GE - Aviation

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GE Party Response to Carson's Letter of Petition for Reconsideration

GE has reviewed Carson's various contentions and claims in their Letter of Petition (dated March 11, 2011) and offers the following comments for the NTSB's consideration. This response will only address each specific claim made in Section A – "*New Information Regarding Contamination and Contamination Source.*" GE has deferred to Sikorsky all responses to Section B – "*The NTSB investigators utilized faulty data from Sikorsky for the GenHel simulations to determine aircraft performance in the final report.*"

In accordance with NTSB procedures, GE's response is being provided to the NTSB within 90 days of receipt of Carson's correspondence (dated April 26, 2011), ie. before July 25, 2011.

First is GE's response to Carson's claim in the introductory paragraph of Section A:
"Carson remains firm in its experienced opinion that the aircraft crashed due to a loss of power to an engine during takeoff from the helipad." GE would again refer the NTSB to the indisputable evidence from the CVR sound spectrum analysis that each engine was running steady at its gas generator (Ng) topping speed and therefore maximum power for the duration of the accident takeoff (see NTSB Sound Spectrum Study Cockpit Voice Recorder – 12 Group Chairman's Report, May 21 2009). Additional evidence includes:

a. This CVR Sound Spectrum Study showed both engines were operating at their topping speed during all 3 takeoffs from H44 that evening, with main rotor speed drooping each time. The engines were not seen to reach topping speed during takeoffs at lower gross weight and altitude that same evening.
b. Carson had previously set each gas generator at a slightly different topping speed during a regular 'topping check'; so 2 distinct frequency lines can be seen on the CVR sound spectrum charts, each representing one of the two engines, and both of which remain steady at a frequency that equates to each engine's actual set topping speed.
c. CT58 operator experience has shown that a 'sticking' pressure regulating valve (PRV) due to silica fiber contamination in the fuel control unit (FCU) can cause the engine's Ng speed to fluctuate, with associated power fluctuations. Also, the effects of a 'sticking' PRV would not be seen until there was a change in power demand; so as long as an engine is operating steady at maximum power it would see no impact from a 'sticking' PRV. There were no Ng speed fluctuations seen on the CVR sound spectrum charts during the accident takeoff, once the engines had reached their topping speeds.
d. T58 test cell experience has shown that a contaminated pilot valve at high power may cause the variable guide vanes (VGV) to suddenly close, choking off airflow to the compressor. This causes a sudden unloading of the compressor, which results in a large and rapid rise in Ng speed and inter-turbine temperature (T5), along with a sudden loss in power and rapid decay of power turbine speed. There was no rapid rise in Ng speed seen on the CVR sound spectrum charts during the accident takeoff, once topping speed had been reached.

The following are GE's responses to each specific claim made by Carson:

1) *"Contaminants found in the fuel control were significant and would affect operation of the unit."*
This claim is unfounded for the following reasons:
   a. It is not "new" to the investigation. Carson has been making this claim since early in the investigation and the NTSB has thoroughly investigated this claim, eventually discounting it due to the lack of any supporting evidence.
   b. Various FCU experts from GE, Columbia (overhauler) and Hamilton Sundstrand (OEM) examined the fuel control filter, PRV and components at various stages of the teardown investigation and all agreed that the components were all clean with the exception of the PRV where only traces of contamination were found. Only Carson disagreed by claiming there was "significant" contamination found.
   c. These same experts who visually examined the FCU filters all agreed that the amount of contamination captured by each filter (including fibers) was not sufficient to affect the function of the filter or cause it to go into bypass. Again, Carson disagreed.
   d. The NTSB Lab did a focused assessment using a 12.5X glass to estimate the amount of "plugged area" for each fuel control filter using the GE Maintenance Manual guidance for inspection and cleaning time intervals. It was concluded that the #1 filters were 10% and 25% plugged, and the #2 filters were 20% and 50% plugged (see NTSB Materials Lab Report No 08-121). GE's own visual assessment was that these numbers were conservative but nonetheless within the acceptable threshold for blockage. They only show that the filters were performing their primary function of capturing contaminants before they could enter the FCU.
   e. The NTSB Lab also closely examined both pilot valves and found them to be very clean, with no evidence of any contamination (refer to para d. on page 1).
   f. Even if there is disagreement on the amount of contaminants found in these PRV's and other valves associated with the FCU's from the accident engines, the CVR sound spectrum study evidence documented on page 1 still clearly shows this had no impact on each engine's operation and ability to maintain topping speed and maximum power.
   g. The *"numerous particles removed from the interior of the PRV assembly when the spool was separated"* were mostly soot and carbon particles from the burnt seals due to the post impact fire.

2) *"Significant JFC26 Contaminant History".*
Various claims in this section are unfounded for the following reasons:
   a. This is also not "new" to the investigation, and was also thoroughly investigated by the NTSB, who concluded this was not relevant to the root cause of this accident.
   b. The NTSB's review of Columbia's overhaul facility records from 2005 to 2008, for both their own and customers' fuel controls, actually revealed the following:
      i. About 38% of all overhauls were non-routine.
      ii. About 10% of all overhauls were due to contamination, typically due to metal.
      iii. There were no documented reports of fiberglass contamination.
   c. GE did make the NTSB aware of the FCU contamination issues during the course of this investigation. Unlike Carson however, GE did not focus on this as central to the NTSB's root cause investigation because the CVR sound spectrum evidence documented on page 1 clearly showed no relevance of PRV or pilot valve contamination to the root cause of this accident.
   d. While recognizing this lack of relevance, the NTSB was still able to discover the possible source of these silica fiber PRV contaminants that had been seen in trace amounts on the accident engines and had been recognized to have caused Ng fluctuations on other CT58 engines in S-61's. The NTSB Lab's conclusion using EDS was that the "E-glass" fibers found in the PRV were a very close match to a fiberglass collector can in the aircraft fuel tank.

3) *"New information regarding contaminant sources within the fuel control system".*
GE agrees that this is "new" information and offers the following comments in response to Carson's claims:
   a. The GE CT58 Accessories Overhaul Manual (SEI-185) does contain certain repair procedures which involve resurfacing and restoration of worn parts in the fuel control system with a synthetic coating

called EPOLY. This is an airworthiness approved material registered as proprietary to Interface Air Repair, Inc (IAR) in California, where the repair is performed. IAR claims EPOLY is "the superior original epoxy repair process", certified by the FAA, EASA, ISO and AS9110. The specific areas for which the Manual allows EPOLY repair are as follows:

i. The T2 servo bore in the fuel control unit (see Carson's reference to *"T2 sleeve" in 3.d*).
ii. The P3 bellows port in the fuel control unit.
Both of these repairs were originally approved via GE Repair Engineering Instructions, REI Nos CT58-5089 and CT58-5096, and later added to the GE Manual.
iii. The fuel pump body, which is not part of the FCU (see Carson's reference to the *"pump housing" in 3.d*). The fuel pump is upstream of the FCU on the CT58 engine.
iv. Carson also refers to the *"PRV valve body" of the fuel control in 3.d.* There is no EPOLY repair of this in the Manual. The only repair is on the PRV housing and involves welding on a new tab, with no EPOLY involvement.

b. In addition, there is only one other EPOLY repair procedure for the CT58 FCU. GE approved a Customer Departure Record, CDR No CT58-99-036, in response to a request from Columbia Helicopters, which authorized the use of an EPOLY repair method to restore the Ng position bore surface in the CT58 fuel control unit. This CDR repair was substantiated by GE as being "similar to the P3 bellows port repair per REI No CT58-5096" (see 3.a.ii above).
c. IAR would not disclose to GE the chemical composition of their proprietary process. However, they did state to GE that EPOLY does not contain silica or fibers, and that it wears in a fine powder form, typically of 10 microns or less, with no long strand fibers.
d. Based on these IAR's statements, GE would suggest that the NTSB examine closely Carson's claim that the coating they had examined by an independent laboratory (*ref. para 3.b*) was actually an EPOLY coating and not some other epoxy coating.
e. GE accepted Sikorsky's Alert Service Bulletin (ASB No 61B28-1, Jan 2010), which replaced the 40 micron airframe fuel filters with 10 micron filters, as mitigation of the risk of FCU contamination for the following reasons:
    i. NTSB evidence that the most probable source of these silica fibers was the collector can in the airframe fuel tank, which is upstream of this 10 micron filter (see para 2.d above).
    ii. Columbia has not reported experiencing any similar silica fiber contamination issues on the CT58 FCU's from their Model 107-II helicopters, which also use a 10 micron airframe fuel filter and have a different fuel tank.
    iii. The military H-3 versions of the S-61, which use T58 engines with a similar FCU with the same size filter, have also not reported experiencing any silica fiber contamination issues. Sikorsky advised GE that all H-3's use the 10 micron airframe fuel filter.
f. Sikorsky's Alert Service Bulletin which introduced the 10 micron fuel filter elements clearly stated that these are replacements for the 40 micron filter elements. This Alert SB was approved by the FAA. GE saw no reason to doubt the validity of this statement, as Carson are now claiming in *para 3.g*.

In summary, nothing presented by Carson in their Letter of Petition has caused GE to change its original opinion that all available evidence clearly shows that this accident resulted from the helicopter being overweight for the prevailing H44 takeoff conditions and loads. The flight crew was unaware of this overweight condition, which led to them continuing the accident takeoff with both engines operating normally at maximum power but main rotor speed significantly drooping as the helicopter load demand increased when they left ground effect.

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