Australian Government
Civil Aviation Safety Authority

AIRWORTHINESS BULLETIN

AWB 22-002 Issue 3 – 5 August 2016

AW139 Inadvertent Autopilot Disengagement

1. Effectivity

All AW139 helicopters from S/N 31201 to S/N 31398 and from S/N 41201 to S/N 41293.

All AW139 helicopters from S/N 31400 to S/N 31699 and from S/N 41300 to S/N 41499.

2. Purpose

To formally advise Australian operators of CASA's monitoring of developments concerning Automatic Flight Control System (AFCS) dropouts on AW139 helicopters, and to issue formal recommendations for Australian operators to consider implementing.

3. Changes

This AWB has been amended to clarify the effectivity.

4. Background

Operators across the globe of AW139 helicopters have been experiencing AFCS dropouts for approximately 2 years, mostly with assets used in SAR and offshore operations. The issue seems to be more prevalent with 'long nose configurations' of the AW139.

Finmeccanica reports that over 1000 dropouts have occurred in a 12 month period.

Dropouts seem to occur in most phases of flight, including when the autopilot is engaged for landing. Several events have occurred whilst in the flare.

Safety aspects

<u>Minor failure</u>

If a single AFCS disengages this functional failure is classified as minor criticality with a slight increase in pilot workload. This condition is covered in the rotorcraft flight manual.

<u>Major failure</u>

The failure is major if the roll and/or yaw axis is affected causing loss of stabilisation, this requires increased attentiveness during hover or approach.

Hazardous failure

Simultaneous failure of both autopilots is considered hazardous at high speed conditions above 140 knots if the loss affects the pitch axis. There have been very few events of both autopilots failing simultaneously (within 3.5 seconds). In this event the aircraft remains fully controllable.

Annunciation

Such autopilot disengagement events are annunciated by aural & visual warnings, and Finmeccanica advises the autopilot has still been available to be re-engaged.

All events are annunciated by:

- Aural warning “AUTOPILOT AUTOPILOT”
- Crew Altering System (CAS) messages “AP1 OFF or AP2 OFF” and “AFCS DEGRADED”

Autopilot engagement/disengagement

The autopilot is engaged through the Autopilot Flight Control System (AFCS) control panel in the interseat console. The autopilot has a quick disconnect on the cyclic stick as required by airworthiness standards.

Root cause analysis

Finmeccanica have identified various vibration modes from the airframe which are transmitted into the autopilot computer compartment which has caused signal errors, triggering an AFCS dropout.

Miscompare monitor

The AFCS has an AHRS miscompare monitor which uses the Attitude Direction Indicator – Standby to determine which autopilot should remain engaged in the event of a AHRS#1/AHRS#2 miscompare. Miscompare will result in a AFCS DEGRADED message without any AFCS channel disconnect.

Interlane monitor

Each AFCS has an interlane monitor which can disengage one autopilot if there is a divergence between the command and monitor lanes. Interlane monitor may trip independently on each side if the disconnect condition is met. Attitude Heading Reference System (AHRS) failure, data freezing or miscompare that could affect AFCS disengagement are:

- Pitch angle
- Roll angle
- Body pitch rate
- Body roll rate
- Body yaw rate

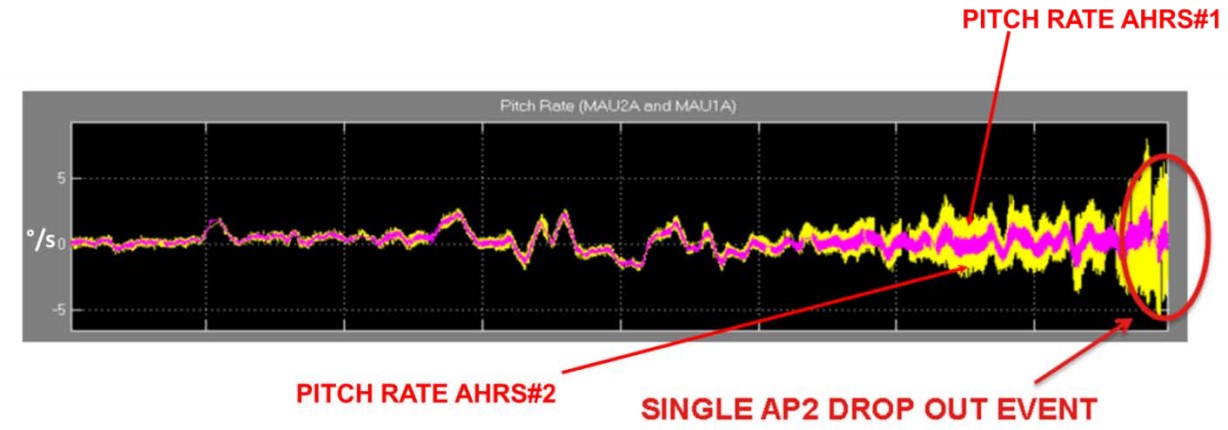

Figure 1 – Pitch rate vibration

In the case shown in Figure 1 AHRS#1 pitch rate magenta trace has experienced a much lower amplitude of approximately ±1° per second and did not cause an AFCS disconnect. In comparison the yellow trace of the pitch rate of AHRS#2 caused a disconnect event with excess of more than ±5° per second. AHRS#2 is more prone to AFCS disengagement.

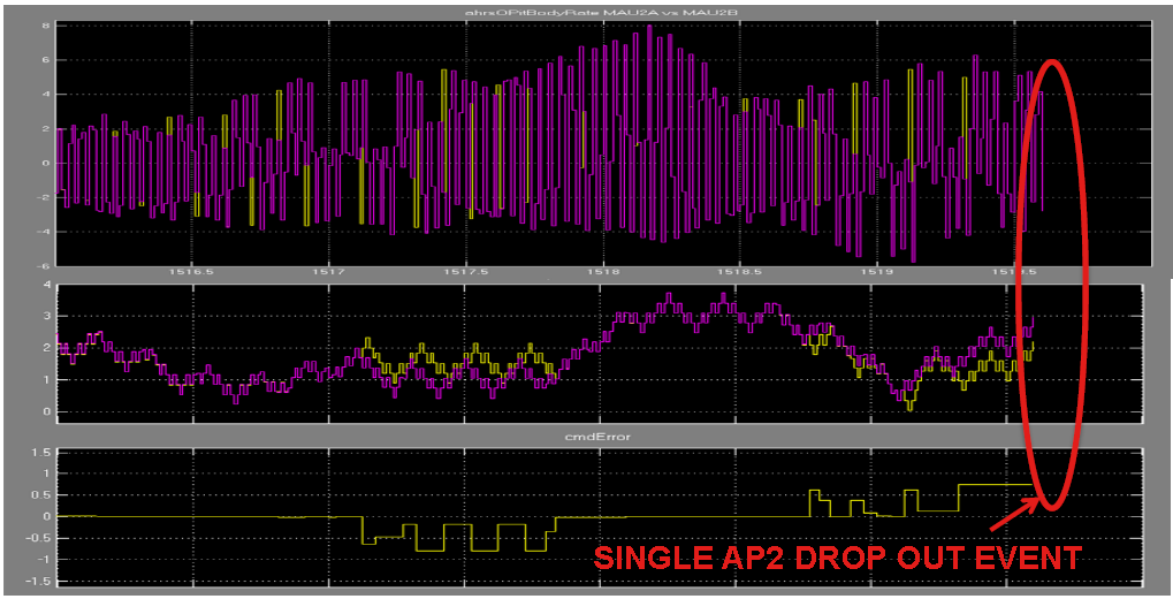

Figure 2 - Periodic splits in data reads between lanes

Figure 2 shows difference between each lane of pitch rate in the AHRS. The top trace shows noisy pitch rate data where periodic splits in data read occur between lanes. The centre trace shows how the commands in each lane react to the spilt in the data reads. The bottom trace shows the command error that builds up and eventually causes the command calculation comparison monitor to disconnect the AFCS channel.

Solution

Finmeccanica have released BT139-414 which defines a set of inspections and slight structural modifications to certain brackets (re-stiffening) that support the AHRS. It's believed deterioration from new-build condition of these structural items is the root cause. The service bulletin requires 60 man-hours to install.

No drop outs have been reported after the structural change has occurred and this modification is incorporated in new aircraft build from serial number 31700 onwards.

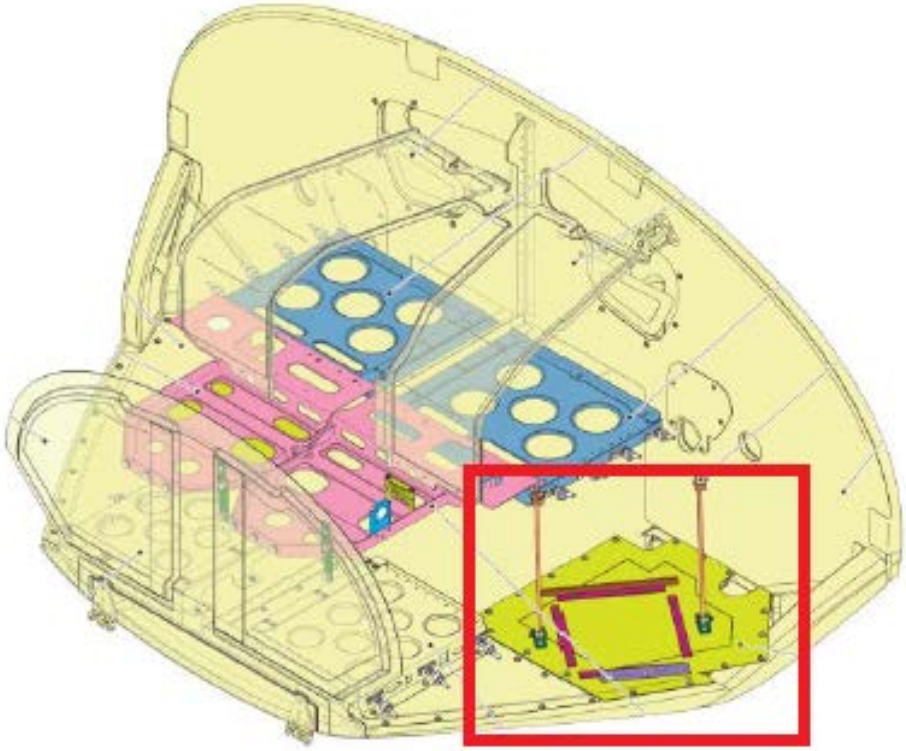

Figure 3 – Modified AHRS support bracket

Whilst this action appears to be resolving the issue, Finmeccanica and Honeywell have also been investigating aspects of the AFCS design to eliminate any other possible causes or contributing factors.

5. Recommendations

CASA recommends that all operators of affected AW139 helicopters:

a) Issue an operational bulletin, formally advising air crews of the prospect of loss of Autopilot at various stages of flight, including during landing/flare

b) Review BT139-414 and its applicability to the operator's fleet

c) Closely monitor and review communications and updates from the manufacturer regarding this issue

In addition, CASA recommends ALL operators of affected AW139 helicopters:

a) Pay close attention to aircraft maintenance actions which may minimise autopilot drop outs including:

- re-tuning of possibly mistuned passive vibration absorber system
- Accurate installation and alignment of AHRS
- AHRS mounting structure control

b) Report all Autopilot dropouts, as well as other significant events and defects via the Service Difficulty Reporting process. This allows CASA to review events across the country and work to monitor and manage issues across all affected operators.

6. Enquiries

Enquiries with regard to the content of this Airworthiness Bulletin should be made via the direct link email address:

AirworthinessBulletin@casa.gov.au

or in writing, to:

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