U.S. Department
of Transportation
**Federal Aviation
Administration**

Office of Accident Investigation and Prevention

800 Independence Avenue SW
Washington DC 20591

JUL 6 2010

James Struhsaker
National Transportation Safety Board (NTSB)
Senior Air Safety Investigator
Kailua-Kona HI 96740

Dear Mr. Struhsaker:

The Federal Aviation Administration (FAA) New York Aircraft Certification Office, in response to your accident investigation information support request 10-169, is providing the following written statement to comments made during the NTSB April 28, 2010, technical review of Carson Helicopters Inc. (CHI).

While the CHI reports of the company flight tests conducted on October 24, 2008 and November 3, 2009 (in support of the accident investigation) contain much comprehensive data, it should be noted that the data presented is only to support the aircraft weight and altitude restrictions of the environmental conditions for that particular test. The data was gathered during what was in effect a free flight hover performance test, that is, the aircraft was not tethered via an instrumented cable. While the data collected was similar to that which would have been revealed during a normal preliminary power required hover performance flight test, the range of data and the flight test methodology were different. Data gained during a certification flight test is analyzed and manipulated to create non-dimensional data in order to develop power required charts. The data presented in the CHI flight test reports were gathered strictly to substantiate the S-61N loading configuration and capability based on the environmental conditions of the test flight. CHI has admitted their sole purpose for performing the tests was an attempt to try and re-create the conditions of the accident and to show that the aircraft had the capability to continue safe flight.

A hover performance flight test accomplished by an applicant (and subsequently verified by the FAA) during aircraft certification supports data analysis far more in depth than what was provided by the CHI reports. During certification flight tests the company is required to provide aircraft hover performance charts presented in the Rotorcraft Flight Manual Supplement (RFMS) for operators to understand what the capability of the aircraft is based on gross weight, ambient temperature, and pressure altitude. They can either choose to present a hover ceiling chart which encompasses the power available provided by the engines and the power required which is based on the aircraft plan form or they can just

supply power available and power required charts in the RFMS for the operator to compute the parameters that can be met. The latter is the case for the S-61 model aircraft.

As stated previously, the power available is generally supplied by the aircraft's engine manufacturer to provide what the resultant torque for each engine would be based on the operating pressure altitude and the ambient temperature. This value reflects the engine installation into the airframe taking into account inlet area, anti-ice systems, or any bleed air degradations and is stated as such on each chart. The power required charts are developed during flight test to establish power requirements for varying weights and should be performed at three different locations, a low altitude location, medium altitude location, and a high altitude location. The flight tests are generally accomplished by employing the tethered hover method. This is where the aircraft is secured to the ground by a cable of fixed length with the cable being instrumented for tension by use of a load cell. As was done during the CHI flight testing which was accomplished in support of the investigation, data gathered during the hover performance tests include torque, rotor RPM, pressure altitude, outside air temperature, relative wind speed (which needs to be 3 knots or less for acceptable data), fuel remaining, cable tension (read from a cockpit display showing the load cell reading), and hover height. It should also be noted that the aircraft weight, ballast, scales used to conduct the weighing of the aircraft and ballast, aircraft cockpit instrumentation (torque, rotor RPM, airspeed indicator, etc.) and flight test instrumentation all need to be calibrated and conformed before any FAA certification flight tests are conducted.

The data is then used to calculate non-dimensional data parameters of coefficient of power (Cp) and coefficient of thrust (Ct) by using air density, disk area, and rotor tip speed. Once this is obtained, a plot can be generated of Cp as a function of $Ct^{3/2}$ (based on the linear relation of weight to power) at each hover height and altitude. From this plot it is now possible to derive power required for varying weights and altitudes. If the applicant chooses to, it can also develop a hover ceiling chart by creating a cross plot of the power required and power available or just leave it as separate charts.

Another method in gathering the data specified above is the free flight hover method whereby the aircraft has a weighted string attached to the aircraft but is not anchored to the ground. This is more difficult due to the dilemma of establishing a consistent hover height and the hazard of potentially encountering a vortex ring state condition. Generally the tester will try to use a form of visual reference to maintain hover height by using a tethered balloon next to the test site or near a surveyed building with the roof being a known height above the ground. This is the method the FAA normally uses when the FAA flight test team performs a spot check of the data at the various locations the applicant has chosen to do the test. The identical data is gathered minus the load cell data which is replaced by a calculation of the actual aircraft weight during the test. The data is then compared directly to the company data by plotting it all along the company supplied Cp-Ct curve that was originally developed.

Although the CHI supplied data from two flight tests performed during the investigation is very in depth and encompasses some of the parameters normally obtained during a standard

hover performance flight test, it should be realized that these tests were not conducted in the same manner as FAA certification tests and only produced a snapshot of the aircraft at a specific weight and environmental condition hoping to replicate the accident aircraft's conditions and not intended to substantiate the power required charts that are found in the RFMS' containing power required charts. CHI has agreed with this position and has stated they were only trying to provide data for the accident investigation and were not trying to prove or disprove the charts.

If you require additional information, please contact Ms. Kimberly Burtch of the Accident Investigation Division at [redacted]

Sincerely,

[redacted]

B. Hooper Harris
Manager, Accident Investigation Division