

NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

September 17, 2020

Enhanced Ground Proximity Warning System (EGPWS)

Specialist's Factual Report
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1. EVENT SUMMARY

Location: Coleman, Texas
Date: February 20, 2020
Aircraft: Beechcraft B200
Registration: N860J
Operator: Lauren Engineers & Constructors Inc.
NTSB Number: CEN20FA093

On February 20, 2020, about 0600 central standard time, a Beechcraft, B200 airplane, N860J, impacted terrain near Lake Coleman, Texas, in open ranchland. The pilot and two passengers were fatally injured, and the airplane was destroyed. The airplane was registered to TLC Air, LLC and operated by Lauren Engineers & Constructors, Inc. The flight was conducted under the provisions of Title 14 *Code of Federal Regulations Part 91*, as a cross-country flight. Instrument meteorological conditions prevailed and a Federal Aviation Administration (FAA) instrument flight rules (IFR) flight plan was filed for the flight. The flight originated from Abilene Regional Airport, (ABI), Abilene, Texas, and was en route to the Valley International Airport (HRL), Harlingen, Texas.

2. GROUP

A group was not convened.

3. DETAILS OF INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following device:

Device Manufacturer/Model: **Honeywell EGPWS KGP 560**
Serial Number: **Unknown**

3.1. Honeywell EGPWS KGP 560 Description

The EGPWS non-volatile memory¹ (NVM) does not continuously record; rather, the EGPWS device stores data to NVM only when certain criteria are met. The readout process at the

¹ Non-volatile memory retains information when power is removed.

manufacturer's facility produces several files of flight history data that encompass operational, documentary, fault, and warning information.

The flight history data warning file outputs performance data as related to the operation of the aircraft. These data only record when an alert or warning related to the EGPWS function activates and the unit then retains data points for 20 seconds prior to the activation of the warning and 10 seconds afterwards. The EGPWS parameters are only sampled 1 time per second, but the actual time of occurrence can be anywhere within the second.

3.1.1. Honeywell EGPWS KGP 560 Data Recovery

Upon arrival at the Vehicle Recorder Division, an exterior examination revealed the device sustained severe impact damage, as shown in Figure 1. The circuit board containing the NVM chips was removed from the unit, as shown in Figures 2. The flight data was stored on the NVM chip labeled U24. This circuit board was sent to the manufacturer for data recovery. After removing the NVM chip from the circuit board, the manufacturer discovered cracks on the chip due to impact from the accident and could not read data from it. The manufacturer advised to have a chip manufacturer perform a raw data reading on the damaged NVM chip and recommended a chip manufacturer. However, the chip manufacturer did not believe they could successfully recover information from the chip and declined the work after reviewing the photos of the damaged NVM chip. The damaged NVM chip then was sent to the Integrated Electronic Engineering Center of Binghamton University for damage evaluation and repair. The tests found cracks in the silicon die inside the chip. The evaluation concluded that no data recovery from the chip was possible due to cracks in the silicon die and that the NVM chip could not be repaired. Thus, no data were recovered from this device. Figure 3 shows a screenshot of the damage evaluation on the NVM chip from the Integrated Electronic Engineering Center of Binghamton University. The full report of the chip damage evaluation is provided as Attachment 1 to this report.



Figure 1: Honeywell EGPWS KGP 560 as received.

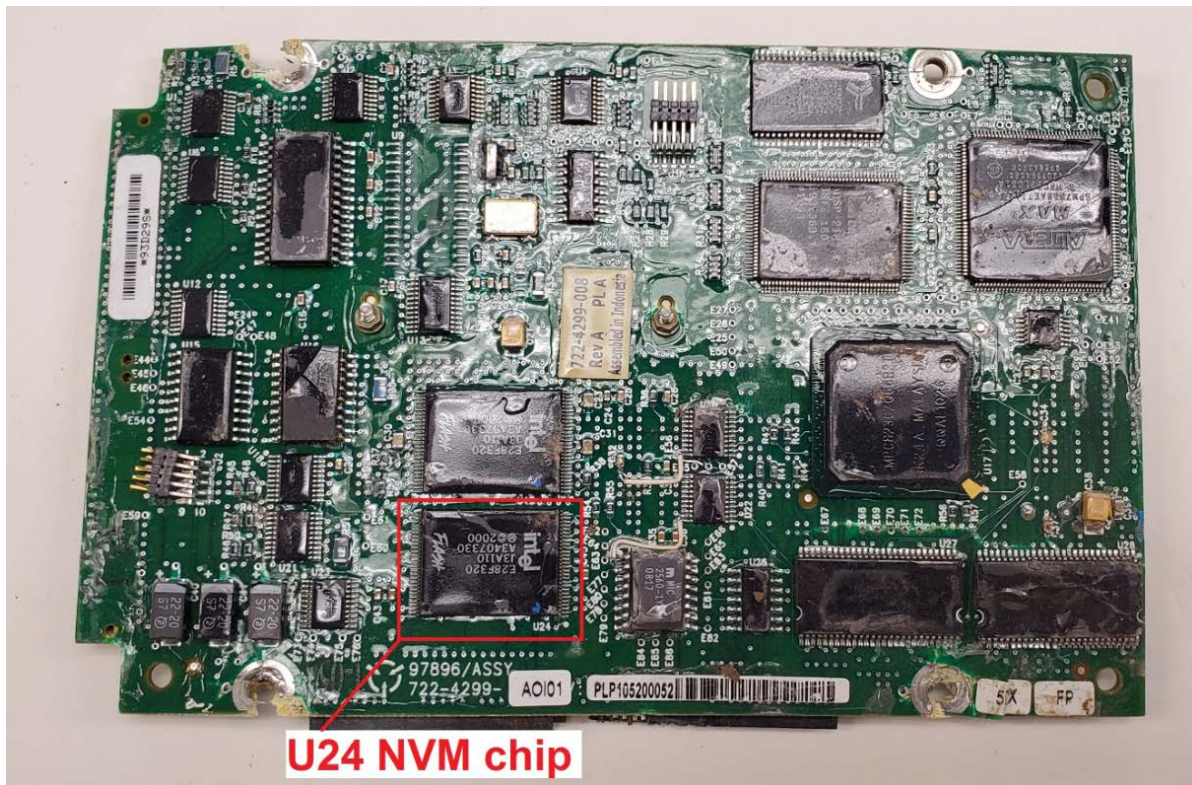


Figure 2: Circuit board containing NVM chip of the Honeywell EGPWS.

Overview

- One module received for analysis
 - Incident id: CEN20FA093
 - The memory module could not be read
 - Sent to Binghamton to evaluate the chip
- Non-destructive evaluation techniques:
 - Initial inspection with optical stereo microscope
 - 2D X-ray Imaging with Phoenix Nanome|x
 - Acoustic microscopy using 100 MHz transducer.
- Results
 - Optical inspection revealed multiple cracks on the back side and a long thin crack on the front side of the module.
 - Side view showed one of the cracks to have propagated along the package thickness, and that the package is slightly bent.
 - X-ray imaging revealed that the memory module consists of a wire-bonded, rectangular die with a leadframe.
 - Package cracks could be easily discerned in the x-ray images. They also revealed possible cracks in the die. No anomalies were detected in any wire bonds. There were inhomogeneities in the die-attach.
 - X-ray images from the side showed a slight bowing of the package
 - Acoustic images show cracks in the silicon die, mold as well as the leadframe. Voids and delaminations were detected in the die attach.
- Conclusion: No data recovery is possible due to cracks in the Silicon die. This module can not be repaired.

Figure 3: Screenshot of the Chip Damage Evaluation from Binghamton University.