NATIONAL TRANSPORTATION SAFETY BOARD

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

November 7, 2011

MATERIALS LABORATORY FACTUAL REPORT Report No. 11-126

A. ACCIDENT INFORMATION

Place	:	Mosby, Missouri
Date	:	August 26, 2011
Vehicle	:	AS-350-B2
NTSB No.	:	CEN11FA599
Investigator	:	Jim Sillman NTSB-CEN

B. COMPONENTS EXAMINED

Tail rotor gearbox screen and associated debris

C. DETAILS OF THE EXAMINATION

The tail rotor gearbox screen and debris that was found clogging the screen were submitted to the NTSB Materials Laboratory to determine the identity of the material in the gearbox screen.

A visual examination under magnification (using a 5x to 50x stereo zoom microscope) of the material removed from the filter screen revealed granular particulates similar in morphology to sand or soil as shown in Figure 1. The debris had a slightly oily appearance on the surface as well as strong hydrocarbon odor.

A sample of the debris was examined by scanning electron microscopy (SEM) and quantitative standardless energy dispersive x-ray spectroscopy (EDS) in accordance with ASTM E1508[1]. The EDS analysis of representative particulates showed the presence of aluminum, silicon, oxygen and iron. These constituents are consistent with elements found in soil.

In order to identify the oily substance on the debris, a sample of the material was also examined by Fourier Transform Infrared (FTIR) Spectrometer with an attenuated total reflectance (ATR) accessory[2]. The spectrometer was used to collect and process infrared

[1] American Society for Testing Materials E1508 Standard Guide for Quantitative Analysis by Energy-Dispersive Spectroscopy, 2008.

[2] An IR spectrum is created when a molecule converts infrared radiation into molecular vibrations. There are two types of molecular vibrations: stretching and bending. These vibrational movements create bands in a spectrum that occur at specific wavelengths (cm^{-1}). Each wavelength is dependent on a number of factors including the mass of the atoms present, the force constants of the bonds present, and the geometry of the

wavelength absorbance/transmission spectra of the sample[3]. The spectrum obtained from the unknown sample suggests that the material was organic as evidenced by the presence of characteristic carbon-hydrogen bonding peaks between ~3000 $cm^{-1}$and ~2800 cm^{-1} as well as a small group of peaks at 1400 $cm^{-1.}$ This peak configuration is indicative of a straight chained, aliphatic hydrocarbon. When compared to the spectra of known materials, the unknown material most closely matched spectra from lubricating oils.

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molecule present. Infrared spectra can help in identifying the chemical composition and/or bonding present in an unknown molecule. The spectrometer radiates a broad band of infrared light through the specimen. Depending on the bonding present, the light will be absorbed, transmitted, or reflected at various wavelengths. From the spectrum produced, information about the bonding present is obtained from the location of group frequency peaks. Most spectra contain additional “fingerprint” peaks that are unique to a particular molecular structure. All molecules have a unique spectrum in IR.

[3] The samples from this aircraft were analyzed using the reflective mode. In reflective mode, the infrared beam is passed through the sample and then reflected off of a reflective IR plate and passed back through the sample where it is detected and analyzed.

Figure 1. Overall picture of tail rotor gearbox filter and debris.