Date: 26 October 2008

Performance Test of N61NH S61 Helicopter to Duplicate Flight conditions of Iron 44 accident

A flight test was conducted on 24 October 2008 by Carson Helicopters in Grants Pass, Oregon. This test was done to replicate flight conditions experienced by 612AZ during the lift-off at the Iron 44 accident.

Two pilots, one mechanic and one observer onboard the A/C.

Aircraft Used- S61 Standard category Tank Equipped helicopter, N61NH. Aircraft was detuned to slightly below minimum spec. 140-1 engines (below performance levels of 612AZ).

A/C weight – 12859 lbs.

Crew - 860 lbs.

Fuel at takeoff- 2810 lbs.

RPM at flat pitch – 108.2

Topping check – # 1 engine 101.8 – 18 deg. 3000' 705 T5; #2 engine 101.5- 16 deg. 3000' 703 T5, 105% torque.

**Flight Test #1 – hover out of ground effect**

2340 lbs. fuel, 370 gallons of water onboard, Aircraft weight gross 19,330 lbs.

13 deg. 7700 ' PA

90 % torque, 103 % Nr, aircraft climbing at 900 FPM.

Pull collective to top stop and hold there, Nr slowly drops off to a low of 95% Nr, won't go lower, 92 % torque, aircraft still climbing at 400 FPM.

Collective lowered 1 ", aircraft Nr goes back to 102% in less than 2 seconds, immediately climbs at faster rate.

**Test # 2**

2200 lbs. fuel, 370 gallons water, aircraft weight 19,190 lbs.

20 deg.  4500' pressure altitude.

101 % torque, lower Nr to 96, no droop in blades, even with Ng at topping.  Lower collective less than 1", aircraft back to 104% in 2 seconds.

**Test #3-   simulate engine power loss**

Same aircraft weight, ease power back on #1 engine, simulate losing power.  Nr droops to 90%, drooping, blade RPM does not come back with loss of power on number 1 engine.

**Test # 4 – takeoff and IGE hover with engines at 106.5 %**

2040 lbs. fuel, 370 gallons water onboard.

20 deg. 1000' pressure alt.

IGE hover   77 % torque, Ng 97,96.5;    push to 100 Nr, aircraft hovering, but sluggish and slow.   Push throttles forward- immediate power, Nr up to 102, easily hover and takeoff.

**From:** Andy Mills
**To:** Struhsaker Jim; Haueter Tom;
**Subject:** reply regarding flight evaluation questions
**Date:** Wednesday, April 14, 2010 11:34:15 AM

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Jim,

I apologize for the slight delay in reply to your questions. I was on vacation for the week when you sent your request, and was gone on business for part of the following week. Please see our answers to your questions shown below each of your original queries.

How did you arrive at a gross weight for test #1 of 19,300 lbs? We calculate 19,149 lbs.

| | |
|---|---|
| Empty weight = | 12,859 lbs |
| Crew = | 860 lbs |
| Fuel = | 2340 lbs |
| Water = 370 gal x 8.35 lb/gal = | 3090 lbs |
| TOTAL = | 19,149 lbs |

2. How did you arrive at a gross weight for test #2 of 19,190 lbs? We calculate 19,009 lbs.

We have rechecked our notes for that test and we concur with your weights. The weights of 19,149 lbs. and 19,009 lbs. are correct, and we erred in the previous weight listing.

3. We calculate that the density altitude (DA) for test #1 was about 9,230 ft (7,700 ft pressure altitude at 13° C). At this DA, the reported climb rate was 900 fpm. In the Whipple Flight Test Report on the November 3, 2009 Carson flight testing, the best performance reported was from flight #1, a 200 fpm climb rate at 19,103 lbs and 8,673 ft density altitude. How do you account for this difference in performance? Why did the helicopter perform significantly better at a higher DA (900 fpm climb at 9,230 ft DA), than at a lower DA (200 fpm climb at 8,673 ft DA)?

The original informal flight test was done to closely replicate accident flight conditions and simply see if the aircraft had any problems flying those weights and to see what the rotor disc would do with collective droop. As such, it was not as structured as the subsequent flight test. However, if you refer to the parameter section under Flight test #1 on the October 2008 report, you will note that the 900 fpm rate of climb at that density altitude was with the rotor Nr at 103 %. The 200 fpm rate of climb listed in the second flight evaluation done in 2009 at 19,103 lbs. was recorded after pulling the collective to top stop and the Nr had deteriorated to 94 %. The large difference in Nr would more than explain the difference in rate of climb.

4. Additionally, in reviewing the Whipple test data, we noted that the performance recorded on flight #1 is significantly better than the performance recorded on any of the tests during flight #2. How do you account for this difference in performance? Why did the helicopter perform significant better during flight #1 than it did during the tests on flight #2?

| Flight | DA | ROC/ROD | Weight |
|---|---|---|---|
| Flight 1 | 8673 | 200 | 19,103 |
| Test 1 | 8490 | 100 | 18,643 |
| Test 2 | 8490 | 0 | 18,518 |
| Test 3 | 8500 | 100 | 18,418 |
| Test 4 | 8450 | 100 | 18,368 |
| Test 5 | 8551 | 300 | 18,300 |
| Test 6 | 8550 | -300 | 19,543 |
| Test 7 | 8490 | -300 | 19,493 |

We would assume that the test ROCs recorded during flight # 2 that you are comparing to flight #1 are the weights ranging from 18,300 to 18,643. These ROC vary from 0 to +300, depending on weight. The ROC on the first test flight was +200 at 19,103.

1) We would submit that this is not a" significantly" better performance, in that the margin of difference of a 100 fpm or so with a 400-600 lb. weight difference on a nearly 20,000 lb. aircraft is not a large margin of difference. However, we agree there is a margin of difference.

2) I spoke with two of the pilots involved in the test evaluation, and they inform me that on the very first test run at 19,103 lb. , they pulled the collective to max stop, and shortly after the rotor stabilized at 94%, they recorded the rate of climb. On the subsequent set of flights, they went to max collective until maximum droop was achieved and held the flight conditions there for a longer period to ensure "maximum worst case flight input " conditions, then recorded ROC and other parameters. They felt that might be why the very first flight was a little better on the ROC.

We feel it has to be reinforced that each of these rates of climb were noted under the worst input conditions, and in every case the rotor stabilized and would not droop below 94% (except when power loss on one engine was purposely induced), even with input conditions that no experienced pilot would induce or hold. As you are aware, this is quite different than what is portrayed on the CVR spectrum plot for Nr.

Introducing larger, positive rates of climb even at the 19,500 lb. weights was as simple as assuming a more normal collective input, as an experienced pilot would normally do (i.e. the collective pitch would be reduced at the pilots determination of best ROC to maintain optimum Nr) . All of these loads were picked up and flown with positive rates of climb up to a stabilized hover by utilizing normal pilot technique at standard Nr levels prior to commencing the maximum input test.

Let me know if I can provide further input,

Best regards,

*Andy Mills*
***General Manager***
***Carson Helicopter Services***
Phone: ------------------
Fax: 541-955-9205
Cell: -------------------

*Andy Mills*
***General Manager***
***Carson Helicopter Services***
Phone: ------------------
Fax: 541-955-9205
Cell: -------------------