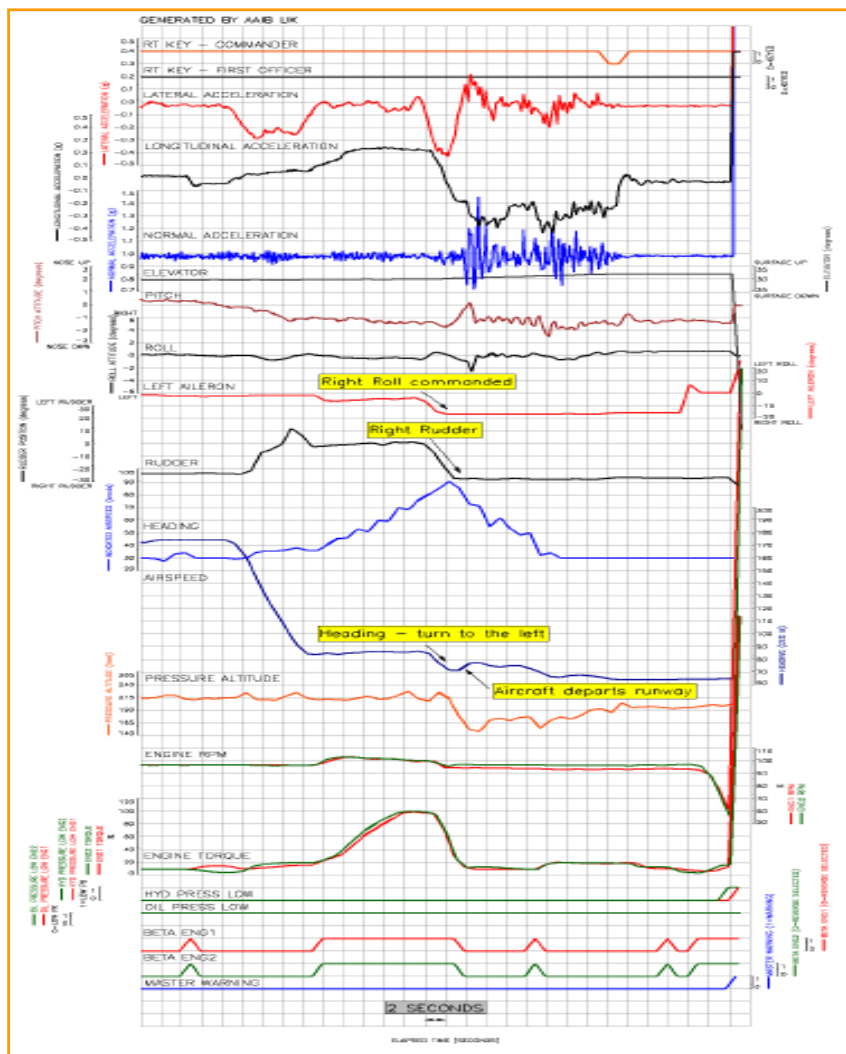


Fig 2: A schematic diagram showing the DFDR data that was downloaded following the incident.

1.12 Wreckage and Impact Information

1.12.1 The aircraft did not sustain any damage and did not impact with any object.

1.12.2 The captain commenced the take-off roll at the threshold of Runway 08.

1.12.2.1 When reaching 70 Kts, the captain moved his hand from the tiller to the control wheel. At the time that this was done, the aircraft immediately veered to the left of the runway.

1.12.2.2 The captain applied full right rudder and aileron into the wind, but was unable to arrest the veering to the left.

1.12.2.3 The aircraft stopped 35m from the runway edge, after it departed the runway. This was done with the brakes. The engines were shut down after the aircraft stopped.

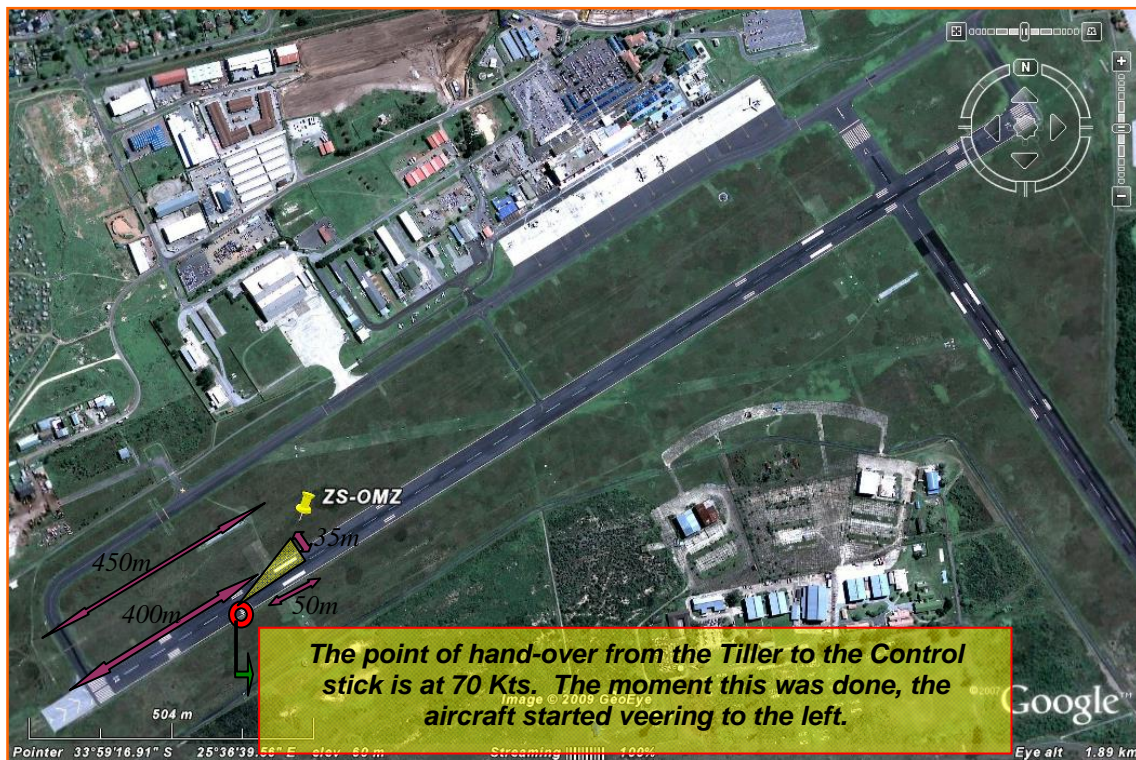


Fig 3: A view of the airport and an indication where the aircraft finally stopped

1.13 Medical and Pathological Information

1.13.1 Not applicable

1.14 Fire

1.14.1 There was no fire. According to information supplied by the ATC the fire services on the airport was on the scene within one (1) minute after the incident occurred.

1.15 Survival Aspects

1.15.1 The aircraft stopped safely, 35m to the left of the runway edge.

1.15.2 The passengers were evacuated safely using the aircraft stairs and were transported to the terminal building by bus.

1.15.3 All passengers received counselling following the incident.

1.16 Tests and Research.

1.16.1 Taxi Tests CAA

After cleaning the brake assemblies from ground and grass collected during the incident, another crew was requested to do taxi tests with the aircraft.

Prior to the test tyre pressures on the nose gear as well as on the main gear were checked and were within prescribed limits. It was also noted that the tyre wear on all wheels were equal and within prescribed limits.

The purpose of the test was to establish the functionality of certain controls. The results are shown in the table below:

TEST	NOTES – On Taxiway	RESULT
Slow speed Taxi Test: Brakes	IAS: +- 15 Kts Equal brake pressure on L/H & R/H brakes.	Functions correctly
Slow speed Taxi Test: Rudder	IAS: +- 15 Kts	Functions correctly with full & free movement
Slow speed Taxi Test: Engines	IAS: +- 15 Kts Opening to full throttle (100% RPM) on both engines	Both engines speed up to full RPM but the L/H engine spools up & down slower than the R/H engine
Slow speed Taxi Test: Steering (Tiller)	IAS: +- 15 Kts Check for response and functionality, both to the left and the right	Functions correctly

TEST	NOTES – On Runway 08	RESULT
Slow speed Taxi Test: Brakes	IAS: +- 30 Kts Equal brake pressure on L/H & R/H brakes	<i>*1 Aircraft pulls to the left. The higher the brake pressure, the more severe the pulling to the left.</i>
Slow speed Taxi Test: Rudder	IAS: +- 30 Kts	Functions correctly with full & free movement
Slow speed Taxi Test: Engines	IAS: +- 30 Kts Opening to full throttle (100% RPM) on both engines	Both engines speed up to full RPM but the L/H engine spools up & down slower than the R/H engine
Slow speed Taxi Test: Steering (Tiller)	IAS: +- 30 Kts Check for response and functionality, both to the left and the right	<i>*2 It was noted that there was excessive free play when turning left (35° + from the neutral position) before responding. When turning right, the response was acceptable.</i>

* Deviation from what would have been normal.

*1 It was noticed that when applying brakes, the aircraft pulls to the left. The higher the brake

that pressure, the more severe the pulling to the left. During the "A-check" and the "C-check" was carried out simultaneously on the aircraft after the ferry flight to Johannesburg, the brakes were examined but no defects were noted during the inspections.

*2 Neither the incident flight crew nor any other flight crew who had flown the aircraft previously reported any adverse effects regarding the excessive free play on the tiller.

1.16.2 Following the results of the taxi test above it was decided to examine the steering system. Investigation revealed that the steering cable showed some stretch and kink marks. The cable was removed and replaced with a serviceable cable by qualified maintenance personnel. This cable has completed 5973 cycles since installation on 26/04/2006.



Fig 4: A view of the steering control box with the damaged control cable inserted and the outer cable casing removed to expose the damage to the cable.

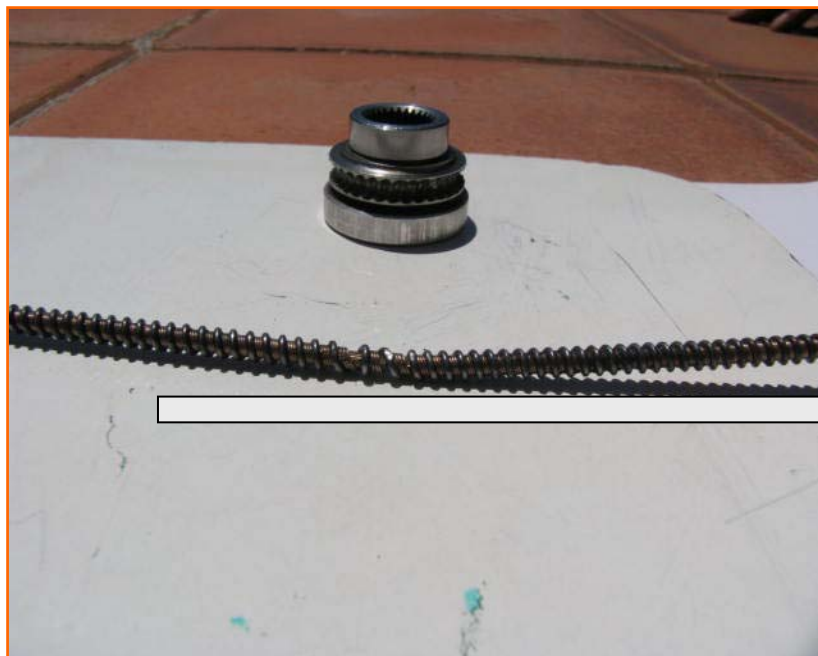
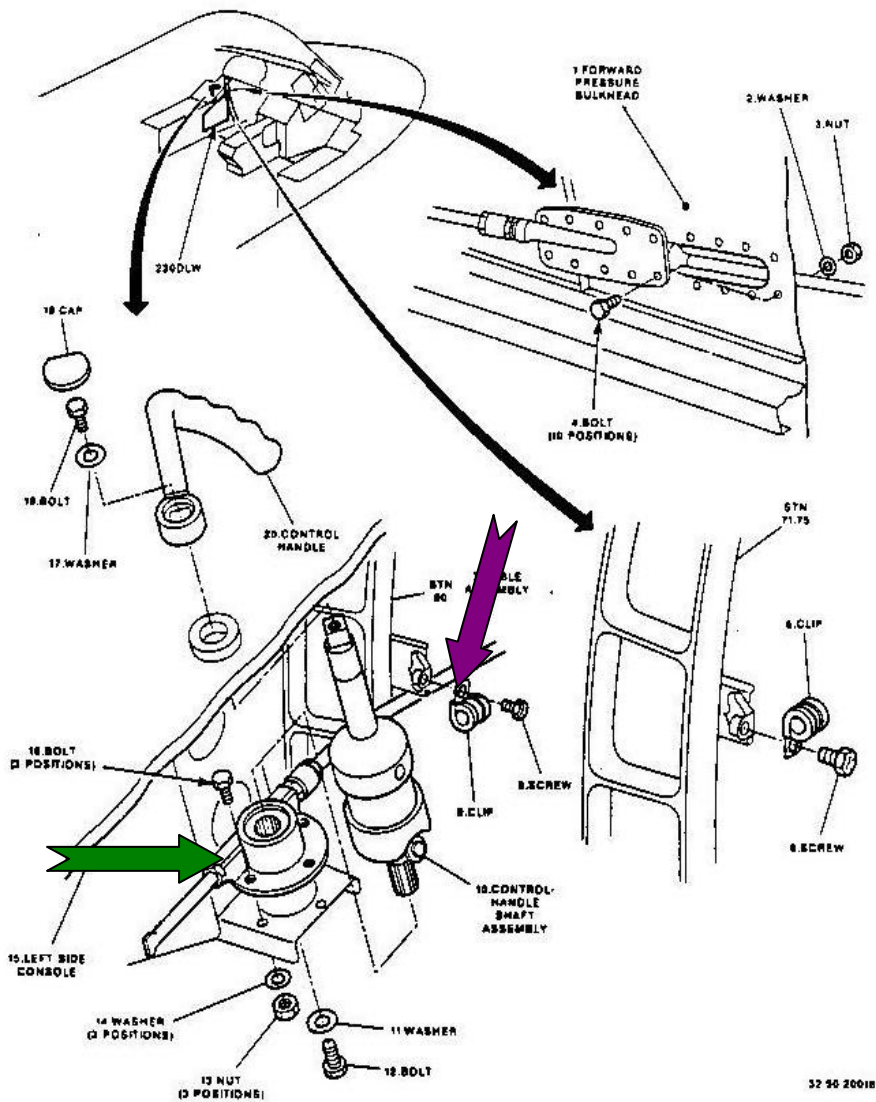


Fig 5: A view of the gear inside the steering control box, showing the damaged Control cable (Stretch & Kink) next to it.



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Nose-wheel Steering Cable-Assembly
Figure 401 (Sheet 1)

Task 32-50-05-990-401-A01

Effectivity: ALL

32-50-05

Page 402
Nov 15/92

Fig 6: An exploded view of the Nose-wheel Steering Cable assembly, showing the position of the Steering Control Box (Green arrow) and the Steering Control Cable (Purple arrow).

1.16.3 Following the replacement of the Steering Control Cable in Port Elizabeth, high speed taxi tests were carried out (up to 70 kts IAS). It was established that the steering operated normal in all aspects. After this, the aircraft was ferried back to Johannesburg where detailed examinations were carried out to ensure the serviceability of the aircraft.

- 1.16.4 Once the aircraft was at the maintenance facility in Johannesburg, the replacement Steering Control Cable was removed and replaced with the damaged cable which was removed in Port Elizabeth. It was noted that the excessive free play when turning to the left was evident again.
- 1.16.5 At this time the IIC (Investigator-in-Charge) decided to have the Steering Control Box and the Steering Control Cable removed for further investigation.
- 1.16.6 Further investigation revealed that the Steering Control Cable slips inside the Steering Control Box when in certain positions. This was as a result of the damaged area on the cable moving over the matching area of the Steering Control Box Gear, which was found to be worn excessively in certain areas. Not only did the above account for the excessive free play that was noticed but also resulted in the tiller being pushed against the self-centering spring loaded cam when taxiing the aircraft.

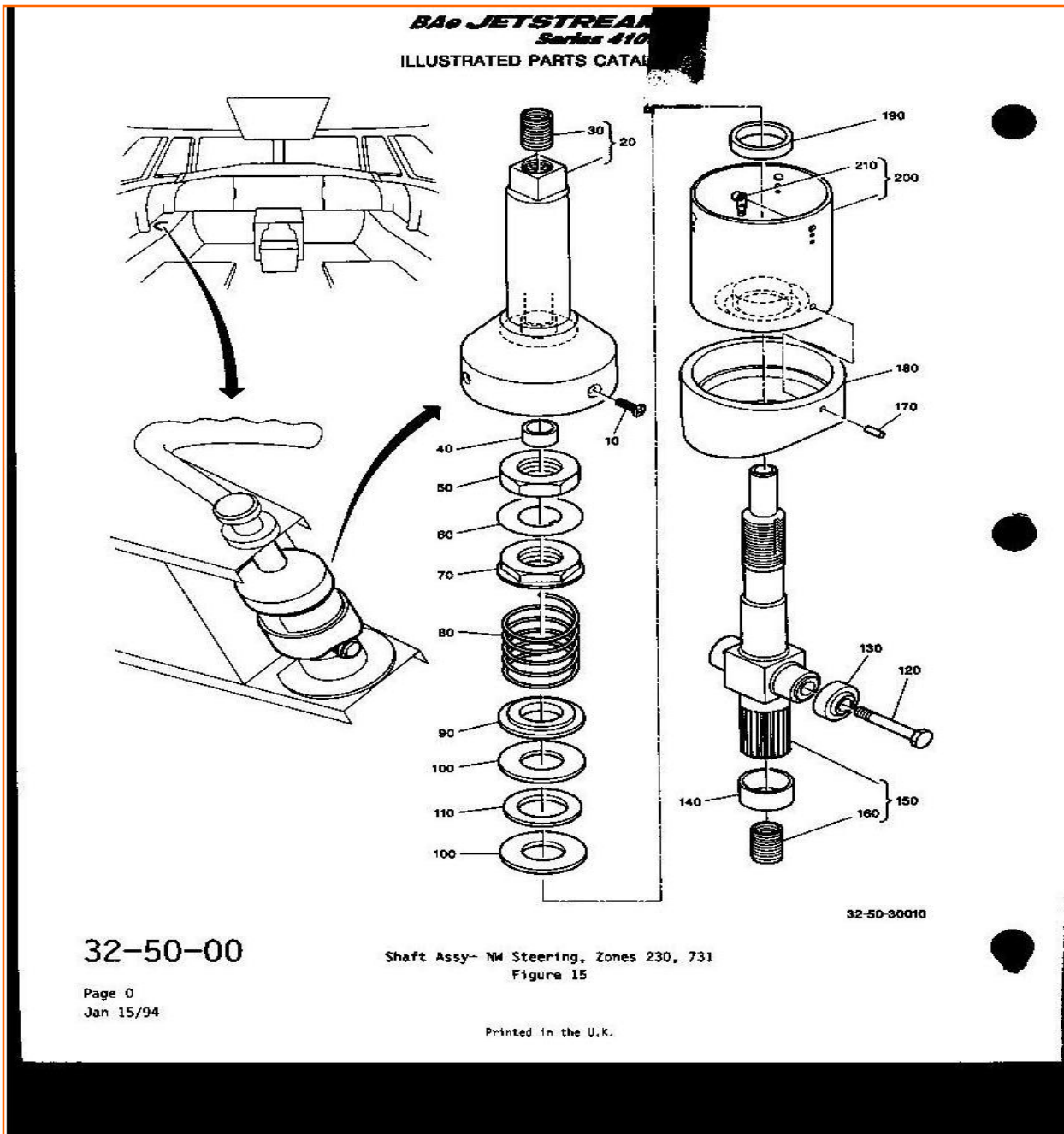


Fig 7: An exploded view of the Shaft Assembly for the Nose Wheel Steering, showing the Spring loaded cam which will center the nose wheels when the applied hand pressure are removed from the tiller.

- 1.16.7 The tiller will centre itself when the hand-over takes place at 70 Kts. If the cable slipped previously, the nose wheels will not be centre but would rather be at an angle to either the left or the right (left in this case) resulting in the aircraft turning in the direction to which the slippage cause the off-set (left in this case).
- 1.16.8 The tiller control with the meshing gear had been in service for 5973 cycles of operation since installation on 26/04/2006. Replacement of the tiller control at that time followed on reports of the aircraft steering excessively. This is an on condition unit and the cable is routed through the sleeve separately. The cable was probably kinked during this installation, resulting in the wear of the meshing teeth over the next 3 years of operation. When the wear became excessive on both the cable and the gear, the cable started slipping intermittently on the gear.
- 1.16.9 The Maintenance Manual specifies that the tiller mechanism and cable is provided as a single unit. However industry practice has become to only replace the cable. Hence wear on the gear teeth remains present and can only be detected once play appears with tiller movement, which as described above can be intermittent. The manufacturer is aware of the practice and has taken the step of repeating the unit serial number on the inner cable to discourage it.
- 1.16.10 No guidance exists from the manufacturer as to what would be a tolerable play in movement of the tiller.
- 1.16.11 To understand the risk of a recurrence the operator inspected its fleet of J41 aircraft and measured the play in tiller movement. According to the results received it would appear that this was an isolated occurrence. See Appendix "B" and based on this to determine what if any an acceptable limit might be.

1.17 Organizational and Management Information

1.17.1 Operator

- 1.17.1.1 The operator was in possession of a valid Part 121 Operating Certificate (AOC; FO 4329), which was issued on 19 April 2009 and which expires on 30 April 2010.
- 1.17.1.2 The last audit at the operator was performed on 26 March 2009. No major findings were recorded.

1.17.2 AMO (Aircraft Maintenance Organization)

- 1.17.2.1 The AMO was in possession of a valid AMO certificate, which was issued on 1 May 2009 and which expires on 30 April 2010.
- 1.17.2.2 The last audit at the AMO was performed on 7 April 2009. No major findings were recorded.
- 1.17.2.3 The steering control cable has completed approximately 5100 cycles since installation in Cape Town, 2 months prior to this incident.

1.18 Additional Information

- 1.18.1 A functional check was carried out on the Steering Actuator and it was examined for

hydraulic leaks, but no problems were observed.

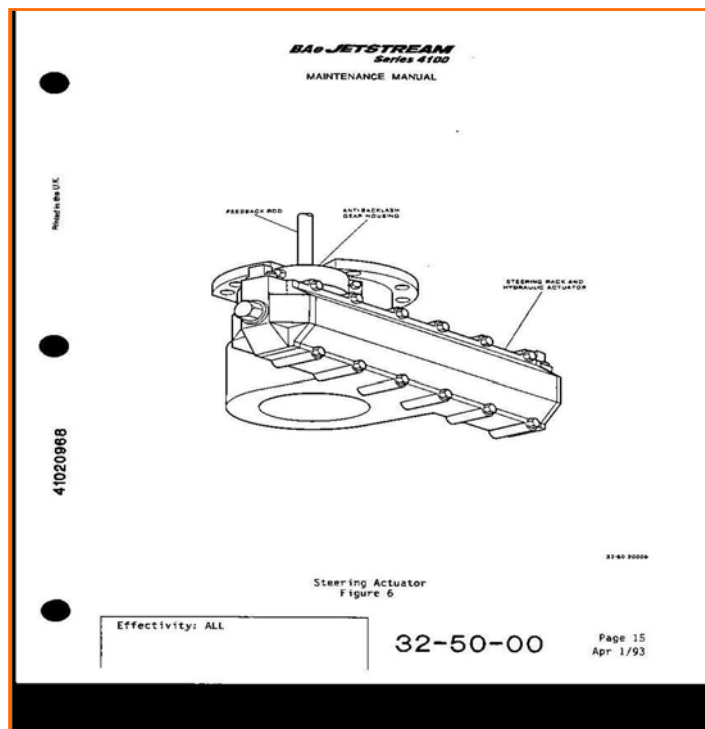


Fig 7: A view of the Steering Actuator.

1.18.2 A functional check was carried out on the Steering Selector Valve and it was examined for hydraulic leaks, but no problems were observed.

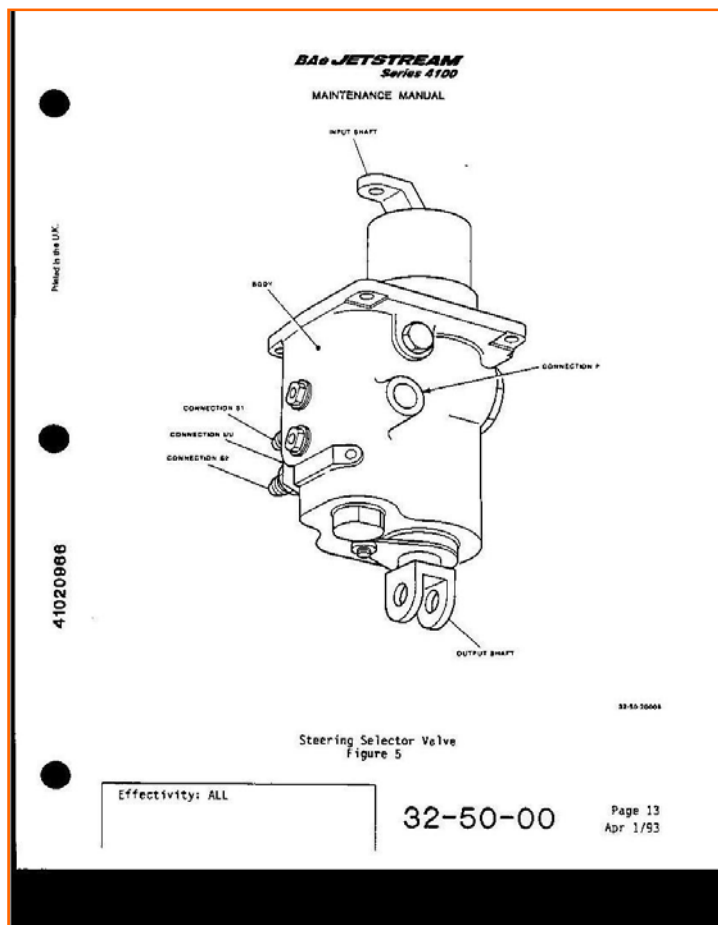


Fig 8: A view of the Steering Selector Valve.

1.18.3 The propellers were replaced as a precautionary measure after contacting long grass.

1.19 Useful or Effective Investigation Techniques

1.19.1 None.

2. ANALYSIS

- 2.1 Investigation revealed that the Steering Control Cable slips inside the Steering Control Box when in certain positions as a result of the damaged area on the cable moving over the matching area of the Steering Control Box Gear, which was found to be worn excessively in certain areas. This resulted in excessive free play as well as the tiller being pushed against the self-centering spring loaded cam when taxiing the aircraft. When the tiller are being pushed against the self-centering spring loaded cam to ensure that the aircraft remains in a straight line, it will centre itself as soon as the hand-over takes place at 70 Kts. This will result in the nose wheels immediately turning to the left as was the case in this incident.
- 2.2 It is the opinion of the IIC that the cable was probably kinked during the installation when it was replaced the last time. This kink in the cable resulted in excessive wear on the gear in the Steering Control Box over a period of time. When the wear became excessive on both the cable and the gear, the cable started slipping on the gear intermittently finally causing the loss of directional control during the take-off run at Port Elizabeth.

3. CONCLUSION

3.1 Findings

- 3.1.1 The aircraft was scheduled on a domestic flight from Port Elizabeth to East London.
- 3.1.2 During the take-off run, at 70 Kts, the aircraft veered left off the runway and stopped 35m beyond the runway edge in long grass and level terrain. Although the captain applied full right rudder and aileron into the wind, he was unable to arrest the veering to the left. The runway was re-opened approximately 1 hour after the incident.
- 3.1.3 After the aircraft came to a stop the aircraft was evacuated. Nobody sustained any injuries and the aircraft did not sustain any damage.
- 3.1.4 Both the captain and the 1st officer were in possession of valid licences, medical certificates and were rated on the aircraft type.
- 3.1.5 According to available records the aircraft was correctly maintained as required by the manufacturer and the regulator.
- 3.1.6 Fine weather conditions prevailed at the time of the incident and the weather did not play a role in the incident.
- 3.1.7 The operator was in possession of a valid Operating Certificate and the AMO was in possession of a valid AMO certificate
- 3.1.8 The Steering Control Cable was probably damaged during a previous installation, which resulted in damage to the gear inside the Steering Control Box and finally

slipping of the cable on the gear.

3.2 Probable Cause/s

3.2.1 Poor maintenance procedures.

4. SAFETY RECOMMENDATIONS

4.1 It is recommended that the Airworthiness- and Flight Operations Departments of the SACAA verify that operators have:

4.1.1 Procedures in place and implemented to ensure that the CVR and DFDR are disabled following an accident or incident to prevent loss of data;

4.1.2 That the serviceability of recorders are verified as called for by the CARs;

4.1.3 Verify that the CARs adequately address the serviceability of recorders;

4.1.4 An audit to be conducted on the compliance with maintenance procedures by SA Air Link as to the serviceability of their aircraft recorders.

4.2 It is recommended that the manufacturer impose a life on the tiller mechanism or alternatively to devise inspection criteria and periodicity which would identify worn mechanisms.

5. APPENDICES

5.1 Appendix "A"

5.2 Appendix "B"

5.3 Appendix "C"

Report reviewed and amended by the Advisory Safety Panel on 20 April 2010

-END-

**ATC FACTUAL REPORT OF INVESTIGATION ZS-OMZ (Link 488)
INCIDENT**

WARNING

The reader of this report is cautioned that the transcription of an ATC recorder audio recording is not a precise science but is the best product possible from the investigation group's investigative effort. The transcript or parts thereof, if taken out of context, could be misleading. The transcript should be viewed as an accident investigation tool to be used in conjunction with other evidence gathered during the investigation. Conclusions or interpretations should not be made using the transcript as the sole source of information.

Location: Port Elizabeth in South Africa

Date: 18 November 2009

Aircraft: Jet stream 41(J4100)

LEGEND:

* - Unintelligible word

TWR – Tower controller

LNK 488 – the aircraft involved in the accident

MA- Fire department personnel

The following transmissions were done on frequency 118.1 MHz. on the 18 November 2009 between the incident aircraft (Link 488, ZS-OMZ) and the control tower at Port Elizabeth.

Source	Content
LNK 488	Link four eight eight good afternoon again request start.
TWR	Link four eight eight afternoon runway zero eight, QNH one zero one seven start approved.
LNK 488	Start approved runway zero eight link four eight eight.
LNK488	Link four eight eight request taxi.
TWR	Link four eight eight taxi holding point runway zero eight.
LNK488	Holding point zero eight link four eight eight.
LNK488	Link four eight eight ready on route check.
TWR	Link four eight eight runway zero eight surface wind one two zero degrees one five gusting twenty two knots cleared take off.
LNK488	Thanks very much * cleared take off link four eight eight.
LNK488	* We have a problem [Double transmission]
TWR	*
MA	Tower Mike Alpha
TWR	Mike Alpha proceed to Charlie one link is on the grass off to the left hand side of the runway expedite please.
MA	Proceeding Mike Alpha.

Appendix “B”

Airlink J41 Fleet Nose Wheel Steering Findings

<u>Registration</u>	<u>Findings</u>	<u>Comments</u>
ZS-OMF	<u>Engineers Report:</u> Nil excessive play on steering tiller. Nose wheel pressures checked and corrected. <u>Pilots report:</u>	Nil
ZS-OMY	<u>Engineers Report:</u> No Excessive play on steering tiller. Nose wheel pressures checked and corrected. <u>Pilots Report:</u> Aircraft tracks to the left in taxi.	Suspect A/C tracking slightly left due runway camber.
ZS-OMZ	<u>Engineers Report:</u> 1. Nose wheel steering cable was replaced. 2. Steering selector valve was removed and sent to APPH for testing, serviceable steering valve fitted. 3. Hydraulic leak check carried out on NLG steering system. <u>Pilots Report:</u> Will be carried out on test flight	Complete system checked out as per attached Work order: 046289. Parts listed under Findings Heading replaced.
ZS-NRE	<u>Engineers Report:</u> Nil defects at time of inspection. <u>Pilots Report:</u> Nil discrepancies at time of taxi test.	Nil
ZS-NRF	<u>Engineers Report:</u> No Excessive play on steering tiller. Nose wheel pressures checked and corrected. <u>Pilots Report:</u> Aircraft pulls slightly to the left in taxi.	Suspect A/C tracking slightly left due to runway camber.
ZS-NRG	<u>Engineers Report:</u> No Excessive play evident on steering tiller. Nose wheel pressures checked and corrected. <u>Pilots Report:</u>	Nil
ZS-NRH	<u>Engineers Report:</u> Inspected steering tiller and tyre pressures, nil defects noted at time of inspection. <u>Pilots Report:</u> Nil discrepancies at time of taxi.	Nil
ZS-NRI	<u>Engineers Report:</u> No Excessive play evident on steering tiller. Nose wheel pressures checked and corrected. <u>Pilots Report:</u>	Nil
ZS-NRJ	<u>Engineers Report:</u> No Excessive play on steering tiller evident. Nose wheel pressures checked and corrected. <u>Pilots Report:</u> Aircraft tracking right, suspect due to 1.06 difference in torque.	Suspect A/C tracking right due to torque difference between L/H and R/H engines.
ZS-NRK	<u>Engineers Report:</u> No Excessive play on steering tiller. Nose wheel pressures checked and corrected. <u>Pilots Report:</u> Aircraft pulls slightly to the right, but it is almost insignificant.	Suspect A/C tracking slightly right due to runway camber.
ZS-NRL	<u>Engineers Report:</u> Nil defects found. <u>Pilots Report:</u>	Nil
ZS-OEX	<u>Engineers Report:</u> No Excessive play on steering tiller evident. Nose wheel pressures checked and corrected. <u>Pilots Report:</u>	Nil

