

## AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/9291	
<b>Aircraft Registration</b>	<b>ZS-EPZ</b>	<b>Date of Accident</b>	10 February 2014		<b>Time of Accident</b>	1030Z
<b>Type of Aircraft</b>	Cessna Caravan C208B (Aeroplane)		<b>Type of Operation</b>		Commercial	
<b>Pilot-in-command Licence Type</b>	Commercial	<b>Age</b>	25	<b>Licence Valid</b>	Yes	
<b>Pilot-in-command Flying Experience</b>	Total Flying Hours	1 859.5		<b>Hours on Type</b>	431.6	
<b>First Officer's Licence Type</b>	Commercial	<b>Age</b>	23	<b>Licence Valid</b>	Yes	
<b>First Officer's Flying Experience</b>	Total Flying Hours	412.6		<b>Hours on Type</b>	4.3	
<b>Last point of departure</b>		MalaMala aerodrome (FAMD): Mpumalanga province.				
<b>Next point of intended landing</b>		O R Tambo international airport (FAOR): Gauteng province.				
<b>Location of the accident site with reference to easily defined geographical points (GPS readings if possible)</b>						
On the taxi way leading to runway 16 threshold at GPS co-ordinates determined to be South 24° 48.732 ' East 31° 32 .359 ' at an elevation of 1 100 feet above mean sea level (AMSL).						
<b>Meteorological Information</b>		Cloud base, 3 500 AGL: Visibility, 10 kilometers: Temperature 27°C: Wind speed, 10 knots: Wind direction 170/10: Dew point, N/a.				
<b>Number of people on board</b>	2 + 11	<b>No. of people injured</b>	0	<b>No. of people killed</b>	0	
<b>Synopsis</b>						
<p>Two certified pilots departed from MalaMala (FAMD) aerodrome with 11 passengers on-board destined for O R Tambo (FAOR). The captain, pilot flying reported that after start up on the apron he taxied the aircraft towards the threshold of runway 16 and everything was normal. As the aircraft began moving down the hill on the taxi way for runway 16, the aircraft drifted off to the left of the centre line. He applied corrective action to the right but was unsuccessful. The aircraft continued drifting towards the left and departed the taxiway. The PF then applied maximum brakes but was unsuccessful. He then requested the first officer to apply brakes on the right hand side but this was also unsuccessful. The aircraft continued rolling, ended up in a ditch and collided with an embankment. The aircraft was substantially damaged but no injuries were reported. Investigation revealed no anomalies with the rudder/brake system.</p>						
<b>Probable Cause</b>						
<p>Poor airmanship.</p>						
IARC Date				Release Date		
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## AIRCRAFT ACCIDENT REPORT

**Name of Owner** : Marukuruku Air (Pty) Ltd  
**Name of Operator** : Federal Air  
**Manufacturer** : Cessna Aircraft Company  
**Model** : Cessna Caravan C208B  
**Nationality** : South African  
**Registration Marks** : ZS-EPZ  
**Place** : South 24°48.732 ' East 31°32 .359 '  
**Date** : 10 February 2014  
**Time** : 1030Z

*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 produced without prejudice to the rights of the CAA, which are reserved.*

## 1. FACTUAL INFORMATION:

### 1.1 History of Flight:

- 1.1.1 On Friday morning 10 February 2014, the crew consisting of two certified commercial pilots signed on for duty at their office at O R Tambo (FAOR) international airport located in Gauteng Province. The roster for the day included three sectors on the list with ZS-EPZ, a Cessna Caravan C208B aircraft, serial number 208B1233, operated by Federal Air. The first two sectors from FAOR international airport to Lusuba (FAUS), Limpopo and MalaMala (FAMD), Mpumalanga were uneventful.
- 1.1.2 The third and last sector was at noon with 11 passengers on-board, charter flight number FDR 161, scheduled for FAOR international airport under instrument meteorological condition (IMC). The captain, pilot flying (PF) reported that the aircraft was facing in an 11 degree heading towards the runway at FAMD. Before departure 1 100.00lbs of Jet A1 fuel was uplifted followed by a thorough pre-flight inspection on the aircraft. The crew supervised embarkation and the first officer gave a pre-flight safety briefing after which the engine was started by the PF. The PF then taxied the aircraft towards the threshold of runway 16.

- 1.1.3 According to the PF's written statement of the occurrence, during the initial stage of taxiing, everything was normal. As the aircraft began moving down the hill on the taxi way, the aircraft drifted off to the left of the centre line. He applied correcting action to the right but was unsuccessful. The aircraft continued drifting towards the left and left the taxiway. He then applied maximum brakes but was unsuccessful. He subsequently requested the first officer, pilot not flying (PNF) to apply brakes on the right hand side but this was also unsuccessful. There was still no braking action. The aircraft continued rolling, ended up in a ditch that ran parallel to the taxi way and collided with an embankment. The PF immediately pulled the fuel shut-off/feather lever in order to avoid fuel from running into the engine as the collision occurred.
- 1.1.4 The aircraft slid to the left with the left wing impacting the embankment. Following the 1<sup>st</sup> witness, a passengers who was seated at the back next to the door on the right hand side, testimony, the aircraft was started uneventfully from the apron followed by taxiing to runway 16. All appered to be normal but suddenly the aircraft drifted off to the left of the taxiway followed by a sudden halt in the ditch located on the left hand side parallel to the taxi way. The passengers were then told by the PF to remain seated and wait for the PNF to open the door for them. The 1<sup>st</sup> passenger then asked himself why a passenger sitting near the rear door could not open the door under those circumstances because before leaving the apron they were given safety briefings, which included how to open the rear door in case of emergency. In addition, passengers were notified after questions that "the aircraft brakes had failed".
- 1.1.5 A further question arose from the 2<sup>nd</sup> witness, also a passenger who was seated at the back as to why the rudder/steering was not used to navigate or retain the aircraft on the runway and the response from the PF was that "the rudder had failed". The PNF opened the doors and a safe disembarkation of the aircraft followed. No injuries were reported. The PF immediately through his mobile telephone informed the operator about the occurrence and the condition of all on-board. The operator immediately dispatched the other aircraft to FAMD to fetch stranded passengers who later arrived at FAOR safely. Further observations in respect of the flight from FAUS to FAMD by the 1<sup>st</sup> witness, revealed that on the downwind leg to FAMD, all appeared well. However a very tight right base seemed too steep indicating to him that the downwind/right base leg was miscalculated. On finals the approach was steep as well, though an uneventful landing was carried out by the first officer. The aircraft was easily navigated to the apron where after it was parked followed by an uneventful disembarkation.

1.1.6 The aircraft was parked on the apron, (FAMD) for approximately 20 minutes whereafter it was prepared for a trip to FAOR. The flight was conducted under the provisions of Part 135 of the Civil Aviation Regulations of 1997, as amended and the operator was in possession of a valid air operating certificate (AOC) that permitted the aircraft to operate predominantly on charter flights within Southern Africa.

1.1.7 The accident happened during day time conditions within FAMD boundaries at GPS coordinates determined to be South 24°48.732 ' East 31°32 .359' at an elevation of 1 100 feet above mean sea level (AMSL).

Approximate accident site parallel to the taxiway on the left hand side

FAMD apron where the aircraft was parked

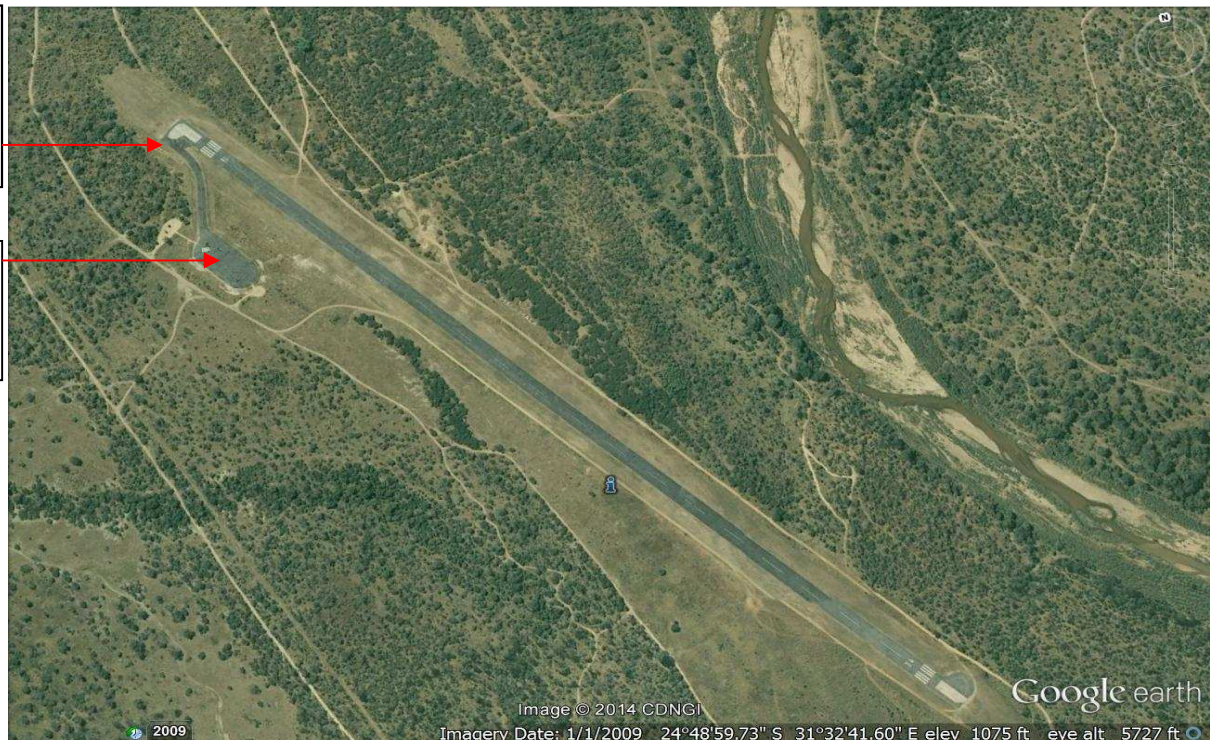


Figure 1: Google Earth image of FAMD aerodrome.

## 1.2 Injuries to Persons:

Injuries	Pilot	Crew	Pass.	Other
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-	-	-
None	2	-	11	-



### 1.3 Damage to Aircraft:

1.3.1 The aircraft was substantially damaged during the accident sequence.



Figure 2: The aircraft as found at the accident site.

### 1.4 Other Damage:

1.4.1 No damage was observed at the accident site.

### 1.5 Personnel Information:

1.5.1 Captain's background (PF):

Nationality	South African	Gender	Male	Age	25
Licence Number	0272218124	Licence Type	Commercial		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	Night, Instrument (A) and Instructor Ratings				
Medical Expiry Date	31 January 2015				
Restrictions	Nil				
Previous Accidents	None				

\*NOTE: The Captain's profile revealed no accident or incident history, enforcement actions, pilot certificate or rating failure, or retest history. Experience:

Total Hours	1 859.5
Total Past 90 Days	77.8
Total on Type Past 90 Days	77.8
Total on Type	431.6

#### 1.5.2 First officer's background (PNF):

Nationality	South African	Gender	Male	Age	23
Licence Number	0272342395	Licence Type	Commercial		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	Night, Instrument (A) and Instructor Ratings				
Medical Expiry Date	28 February 2015				
Restrictions	Nil				
Previous Accidents	None				

\*NOTE: The first officer's profile also revealed no accident or incident history, enforcement actions, pilot certificate or rating failure, or retest history.

#### Experience:

Total Hours	412.6
Total Past 90 Days	15.7
Total on Type Past 90 Days	15.7
Total on Type	4.3

#### 1.5.3 Crew Resource Management (CRM):

CRM is an essential element in the operation of commercial aircraft. In essence, it is the practical application of various aspects of human factors, including situational awareness, decision making, threat and error management (TEM), team co-operation and communication among various people who are involved in the operation of flights. These include flight and cabin crews, maintenance personnel, air traffic controllers and dispatchers. The principles of CRM integrate both technical and non-technical skills. As the name implies, CRM seeks to manage the available human resources effectively to reduce risk and maximise efficiency.

#### 1.5.4 Flight crew training:

The flight crew underwent initial CRM training as required by the regulation. In addition, both flight crew members also underwent proficiency checks. These checks take the form of an operator's proficiency check (OPC), line check (LC) as captain and include a CRM assessment, which is graded by the type rating examiner (TRE). CRM training and outcomes were as follows:

Captain:		First Officer:	
CRM Training	16 January 2014 and expires on 31 January 2015	CRM Training	13 February 2014 and expires on 28 February 2015
Line Check due date	08 May 2013 and expires on 31 May 2014	OPC	06 February 2014 and expires on 31 August 2014
OPC due date	31 August 2014		

\*NOTE: The Captain's, PF, LC assessment was graded "Good Standard" and the first officer's, PNF, assessment during the OPC course was graded "Satisfactory".

#### 1.6 Aircraft Information:

- 1.6.1 A Cessna Caravan C208B aircraft is an all metal high wing, single engine aircraft equipped with tricycle landing gear for general utility purposes. The aircraft flight control system consists of conventional aileron, elevator and rudder control surfaces. Control surfaces are manually operated through mechanical linkage using a control wheel for the ailerons, elevators and rudder/brake pedal for the rudder. The aircraft has a hydraulically interconnected differential brake system, meaning that the left or right brake can be applied individually, which will then enables the aircraft to turn about on its axis.



Figure 3: The aircraft photo shot before the accident.

#### Airframe:

Type	Cessna C208B	
Serial Number	208B1233	
Manufacturer	Cessna Aircraft Company	
Date of Manufacture	2007	
Service Ceiling	27 600 feet	
Maximum take-off Weight	9 062 lbs	
Empty Weight	5 311 lbs	
Total Airframe Hours (At time of Accident)	3 266.2	
Last MPI (Hours & Date)	3 195.3	07 January 2014
Hours flown before the accident	70.9	
C of A (Issue Date)	29 January 2010	
C of A (Expiry Date)	01 January 2015	
C of R (Issue Date) (Present owner)	26 January 2010	
Recommended fuel used	Jet A1	
Operating Categories	Standard Part 135	

\*NOTE: This aircraft was imported from the United States of America in 2009 and was registered in South Africa the same year with registration ZS-EPZ endorsed on the certificate of registration. The aircraft maintenance organisation (AMO) that performed the last mandatory periodic inspection (MPI) on the aircraft prior to the occurrence was in possession of a valid AMO approval certificate no 1069.



All applicable or relevant aircraft documentation such as the certificate of registration (C of R), the certificate of airworthiness (C of A), the radio station licence, the mass and balance certificates were scrutinised during the investigation and all were found to be valid in accordance with the existing regulations. Further examination of the aircraft maintenance documentation such as aircraft logbooks and the maintenance work package were obtained from the aircraft maintenance organisation and reviewed and all entries made were appropriately certified in terms of general maintenance rules.

**Engine:**

Type	Honeywell TPE 331-12JR-702
Serial Number	P123131
Hours since New	Unknown
Hours since Overhaul	22.4

**Propeller:**

Type	Hartzell HCB4TN-5NL/LT10
Serial Number	CDA5433
Hours since New	Unknown
Hours since Overhaul	98.7

According to the pilot's operating handbook (POH), the maximum certified take-off weight for this aircraft type was not allowed to exceed 9 062 pounds. The aircraft empty weight information used in the weight and balance calculation was obtained from the last weighing report that was conducted on 20 April 2012 at Wonderboom (FAWB) by AMO no 247. The aircraft weight and balance at the time of the occurrence were calculated to be **9 039** pounds and the maximum allowable weight was 9 062 pounds. A weight and balance calculation determined that the aircraft was being operated within its load limits and at close proximity to its forward centre of gravity (CG). Below is the aircraft load sheet obtained from the operator.

FederalAir		LOADSHEET		AIRCRAFT TYPE: 208B	
		AIRCRAFT: ZS-EPZ		FLIGHT NO. FDR 161	
		CAPTAIN: N.Foster		FIRST OFFICER: Cameron Booth	
		ROUTE: FAMO - FAOR		DATE: 2014/02/10	
<b>A. AIRCRAFT</b>		<b>C208B</b>		<b>LIMIT (lbs)</b>	<b>WEIGHT (LBS)</b>
BASIC EMPTY WEIGHT: (includes oil & extra equipment)		5000	5311	101.50	10170.57
COCKPIT SEATS			374	180.27	598.41
OPERATING EMPTY WEIGHT:		6400	5685	189.45	10769.97
		WEIGHT WITHIN LIMITS CoG WITHIN LIMITS			
<b>B. PAYLOAD</b>		<b>Male</b>	<b>Female</b>	<b>Children</b>	<b>Infant</b>
PASSENGERS:		5	6		
BAGGAGE/CARGO: POD ZONE A		12	1948	249.14	4903.51
POD ZONE B		230	110	132.40	145.97
POD ZONE C		310	110	182.09	200.75
POD ZONE D		270	221	233.40	514.65
AFT COMPARTMENT:		280		287.60	
AFT SECTION		397		344.00	
ZERO FUEL WEIGHT:		8500	7874	203.60	16234.88
		WEIGHT WITHIN LIMITS CoG WITHIN LIMITS			
<b>C. FUEL (USABLE QUANTITY)</b>		<b>LOADED:</b>	1100.00 lbs		
		<b>RAMP WEIGHT:</b>	9097	1100	205.73
			9074	203.86	18497.66
		WEIGHT WITHIN LIMITS			
<b>MINUS TAXI:</b>		35 lbs			
		<b>TAKE OFF WEIGHT:</b>	9062	1065	193.24
			9038	202.38	18282.86
		WEIGHT WITHIN LIMITS			
<b>MINUS FUEL BURN:</b>		415 lbs			
		<b>LANDING WEIGHT:</b>	9062	850	190.15
			8624	202.59	17479.86
		WEIGHT WITHIN LIMITS CoG WITHIN LIMITS			
<b>ALTERNATE LANDING WEIGHT:</b>		8424 lbs			
<b>D. LMC</b>		<b>CHANGE</b>			
		<b>WEIGHT</b>			
		<b>MOMENT</b>			
A: Δ FUEL					
B: Δ CARGO					
C: Δ PASSENGERS					
D: TOTAL CHANGE					
= Δ A + Δ B + Δ C					
REVISED T/O WEIGHT					
= TOW ± D					
REVISED LDG WEIGHT					
= LDG WT ± D					
I hereby certify the load distribution to be in accordance with the requirements prescribed in the "Flight Operations or Owners' Manual" and that the maximum certificate weight has not been exceeded.					
Signed: <i>N.Foster</i>					
(Pilot in Command)					
Licence No.: 0272212124					
Date: 10/2/14					

Figure 4: Aircraft load sheet from the operator.

## 1.7 Meteorological Information:

### 1.7.1 Weather information as per the captain questionnaire.

Wind direction	170/10	Wind speed	10 knots	Visibility	10 Km
Temperature	27°C	Cloud cover	3 500 AGL	Cloud base	3 500 AGL
Dew point	N/a				

## 1.8 Aids to Navigation:

1.8.1 The aircraft was fitted with the following navigational aids.

- Magnetic compass.
- Panel-mounted Garmin GPS.
- Weather Radar
- Transponder.
- ADF (Automatic Direction Finder).
- DME (Distance Measuring Equipment).
- VOR (Variable Omni Range) finder.
- Instrument landing system (ILS).

## 1.9 Communications:

1.9.1 The aircraft was fitted with standard communication equipment certified for the aircraft type. The aircraft was equipped with a very high frequency (VHF) receiver which was serviceable at the time of the occurrence.

## 1.10 Aerodrome Information:

Aerodrome Location	MalaMala (FAMD) aerodrome in Mpumalanga.	
Aerodrome Co-ordinates	South 24°48.732 ' East 31°32 .359'	
Aerodrome Elevation	1 100 feet AMSL	
Runway Designations	16 and 34	
Runway Dimensions	1 420 x 23	
Runway Used	Taxi way to runway 16	
Runway Surface	Asphalt	
Approach Facilities	None	

## 1.11 Flight Recorders:

1.11.1 The aircraft was not equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR) nor was it required by the regulation to be fitted to this aircraft type.

## 1.12 Wreckage and Impact Information:

1.12.1 The aircraft ended in a ditch located on the left hand side parallel to the taxi way while taxiing towards runway 16. The aircraft's four bladed propeller struck the embankment and came to a complete stop simultaneously. The aircraft ultimately slid towards the left hand side and came to rest on the left wing. The entire fuselage remained intact except damages to the propeller, the left hand side leading edge/de-icing boot, the left hand wing under skin, the pitot tube and the engine due to sudden stoppage.



Figure 5: The left wing showing damage on the leading edge de-icing boot.



Figure 6: Damaged pitot-tube.



### **1.13 Medical and Pathological Information:**

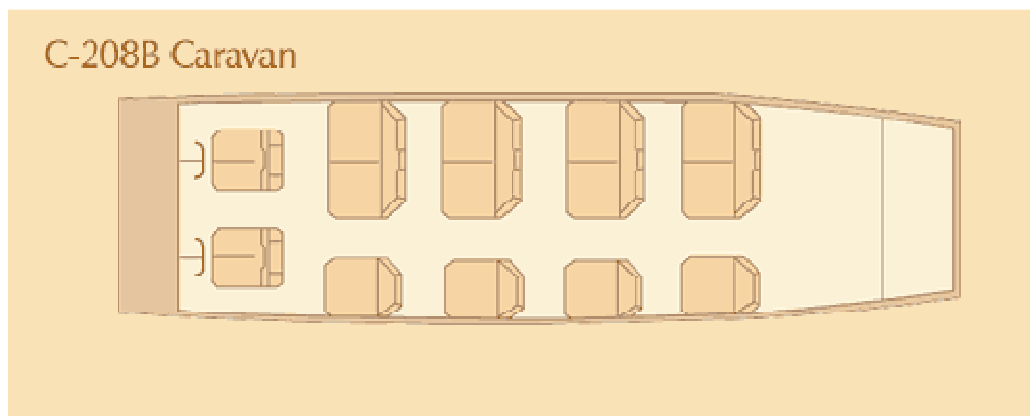
1.13.1 Considered not necessary.

### **1.14 Fire:**

1.14.1 No fire was reported.

### **1.15 Survival Aspects:**

1.15.1 The accident was considered to be survivable due to the fact that all occupants were wearing the aircraft equipped safety harnesses and that the aircraft cockpit area and the entire fuselage remained intact. Below is the aircraft cabin layout.



**Figure 7: Cessna Caravan C208B cabin layout.**

### **1.16 Tests and Research:**

1.16.1 This was an off-site investigation, and the information received from the crew indicated good weather conditions with clear visibility at the time of the accident. The investigation further revealed that, the operator's responsible person accompanied by maintenance personnel who were appropriately rated on the Cessna Caravan C208B series were dispatched to the accident site and examined the aircraft. Firstly, an access/inspection panel located rearward inside the aircraft cabin, leading to the aft-fuselage, through to the bulkhead was opened and all cables were subjected to a visual inspection which revealed no evidence of disturbance, wear and looseness. Since these aircraft has an independent rudder/brakes which can be used to steer by pressing one brake pedal harder than the other, the aircraft rudder was examined independently and all were found to be operating normally.

1.16.2 The hydraulic brake fluid ,MIL H5606 reservoir was checked for security and proper level and was found to be in accordance with the manufacturer's specifications. The master brake cylinders, brake discs, brake assemblies and hydraulic lines were subjected to visual inspection and no abnormalities were found. Both landing gear upper fairings were removed with the intention to attach a rope in order to pull the aircraft out of the ditch with the assistance of a truck. Below are pictures of the landing gear with evidence of upper fairings removed and the aircraft as it was pulled out of the ditch by means of a truck.



**Figure 8 and 9: Right and left.**



**Figure 10: The aircraft as it was pulled out of the ditch.**

1.16.3 The aircraft was successfully pulled out of the ditch and subjected to brake system examination in the presence of the operator's representative and was found to have sufficient pressure and fully functional. The parking brake was also examined by applying foot pressure at the top of the brake pedal, thus closing the parking valve by locking the hydraulic pressure and was also working in accordance with the manufacturer's specification. The operator's representative confirmed the condition of the rudder/brake system and the PF remarks to the investigators and answers provided to the passengers were proved to be incorrect and was eliminated. Below is a Cessna Caravan C208B cockpit.



Figure 11: Cessna Caravan C208B cockpit layout.

## 1.17 Organizational and Management Information:

1.17.1 This was a commercial/charter flight.

1.17.2 The flight was conducted under the provisions of Part 135 of the Civil Aviation Regulations of 1997 as amended and the operator was in possession of a valid air operating certificate (AOC) No CAA/N933D expiring on 09 June 2014 at the time of the occurrence.

1.17.3 The AMO that performed the last maintenance on the aircraft prior to the accident flight was in possession of a valid AMO approval certificate number 1069.

**1.18 Additional Information:**

1.18.1 None.

**1.19 Useful or Effective Investigation Techniques:**

1.19.1 Not necessary during this investigation.

**1. ANALYSIS:**

2.1 It is important to mention the role of human factors in this accident and it is also believed that human error, rather than mechanical failure underlies most aviation accidents and incidents recorded world wide. The term "human factors" has grown increasingly popular as the commercial aviation industry has realized that if understood narrowly, human factors are often considered identical with crew resource management. However, the concept of "human factors" is much broader in both its knowledge base and scope. An investigation of human factors involves gathering information about human abilities, limitations, and other characteristics and applying it to tools, machines, systems, tasks, jobs, and environments to produce safe, comfortable, and effective human use. In aviation, the study of human factors is dedicated to better understanding how humans can most safely and efficiently be integrated with the technology. That understanding is then translated into design, training, policies, or procedures to help humans perform better.

2.2 Flight crew communication relies on the use of audio, visual, and solid methods. All these methods must be used appropriately in the communication that takes place during flight. This includes crewmembers to aircraft, crewmember to crewmember, and aircraft to crewmember communication. The crew was appropriately rated and fit to undertake the flight. The accident happened during taxiing towards runway 16 at FAMD and the flight was scheduled for FAOR, charter flight number FDR 161 with 13 occupants on-board. Available information reveals that fine weather conditions prevailed in the area at the time of the flight and subsequent accident. The prevailing weather conditions were therefore not considered to have had any bearing on the accident. After the accident the aircraft was subjected to a thorough rudder/brake system examination in which no anomalies was identified.



- 2.3 The PF statement and remarks made after the accident were therefore eliminated. The investigation concluded that during downhill taxiing the crew was somewhat distracted, up to the time the aircraft drifted off to the left of the taxi way. In addition, this has to some extent identified that few seconds before the accident, the aircraft was not under the control of either pilot. Taxiing is described as the controlled movement of the aircraft under its own power while on the ground. The PF must thoroughly understand taxiing procedures and be proficient or capable in maintaining positive control of the aircraft's direction and speed of movement on the ground. In addition, the pilot must be watchful and visually check the location and movements of everything else along the taxi path. Initially, whoever in control of the aircraft should taxi with the heels of his feet resting on the cockpit floor panel and the toes of the feet on the bottom of the rudder pedals.
- 2.4 The feet should be slid up onto the brake pedals only when it is necessary to depress the brakes. This will permit the simultaneous application of rudder and brake whenever needed. The brakes are used primarily to stop the aircraft at a desired point, to slow the aircraft, or as an aid in making a controlled turn. Whenever used, they must be applied smoothly, evenly, and cautiously at all times. The safety of the aircraft and the passengers are the prime responsibility of the captain, even if the role of flying the aircraft has been delegated to the first officer. Maintaining situational awareness is paramount to the safe operation of any aircraft. Good airmanship and adherence to the company approved standard operating procedures would have prevented this accident.

### **3. CONCLUSION:**

#### **3.1 Findings:**

- 3.1.1 The captain and the first officer had valid commercial pilot licences and had the aircraft type endorsed on their profiles.
- 3.1.2 The crew medical was valid with no restrictions.
- 3.1.3 The crew underwent CRM and OPC courses.
- 3.1.4 The aircraft was in possession of a valid Certificate of Airworthiness (C of A) and AOC.
- 3.1.5 The aircraft weight was within its limitation and had flown a total of 70.9 hours since the last maintenance inspection was certified.

- 3.1.6 The Aircraft Maintenance Organisation (AMO) that performed the last maintenance inspection on the aircraft prior to the accident flight was in possession of a valid AMO Approval certificate No 1069.
- 3.1.7 Available information indicated that fine weather conditions prevailed in the area at the time of the flight and subsequent accident.
- 3.1.8 Examination of the aircraft technical logbooks revealed no evidence of anomalies or deficiencies.
- 3.1.9 Examination of the brake system revealed no anomalies.
- 3.1.10 The accident was considered survivable.

### **3.2 Probable Cause/s:**

- 3.2.1 Poor airmanship.

## **4. SAFETY RECOMMENDATIONS:**

- 4.1 None.

## **5. APPENDICES:**

- 5.1 Cessna Caravan C208B brake system as per the POH:
- (i) The aircraft has a single disc, hydraulically actuated brake on each main landing gear wheel. Each brake is connected by a hydraulic line, to a master cylinder to each of the pilot's rudder pedals. The brakes are applied by applying pressure to the top of either the left or right set of rudder pedals, which are interconnected. When the aircraft is parked, both main wheel brakes with the rudder pedals may be set by utilising the parking brake which is operated by a handle on the lower left side of the instruments panel. To apply the parking brake, set the brakes with the rudder pedals and pull the handle aft. To release the parking brake, push the handle fully in. A brake fluid reservoir located just forward of the fire wall on the left side of the engine compartment provides additional brake fluid for the brake master cylinders. The fluid in the reservoir should be checked for proper level prior to each flight. Some of the symptoms of the impending brake failure are: gradual decrease in braking action after brake application, noisy or dragging brakes, soft or spongy pedals, and excessive travel and weak braking action. If any of these symptoms appear, the brake system is in need of immediate attention. If during taxi or landing roll, braking action decreases, let

up on the pedals and then re-apply the brakes with heavy pressure. If the brakes become spongy or pedal travel increases, pumping the pedals should build braking pressure. If one brake becomes weak or fails, use the other brake sparingly while using opposite rudder as required to off-set the good brake.

## 5.2 Pilot in command responsibilities as per the Operator's Manual of Procedures:

The authority, duties and responsibilities of pilot in command are in accordance with Federal Air Operations Manual and the South African CAT's and CAR's.

The pilot in command shall:

- ❖ Take all reasonable steps to maintain familiarity with all relevant aviation regulations, notices, circulars, procedures and the contents of the operations manual.
- ❖ Be responsible for the safe operation of the aircraft and safety of its occupants and cargo during flight time.
- ❖ Have authority to give all commands he deems necessary for the purpose of securing the safety of the aircraft and of persons or property carried therein and all persons carried in the aircraft shall obey such commands.
- ❖ Have authority to disembark any person, or any part of the cargo, which in his opinion, may represent any potential hazard of the safety of the aircraft or its occupants.
- ❖ Not allow any person to be carried out on the aircraft that appears to be under the influence of alcohol and drugs to the extent that the safety of the aircraft or its occupants is likely to be endangered.
- ❖ Have the right to refuse transportation of inadmissible passengers, deportees or persons in custody if their carriage poses any risk to the safety of the aircraft or its occupants.
- ❖ Ensure that all passengers are briefed on the location of emergency exits and the location and use of all relevant safety and emergency equipment.
- ❖ Ensure that procedures and checklists are complied with.
- ❖ In the absence of qualified persons or engineers, ensure that the refuelling is supervised with particular attention paid to:
  - Correct amount of fuel.
  - Fuel water checks.

- Fire safety precautions.
  - Checking filter caps for security and correct placement after refuelling.
- 
- ❖ Take all reasonable steps to ensure that the aircraft mass and balance are within the calculated limits for the operations conditions.
  - ❖ Confirm that the aircraft's performance will enable it to safely complete the proposed flight.
  - ❖ Not permit any crew member to perform any activity during take-off and before, initial climb, final approach and landing except those duties required for the safe operation of the aircraft.
  - ❖ Take all reasonable steps to ensure that before take-off and before landing the crew are properly secured in the allocated seats.
  - ❖ Take all responsible steps to ensure that whenever he considers it advisable (e.g. in turbulent conditions), all passengers are properly secured in their seats, and cabin baggage is properly stowed. He should encourage the use of seat belts throughout the flight.
  - ❖ Ensure that all relevant required documents and manuals are carried on the aircraft and will remain valid throughout the flight or series of flights.
  - ❖ Ensure that pre-flight inspection has been carried out.
  - ❖ Maintain a high standard of discipline, conduct and appearances as a representative of Federal Air.
  - ❖ In an immediate situation that requires immediate decisions and actions, take the relevant action he or she considers necessary under the circumstances. In such cases he may deviate from the rules, operational procedures and methods in the interest of safety.
  - ❖ Apply greater safety margins, including aerodrome minima, if he or she deems it necessary.
  - ❖ Ensure that, should maintenance be required whilst away from base the technical manager is contacted for advice.

### 5.3 Safety Management System (SMS):

The operator had an SMS in place, which is designed to identify potential threats to safety in operations and put in place preventative measures. In this regard evidence showed that the flight crew was trained accordingly and their competency checked

in the operation of a Cessna Caravan C208B aircraft. This training involved achieving sufficient competency for a Cessna Caravan C208B type rating and operator proficiency checks as required. These checks were carried out by the operator's training section with a qualified TRE. This training took place in an approved simulator and was concluded during normal line operations.

#### 5.4 Brake system illustrated parts catalogue (IPC) details:



## BRAKE SYSTEM - FIGURE 01

ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	EFFECTIVITY FROM TO	UNITS PER ASSY
		BRAKE SYSTEM		
1	2682002-1	· RESERVOIR ASSY-BRAKE FLUID FSO 2682004-1	0001 0142 B0001 B0138	01
- 2	2682004-1	· RESERVOIR ASSY-BRAKE FLUID	0143 & ON B0139 & ON	01
3	MS3367-2-9	· STRAP		01
4	71014	· · CAP-RESERVOIR V27901		01
5	AN833-3D	· · ELBOW		01
6	AN924-3D	· · NUT		01
7	NAS1149D0616K	· · WASHER		01
8	MS28778-3	· · O-RING		01
9	MS9058-03	· · BACK-UP RING		01
10	AN6289D3	· · NUT		01
11	2653013-1	· BRACKET ASSY-BRAKE RESERVOIR		01
12	2600100-6	· LINE ASSY-RESERVOIR TO TEE AT FIREWALL		01
13	AN924-3	· NUT		01
14	NAS1149F0663P	· WASHER		01
15	AN834-3	· TEE		01
16	S2889-3-0112	· HOSE ASSY TEE AT FIREWALL TO BRAKE CYLINDER FSO S3309A0112-000D	0001 0302 B0001 B0735	NP R
- 16A	S3465-2-0112	· HOSE ASSY TEE AT FIREWALL TO BRAKE CYLINDER FSO S3309A0112-000D	0303 0532 B0736 B2329	NP R
- 16B	S3309A0112-000D	· HOSE ASSY	0533 & ON B2330 & ON	01 R
17	S2889-3-0103	· HOSE ASSY TEE FIREWALL TO BRAKE CYLINDER FSO S3309A0103-000D REFER TO NOTE 2	0001 0278 B0001 B0674	NP R
- 17A	S3309A0103-000D	· HOSE ASSY TEE FIREWALL TO BRAKE CYLINDER	0001 0278 B0001 B0674	01 R
18	S2889-3-0160	· HOSE ASSY ELBOW TO BRAKE CYLINDER FSO S3309A0160-000D	0279 0302 B0675 B0733	NP R
- 18A	S3465-2-0160	· HOSE ASSY TEE FIREWALL TO BRAKE CYLINDER FSO S3309A0160-000D	0303 0532 B0734 B2329	NP R
- 18B	S3309A0160-000D	· HOSE ASSY	0533 & ON B2330 & ON	01 R
19	2600100-65	· LINE ASSY REFER TO NOTE 1	0279 & ON B0675 & ON	01

- item not illustrated

ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	EFFECTIVITY		UNITS PER ASSY
			FROM	TO	
20	AN924-3	· NUT REFER TO NOTE 1	0279	& ON B0675	01
21	AN837-3	· ELBOW REFER TO NOTE 1	0279	& ON B0675	01
22	MS35489-134	· GROMMET REFER TO NOTE 1	0278	& ON B0675	01
23	AN833-3D	· ELBOW			04
24	MS28778-3	· O-RING			04
25	AN924-3D	· NUT			04
26		· BRAKE CYLINDER ASSY- MASTER REFER TO 32-41-01 FIGURE 01			RF
27		· RUDDER PEDALS INSTALLATION REFER TO 27-20-02 FIGURE 02			RF
28	MS20392-2C25	· PIN LOWER			02
29	MS20392-2C17	· PIN UPPER			02
30	NAS1149F0332P	· WASHER			04
31	MS24665-132	· COTTER PIN			04
32	S2889-3-0132	· HOSE ASSY BRAKE CYL TO PARKING BRAKE VALVE FSO S3309A0132-000D	0001	0302 B0001 B0735	NP R
- 32A	S3465-2-0132	· HOSE ASSY BRAKE CYL TO PARKING BRAKE VALVE FSO S3309A0132-000D	0303	0532 B0736 B2329	NP R
- 32B	S3309A0132-000D	· HOSE ASSY	0533	& ON B2330 & ON	01 R
33	S2889-3-0146	· HOSE ASSY BRAKE CYL TO PARKING BRAKE VALVE FSO S3309A0146-000D	0001	0302 B0001 B0735	NP R
- 33A	S3465-2-0146	· HOSE ASSY BRAKE CYL TO PARKING BRAKE VALVE FSO S3309A0146-000D	0303	0532 B0736 B2329	NP R
- 33B	S3309A0146-000D	· HOSE ASSY	0533	& ON B2330 & ON	01 R
34	S1050-1	· GROMMET BKI			AR
35	S1050-1	· GROMMET BKI			AR
36		· PARKING BRAKE INSTALLATION REFER TO 32-42-00 FIGURE 01			RF
37	2600100-17	· LINE ASSY-RH PARKING BRAKE VALVE TO UNION			01
38	2600100-1	· LINE ASSY-LH PARKING BRAKE VALVE TO UNION			01
39	AN832-3D	· UNION			02
- 40	AN924-3D	· NUT			02

- item not illustrated

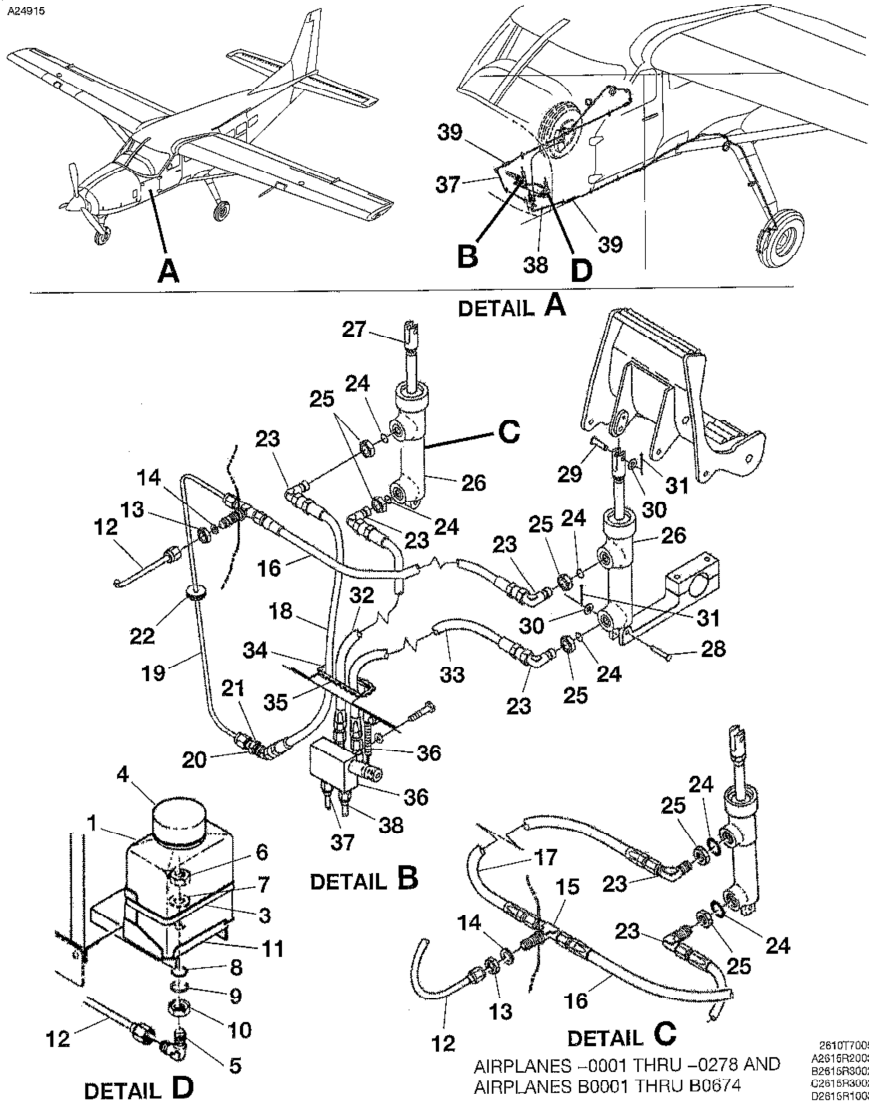
ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	EFFECTIVITY		UNITS PER ASSY
			FROM	TO	
- 41	NAS1149D0663K	· WASHER			02
<b>NOTE 1:</b> AIRPLANES -0279 AND ON AND B0675 AND ON, AND AIRPLANES -0001 THRU -0278 AND B0001 THRU B0674 INCORPORATING SK208-136.					
<b>NOTE 2:</b> AIRPLANES -0001 THRU -0278 AND B0001 THRU B0674 NOT INCOPRORATING SK208-136.					
- 75	2600100-2	· LINE ASSY	0001	0089	02
- 76	2600100-48	· LINE ASSY	0090	& ON	01
- 77	2600100-57	· LINE ASSY	B0001	& ON	01
- 78	AS5174D0303	· UNION			02
- 79	AN837-3	· ELBOW			02
- 80	AN924-3	· NUT			02
- 81	NAS1149D0663K	· WASHER			02
- 82		· CLAMP ATTACH MAIN GEAR STRUT REFER TO 30-10-03 FIGURE 01			RF
- 83	MS21919WDG3	· CLAMP ATTACH TO BRAKE LINE	0001 B0001	0197 B0232	02
- 84	MS21919WDG6	· CLAMP ATTACH TO BRAKE LINE	0198 B0233	0532 B2329	NP R
- 84A	MS21919WDG7	· CLAMP ATTACH TO BRAKE LINE	0533 B2330	& ON & ON	04 R
- 85	MS35207-262	· SCREW	0001	& ON	02
- 86	AN520-10R11	· SCREW	B0001	& ON	02
- 87	NAS43HT3-13	· SPACER	B0001	& ON	02
- 88	NAS1149F0332P	· WASHER	B0001	& ON	02
- 89	MS21044N3	· NUT			02
- 90	S2583-1	· TAPE FSO R881415	0001 B0001	0302 B0735	NP
- 90A	R881424	· TAPE	0303 B0736	& ON & ON	AR
- 91	2600100-3	· LINE ASSY	0001	0089	02
- 92	2600100-49	· LINE ASSY	0090 B0001	& ON & ON	02
- 93	MS35489-35	· GROMMET	0001 B0001	0197 B0232	02
- 94	AN735-34	· CLAMP ATTACH TO MAIN GEAR STRUT	0001	0337	02
- 94A	MS21919WCG32	· CLAMP REFER TO NOTE 1	0338	& ON	02
- 95	AN735-36	· CLAMP ATTACH TO MAIN GEAR STRUT	B0001	B0893	02
- 95A	MS21919WCG34	· CLAMP REFER TO NOTE 1	B0894	& ON	02
- 96	MS21919WDG3	· CLAMP ATTACH TO BRAKE LINE	0001 B0001	0197 B0232	02
- 97	MS21919WDG6	· CLAMP ATTACH TO BRAKE LINE	0198 B0233	0532 B2329	NP R
- 97A	MS21919WDG7	· CLAMP ATTACH TO BRAKE LINE	0533 B2330	& ON & ON	02 R

- item not illustrated

ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	EFFECTIVITY		UNITS PER ASSY
			FROM	TO	
- 98	MS35207-262	· SCREW			02
- 99	MS21044N3	· NUT			02
100	2600100-4	· LINE ASSY-LH ELBOW TO BRAKE FSO S3309A0664-000D	0001	0197 B0001 B0232	NP R
101	2600100-5	· LINE ASSY-RH ELBOW TO BRAKE FSO S3309A0664-000D	0001	0197 B0001 B0232	NP R
102	2682000-3	· LINE ASSY-FLEXIBLE-ELBOW TO BRAKE FSO S3309A0664-000D	0198	0213 B0233 B0295	NP R
- 103	2641027-6	· LINE ASSY-FLEXIBLE-ELBOW TO BRAKE FSO S3309A0664-000D	0214	0302 B0296 B0735	NP R
- 103A	2641027-17	· LINE ASSY-FLEXIBLE-ELBOW TO BRAKE FSO S3309A0664-000D	0303	0532 B0736 B2329	NP R
- 103B	S3309A0664-000D	· HOSE ASSY-ELBOW TO BRAKE	0533	& ON B2330 & ON	02 R
104	MS21919WDG3	· CLAMP			02
- 105	MS35207-262	· SCREW			02
- 106	MS21044N3	· NUT			02
107	AN921-3	· ELBOW			02
- 108	AN833-3	· ELBOW ALT FOR AN921-3			02
- 109	AN924-3	· NUT			02
- 110	MS28778-3	· O-RING			02
111		· MAIN WHEEL BRAKE ASSY REFER TO 32-40-00 FIGURE 03			RF
112	S4132-1	· ANCHOR	0001	0089	12
- 113	S4132-1	· ANCHOR	0090	0106	08
- 114	S4132-1	· ANCHOR	0107	& ON	06
- 115	S4132-1	· ANCHOR	B0001	& ON	08
- 116	S1021Z6-8	· SCREW			01
- 117	MS3367-1-9	· STRAP			01

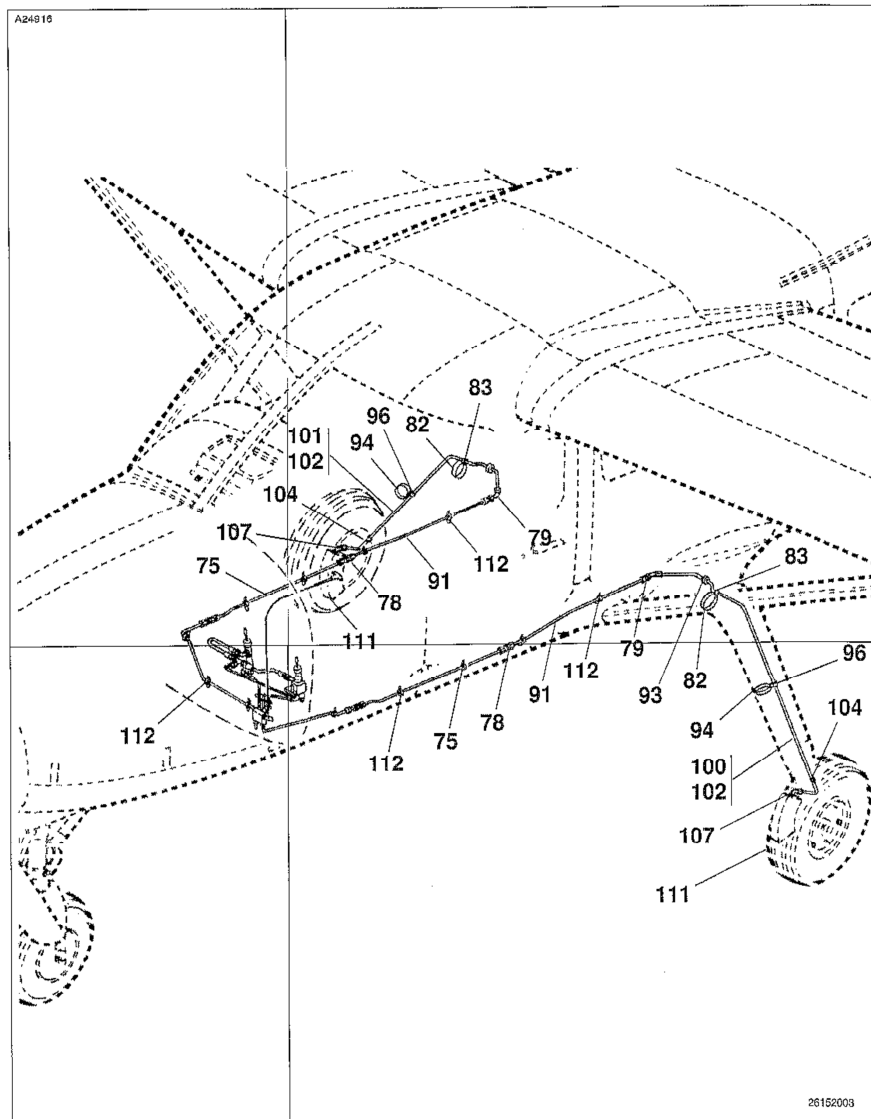
**NOTE 1:** AIRPLANES -0338 AND ON AND B0894 AND ON AND AIRPLANES -0001 THRU -0337 AND B0001 THRU B0896 INCORPORATING CAB03-5.

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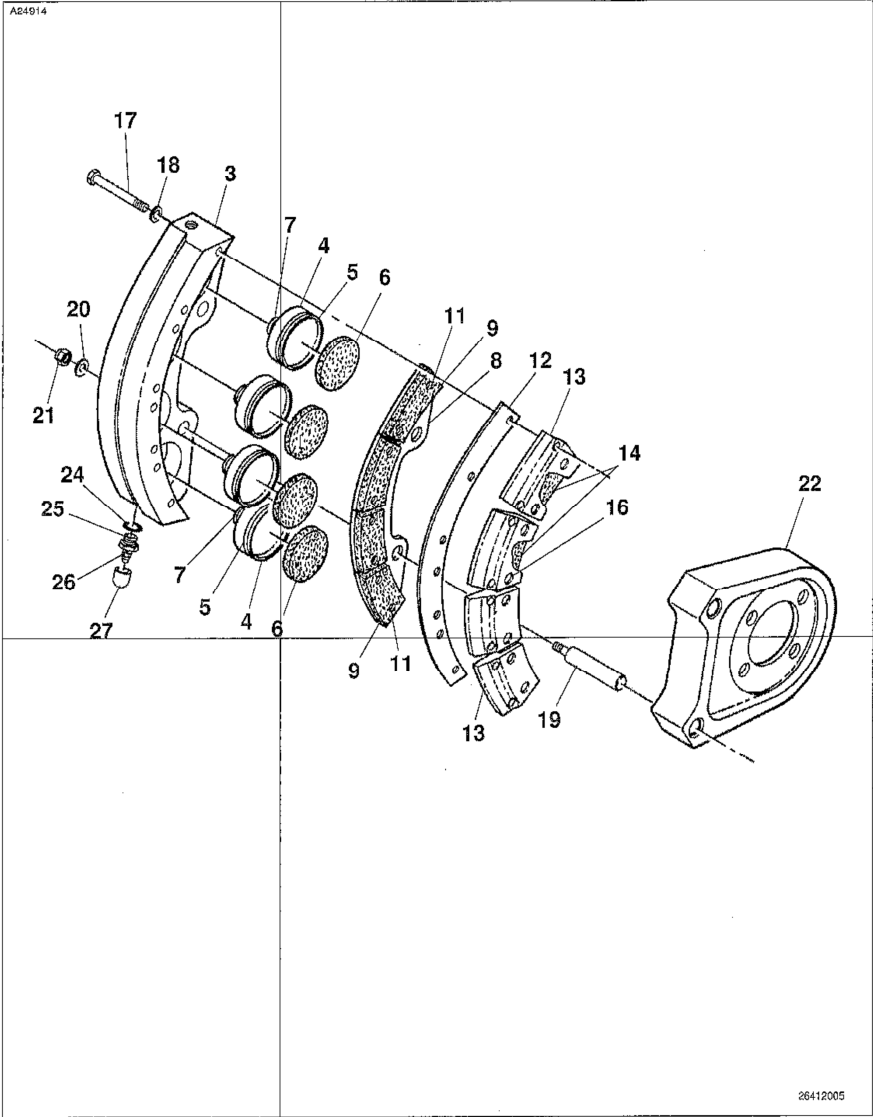


Sheet 2 of 2

## MAIN WHEEL BRAKE ASSEMBLY - FIGURE 03

ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	EFFECTIVITY FROM TO	UNITS PER ASSY
MAIN WHEEL BRAKE ASSEMBLY				
- 1	C163030-1001	· BRAKE ASSY-MAIN WHEEL FSO 030-18200 REFER TO NOTE 1	0001 0115	NP
- 2	030-18200	· BRAKE ASSY-MAIN WHEEL REFER TO NOTE 1	V33269 0116 & ON B0001 & ON	02
3	061-11800	· · CYLINDER-BRAKE	V33269	01
4	092-06700	· · PISTON ASSY-BRAKE	V33269	04
5	MS28775-224	· · · O-RING	V33269	01
6	088-00100	· · · INSULATOR	V33269	01
7	082-02000	· · · SPRING-FRICTION	V33269	01
8	073-08500	· · PLATE ASSY-PRESSURE	V33269	01
9		· · · LINING-BRAKE ORGANIC FSO 066-03300	0001 0135 B0001 B0102	RF
- 10	066-03300	· · · LINING-BRAKE METALLIC REFER TO NOTE 2 AND NOTE 3	0136 & ON B0103 & ON	04
11	177-00300	· · · PIN-CARRIER	V33269	02
12	068-02800	· · SHIM-BACK PLATE	V33269	01
13	074-06600	· · BACK PLATE ASSY-BRAKE	V33269	04
14		· · · LINING-BRAKE ORGANIC FSO 066-03300	0001 0135 B0001 B0102	RF
- 15	066-03300	· · · LINING-BRAKE METALLIC REFER TO NOTE 2 AND NOTE 3	0136 & ON B0103 & ON	01
16	177-00300	· · · PIN-CARRIER	V33269	02
17	103-14300	· · BOLT	V33269	08
18	095-10400	· · WASHER	V33269	08
19	069-01900	· · BOLT-ANCHOR	V33269	02
20	095-10200	· · WASHER	V33269	02
21	094-10300	· · NUT	V33269	02
22	075-16800	· · TORQUE PLATE ASSY-BRAKE	V33269 0001 0115	01
- 23	075-17100	· · TORQUE PLATE ASSY-BRAKE	V33269 0116 & ON B0001 & ON	01
24	MS28775-011	· · O-RING	V33269	01
25	081-00500	· · SEAT-BLEEDER	V33269	01
26	079-00300	· · SCREW-BLEEDER	V33269	01
27	183-00100	· · CAP-BLEEDER	V33269	01
<b>NOTE 1:</b> BRAKE ASSY DESCRIBED IS NORMALLY LH, REVERSE BLEEDER FITTINGS FOR RH INSTALLATION.				
<b>NOTE 2:</b> WHEN ORDERING THIS PART, REFER TO MAINTENANCE MANUAL FOR INSTALLATION AND BREAK-IN PROCEDURES.				
<b>NOTE 3:</b> WHEN INITIALLY ORDERING THIS PART FOR AIRPLANES PRIOR TO -0136 OR B0103, LININGS MUST BE REPLACED ON BOTH LH AND RH BRAKE ASSEMBLIES.				

- item not illustrated

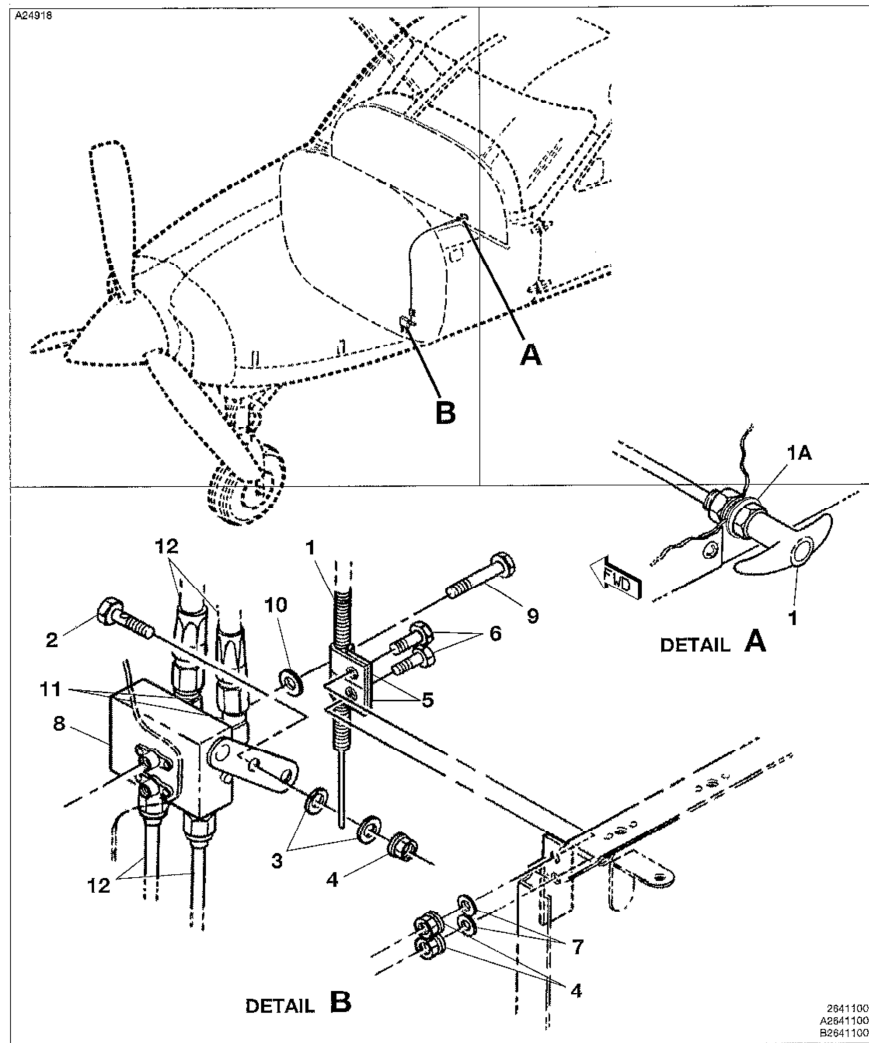


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## PARKING BRAKE INSTALLATION - FIGURE 01

ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	EFFECTIVITY FROM TO	UNITS PER ASSY
		PARKING BRAKE INSTALLATION		
1	S1779-3	· CONTROL ASSY-PARKING BRAKE		01
1A	NAS1149F0632P	· WASHER		01 R
2	S2323-5	· CLAMP		01
3	NAS1149D0332K	· WASHER		02
4	MS21044N3	· NUT		03
5	S2226-1	· CLAMP		02
6	AN3-4A	· BOLT		02
7	NAS1149F0332P	· WASHER		02
8	9910564-1	· VALVE ASSY-PARKING BRAKE REFER TO NOTE 1		01
9	AN3-12A	· BOLT		02
10	NAS1149F0363P	· WASHER		02
11	MS20822-3D	· · ELBOW		02
12		· BRAKE SYSTEM REFER TO 32-41-00 FIGURE 01		RF
<b>NOTE 1:</b> WHEN INITIALLY ORDERING THIS PART FOR AIRPLANES PRIOR TO -0132 OR B0055, ALSO ORDER MS20822-3D ELBOW.				

- item not illustrated



Sheet 1 of 1

## BRAKE RETURN SPRING INSTALLATION - FIGURE 01

ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	EFFECTIVITY FROM TO	UNITS PER ASSY
		BRAKE RETURN SPRING INSTALLATION	B5000 & ON	
1	2682005-9	· RETURN SPRING ASSY-BRAKE		01
2	AN3-7	· BOLT		02
3	NAS6203-13D	· BOLT		04
4	NAS1149F0332P	· WASHER		04
5	MS17825-3	· NUT		04
6	MS24665-132	· COTTER PIN		04
7	2682005-7	· RETURN SPRING SUPPORT-OUTBD		01
8	2682005-8	· RETURN SPRING SUPPORT-INBD		01
9	AN3-20A	· BOLT		04
10		· FOOT REST-PILOT REFER TO 53-20-00 FIGURE 02 AND FIGURE 03		RF
11		· BRAKE SYSTEM REFER TO 27-20-02 FIGURE 02		RF

- item not illustrated

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