Havarikommissionen
Accident Investigation Board Denmark

# BULLETIN

## Serious incident

## 26-2-2018

## involving

## CIRRUS (SF50 Vision Jet)

## N3AD

Certain report data are generated via the EC common aviation database

## FOREWORD

This bulletin reflects the opinion of the Danish Accident Investigation Board regarding the circumstances of the occurrence and its causes and consequences.

In accordance with the provisions of the Danish Air Navigation Act and pursuant to Annex 13 of the International Civil Aviation Convention, the safety investigation is of an exclusively technical and operational nature, and its objective is not the assignment of blame or liability.

The safety investigation was carried out without having necessarily used legal evidence procedures and with no other basic aim than preventing future accidents and serious incidents.

Consequently, any use of this bulletin for purposes other than preventing future accidents and serious incidents may lead to erroneous or misleading interpretations.

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**BULLETIN**

## General

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|---|---|
| File number: | 2018-134 |
| UTC date: | 26-02-2018 |
| UTC time: | 18:04 |
| Occurrence class: | Serious incident |
| Location: | Nuuk (BGGH) |
| Injury level: | None |

## Aircraft

| | |
|---|---|
| Aircraft registration: | N3AD |
| Aircraft make/model: | CIRRUS (SF50 Vision Jet) |
| Current flight rules: | Instrument Flight Rules (IFR) |
| Operation type: | Non-Commercial Operations Relocation Delivery |
| Flight phase: | Landing |
| Aircraft category: | Fixed Wing Aeroplane Small Aeroplane |
| Last departure point: | Canada CYFB (YFB): Iqaluit, N.W.T. |
| Planned destination: | Greenland (Denmark) BGGH (GOH): Nuuk |
| Aircraft damage: | Minor |
| Engine make/model: | Williams International FJ33-5A |

## SYNOPSIS

## Notification

All times in this report are UTC.

The Aerodrome Flight Information Service (AFIS) at Nuuk (BGGH) notified the Aviation Unit of the Danish Accident Investigation Board (AIB) of the serious incident on 26-2-2018 at 18:15 hours.

The AIB notified the National Transportation Safety Board (NTSB), the European Aviation Safety Agency (EASA) and the European Commission (DG Move) on 27-2-2018.

The NTSB appointed a non-travelling accredited representative to the AIB safety investigation.

The AIB notified the Bundesstelle für Flugunfalluntersuchung (BFU) and the International Civil Aviation Organization (ICAO) on 4-4-2018.

## Summary

Insufficient torqueing of a brake tube fitting leading to leakage of hydraulic brake fluid and a consequential partial brake failure resulted in a runway side excursion.

The serious incident occurred in daylight and under visual meteorological conditions (VMC).

## FACTUAL INFORMATION

### History of the flight

The serious incident occurred upon landing on runway 05 in Nuuk (BGGH) in Greenland.

The serious incident flight was part of an aircraft delivery flight from the United States to Europe.

The aircraft departed Iqaluit (CYFB) in Canada at 16:27 hours.

The serious incident flight was uneventful until the landing in BGGH.

At initial radio contact with Nuuk AFIS, the pilot obtained the following weather report:

*The wind is 140 magnetic 2 knots. The visibility is more than 10 kilometres. Sky clear. Temperature minus 9. Dewpoint minus 18. The QNH in Nuuk 1019. Transition level is 90. Runway condition - runway is 10% covered with 1 millimetre of compact snow. Braking action good.*

During descent, the pilot got visual contact with BGGH and requested a visual approach to runway 05.

Nuuk AFIS reported that the approach would be a visual approach to runway 05. The wind was variable 4 knots. At the thresholds to runway 05 and runway 23, the wind was 110 magnetic 11 knots.

Just before landing, Nuuk AFIS reported the wind at threshold to runway 05 to be 150 magnetic 5 knots and at threshold to runway 23 to be 110 magnetic 12 knots.

During the landing roll, the pilot applied both toe-brake pedals to stop the aircraft, but shortly after the pilot experienced a total loss of brake pressure for the left brake pedal. The aircraft started veering to the right.

In order to regain directional control, the pilot released the pressure on both toe-brake pedals.

The pilot instructed the passenger in the right pilot seat to apply both toe-brake pedals. The passenger in the right pilot seat noted a total loss of brake pressure for the left brake pedal. The aircraft started veering to the right.

The pilot regained directional control and realized that it was impossible to stop the aircraft within the remaining available runway.

For that reason, the pilot decided to stop the aircraft by use only of the right toe-brake pedal.

The aircraft veered to the right, ran off the side of the runway and ended up in a snowbank parallel to the runway.

The pilot declared an emergency (*MAYDAY, MAYDAY, MAYDAY).*

Nuuk AFIS alerted the fire and rescue services.

## Injuries to persons

| *Injuries* | *Crew* | *Passengers* | *Others* |
|---|---|---|---|
| Fatal | | | |
| Serious | | | |
| None | 1 | 1 | |

## Damage to aircraft

Because of impact with a snowbank parallel to the runway, the aircraft nose wheel door, the left main wheel door, and wing profile fairings suffered minor damages.

## Other damage

There were no other damages.

## Personnel information

License and medical certificate

The pilot - male, 44 years - was the holder of an US Temporary Airman Certificate, issued on 22-2-2018, based on a German Airline Transport Pilot License (ATPL) issued on 24-6-2013.

The US Temporary Airman Certificate contained the following type ratings:

- Airplane single and multiengine engine land.
- SF-50 US test passed.
- Instrument airplane; Glider.

The medical certificate (class 1) was valid until 20-5-2018. The medical certificate held no limitations.

Flying experience

| | Last 24 hours | Last 90 days | Total |
|---|---|---|---|
| All types | 7 | 18 | 14000 |
| This type | - | - | - |
| Landings this type | - | - | - |

## Aircraft information

General information

| | |
|---|---|
| Registration: | N3AD |
| Type: | Cirrus |
| Model: | SF50 Vision Jet |
| Manufacturer: | Cirrus Design Corporation |
| Serial number: | 0034 |
| Year of manufacture: | 2018 |
| Engine manufacturer: | Williams International |
| Engine type: | FJ33-5A |
| Aircraft total airframe hours: | 5.3 hours (on 14-2-2018) |
| Standard airworthiness certificate: | Valid until 28-2-2019 |

Brake system

A schematic overview of the brake system – see appendix 1.

Brake tube routing and fittings (extracts) – see appendix 2.

Airplane Flight Manual (AFM) (extract)

*Abnormal procedures - Landing With Failed Brakes.*

See appendix 3.

## Meteorological information

Terminal Aerodrome Forecast (TAF)

bggh 261709z 2618/2701 vrb05kt 9999 few020=

Aviation Rutine Weather Report (METAR)

bggh 261750z 12001kt 9999 skc m09/m18 q1019=

bggh 261850z 09004kt 350v150 9999 skc m10/m16 q1019=

SNOWTAM

BGGH issued the latest SNOWTAM at 09:59 hours.

*260959 BGGHZTZX*
*SWBG0486 BGGH 02260935*
*(SNOWTAM 0486*
*A)BGGH*
*B)02260935*
*C)05 F)8/8/8 G)2/2/2 H)5/5/5 N)8/GOOD*
*R)48/POOR*
*T)RWY CONTAMINATION 010 PERCENT 2MM COMPACTED SNOW - MEASURED FRICTION COEFFICIENTS 80/80/80 TAP)*

## Communication

The pilot of N3AD was in radio contact with Nuuk AFIS (119.100 MHz).

The AIB obtained involved ATS voice recording. The ATS voice recording was of good quality and useful to the AIB safety investigation.

## Aerodrome information

General information

The Aeronautical Information Publication - Greenland (extract)

| | |
|---|---|
| Location indicator: | BGGH |
| Position: | 64 11 27.32N 051 40 41.03W |
| Elevation (msl): | 283 feet |
| Runway 05: | 018.5° GEO / 046.5° MAG - 950 x 30 M |
| Rescue and firefighting services: | CAT 5 |

ICAO aerodrome chart

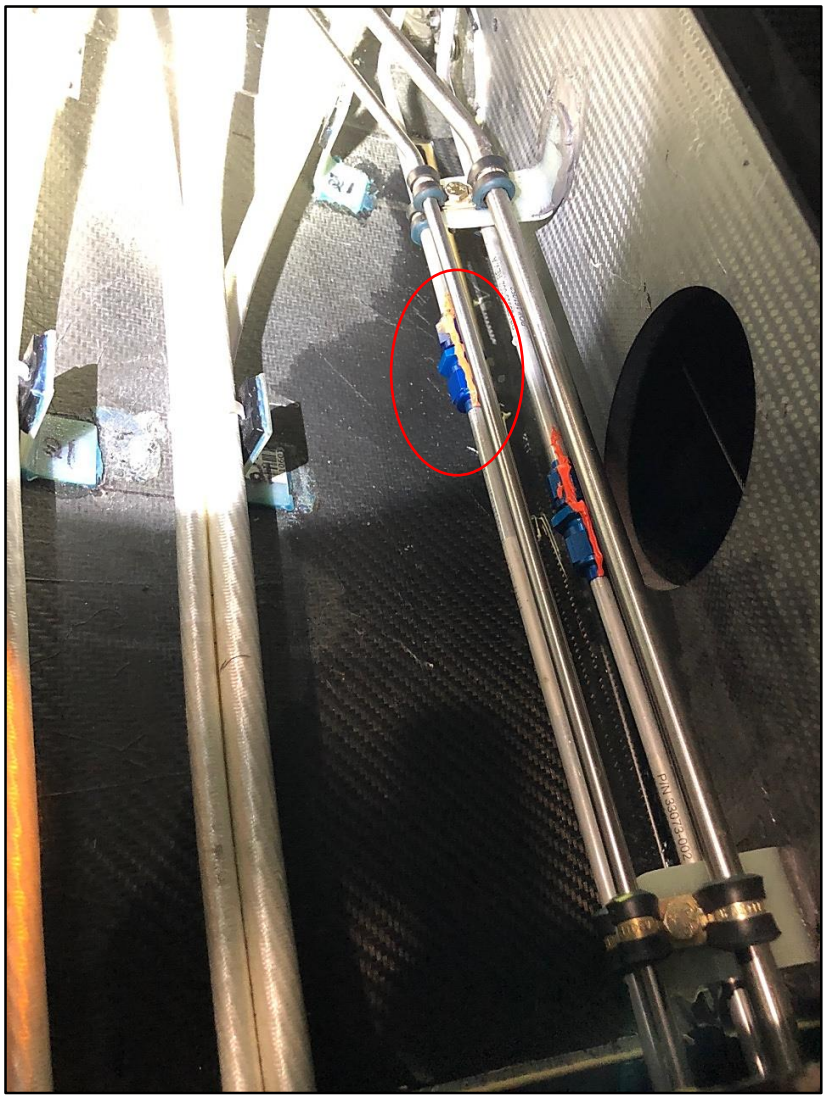
See appendix 4.

## AIB technical safety investigation

Brake tube fitting

An examination of a sealed brake tube fitting below the flight crew seats revealed leakage of hydraulic brake fluid over a period.

After having broken the torque seal, it was possible to tighten the brake tube fitting in accordance with the specifications of the aircraft manufacturer.



Aircraft manufacturer quality assurance

On request by the AIB, the aircraft manufacturer stated that quality control measures for the brake assembly process were in place.

## ANALYSIS

### General

The license, the qualifications and the medical status held by the pilot had, in the AIB's opinion, no influence on the sequence of events.

The observed weather conditions at BGGH were equivalent to the forecasted weather conditions. At an early stage of the final approach to BGGH, the pilot got visual contact with the runway, which in combination with the good weather conditions reduced the overall pilot workload and allowed a surplus of mental resources to handle the landing roll occurrence.

### Runway side excursion

During the landing roll, the pilot experienced a partial brake failure.

Taking into consideration the physical runway environment at BGGH and because of no other aircraft deceleration alternatives to the aircraft brakes, the decision of the pilot on deliberately running of the side of the runway, in the opinion of the AIB, reduced the severity of this serious incident.

The pilot handling was in accordance with the abnormal procedures.

### Hydraulic fluid leakage

The root cause to the partial brake failure was insufficient torqueing of a brake tube fitting resulting in leakage of hydraulic brake fluid over a period.

Even though, quality control measures were in place, this safety investigation revealed that the quality control measures at some point during the brake assembly process most likely failed.

## CONCLUSIONS

Insufficient torqueing of a brake tube fitting leading to leakage of hydraulic brake fluid and a consequential partial brake failure resulted in a runway side excursion.

## PREVENTIVE ACTIONS

Because of this serious incident, the aircraft manufacturer issued:

1. Service Advisory SA-18-01 (issued on 14-3-2018). See appendix 5.

2. Service Bulletin SB5X-32-03 (issued on 19-6-2018). See appendix 6.

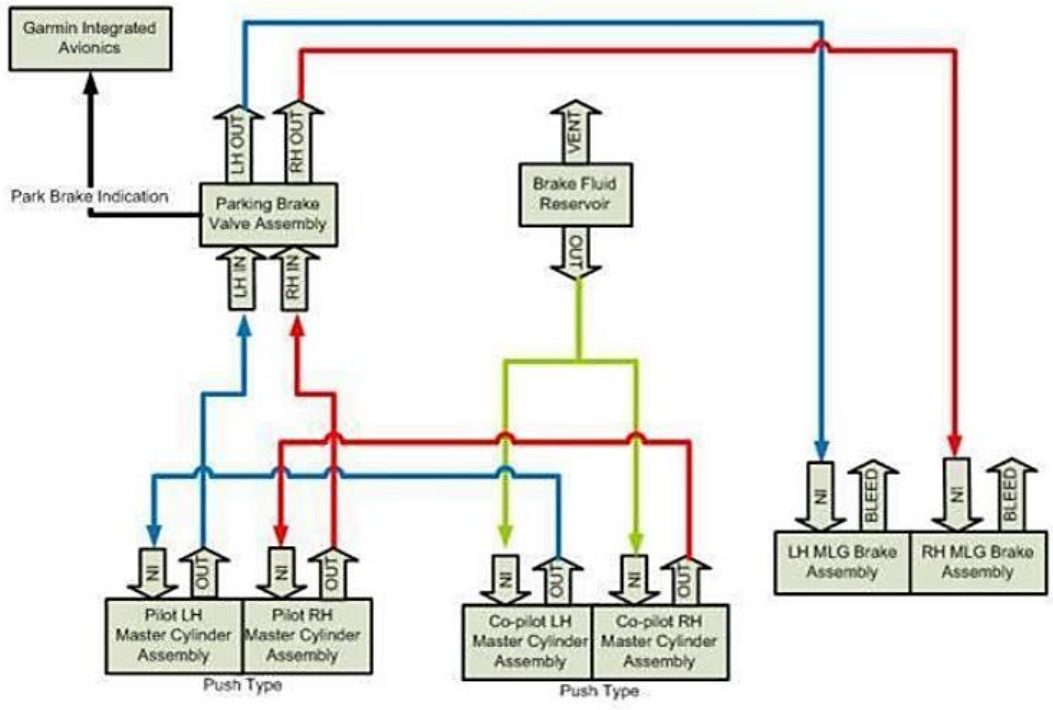
## APPENDIX 1

Return to brake system

### 2.2 Brake System

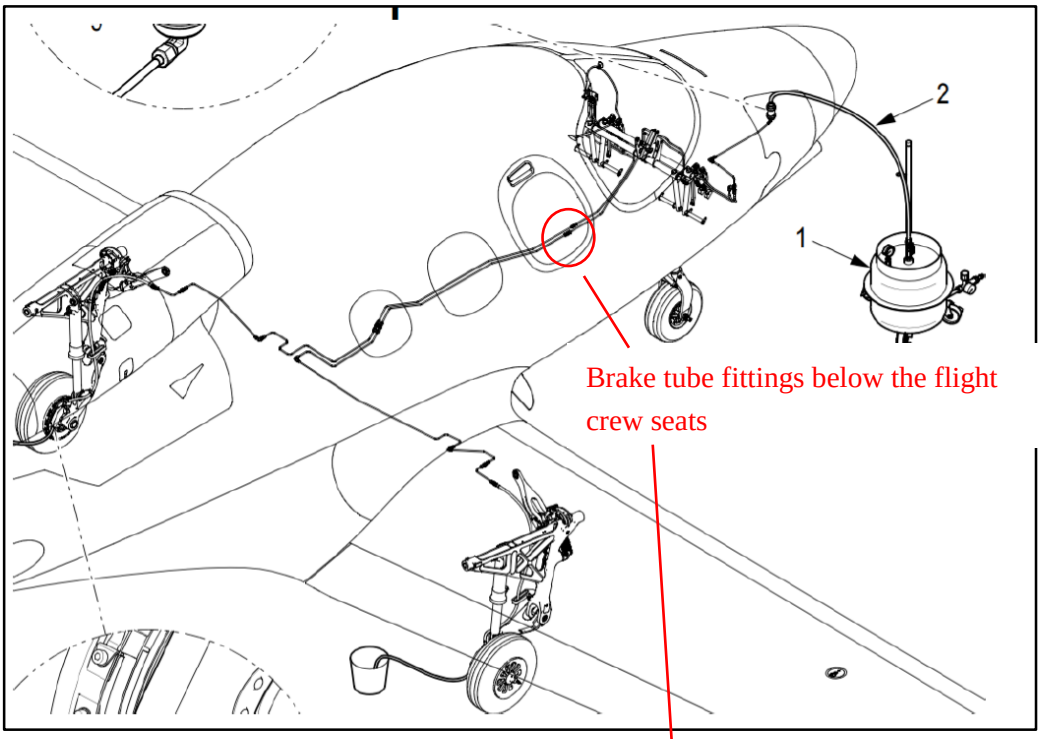
The SF50 brake system consists of a brake assembly for each main landing gear, redundant pilot/co-pilot master cylinders, fluid reservoir, and parking brake with indication. The brakes are actuated by an un-boosted, independent and conventional hydraulic system for fluid power transfer. Conventional pilot toe inputs at the left and/or right rudder pedals generate hydraulic pressure to engage the associated main wheel brake. The system uses fire-resistant MIL-PRF-87257 hydraulic fluid, and therefore does not provide active temperature monitoring or indication of brake caliper or fluid temperature. A schematic of the brake system is shown below.

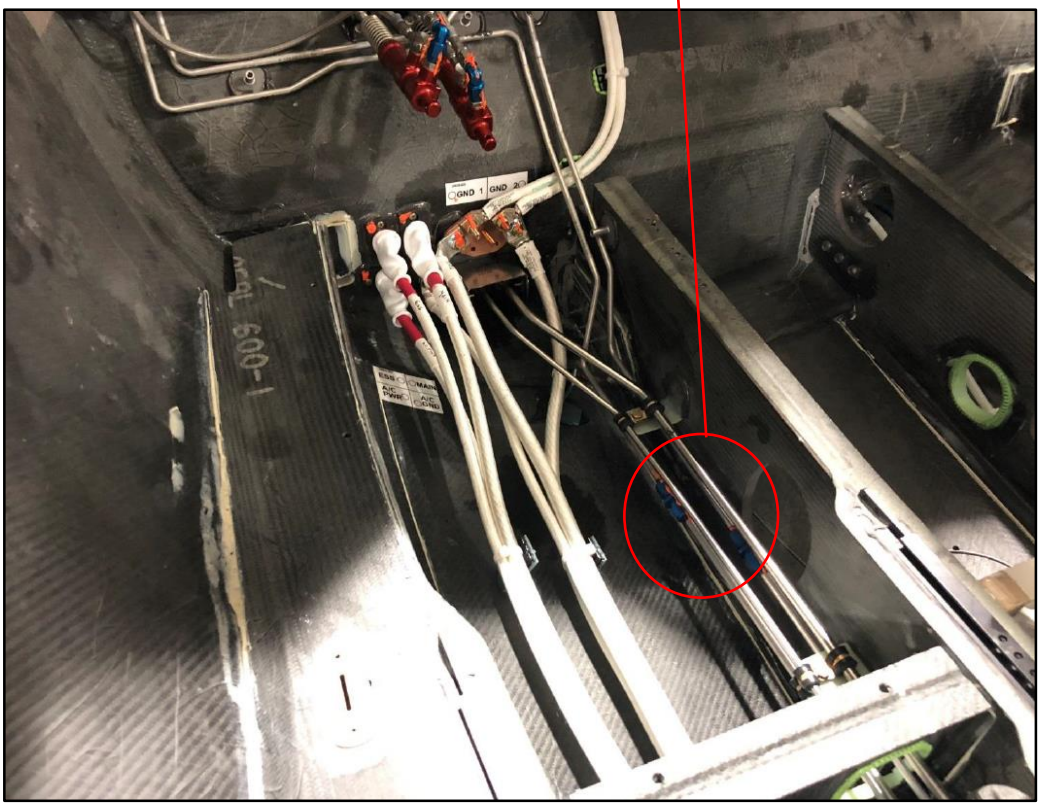
The aircraft does not include other speed reduction devices (speed brakes, thrust reversers, etc) such that the brakes are the only source of pilot-controlled deceleration for taxi, takeoff, and landing. The aircraft uses differential braking for ground maneuvering during taxi and directional control during takeoff and landings at lower airspeeds (typically airspeed < 35kts), while the aircraft rudder authority is used for directional control at higher airspeeds (typically airspeeds of 30-90 kts).



## APPENDIX 2

Return to brake system



## APPENDIX 3

Return to AFM



# Landing With Failed Brakes

◆ If one brake is inoperative:

a. Land on the side of runway corresponding to the inoperative brake.
b. Maintain directional control using rudder and operational brake.
c. Shut down engine as soon as practical.

Procedure Complete

◆ If both brakes are inoperative:

a. Divert to the longest, widest runway with the most direct headwind.
b. Land on downwind side of the runway.
c. Use the rudder and aileron for directional control.
d. Shut down engine as soon as practical.

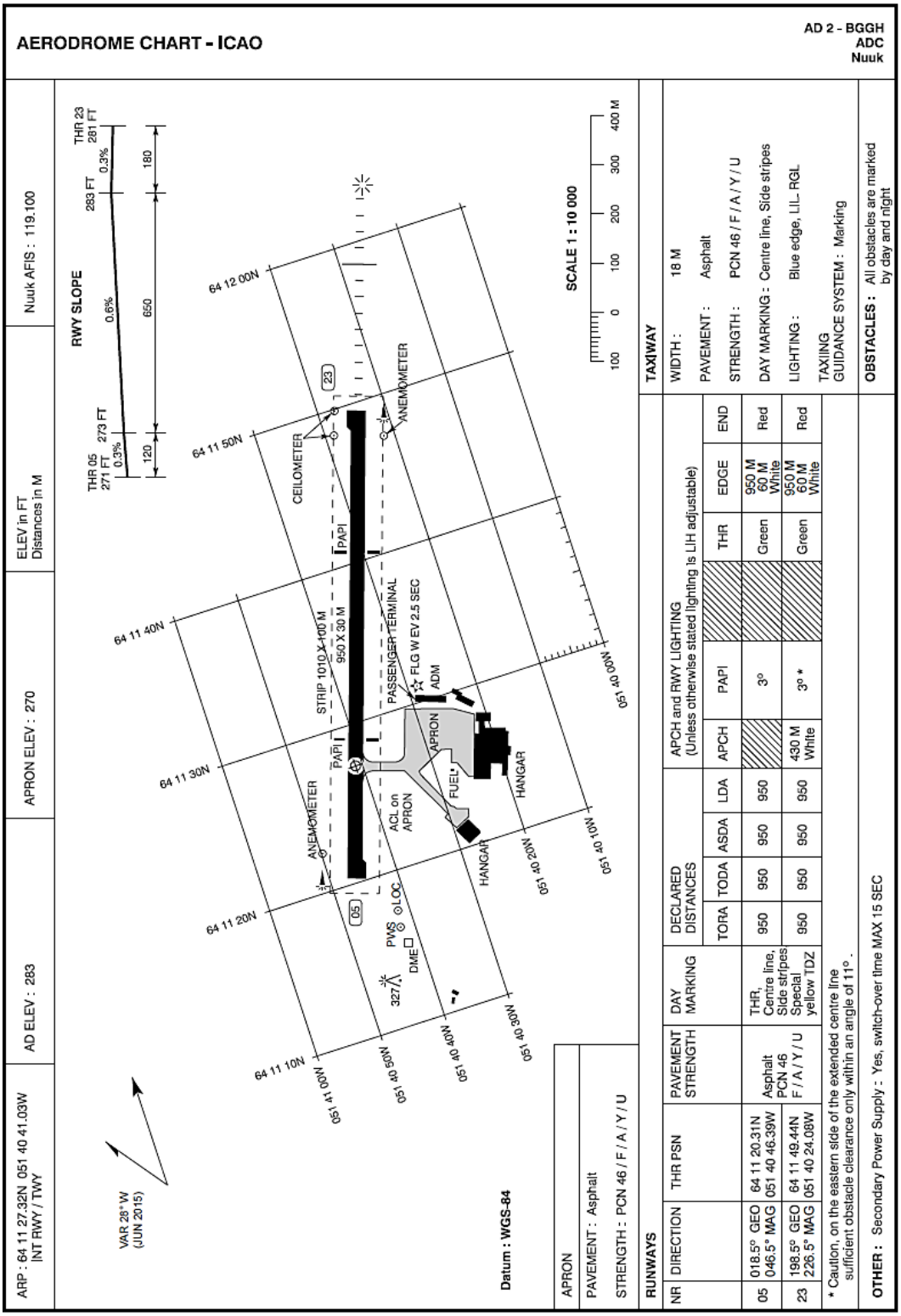
Procedure Complete

• *NOTE* •

Rudder effectiveness will decrease with decreasing airspeed.

## APPENDIX 4

Return to aerodrome information



## APPENDIX 5

Return to preventive actions

CIRRUS

SF5X
Service Advisory

**Number:** **SA18-01**
Issued: 14 Mar 2018

**SUBJECT:** Discussion of Braking Performance and Actions Taken

1. **EFFECTIVITY**

   SF50 Serials 0005 and subs

2. **DESCRIPTION**

   On some production aircraft, Cirrus has observed a condition which causes brake pedals to feel soft or spongy, which could affect brake effectiveness.

3. **PROCEDURE**

   As a precautionary measure, Cirrus recommends the following procedures be performed.

   A. Before flight:

      (1) Test pilot and co-pilot brakes by pressing brake pedals.

      **WARNING: Do not fly aircraft if brake pedals on either side feel soft or spongy.**

      (2) If brake pedals feel soft or spongy, contact Cirrus Aircraft for disposition:
      - AOG/Emergency Assistance: 800-921-2737
      - International Hot Line: 218-788-3000

   B. During descent:

      (1) Test pilot and (if applicable) co-pilot brakes.

      (2) If brake pedals feel soft or spongy: (Refer to AFM Abnormal Procedure Landing with Failed Brakes)

         (a) Divert to the longest, widest runway with crosswind from inoperative brake side.
            1 Land on the side of runway corresponding to the inoperative brake.
            2 Maintain directional control using rudder and operational brake.
            3 Touch down as early as practical at as slow speed as practical.
            4 Shut down engine as soon as practical.

         (b) Make an early go-around decision if runway length is insufficient.

         (c) Coordinate and inform ATC about potential issue as applicable.

         (d) Upon landing, contact Cirrus Aircraft for disposition:
         - AOG/Emergency Assistance: 800-921-2737
         - International Hot Line: 218-788-3000

EFFECTIVITY:
SF50 Serials 0005 and subs

SA18-01
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## APPENDIX 6

Return to preventive actions

**CIRRUS**

SF5X
Service Bulletin

**Number:** **SB5X-32-03**
Issued: 19 Jun 2018

**SNS SUBJECT:** 32-42 - BRAKES - Brake System Update

1. **COMPLIANCE**

   **Mandatory:** Cirrus considers this Service Bulletin to be MANDATORY. Accomplish this Service Bulletin at next scheduled maintenance or 25 flight hours, whichever occurs first. Compliance time begins upon receipt of this Service Bulletin.

2. **EFFECTIVITY**

   SF50 Serials 0005 thru 0055

3. **APPROVAL**

   FAA approval has been obtained on all technical data in this Service Bulletin that affects type design.

   Aircraft not operating under FAA requirements and regulatory oversight: It is the operator's responsibility to ensure that installation of this Service Bulletin has been accepted by the local airworthiness authority.

4. **PURPOSE**

   On affected aircraft, Cirrus has been made aware of a condition which causes brake pedals to feel soft or spongy, which could affect brake performance. To correct this condition this Service Bulletin provides instructions for pressure testing and bleeding the system as well as replacement of the MLG brake hoses to provide better separation between the hose and landing gear strut.

5. **DESCRIPTION**

   This Service Bulletin contains instructions for pressure testing and bleeding the brake system and replacing brake hoses.

6. **WARRANTY INFORMATION**

   For aircraft under warranty, enrolled in JetStream Plus or JetStream Concierge at the issue date of this Service Bulletin, Cirrus will cover all parts and labor costs for this Service Bulletin if the work is accomplished within the compliance time period and the work is performed at an Authorized SF5X Cirrus Service Center.

7. **MANPOWER REQUIREMENTS**

   5.0 man-hours

8. **OTHER PUBLICATIONS AFFECTED**

   SF50 Airplane Maintenance Manual (p/n 31448-001)

9. **WEIGHT AND BALANCE**

   N/A

EFFECTIVITY:
SF50 Serials 0005 thru 0055

SB5X-32-03
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## 10. MATERIAL INFORMATION

The following parts are required to comply with this Service Bulletin. Parts can be obtained from an Authorized Cirrus Service Center or Parts Distributor.

| Item No. | Description | P/N or Spec. | Supplier | Quantity |
|---|---|---|---|---|
| 1 | Brake Hose | 32503-001 | Cirrus | 2 |

## 11. ACCOMPLISHMENT INSTRUCTIONS.

A. Acquire necessary tools, equipment, and supplies.

| Description | P/N or Spec. | Supplier | Purpose |
|---|---|---|---|
| Syringe | - | Any Source | Fill brake fluid reservoir. |
| Pressurized Brake Bleeder | 7300 (or equivalent) | Ammco Tools | Pressurize brake system. |
| Hydraulic Hand Pump | - | Any Source | Pressure test. |
| Isopropyl Alcohol | - | Any Source | Clean leaked fluid. |
| Wheel Chocks | WCK1001 | Cirrus | Block wheels. |
| Hydraulic Fluid | MIL-PRF-87257 | Any Source | Replenish brake system. |
| Tubing | - | Any Source | Drain brake fluid. |
| Hose Clamps | - | Any Source | Secure tubing to fittings. |

B. Remove RH nose access panel. (Refer to AMM 6-00)

C. Replace MLG to caliper brake hose.

(1) Remove and retain brake fluid reservoir plug.

(2) Using a syringe, fill brake fluid reservoir to threads with brake fluid.

(3) Prepare brake bleed pot.

(a) Check brake fluid level in bleed pot. If there is not at least one gallon, fill with more fluid.

(b) Connect bleed pot to air source and pressurize to 10 psi.

(c) Open feed tube valve.

(d) Allow fluid to flow into empty container until there are no more bubbles.

(e) Close feed tube valve.

(f) Pressurize bleed pot to 30 psi.

**Note:** Keep feeder tube valve closed.

(4) Attach bleed pot feeder tube to brake fluid reservoir.

(5) Place wheel chocks into position.

(6) Disengage parking brake.

(7) Remove RH and LH MLG brake hoses. (Refer to AMM 32-42)

(8) Install new RH and LH MLG brake hoses (item 1). (Refer to AMM 32-42)

D. *Serials 0005 thru 0043:* Pressure test brake system.

(1) Ensure brake hoses are attached to both main landing gear calipers and properly torqued and torque striped.

(2) Disconnect brake fluid reservoir and attach pressure supply equipment in its place.

**Note:** Do not connect hydraulic hand pump to brake fluid reservoir inlet.

Support attachment point of hydraulic hand pump hose to prevent damage of the forward brake line assembly.

(3) Open fluid fill cap on hand pump and ensure that hydraulic fluid is filled to bottom of cap threads.

(4) Verify pressure gauge reads 0 psi. If pressure reading is greater than 0 psi, relieve remaining pressure.

**Note:** Only hand tighten valve and cap.

(5) Ensure relief valve of hand pump is completely closed and fill cap is secure.

(6) Using hand pump, increase system pressure by 100 psi and hold for 1 minute.

(7) Inspect all fluid fittings in brake system for leaks.

(a) If leak is found, inspect area to determine which fitting or fittings are leaking.

(b) To correct a leak:

**Note:** Release system pressure before loosening or removing any fittings.

1 Release system pressure and close valve connecting pressure supply equipment to brake system to prevent further leakage.

2 Loosen leaking fitting and ensure system fluid is applied to fitting threads. If applicable, replace copper crush seal washers.

3 Torque fitting and increase system pressure to pressure at which leak was discovered.

4 If fitting continues to leak at same pressure, release system pressure and replace fitting and, if necessary, associated brake line.

5 If leak is located at port of Beringer component, replace bolt or adapter.

6 If leak continues at same location and pressure after replacing bolt or adapter and applicable crush seal washers, contact Cirrus for disposition.

(8) Clean any fluid that leaked onto aircraft with isopropyl alcohol.

(9) Repeat steps (5) thru (8) until maximum pressure of 900 psi +0/-30 psi is reached.

**Note:** At maximum pressure, there shall be no pressure drop or leaking brake fluid during 1 minute hold. If pressure does drop during the hold, recheck all fitting locations to find and fix source of pressure leak.

(10) Remove hydraulic hand pump from brake system and reattach brake fluid reservoir.

E. Bleed brake system.

(1) Attach overflow tubing to RH and LH caliper bleeder valves.

(2) Place the ends of both overflow tubes in empty containers.

(3) Open feed tube valve connected to brake fluid reservoir.

(4) Open both bleeder valves approximately 1 turn.

(5) For approximately one to two minutes, allow fluid to flow until overflow tubing is clear of bubbles and there is fluid flowing out of overflow tubing attached to both calipers. Move tubing as necessary to push air through system.

**Note:** It is acceptable if fluid at calipers is not yet clear of bubbles.

(6) Close bleeder valve on left side. Leave bleeder valve on right side open one turn.

(7) Ensure RH overflow tubing end is completely submerged in fluid. If necessary, continue to let fluid flow until possible.

**CAUTION:** Caliper may be damaged if over tightened.

(8) Fully depress, and then slowly release RH pedal on co-pilot side three times.
(9) Fully depress, and then slowly release RH pedal on pilot side three times.
(10) Purge air from RH caliper.
  (a) Co-pilot side:
    1 Fully depress and hold RH pedal.
    2 Close RH bleeder valve.
    3 Slowly release RH pedal.
    4 Open RH bleeder valve.
  (b) Repeat for pilot side.
(11) Repeat RH caliper air purge at least three times. Verify fluid flowing out of tubing attached to RH caliper is clear of bubbles before continuing procedure.
(12) Close bleeder valve on RH side and open bleeder valve on LH side one turn.

**CAUTION:** Caliper may be damaged if over tightened.

(13) Ensure LH overflow tubing end is completely submerged in fluid. If necessary, continue to let fluid flow until possible.
(14) Fully depress, and then slowly release LH pedal on co-pilot side three times.
(15) Fully depress, and then slowly release LH pedal on pilot side three times.
(16) Purge air from LH caliper.
  (a) Co-pilot side:
    1 Fully depress and hold LH pedal.
    2 Close LH bleeder valve.
    3 Slowly release LH pedal.
    4 Open LH bleeder valve.
  (b) Repeat for pilot side.
(17) Repeat LH caliper air purge at least three times. Verify fluid flowing out of tubing attached to LH caliper is clear of bubbles before continuing.

**Note:** The system is purged of air when there are no air bubbles in overflow tubing.

(18) Close both bleeder valves.

**CAUTION:** Calipers may be damaged if over tightened.

(19) Close hydraulic tank feed valve and depressurize tank by removing air source. Verify pressure on both gauges reads zero.
(20) Remove overflow tubing from bleeder valves.
(21) Torque bleeder valves 148.0±7.0 in-lb (16.7±0.8 Nm). (Refer to AMM 20-60)
(22) Clean any residual fluid from bleeder valves, including inside opening. (Refer to AMM 20-30)
(23) Remove fittings and feed tubing from brake reservoir. Cap off feed tubing after removal to prevent spillage.
(24) To prevent overflow of brake reservoir, use syringe to add or remove hydraulic fluid as required to obtain level of 7 mL below top of reservoir.
(25) Re-install plastic cap onto brake reservoir.

(26) Depress each rudder pedal with your feet and confirm there is solid pressure and pedals do not sink under steady pressure.

**Note:** While depressing rudder pedals, all pedals should feel similar.

(27) Engage parking brake. Verify brakes are holding by pushing on each end of wing and confirming airplane does not move.

(28) If parking brake does not hold, but pedals have solid pressure, check rigging adjustment of parking brake valve. If rigging is determined to be correct, valve may be defective.

(29) If any of these checks fails, repeat brake bleeding procedure until satisfactory results are obtained.

F. Install RH nose access panel. (Refer to AMM 6-00)

G. Complete airplane records by noting compliance with SB5X-32-03 in Aircraft Logbook.

To submit a Technical Publication change request, visit:
http://servicecenters.cirrusdesign.com/tech_pubs/SF50/serviceloopform.asp
or contact us by email at techpubs@cirrusaircraft.com.