RESPONSE OF BILL COULTAS TO NTSB QUESTIONS

From: Zoé Keliher, NTSB Investigator:

“I was hoping Mr. Coultas could help the investigation by answering the following questions:”

- In reference to the CVR: Can you confirm that we are correct in translating what you were saying:

H-36 1st landing: "Power check - 32 degrees there's three knots showin' eighty - okay power's good."

The copilot is probably stating that the outside air temperature was 32° C, the airspeed was 3 knots, and the engine torques were 80 percent, as these items are typically recorded during a power check.

COULTAS ANSWER: Yes

- H-44 1st takeoff: As the takeoff continued, the copilot announced "eight seven," likely referring to the engine torque gauge, and then "one hundred and two percent power's good," likely referring to the main rotor speed (NR).

ANSWER: Yes

- H-44 2nd takeoff: The copilot stated "power's good showing one oh three - ninety percent torque." The copilot was probably referring to an NR of 103 percent.

ANSWER: Yes

- H-44 accident takeoff: At 1941:02, he stated "okay there's seventy five - there's eighty, and then, at 1941:06, "there's eighty five," all of which were probably engine torque readings. About 4 seconds later, he stated "there's ninety showin' ah hundred and three percent," probably referring to an engine torque reading of 90 percent and an NR reading of 103 percent.

ANSWER: Yes. However, we were no longer at 32 degrees Celcius, which I believe is a point I make in close approximation to these statements. We were at approximately 19-20 degrees Celcius and I believe I called out to Roark that we were “twelve degrees cooler” or words to that effect.

- Do you ever reach topping during normal procedures?

ANSWER:

No, only if a vertical takeoff is required after we are confronted with additional hazards and/or conditions. Also, topping can be reached as a normal part of engine maintenance or

engine replacement checks. If the question is directed to the day of the accident, we did not reach topping power on the first (H-36), second or third ("accident") flights into and out of H-44 that day.

- How often do you encounter engine topping?

ANSWER:

Infrequently. Topping power can be expected where there is an unforeseen circumstance due to terrain, weather, site conditions or other factors that demand maximum engine power. This can be in emergency situations or a potential hazardous situations, which is not to the point of an emergency, but could be unless the pilot takes certain actions. Topping power is specifically achieved during post-maintenance check flights or after engine replacement or after some other maintenance that requires it to be re-set.

- At a high density altitude with a heavy load, would you expect to reach topping?

ANSWER:

No, unless confronted with unanticipated conditions, hazards or unexpected wind changes. Topping power would only be achieved if some flight parameter exceeded the anticipated condition and the power requirement was higher than expected in a high density altitude and/or high gross weight condition. Our flight planning avoids the need for topping power. During our calculations, we planned for unforeseen problems such as the dust issue at H-44. Our calculations for the first flight to H-36 and the second, and third flights to H-44 showed we would not need topping power. From all of my observations, the engines did not reach topping power.

- Now that the NTSB has released the VCR transcript and issued numerous factual reports, maybe this information (specifically the CVR transcript and the sound spectrum study) has helped you recall the specifics of the day's flights…. In my previous interview with you, you indicated that the helicopter's engines did not reach on the first two H-44 take-offs. DO you now recall observing that the engines reached topping on the first, second, or accident take-off from H-44?

ANSWER:

Are you asking me to change my testimony and/or asking for an opinion? The answer to the first is that I do not wish to change my statements. I am confirmed in my original statements by the evidence I have reviewed since then.

Having reviewed as much of the CVR transcript has been made available to me and having reviewed the various reports, and now having had the chance to reflect upon the circumstances of the past two years, I did not observe the engines reaching topping on the first (H-36), second, or accident takeoffs (H-44). Nothing in my scan, on my gauges or anything I felt or observed gave me any evidence that topping had occurred. In fact, we

were out of ground effect and had transitioned to forward flight before the nose suddenly dipped, which felt to me definitely as a loss of power.
If your question is asking me to bring in other data, including the sound spectrum analysis, I assume in this question you are asking me for my conclusions?

If so, I would say that the initial sound spectrum data from what I understand, initially indicated a degradation in the flat pitch Nr rpm on each successive take-off. Nr on the first take-off was 108 to 108.5%, and on the second 107%. On the third take-off it was between 106 and 106.5%, at least from what I read in the initial report.

But as I read the errata entry, those values are no longer reflected in the Sound Spectrum Study. It is stated in the Errata sheet dated April 9, 2010 paragraph entitled, "D. DETAILS OF INVESTIGATION", that the initial assumption the 100% main rotor speed (Nr) equals a frequency of 663.1 Hz "is incorrect". It goes on, "According to the manufacturer, the correct number should be 659.76 hertz when using the Planetary Mesh to calculate 100% rotor speeds. This error affected only the main rotor speed data shown on all of the plots in the original report. Using the new number results in an overall increase in approximately 1.00506% in the rotor system values depicted on the original plots. Please replace plots 3 thru 14 found in the original Sound Spectrum Report dated August 17, 2009 ..."

The above statement would lead me to believe that we should add 1% to the original Nr numbers; however, that is not reflected in new Charts 5,7,11,12,13,14, or 15. Based on this there is not an indication of a significant degradation in flat pitch Nr rpm on each successive take-off from H-44. Nr on the first take-off is 108.5%, on the second 108.5%, and on the third 108.5% (plus or minus 0.1%).

New Chart 12 shows the Nr and Ng along with the time of each of my power comment. The events are now closer together than on the previous study. It should be noted that the new Chart 12 also has a scale change; the right scale is no longer the same as that on the left. It is interesting that the Ng reaches topping while the Nr is dropping through 103%.

It is my opinion that the Ng of 102% did not result in a corresponding increase in torque because there is no question that the engine lost power, and that from what I have now been shown and told, I recognized this by opening the emergency throttle to No. 2 as the manual suggests.

Going back to the sound spectrum analysis, if you want to ignore the errata, and use the original, on each take-off graph (I'm referring to charts 5, 7 and 8) it shows up to a 10 second delay between the time Nr begins to drop and the Ng begins to climb. This can be very clearly seen on chart 14. I attribute this to the likelihood that the fuel control units and the pressure regulating valves were not responding as required by the position of the collective. I cannot remember clearly doing it, but I had to be the person who opened engine No. 2's emergency throttle halfway, as I saw was found in the wreckage. I have spoken with a witness who visited me in the hospital who recently told me I said that I opened number 2 emergency throttle as soon as I regained consciousness.

The charts illustrate that the Ng on both engines was erratic as the collective was raised. There appears to that the disparity between Ng is as much as 6%. Sometimes No. 1 loses Ng rpm while No. 2 is accelerating and on the other take-offs the opposite occurs. At the last take-off, No. 1 initially lost Ng rpm and then increased rpm while No. 2 gained Ng rpm and dropped rpm before accelerating. By then rotor rpm was already deceasing and the engine could not accelerate at the rate necessary to catch up to and reverse Nr degradation. I can tell you that we rose to between 60 and 70 feet on the accident take-off so we were definitely able to hover out of ground effect.

If you are asking me to state my opinion from everything I saw, felt and heard at the time of the H-44 take-off that ultimately ended in the crash, it is my opinion that engine No. 2 was not getting sufficient fuel and that there was a sudden loss of power. The nose dropped and then Roark pulled it back up. I must have then opened the emergency throttle on No. 2. We did not hear any impact until after this event. We definitely heard and saw the effect of the initial impact of the blades on a tree.

I am familiar with the GE, CT58 Turboshaft Maintenance Manual. On page 175 it states:

> **Trouble: "NG stays at maximum with Nf abnormally low when under load (indicates low power output)."**
> **Probable cause: "Stator vanes remain closed".**
> **Troubleshooting: "(4) Check fuel system filters for contamination (75-30-1)."**
> **Corrective action: "Replace fuel control and pilot valve. Correct source and clean fuel system as necessary."**

The question seems to focus on the initial sound spectrum study cockpit voice recorder analysis. In the analysis that I have seen, it appears that Ng speed was identified by its sound measured in Hz where 100% Ng speed (i.e., 26,300 rpm) equals 438.33 Hz. At the topping limit about 102-102.2% Ng, the rpm would be somewhere between 26,826 and 26,879 rpm as best I can calculate. This is what was depicted in the sound spectrum analysis charts/graphs. In each take-off from H-44 with firefighters, the charts/graphs show that Ng did not go to topping. The Ng of 102% did not result in a corresponding increase in torque either because the conditions on that day caused fuel contamination with the type of filtering system on the CT58s, which in turn caused stator vanes to remain closed or they were operating inconsistently. The flight characteristics at the time of the accident were consistent with this type of fuel starvation. My reaction with the emergency throttle confirms this to me.

> **The loss of power happened after we transitioned to forward flight and were both out of HOGE and the general landing area.**

- Would you normally discuss reaching topping with the PIC?

Answer:

When? Preflight planning? Normally, no. During flight planning, Roark and I determined and discussed what our anticipated power requirements would be based on the data. We might bring it up if there was an unforeseen situation during the actual flight where we might need it and why.

On the day of the accident, our calculations were based on the materials and data we were provided and indicated that the take-off, vertical climb, HOGE and transition forward flight would not require topping power. Prior flights of the day all supported that and nothing that I saw, felt or heard up until the nose dipped on the crash take-off from H-44 indicated that the aircraft was having any difficulties or that our calculation had been incomplete. The aircraft did not feel "sluggish", it maneuvered normally and climbed as we had always expected, including out of ground effect. It did not go to topping from what I saw, felt and heard and I do not see where we discussed it on the CVR.

These statements are true and correct to the best of my knowledge.

WILLIAM H. COULTAS

Thank you so much for your help, Zoë. Let me know if I can be any more help.

Now that I have answered these questions, I have a couple I would like the NTSB to answer.

1. Why is 32 degrees Celsius, 6103 feet pressure altitude and zero wind being used as the temperature, altitude and wind to compute actual conditions created by the NTSB's investigators. I specifically recall stating the actual temperature of 12 to 13 degrees cooler when asked by Roark while we were sitting on the ground at H-44. Also, the altitude at H-44 per the NTSB's own report is 5946 feet and per the CVR the wind call-out from the forest service personnel on the ground at H-44 was 3-5 knots out of the southeast. This is a serious concern because it specifically affects the performance of the helicopter and determines without doubt the aircraft had sufficient power to execute the takeoff.

2. Why hasn't the NTSB focused on the finding of the #2 engine emergency throttle position? After I had ensured both engine throttles were at the full forward position and the rotor RPM was decreasing, I have memories that I grabbed the #2 emergency throttle and advanced it forward. Because I was unable to recall this with the same detail as other events, I did not want to assume those actions. However, on 9 November 2010 at 11:28 am local time I received a phone call from Roger Douglas. After some brief friendly conversation he asked how I was doing. I replied I was having a hard time trying to understand the direction the NTSB's investigation is going in light of all of the physical

evidence. Evidence such as the NTSB's insistence of using 32 degrees not the actual 19-20 Celsius that I reference while on the ground at H-44. 6103 feet PA as the actual altitude and a zero wind condition when the actual temperature is clearly heard on the CVR. Missing FCU parts, contaminates found in the #2 FCU; specifically the PRV. A 30% torque split between the #1 and #2 engines. A lack of FOD damage to the #2 engine and the position of the #2 engine emergency throttle. I then said that I wished that I could vividly recall moving the #2 engine emergency throttle with the same vivid memory of recalling the temperature of 19-20 Celsius. He replied, "wait, wait,!! When Deb and I came and seen you in the ICU after you woke up, you told me that you moved that #2 emergency throttle". I replied "I did"?, and Roger said "yes, you did". I then asked if he could recall in enough detail that conversation to testify, and he told me "yes". I told him to remember this conversation.

3. Why has there been no concern regarding the missing #2 FCU parts? Did the NTSB conduct an investigation after learning of the missing FCU parts? Who was responsible for the chain of custody of the engines and FCU's?

4. Why was contaminate removed from the FCU fuel filter prior to determining the percentage of blockage? Why was that blockage test not performed per the manufacturers procedures?

5. Why was the PRV contaminate study withdrawn before it was completed?

6. Why the focus on the 2.5 minute power charts when the flight lasted ninety seconds? We obviously never held power at any level between 2.5 and 5 minutes. We'd crashed by then.

7. If the sound spectrum analysis is so accurate, where on the analysis is the four plots that represent the rotor blade impacts to the four known trees found during the post-crash investigation?

8. Why has the NTSB not determined the source of the fiberglass fibers found in the #2 FCU PRV? Are these fibers consistent with the plating material that Columbia Helicopters, Inc. applied during the FCU overhaul? Or, are these fibers from the aircrafts center tank collector can? Why has there been no focus on this contaiminates source? This lack of concern is disturbing.

From: Struhsaker Jim
To: gaanderson----------
cc: Julius Chris; Keliher Zoe; Struhsaker Jim;
Subject: Weaverville, Co-Pilot response
Date: Tuesday, November 30, 2010 11:36:00 AM

November 30, 2010

Dear Mr. Coultas,

I am writing in response to the questions you asked in your e-mail of November 16, 2010. Since some of your questions address areas of the investigation that are beyond the scope of Ms. Keliher's work as the operations group chairman, she requested that I respond to you. Before responding to your individual questions, I would like to inform you that the Board is scheduled to meet regarding this accident on December 7, 2010. At this meeting, the Board will discuss and adopt findings, probable cause and recommendations. The Board's final report on the accident will be issued about 1 month after the meeting. The report will contain the NTSB's analysis of the facts, conditions and circumstances of the accident. I am not at liberty to answer analytical questions prior to the release of the report. Therefore, my answers to your questions as given below include only factual information. All the documents that I refer to in my answers, as well as many more that pertain to the accident, can be found online at www.ntsb.gov. The majority of the documents are contained in the public docket for this accident investigation, located at:

http://www.ntsb.gov/Dockets/Aviation/LAX08PA259/default.htm

I encourage you to review the contents of the public docket in detail. I also encourage you to watch the webcast of the Board meeting on December 7th. The meeting begins at 9:30 am eastern standard time, and there will be a link on the homepage of the NTSB website (www.ntsb.gov) for the webcast. If you are not available at the time of the Board meeting, the webcast is archived so that you can view it at a later time.

1. Why is 32 degrees Celsius, 6103 feet pressure altitude and zero wind being used as the temperature, altitude and wind to compute actual conditions created by the NTSB's investigators. I specifically recall stating the actual temperature of 12 to 13 degrees cooler when asked by Roark while we were sitting on the ground at H-44. Also, the altitude at H-44 per the NTSB's own report is 5946 feet and per the CVR the wind call-out from the forest service personnel on the ground at H-44 was 3-5 knots out of the southeast. This is a serious concern because it specifically affects the performance of the helicopter and determines without doubt the aircraft had sufficient power to execute the takeoff.

   The temperature, pressure altitude, and wind speed at H-44 for the accident takeoff were estimated at 23° C (not 32°C); 6,106 feet; and calm, respectively. The details of how these estimates were made can be found in the Meteorology Factual Report and the addendum to that report, which are available in the public docket at the link given above. Additionally, there is an Approach and Landing Study in the docket which was conducted in order to accurately estimate the helicopter's altitude when the CVR recorded your statement that the OAT was 20°C.

2. Why hasn't the NTSB focused on the finding of the #2 engine emergency throttle position? After I had ensured both engine throttles were at the full forward position and the rotor RPM was decreasing, I have memories that I grabbed the #2 emergency throttle and advanced it forward. Because I was unable to recall this with the same detail as other events, I did not want to assume those actions. However, on 9 November 2010 at 11:28 am local time I received a phone call from Roger Douglas. After some brief friendly conversation he asked how I was doing. I replied I was having a hard time trying to understand the direction the NTSB's investigation is going in light of all of the physical evidence. Evidence such as the NTSB's insistence of using 32 degrees not the actual 19-20 Celsius that I reference while on the ground at H-44. 6103 feet PA as the actual altitude and a zero wind condition when the actual temperature is clearly heard on the CVR. Missing FCU parts, contaminates found in the #2 FCU; specifically

the PRV. A 30% torque split between the #1 and #2 engines. A lack of FOD damage to the #2 engine and the position of the #2 engine emergency throttle. I then said that I wished that I could vividly recall moving the #2 engine emergency throttle with the same vivid memory of recalling the temperature of 19-20 Celsius. He replied, "wait, wait,!! When Deb and I came and seen you in the ICU after you woke up, you told me that you moved that #2 emergency throttle". I replied "I did"?, and Roger said "yes, you did". I then asked if he could recall in enough detail that conversation to testify, and he told me "yes". I told him to remember this conversation.

You are correct in stating that, as documented in the Airworthiness Group Chairman's Factual Report, the cockpit emergency throttles were found mismatched with the #2 advanced about halfway and the # 1 shut-off. However, you did not make note of the fact that the report also states that "this position may not be representative as [the emergency throttles] are friction-detented only." Further, the report also documents that when the FCUs were examined on scene both emergency throttles were found in the closed, or shut-off, position. (See pages 66 and 72 of the Airworthiness Group Chairman's Factual Report, which is available in the public docket.)

3. Why has there been no concern regarding the missing #2 FCU parts? Did the NTSB conduct an investigation after learning of the missing FCU parts? Who was responsible for the chain of custody of the engines and FCU's?

I believe you are referring to components of the #1 FCU's T2 bellows assembly. Following the examination at the Columbia Helicopters' facility, both FCUs were stored at Columbia Helicopters and then shipped to the NTSB headquarters in Washington, DC. Upon opening the shipping containers, the NTSB conducted an inventory of the hardware, which revealed that the following components of the #1 FCU's T2 bellows assembly were not present: aluminum dust cover, snap retainer ring, spring retainer cap, spring, and bellows. A review of a video recording taken by Columbia Helicopters personnel of the

packaging of the FCU parts determined that the missing parts were not present at the time of packaging and therefore were not packaged and shipped to the NTSB. The NTSB did conduct an investigation into the disappearance of these parts. It can be found at:
http://www.ntsb.gov/Info/FOIA-2009-00249%20release.pdf

4. Why was contaminate removed from the FCU fuel filter prior to determining the percentage of blockage? Why was that blockage test not performed per the manufacturers procedures?

As described in the Errata Sheet for Materials Laboratory Report 08-121, which is available in the public docket, prior to performing the light examination with a magnifying glass and estimating the amount of plugging of available open area on each screen filter, sample particles were removed with carbon double-sided adhesive tape from the screen filters. The amount of plugging of available open area was determined later using an adjacent area of the screen where particles were not removed with double adhesive tape.

As described in Materials Laboratory Report 08-121, the inspection procedure used was as follows: Fiber optic light was inserted inside a screen filter. When viewed from outside the screen with a 12.5X glass, the available open areas were estimated by the amount of light that passed the inner 40 micrometer screen. The estimate takes into account the available open areas all around the circumference of the filter. The permanent and removable filters were inspected separately (disassembled from each other).

5. Why was the PRV contaminate study withdrawn before it was completed?

Materials Laboratory Report 08-121 was completed, and it is available in the public docket.

6. Why the focus on the 2.5 minute power charts when the flight lasted ninety seconds? We obviously never held power at any level between 2.5 and 5 minutes. We'd crashed by then.

The discussion of 2.5 minute power charts and 5 minute power charts in the Operations Factual Report pertains to their use in preflight load calculations.

7. If the sound spectrum analysis is so accurate, where on the analysis is the four plots that represent the rotor blade impacts to the four known trees found during the post-crash investigation?

The sound spectrum analysis was conducted to document significant rotor system and engine sounds that could be heard during the flights. No attempt was made to identify sounds correlating with blade strikes, although such sounds may have been recorded.

8. Why has the NTSB not determined the source of the fiberglass fibers found in the #2 FCU PRV? Are these fibers consistent with the plating material that Columbia Helicopters, Inc. applied during the FCU overhaul? Or, are these fibers from the aircrafts center tank collector can? Why has there been no focus on this contaiminates source? This lack of concern is disturbing.

The microscopic particles found in the PRV from the #2 FCU were not fiberglass. As detailed in Materials Laboratory Report 08-121, energy dispersive spectroscopy (EDS) of the microscopic particles found in the PRV from the #2 FCU showed elemental peaks of carbon and oxygen, which indicated the particles were not fiberglass. However, EDS of the microscopic particles found in the PRV from the #1 FCU showed elemental peaks of silicon, aluminum and calcium, which indicated that these particles were fiberglass.

Report 08-121 also details the results of examination of a sample of the wall portion from a collector can that was submitted to the NTSB Materials Laboratory by Carson Helicopters. The diameter of the straight rod fibers from the

collector can measured between 8 and 10 micrometers, similar to the diameter of the fibers found in the PRV from the #1 FCU. EDS analysis of a straight rod fiber from the collector can produced a spectrum that contained major elemental peaks of silicon, aluminum and calcium with minor elemental peaks of magnesium, oxygen, carbon, consistent with silicate glass fiber such as E-glass.

Again, I urge you to review the documents in the public docket and listen to the Board meeting. If you have further questions, please feel free to contact me directly.

Sincerely,

James F. Struhsaker
Investigator-In-Charge
Senior Air Safety Investigator
National Transportation Safety Board

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