

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594



January 6, 2017

MATERIALS LABORATORY FACTUAL REPORT

Report No. 17-005

A. ACCIDENT INFORMATION

Place : Fargo, ND
Date : 12/1/2016
Vehicle : Cessna 340, N123KK
NTSB No. : CEN17FA045
Investigator : Arnold Scott

B. COMPONENTS EXAMINED

Programmable compressor package for environmental air sampling (figures 1-5).

C. GROUP MEMBERS

Dr. Colm Sweeney	NOAA
Jack Higgs	NOAA
Henry J Soderlund	Textron Aviation
Joseph Panagiotou	NTSB

D. DETAILS OF THE EXAMINATION

A programmable compressor package manufactured by High Precision Devices was submitted for examination. The compressor package, which had been contained within a hard shell plastic suitcase (similar to a Pelican® case), was aboard a Cessna 340 that experienced an in-flight fire resulting in a ground collision and post-crash fire. Where the compressor package came to rest post collision and its exposure to the post-crash fire is unknown. The compressor package was recovered without the plastic suitcase it had been enclosed in. This examination sought to examine the fire damage patterns and if there were indications consistent with a fire origin within the compressor package.

The components of the compressor package were enclosed within an aluminum case (figures 1-5). This aluminum case had two tube fittings and portions of tubes protruding from it. These tubes were for drawing the air sample in and for delivering the air sample to a separate flask package. There were also electrical connections for charging the battery internal to the compressor package and for controlling the activation of the compressor package. The battery pack inside the compressor package was a 24 Volt 14.8 Ampere-hour nickel metal hydride (NiMH) rechargeable battery pack. Overall, the exterior of the compressor package was sooted and exhibited areas where charred

debris had adhered. The compressor package case exhibited mechanical damage and inward deformation in some areas.

The compressor package was opened to reveal the internal components (figure 6). The case was separated into three distinct sections. There was a section where the two compressor pumps were mounted (figure 7) and a section where the battery pack was housed along with the circuit boards and external connections (figure 8). These two sections were separated by a hollow section in the middle of the case. This hollow section formed a pass through open to the exterior of the compressor case but closed to its interior. Overall, the compressor pump section exhibited the most blackened & charred appearance within the case. Based on the flow path of the re-solidified pump head material the compressor package was oriented with the top cover facing upward when the pump head melted. Wire bundles traversing from the pump section to the battery & control circuit sections exhibited a gradient of thermal damage that lessened towards the battery and circuit board section. A side panel was removed from the compressor case to gain access to the battery (figure 9). The battery was contained within an aluminum extrusion fastened to both side panels of the compressor case. Removal of the side panel again revealed a thermal damage gradient that lessened towards the battery section. There was more wire insulation and thermally sensitive material surviving undamaged in the battery section of the compressor case than in the compressor section.

The aluminum extrusion containing the battery was removed and examined. No evidence of bulging or other deformation was observed. The end plates closing the ends of the aluminum extrusion were removed to gain access to the battery inside (figure 10). The battery pack had an insulating paper overwrap (figure 11). This overwrap material was thermally decomposed and darkened in color. Although it had become brittle, it mostly remained intact. A portion of the overwrap had separated exposing some of the cells inside the battery pack. The cells were still wrapped within a clear insulating material and did not exhibit signs of deformation (figure 12). Electrolyte appeared to have leaked from the cells within the battery pack, which is consistent with exposure to a high temperature environment.

Joseph Panagiotou
Fire Protection Engineer



Figure 1: Top side of compressor case.



Figure 2: Bottom side of compressor case.



Figure 3: Side of compressor case.



Figure 4: Side of compressor case.



Figure 5: Back side of compressor case.

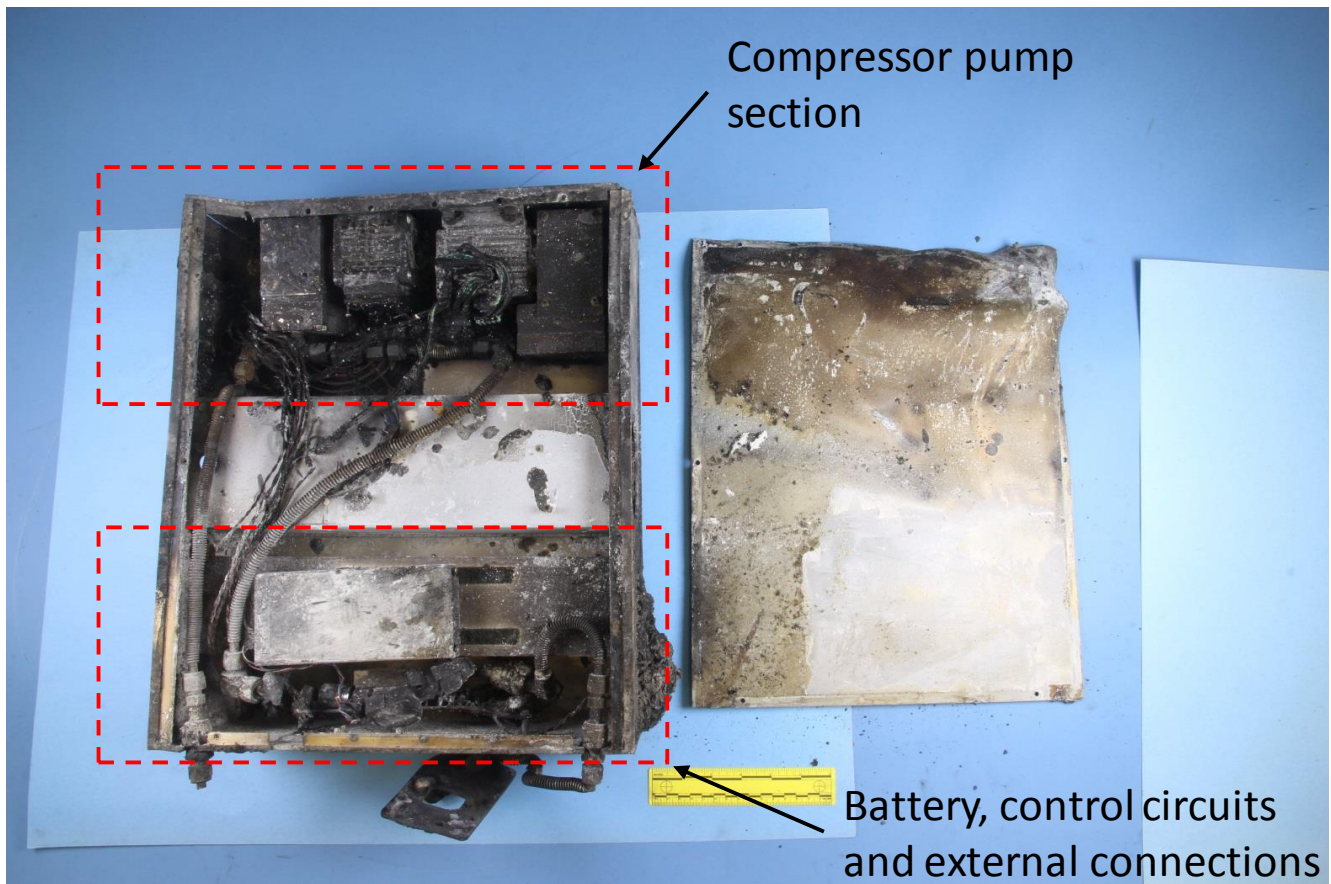


Figure 6: Compressor case internal components looking in from the top side.

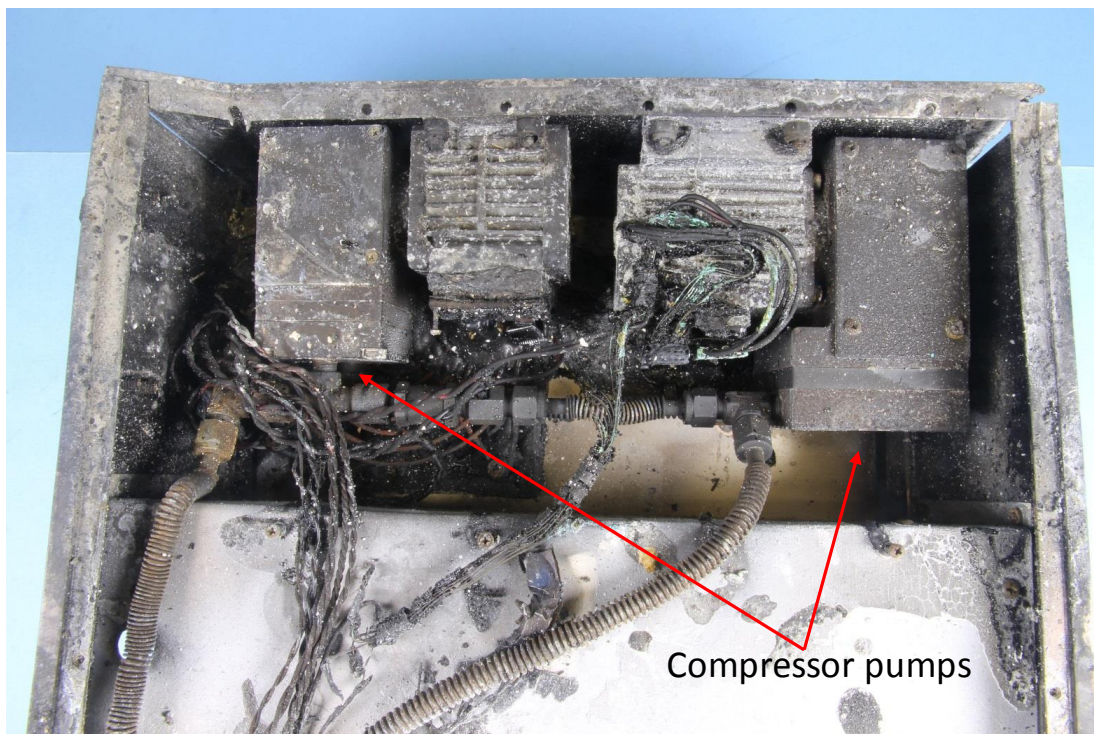


Figure 7: Compressor section of case.

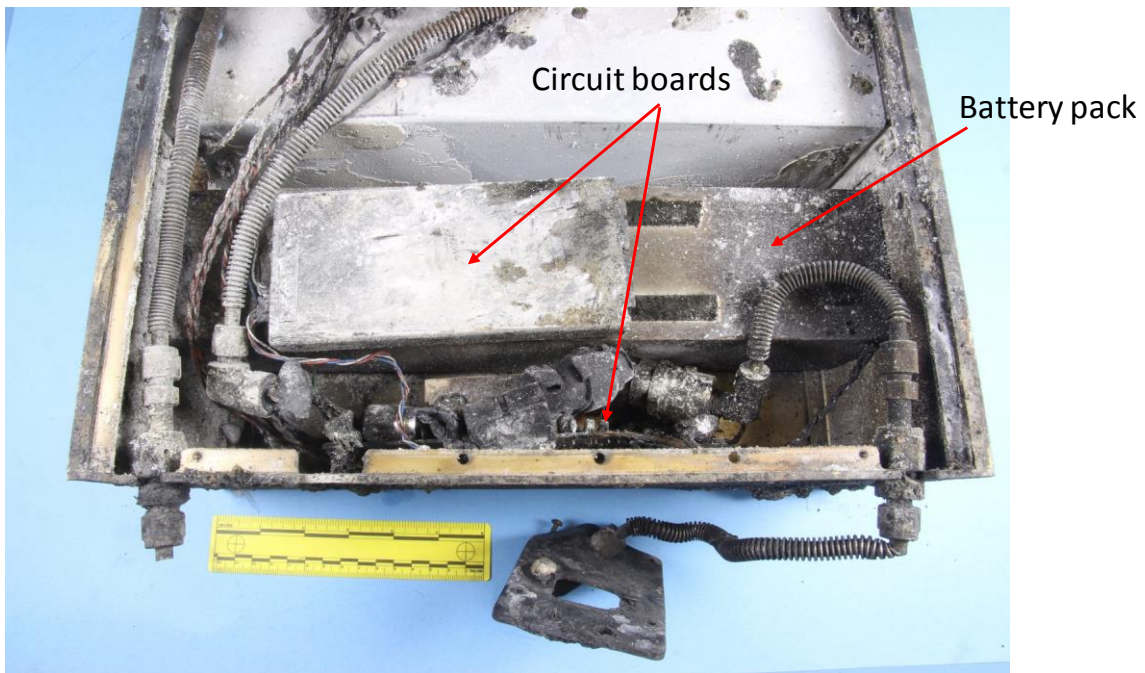


Figure 8: Battery section of case.

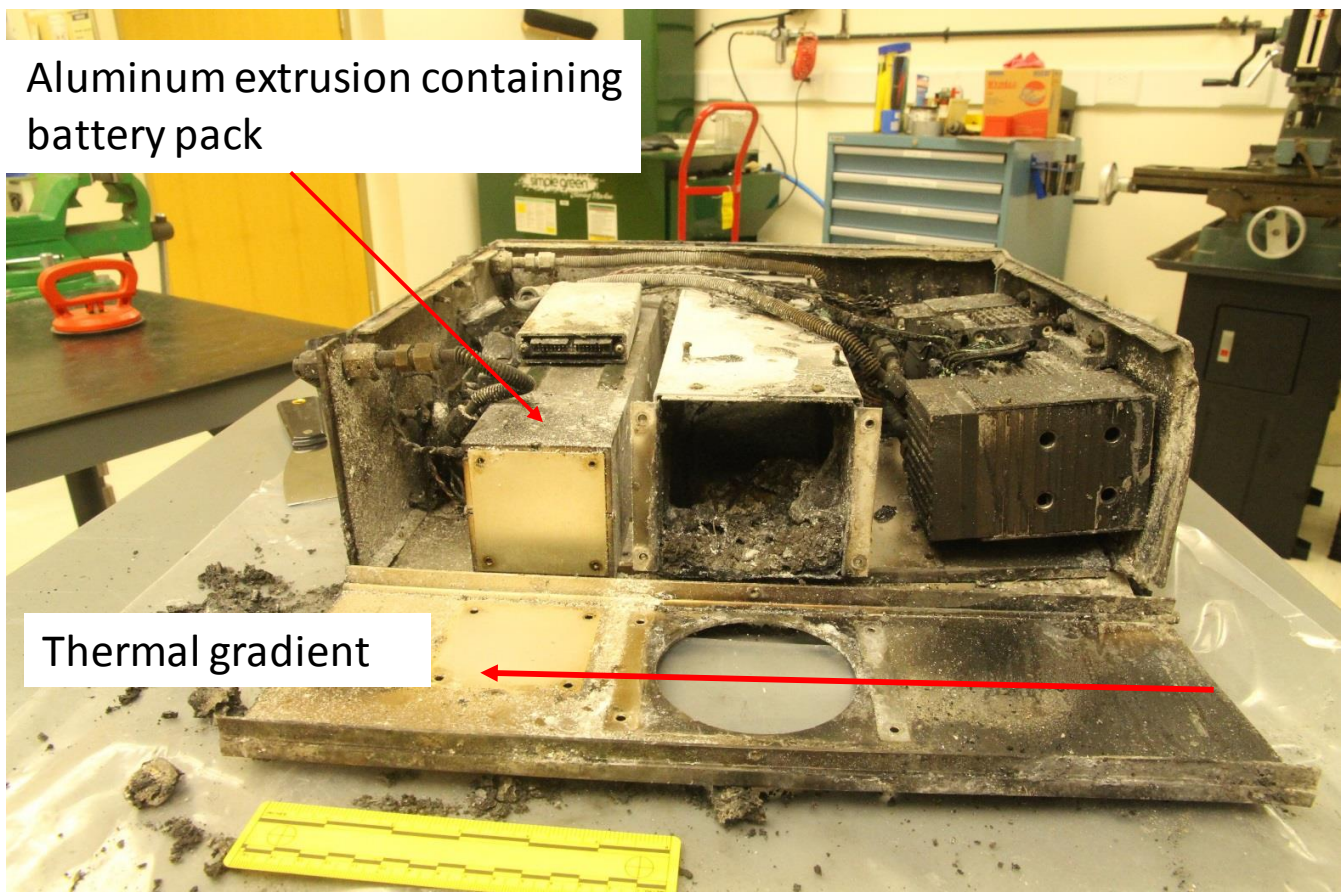


Figure 9: Side panel removed from compressor case.

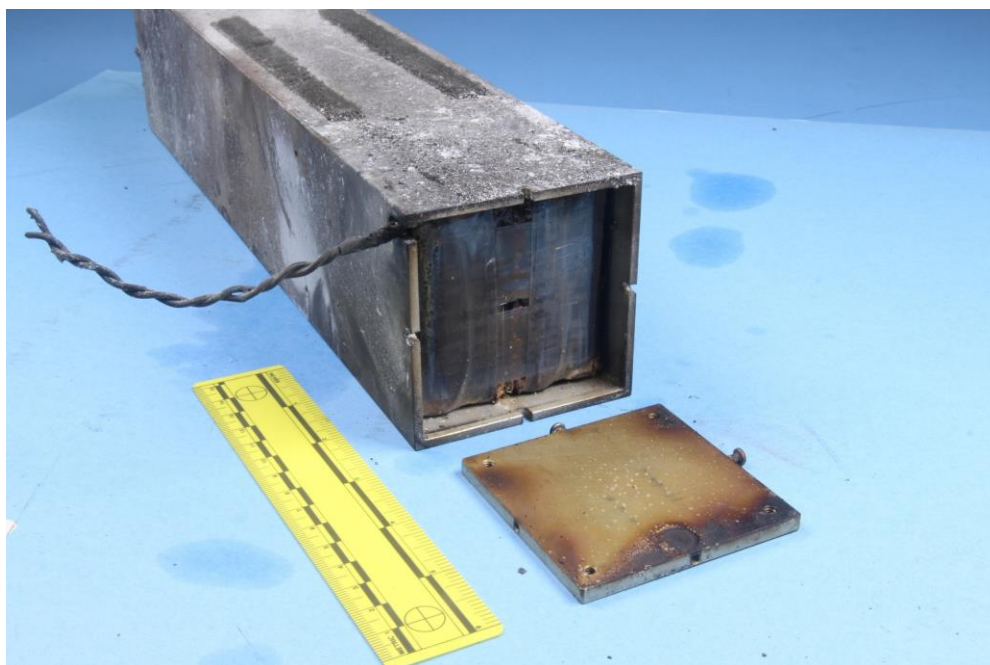


Figure 10: Battery pack inside extrusion.



Figure 11: Battery pack with insulating paper.



Figure 12: Cells visible within battery pack.