DOCKET NO. SA 516

EXHIBIT NO. 8E

# NATIONAL TRANSPORTATION SAFETY BOARD

## WASHINGTON, D.C.

P&W LETTER TO NTSB, DATED FEBRUARY 16, 1990, REGARDING ANALYSIS OF FUEL FROM AVIANCA FLIGHT 502 AS GUIDE FOR FUEL TESTS

by

Gordon J. Hookey

UNITED TECHNOLOGIES PRATT&WHITNEY

400 Main Street
East Hartford, Connecticut 06108

AVIANCA 052
ACCIDENT FILE

In Reply Please Refer To:
CMS:MLY:90-02-16-3

February 16, 1990

Mr. Edgar R. Fraser
National Transportation Safety Board
Aviation Accident Division (AI-30)
800 Independence Avenue, S.W.
Washington, D.C. 20594

Subject: Avianca Flight 052 Accident, Fuel Analysis

Dear Mr. Fraser:

As you requested, an analysis was performed on fuel samples taken from the engine pump filter on all four engines and the Aircraft No. 4 Aft Fuel Tank Boost Pump Drain. A summary of the analysis is as follows:

- Fuel samples from #1 through #4 were similar to jet A-1; fuel samples from all four engines were identical.
- Contamination in fuel was present as sediment consisting of metal debris (predominantly Al), cellulose fibers and sand/soil.
- Water in fuel averaged 50 ppm
- Heat of combustion averaged 18,483 BTU/lb.

Details of the chemical analysis is attached. Please call me if I can be of further assistance.

Regards,

Michael L. Young

Michael L. Young
Customer Maintenance Support
MLY/ref/2779W/25

Attachment

cc: J. C. Sumner

ATTACHMENT 4

o Qualitative identification of fuel by gaschromatography .

Comparison of Avianca fuel samples to Jet A-1 indicated the presence of the same major hydrocarbon fractions, however, the Avianca fuels appeared to be a narrower cut, but within the band, of Jet A-1. In the Avianca fuel, the early-eluting, low-boiling fractions were present in lower concentration.

o Thermogravimetric (TGA), scanning electron microscopic (SEM), and infrared analysis of debris filtered from fuel samples.

Visual inspection of debris removed from the fuel samples revealed crystalline particles, metal particles and fibers. Sediments in fuel from engines #1, #2 and #3 were analyzed by TGA; the amount of debris in fuel samples from engine #4 and the aircraft #4 aft fuel tank was too small for analysis. A separation of the debris into organic combustible vs. non combustible portions showed 26% by weight of organic, combustible matter in debris from engine #1, 83w% organic matter in debris from engine #2, and 66w% organic matter in debris from engine#3.

SEM analysis of the noncombustible fraction of the debris indicated predominant amounts of aluminum and minor amounts of iron and chromium in debris from fuel sample#1; also indicated were smaller amounts of elements attributed to soil (silicone, magnesium and calcium). The noncombustible residue in fuel samples #2 and #3 contained major amounts of the elements associated with soil.

The fibers found in samples #2 and #3 were identified by infrared analysis as cellulose, the base material of cotton, wood and other naturally occurring compounds.

o Water content and net heat of combustion (NHOC) results of Avianca fuel samples are summarized in the table below:

| Fuel Sample | Water, ppm | NHOC, BTU/lb |
|---|---|---|
| Eng. #1 | 35 | 18,483 |
| Eng. #2 | 47 | 18,482 |
| Eng. #3 | 55 | 18,476 |
| Eng. #4 / AFT Fuel Tank Boost Pump Drain | 49 | 18,484 |
| Eng. #4/ Main Fuel Control (duplicate samle containers | 72; 64 | 18,488; 18,486 |

ATTACHMENT 4