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Cc: [Michael Budinski](#)
Subject: ERA23FA357-(Material found in induction pipe)
Date: Wednesday, March 20, 2024 5:37:31 PM

Aaron,

The induction pipe from the accident aircraft was submitted to the Materials Laboratory for examination. A dark blue colored substance was found inside the pipe. A sample of the blue material was removed and examined using a Fourier Transform Infrared (FTIR) spectrometer with a diamond attenuated total reflectance (ATR) accessory in accordance with ASTM E1252-98 (American Society for Testing Materials E1252-98: *Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis*). The spectrometer was used to collect and process infrared wavelength absorbance spectra of the unknown material.

The spectrum for the material contained the following combination of spectral peaks corresponding to particular functional groups found within the molecular structure of the material. The presence of a broad, peak $\sim 3340\text{ cm}^{-1}$ is indicative of a nitrogen-hydrogen (N-H) (primary) stretching bond. A broad peak located in this area can also be indicative of an oxygen-hydrogen (O-H) bond. The presence of a doublet peak at $\sim 2920\text{ cm}^{-1}$ and $\sim 2850\text{ cm}^{-1}$ is indicative of a carbon-hydrogen (C-H) (alkane) stretching bond. A peak at $\sim 1730\text{ cm}^{-1}$ is indicative of a carbon-oxygen (C=O) (carbonyl) double bond. A peak at $\sim 1580\text{ cm}^{-1}$ is indicative of a nitrogen-hydrogen₂ (N-H₂) deformation bond. A peak at $\sim 1520\text{ cm}^{-1}$ is indicative of a carbon-carbon double (C=C) (aromatic) bond. A peak at $\sim 1460\text{ cm}^{-1}$ is indicative of a carbon-hydrogen₂ (C-H₂) bending bond. A peak at $\sim 1380\text{ cm}^{-1}$ is indicative of a carbon-hydrogen₃ (C-H₃) symmetric deformation bond. A small peak at $\sim 1160\text{ cm}^{-1}$ is indicative of a carbon-nitrogen (C-N) stretching bond. A peak at $\sim 1460\text{ cm}^{-1}$ is indicative of a carbon-hydrogen₂ (C-H₂) bending bond. A peak at $\sim 1100\text{ cm}^{-1}$ is indicative of a carbon-hydrogen (C-H) (aromatic) bending bond. A peak at $\sim 1020\text{ cm}^{-1}$ is indicative of a carbon-oxygen (C-O) bond. The spectrum was consistent with presence of an aromatic hydrocarbon, a straight-chained alkane, a carboxy/carbonyl, and an amine within blue material.

A spectral library search was performed on the unknown spectrum. The library search found matches of several significant spectral peaks within the unknown spectrum to peaks in the spectra of several materials. These materials also were spectrally similar to one another as well. These materials included anti-static materials, anti-corrosion materials, emulsifiers, gum preventatives, and dyes. These materials are commonly used as additives in aviation gasoline. The library search peak similarities with the lack of a single strong spectral match suggested that the unknown blue material was a mixture. A mixture spectral search was performed on the unknown spectrum. This search found matches to several combinations of the additive materials identified in the single component search. Based on the spectral search

information and the color of the material, the unknown mixture was likely weathered (evaporated) aviation gasoline. The mixture of fuel additives and aromatic components, which are not as volatile as the straight-chained alkanes, was left behind on the surface of the induction pipe after the more volatile components had evaporated.

If you have any questions or comments, let me know.

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