GE - Aviation

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GE Submission to NTSB for Carson S-61N Accident (N612AZ)

History of Flight (8/5/08)

During takeoff and initial departure from Helispot H44 (~6,000 feet elevation in Trinity National Forest), the helicopter with 3 crew and 10 firefighters on board experienced a droop in main rotor speed, and subsequently impacted trees and terrain. Post impact fire destroyed the helicopter, with 9 fatalities and 4 injuries. The helicopter was being operated in VMC conditions by Carson Helicopter Services under contract to the US Forest Services.

Subsequent Investigation

NTSB teardown investigation of both CT58 engines and their fuel controls (FCU), supported by all the parties, found no evidence of any mechanical malfunction or fuel system anomaly which could have caused a loss of engine power to the main rotor. The NTSB's CVR Sound Spectrum Study showed that both engines were operating at their 'topping' gas generator speed (Ng) during all 3 takeoffs from H44 that evening, including the accident takeoff. The term 'topping' refers to the maximum gas generator speed available, when the engine would also be producing maximum power. This CVR sound spectrum study also showed main rotor speed drooping while the engines were running at 'topping' Ng during all 3 H44 takeoffs, with the most severe droop being experienced during the accident takeoff.

The NTSB's detailed calculation of the empty weight of N612AZ based on its documented historical configurations showed it to be 1,440 pounds heavier than that provided in Carson's weight charts to their pilots for load calculations. Carson disputes this calculation on various grounds, but acknowledges that the helicopter was more than 1,000 pounds heavier than their own charts stated. When the documented payloads and estimated fuel loads for each of the 3 H44 takeoffs are taken into consideration, the gross weight for the accident (third) H44 takeoff was much heavier than for the first two H44 takeoffs. Specifically, using the NTSB's calculated empty weight, the gross weight for the first H44 takeoff was 18,385 pounds, for the second takeoff it was 18,025 pounds, and for the accident takeoff it was 19,110 pounds.

At the prevailing H44 conditions for the accident takeoff of 6,106 feet pressure altitude, 23ºC OAT and 19,110 pounds gross weight, GE's Power Study concluded that even with both engines running at their 'topping' speed and producing maximum power with their documented performance margins, the total power available would still be insufficient to sustain hover out of ground effect (HOGE). This Power Study also noted that during the first H44 takeoff, at 6,106 feet PA and 29ºC OAT with 18,385 pounds gross weight, both engines running at 'topping' would provide minimal margin to that required for hover OGE. This is consistent with GE's analysis of the SkyConnect data for N612AZ's first departure from H44 between the trees, and with witness reports on board who commented that the helicopter felt like it was 'laboring' and expressed concern for their safety as this flight path took them below the tree-top level.

GE Flight Crew Procedural Concerns

1) During none of the H44 takeoffs did the pilots pause while still hovering in ground effect (HIGE) for long enough to perform a power assurance check, which would have shown them they had insufficient power available to hover out of ground effect for their prevailing weight and ambient conditions. Had this been done, they may also have seen that the torque was too high for a HIGE at their calculated gross weight at these conditions. This would have been a 'red flag' to them that something was not right.
2) The pilots should have noticed during an in-flight power check when approaching H36 Helispot about 2 hours before the accident that the engines were operating at a torque level that was too high for the helicopter's calculated gross weight. The pilots recorded the engine torques as 80% during this power check, which is about 6% higher than what it should have been for this weight and flight conditions. This power check should have indicated to the pilots that their assumed weight was too low by more than 1,000 pounds. Yet they continued to fly using load calculations based on an erroneous calculated weight and took on additional payload and fuel load just before the accident takeoff.
3) The pilots did not notice (or failed to take into account) that the engines reached topping speed during each of their first 2 H44 takeoffs. The engines should not have been anywhere near topping speed on either takeoff based on the calculated helicopter gross weight they were using (refer to GE Power Study). This again should have been a 'red flag' to the pilots that something was not right. Pilots performing passenger-carrying operations (ie. non-jettisonable load) should not approach topping during takeoff. So not only should the topping on the first two takeoffs have alerted the pilots to the overweight condition, it also should have caused them to abort the takeoff and ascertain why they were outside safe operating parameters. Further, if the pilots had known the engines were at topping during the second takeoff, they would have known they could not take on an additional 1,000+ pounds of payload and fuel load for the third (accident) H44 takeoff.

GE's Opinion on Cause of Accident

GE believes all available evidence clearly shows that the crash resulted from the helicopter being overweight for the prevailing H44 takeoff conditions and loads. Even with both engines running at their maximum power throughout the accident takeoff, this overweight condition still led to a significant droop in main rotor speed as the helicopter left ground effect. This main rotor speed droop caused a large reduction in the lift capability of the main rotor blades. As the pilots were transitioning to forward flight this loss of lift capability caused the helicopter to descend into the trees and subsequently crash. In summary, N612AZ's actual gross weight at the prevailing ambient conditions was beyond the maximum hover OGE power capability of the two normally operating engines.

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