

ATTACHMENT 3

TO

SYSTEMS GROUP CHAIRMAN'S FACTUAL
REPORT

CEN17FA168

AHRS Investigation Field Notes

AHRS Investigation Field Notes

Case details (if available)

Record	BFU17-0688	Location	Amarillo, TX (USA)
Aircraft Type	Pilatus 12	Aircraft Registration	N933DC
Date Event	28 th of April, 2017	Date Received (at NG LITEF)	03 rd of July, 2017

Unit Under Investigation

Device Class	AHRS	Manufacturer	NG LITEF
Device Type	LCR-92		
P/N	124210-2011-003	S/N	1880

Additional Information

Investigation conducted by NTSB (case #CEN17FA168)

Investigation Steps

General

The investigation was conducted on the 8th of August, 2017, at the Northrop Grumman LITEF GmbH (NG LITEF) facility in Freiburg, Germany under oversight of the German BFU and presence of NG LITEF personnel.

Condition of the unit

The box containing the unit was stored in quarantine at NG LITEF and remained unopened until the day of the investigation. It was opened in the presence of the BFU.

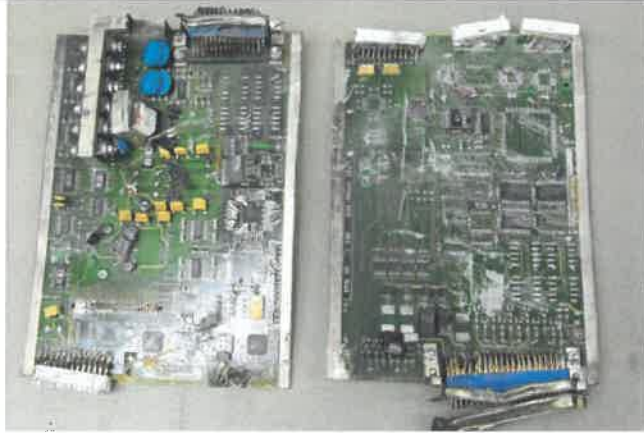


Box was opened in the presence of the BFU



Content of the box

A visual inspection was conducted. Three loose circuit boards were inside an antistatic-bag, they were identified as CPU board, interface module and synchro interface module.

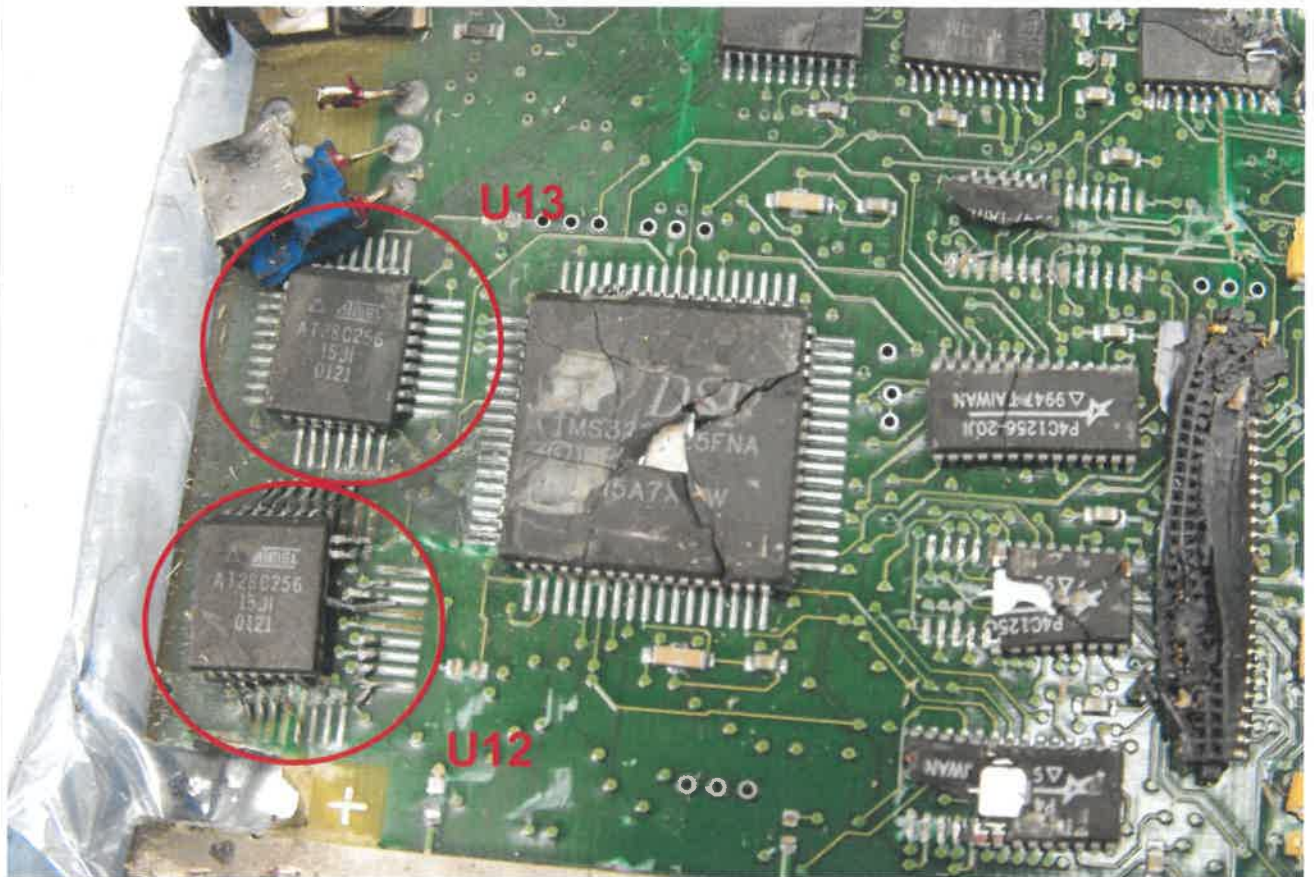


Synchro interface board, interface board



CPU board

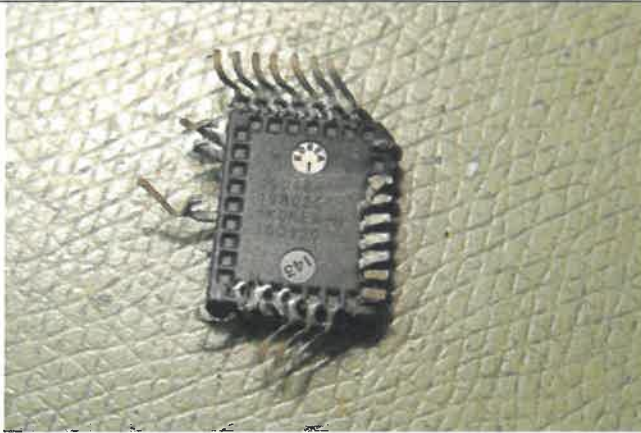
The CPU board was P/N 117581-2281, S/N 2302 REV H.



Condition of the memory chips

The CPU board contained two memory chips (256K EEPROM, ATMEL AT28C256). Due to impact forces, both chips were damaged.

The decision was made to remove chip U12 mechanically as it appeared to be almost completely loose on the circuit board. The second chip U13 was de-soldered.



U12 (mechanically removed)



U13 (unsoldered)

Both chips were cleaned and prepared for read-out. U12 was soldered onto an adapter board. The package of U13 had a visible crack (see picture).

Download of data from memory chips



Read-out of U13

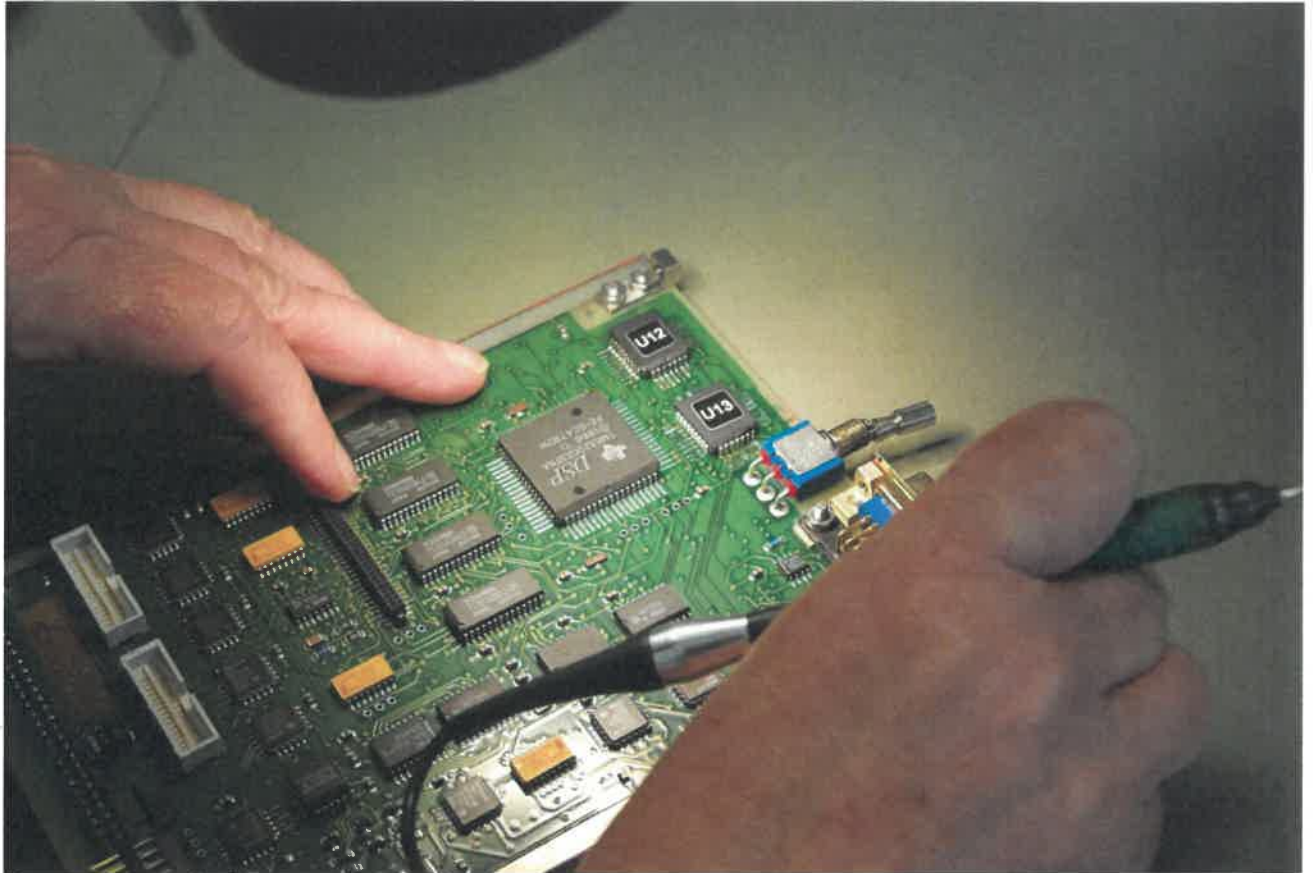


Read-out of U12

Download of BITE data

The data downloaded from each individual chip was re-programmed on unused new chips and labelled U12 and U13.

The two reprogrammed chips were soldered onto a surrogate board provided by NG LITEF. The surrogate board was then installed into a known-good unit which was earlier tested in the presence of the BFU. The BITE history was then downloaded by the AHRS test system.



Surrogate board with re-programmed chips

BITE data

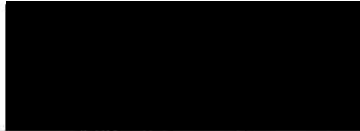
The BITE history contains 28 records, the total elapsed time recorded of the unit was 2936.5 hours. The last entry "Roll Synchro Fail" was recorded at 2923.4 hours and thus 13.1 hours before the last power-off.

Service history

S/N 1880 was manufactured in January 2002. According to NG LITEF records, this S/N was never returned to the NG LITEF facility or to MASCO for repair or modification.

The unit remains at the NG LITEF facility in quarantine until further instructions are received by the NTSB.

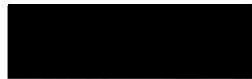
1. The elapsed time of the unit was 2936.5 hours.
2. The last recorded fault was recorded at elapsed time 2923.4 hours (Roll Synchro Fail)
3. The unit was never returned to NG LITEF or MASCO for repair or modification.



Philipp Lampert, BFU



Dr. Holger Salbach, Northrop Grumman LITEF GmbH



Heinz Alt, Northrop Grumman LITEF GmbH

ATTACHMET A - BITE HISTORY

MAINTENANCE DATA

UUT Part Nr. : 124210-2011/003
Serial Nr. : 1880

DATE: 8.08.2017
TIME: 15:10:17

Elapsed time: 2936.5 hours

=====			
Record Nr. : 28	Elapsed time: 2923.4 hours		
Label350 : 0000	Label351 : 0000	Label352 : 0000	Label353 : 0008 Roll Synchro Fail
=====			
Record Nr. : 27	Elapsed time: 2855.0 hours		
Label350 : 0000	Label351 : 0000	Label352 : 0000	Label353 : 0014 Heading Synchro 1 Pitch Synchro Fail
=====			
Record Nr. : 26	Elapsed time: 2854.9 hours		
Label350 : 0000	Label351 : 0000	Label352 : 0000	Label353 : 0014 Heading Synchro 1 Pitch Synchro Fail
=====			
Record Nr. : 25	Elapsed time: 2793.6 hours		
Label350 : 0000	Label351 : 0000	Label352 : 0000	Label353 : 0010 Pitch Synchro Fail
=====			
Record Nr. : 24	Elapsed time: 2724.4 hours		
Label350 : 0000	Label351 : 0000	Label352 : 0000	Label353 : 0004 Heading Synchro 1
=====			
Record Nr. : 23	Elapsed time: 2724.4 hours		
Label350 : 0000	Label351 : 0000	Label352 : 0000	Label353 : 0014 Heading Synchro 1 Pitch Synchro Fail
=====			
Record Nr. : 22	Elapsed time: 2724.4 hours		
Label350 : 0000	Label351 : 0000	Label352 : 0000	Label353 : 001C Heading Synchro 1 Roll Synchro Fail Pitch Synchro Fail
=====			
Record Nr. : 21	Elapsed time: 2702.9 hours		
Label350 : 0000	Label351 : 0000	Label352 : 0000	Label353 : 0010 Pitch Synchro Fail
=====			
Record Nr. : 20	Elapsed time: 2695.1 hours		
Label350 : 0000	Label351 : 0000	Label352 : 0000	Label353 : 0004 Heading Synchro 1
=====			
Record Nr. : 19	Elapsed time: 2649.2 hours		
Label350 : 0000	Label351 : 0000	Label352 : 0000	Label353 : 0008 Roll Synchro Fail
=====			
Record Nr. : 18	Elapsed time: 2350.4 hours		
Label350 : 0000	Label351 : 0000	Label352 : 0000	Label353 : 0004 Heading Synchro 1
=====			

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Record Nr. : 17      Elapsed time: 2161.7 hours
Label350 : 0000      Label351 : 0000      Label352 : 0000      Label353 : 0004
                    |                          |                          |Heading Synchro 1
=====
Record Nr. : 16      Elapsed time: 2161.6 hours
Label350 : 0000      Label351 : 0000      Label352 : 0000      Label353 : 0008
                    |                          |                          |Roll Synchro Fail
=====
Record Nr. : 15      Elapsed time: 2161.2 hours
Label350 : 0000      Label351 : 0000      Label352 : 0000      Label353 : 0018
                    |                          |                          |Roll Synchro Fail
                    |                          |                          |Pitch Synchro Fail
=====
Record Nr. : 14      Elapsed time: 2131.1 hours
Label350 : 0000      Label351 : 0000      Label352 : 0000      Label353 : 0004
                    |                          |                          |Heading Synchro 1
=====
Record Nr. : 13      Elapsed time: 2065.8 hours
Label350 : 0000      Label351 : 0000      Label352 : 0000      Label353 : 0004
                    |                          |                          |Heading Synchro 1
=====
Record Nr. : 12      Elapsed time: 1888.6 hours
Label350 : 0000      Label351 : 0000      Label352 : 0000      Label353 : 0018
                    |                          |                          |Roll Synchro Fail
                    |                          |                          |Pitch Synchro Fail
=====
Record Nr. : 11      Elapsed time: 1543.1 hours
Label350 : 0000      Label351 : 0000      Label352 : 0000      Label353 : 0004
                    |                          |                          |Heading Synchro 1
=====
Record Nr. : 10      Elapsed time: 1466.5 hours
Label350 : 0000      Label351 : 0000      Label352 : 0000      Label353 : 0018
                    |                          |                          |Roll Synchro Fail
                    |                          |                          |Pitch Synchro Fail
=====
Record Nr. : 9       Elapsed time: 1383.1 hours
Label350 : 0000      Label351 : 0000      Label352 : 0000      Label353 : 0004
                    |                          |                          |Heading Synchro 1
=====
Record Nr. : 8       Elapsed time: 1148.6 hours
Label350 : 0000      Label351 : 0000      Label352 : 0000      Label353 : 0018
                    |                          |                          |Roll Synchro Fail
                    |                          |                          |Pitch Synchro Fail
=====
Record Nr. : 7       Elapsed time: 1065.0 hours
Label350 : 0000      Label351 : 0000      Label352 : 0000      Label353 : 0014
                    |                          |                          |Heading Synchro 1
                    |                          |                          |Pitch Synchro Fail
=====
Record Nr. : 6       Elapsed time: 1054.4 hours
Label350 : 0000      Label351 : 0000      Label352 : 0000      Label353 : 0004
                    |                          |                          |Heading Synchro 1
=====

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Record Nr. : 5      Elapsed time: 974.3 hours
Label350 : 0000    | Label351 : 0000    | Label352 : 0000    | Label353 : 0018
                    |                    |                    | |Roll Synchro Fail
                    |                    |                    | |Pitch Synchro Fail
=====
Record Nr. : 4      Elapsed time: 604.2 hours
Label350 : 0000    | Label351 : 0000    | Label352 : 0000    | Label353 : 0004
                    |                    |                    | |Heading Synchro 1
=====
Record Nr. : 3      Elapsed time: 56.5 hours
Label350 : 0000    | Label351 : 0000    | Label352 : 0000    | Label353 : 0010
                    |                    |                    | |Pitch Synchro Fail
=====
Record Nr. : 2      Elapsed time: 8.4 hours
Label350 : 0004    | Label351 : 0000    | Label352 : 0000    | Label353 : 0000
MSU CalPROM Fail  |                    |                    | |
=====
Record Nr. : 1      Elapsed time: 8.4 hours
Label350 : 0004    | Label351 : 0000    | Label352 : 0000    | Label353 : 0000
MSU CalPROM Fail  |                    |                    | |

```