ACCIDENT INVESTIGATION COMMISSION

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Safety recommendation: AIC 21-R04/20-2003

Addressed to: Hevilift (PNG) Aviation Limited

Date issued: 01 July 2021

Investigation link: AIC 20-2003

Action status: Issued

Accident Background

On 18 October 2020, at about 08:54 local time (17 October 2020 at 22:54 UTC[1]), a DHC-6-400 Twin Otter aircraft, registered P2-KSY, owned and operated by Hevilift (PNG) Aviation Limited, was conducting an IFR passenger flight from Kairik Airstrip, Enga Province to Kagamuga Airport, Mount Hagen, Western Highlands Province, when it experienced a smoke event during a weather-related aerodrome overfly at Kagamuga.

According to the Flight Data Recorder, about 34 nm from Mt. Hagen, at 08:34:55, hydraulic pressure spiked up to 1,888 psi and remained above 1,575 psi for about 9 minutes. At 08:49:01, the pressure spiked again up to 1,900 and remained above 1,575 psi for about 9 minutes. Information about hydraulic pressure is constantly available to the crew through the multi-function display unit. However, there was no evidence that the crew noticed these abnormal parameters or that they reacted to them.

At 08:54:36, while tracking to overfly the aerodrome, the CAS[2] *Hydraulic Power Failure Warning* message displayed on the MFDU along with the *Master Warning*[3] activation. At that time, the actual hydraulic Brake Pressure was 1760 psi, and the System Pressure was about 1784 psi. The *Hydraulic Pump Over Temp Caution* activated along with the *Master Caution* seconds later.

The crew confirmed that they did not action the QRH *Hydraulic Abnormalities* checklist following the alerts received in the cockpit. The PIC stated during interview that, in his opinion, it was much more important to land as soon as practicable following the recognition of the hydraulic system abnormalities than to carry out any related emergency procedures.

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[1] The 24-hour clock, in Coordinated Universal Time (UTC), is used in this report to describe the local time as specific events occurred. Local time in the area of the serious incident, Papua New Guinea Time (Pacific/Port Moresby Time) is UTC + 10 hours.

[2] Crew Alerting System (CAS) is an integrated system that provides the flight crew with alert messages such as Warning, Caution, Advisory and Status messages related to the aircraft's systems. Only Warning and Caution messages are annunciated.

[3] The red MASTER WARNING switchlight provided directly above each pilot's primary flight display will illuminate whenever a Warning CAS Message appears, together with a triple chime. **Source:** *Section 7 of DHC-6-400 AFM.*

Safety deficiency description

Viking Air Limited All Operators Message

On 8 March 2018, Viking Air Limited issued an *All Operators Message DHC-6-AOM-29-001* (AOM) (see Appendix A) based on previous reports of the hydraulic system pressure switch failing in the "ON[4]" position resulting in a continuously running electric motor-driven pump and subsequent overheating of the electric motor-driven pump. They also highlighted the use of an existing abnormal procedure; *Hydraulic System Pump/Motor Over Temp,* contained in the *Aircraft Flight Manual* (AFM).

The AOM provided an interim directive to operators of the *DHC-6-400* requiring them to disseminate the information contained in the AOM to flight crews. As a result of the directive, crews were required to action the *Hydraulic Pump Over Temp* abnormal procedure already existing in section 3.16.2 (see Appendix B) of the AFM in the event of the following:

1. *Smoke and/or fumes are observed in the cockpit, and a simultaneous sustained system hydraulic pressure of greater than 1575 psi is observed; or*
2. *If a sustained system hydraulic pressure of greater than 1575 psi is observed.*

At the time of the occurrence, Viking's Quick Reference Handbook (QRH) that was current was issue 3 (effective date 7 March 2019. It contained the *Hydraulic Pump Over Temp* abnormal procedure (see Appendix C).

Document Control

Pursuant to the *Civil Aviation Rules, Part 100, section 100.111 Document Control*, the Operator uses the *Hevilift Group Document Control Manual* (DCM), for document control.

According to the DCM, *Section 2.3.1 Group Document Controller*, it states:

> *The Document Controller, as a part of the Hevilift Group Safety and Compliance department, will manage, control and maintain all the documents and records such as manuals and forms by:*
>
> *a. Processing the new release, revision and removal of obsolete registered controlled documents and forms.*
>
> *b. Maintaining the accuracy of Document Master Register, List of Controlled Documents and Air Maestro[5] controlled folders.*
>
> *c. Ensuring that latest revision is in place and obsolete versions are removed to prevent unintended use.*
>
> *d. Uploading and distribution of controlled documents and records in Air Maestro and to respective copy holders[6], if necessary.*
>
> *e. Updating and tracking of Master Register in coordination with QAS from respective bases applicable both for internal and external documents including the technical publications.*
>
> *f. Ensuring approved company standard formatting is applied.*

According to the information provided by the Operator, they did not receive the Viking AOM. Further information they provided to the AIC indicated that the AOM was not uploaded into the Air Maestro system by the Document Controller and for dissemination to relevant personnel of Hevilift (PNG) Limited including flight crews.

Although the Operator was unable to provide information whether the AOM was in fact received by the Document Controller for processing or not, the AIC established that the AOM had been sent by Viking Air Limited via email to Hevilift Group on 8 March 2018, the same day the AOM was issued.

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[4] The pressure switch is considered to be "ON" when it provides grounding to the relay, subsequently causing the relay contacts to close, thus producing DC power to work the electric motor-driven pump.
[5] Air Maestro is a cloud-based software used by the Operator for different purposes including document control.
[6] Person(s) nominated by the organisation to acquire the manual/document and be notified of all amendment revisions. *Source: Hevilift Group Document Control Manual.*

The AIC also identified that the Operator's DHC-6-400 QRH in use was revision 3 (effective date 25 November 2015) which, at the time of the occurrence was outdated, and it did not contain certain procedures such as the *Hydraulic Power Fail Warning* and *Hydraulic Press Low Warning* emergency procedures which the Manufacturer's current version had (see Appendix C).

Conclusion

The investigation determined that even when the manufacturer released an AOM directing Operators to ensure their pilots action the *Hydraulic Pump Over Temp* abnormal procedure when smoke and/or fumes are observed in the cockpit, or when any symptoms related to abnormally high hydraulic system pressure is observed, in the context of the occurrence, that procedure was not carried out by the crew as they were unaware of the manufacturer's AOM.

The investigation also determined that the Operator's document control system did not effectively ensure that external documents and technical publications were distributed to the appropriate personnel and, in this particular case, the AOM was never brought to the knowledge of the pilots.

The lack of awareness about the AOM, may have contributed to the lack of attention from the flight crew to the hydraulic system parameters in flight, causing them not to detect and react to the two spikes of continuous high pressure. In the same manner, the lack of awareness about the AOM may have also contributed to the PIC's decision to focus on landing as soon as practicable, rather than to apply abnormal or emergency procedures.

Recommendation number AIC 21-R04/20-2003 to Hevilift (PNG) Aviation Limited

The PNG Accident Investigation Commission (AIC) recommends that Hevilift (PNG) Aviation Limited should ensure that its Document Control system consistently effects, maintains and implements the Operators controlled documents as appropriate, and in a timely manner, so that documents are effectively disseminated across all the relevant organisational areas and staff as appropriate.

Action requested

The AIC requests that Hevilift (PNG) Aviation Limited note recommendation AIC 21-R04/20-2003 and provide a response to the AIC within 90 days, **but no later than 29/09/2021**, and explain including with evidence how Hevilift (PNG) Aviation Limited has addressed the safety deficiency identified in Safety Recommendation AIC 21-R04/20-2003.

Hubert Namani, LLB
Chief Commissioner

01 July 2021

Hevilift (PNG) Aviation Limited (Hevilift) response

On 18 July 2021, the PNG Accident Investigation Commission (AIC) received a response email from Hevilift (PNG) Aviation Limited. Hevilift stated that they would conduct a review of their Document Control Manual to ensure operational documentation is updated and disseminated in a timely manner.

On 5 October 2021, Hevilift advised PNG AIC that they have reviewed the Hevilift document control process and updated their document distribution list to ensure it contains relevant and current personnel's information to be in receipt of appropriate technical publications from the Document Controller who shall implement existing procedures to ensure timely update and dissemination of operational documents.

AIC assessment

The AIC has assessed the responses provided by Hevilift and notes that Hevilift accepts the Safety Deficiency and Safety Recommendation. The AIC has accepted the response providing safety action taken to address the deficiency.

The AIC assigns Hevilift's response as *satisfactory*.

The AIC recorded the **Status of the AIC Recommendation: CLOSED.**

Hubert Namani, LLB
Chief Commissioner

14 October 2021

Appendix A: Viking Operator Message DHC-6-AOM-29-001

VIKING

ALL OPERATORS MESSAGE DHC-6-AOM-29-001

TO: ALL OPERATORS OF DHC-6 SERIES 400 TWIN OTTER AIRCRAFT

ATTN: DIRECTOR/MANAGER OF: MAINTENANCE

FROM: VIKING AIR LIMITED

DATE: 08-MAR-2018

SUBJECT: HYDRAULIC SYSTEM PUMP/MOTOR OVER TEMP - AFM ABNORMAL PROCEDURE

PURPOSE:

This AOM highlights the use of an existing abnormal procedure in the AFM for the possible failure of the hydraulic pressure switch in the "ON" position resulting in a continuously running hydraulic pump motor and a subsequent, or impending, overheat of the hydraulic system pump/motor assembly.

BACKGROUND:

There have been reports of the hydraulic system pressure switch failing in the "ON" position resulting in a continuously running hydraulic pump/motor and a subsequent overheating of the hydraulic pump/motor assembly. Operators have reported burning fumes and/or smoke, often emanating from the hinged door of the emergency hand pump socket located in the cockpit floor. Further, indications of a continuously running hydraulic pump, causing a sustained hydraulic pressure of greater than 1575 psi have been observed on the hydraulic system pressure MFD display. The sustained hydraulic pressure above normal values is not in itself a hazard, but is an indication of a continuously running hydraulic pump/motor and the potential for pump/motor assembly overheat condition.

INTERIM DIRECTIVE

Operators are directed to disseminate this AOM to flight crews advising them of the indications and to highlight the existing procedures to be actioned in the event of an occurrence of this abnormal condition.

The recommended action is the HYDRAULIC PUMP OVER TEMP abnormal procedure from 3.16.2 of the AFM if:

1. **Smoke and/or fumes are observed in the cockpit, and a simultaneous sustained system hydraulic pressure of greater than 1575 psi is observed; or**
2. **If a sustained system hydraulic pressure of greater than 1575 PSI is observed.**

VIKING

ALL OPERATORS MESSAGE DHC-6-AOM-29-001

INFORMATION:

Operators are directed to advise Viking Air Technical Support of past and future occurrences of this fault. For further information or to provide feedback on this matter, please contact our Technical Support help desk at

Email : technical.support@vikingair.com
Fax : +1(250)-656-0673
Phone: +1(250)-656-7227
Toll Free: 1-800-663-8444 International Toll Free: +1-800-6727-6727

Sincerely,

Martin Swan
Vice President, Engineering

Appendix B: Viking Air Limited and Hevilift (PNG) Aviation Limited AFM – Hydraulic System Abnormalities, Section 3.16.2 Hydraulic Pump Over Temp

3.16.2 Hydraulic Pump Over Temp

INDICATION

Display of HYD PUMP OVER TEMP caution level (amber) CAS message.

PROBABLE CAUSE

Electric hydraulic pump has overheated.

ACTION

IF ON GROUND:

1 Stop aircraft and apply parking brake.

2 Pull HYDRAULIC OIL PUMP circuit breaker (position C6).

3 Use hydraulic hand pump to pressurize system.

4 Taxi with caution, maintaining hydraulic pressure with hand pump.

5 Repair before flight.

IF IN FLIGHT:

⚠ WARNING

DO NOT LAND AIRCRAFT UNTIL THE FOLLOWING CHECKLIST IS COMPLETED.

1 Pull HYDRAULIC OIL PUMP circuit breaker (position C6).

2 Use hydraulic hand pump to pressurize system.

3 Ensure that hydraulic system pressure is maintained at or above 1,500 PSI at all times following flap extension. After landing, nose wheel steering should be used with caution. Large movements of the nose wheel steering tiller may deplete the hydraulic system pressure faster than the pilot can operate the pump.

4 After landing, taxi with caution, maintaining hydraulic pressure with hand pump.

Appendix C: Viking DHC-6-400 QRH – Hydraulic System Abnormalities

10.1 Hydraulic Press Low (In Flight) – Amber

Hydraulic Press Low

DO NOT LAND AIRCRAFT UNTIL THE FOLLOWING CHECKLIST IS COMPLETED

Hydraulic System Pressure ..... maintain using Hydraulic Hand Pump
30 to 40 strokes are needed to produce 1,500 PSI

If hydraulic pressure can be maintained with the hand pump:

Following flap extension ..... maintain 1500 psi
HYDRAULIC OIL PUMP CB (C6) ..... CHECK (do not reset in flight)
After landing ..... nosewheel steering to be used with caution

If hydraulic pressure cannot be maintained with the hand pump:

HYDRAULIC OIL PUMP CB (C6) ..... PULL

Prepare for:

Flapless Landing, limited or no wheel braking, use zero/reverse to stop aircraft and no nosewheel steering available.
Complete Flapless Landing checklist

10.2 Hydraulic Press Low (On Ground) – Red

Hydraulic Press Low

Bring aircraft to stop using Reverse or Zero Thrust
HYDRAULIC OIL PUMP CB (C6) ..... Check, RESET if necessary

If hydraulic pressures do not return to normal:

Hydraulic System Pressure ..... maintain using Hydraulic Hand Pump
30 to 40 strokes are needed to produce 1,500 PSI

If hydraulic pressure cannot be maintained with the hand pump:

Plan for no nosewheel steering, limited wheel braking, shutdown engines without feathering and tow to repair facility.

10.3 Hydraulic Pump Over Temp

Hyd Pump Over Temp

On ground:

Aircraft.....Stop and apply parking brake
HYDRAULIC OIL PUMP CB (C6).....PULL OUT
Hydraulic Hand Pump.....Maintain 1,500 psi
Taxi with caution. Repair before flight.

In flight:

HYDRAULIC OIL PUMP CB (C6).....PULL OUT
Complete.....Hydraulic Pressure Low (In Flight) - Amber

10.4 Hydraulic Power Fail

Hydraulic Power Fail

HYDRAULIC OIL PUMP CB (C6).....Check, RESET if appropriate
Hydraulic pump handle.....maintain 1500 psi if necessary