USDA United States Department of Agriculture | Forest Service | Washington Office | 1400 Independence Avenue, SW Washington, DC 20250

File Code: 6730

Date: May 26, 2010

Mr. Thomas E. Haueter
Chief, Major Investigations Division
National Transportation Safety Board
[redacted]

Subject: US Forest Service Submittal for the LAX08PA259 Weaverville, California Sikorsky, S-61N Helicopter, N612AZ Accident

Reference: NTSB Final Technical Meeting April 28, 2010

Dear Mr. Haueter:

As discussed during the reference technical review, please find enclosed a copy of the US Forest Service submission to the Weaverville Accident Investigation.

We would like to thank the NTSB for giving us the opportunity to make this submission. If you have any questions, please contact me at (202) [redacted] or via email at [redacted]

Best Regards,

[redacted]
JANETTE S. KAISER
USFS Serious Accident Investigation Team Lead

cc: Mr. Jim Struhsaker
Investigator in Charge
National Transportation Safety Board
[redacted]

Submission to the

National Transportation Safety Board

for the

LAX08PA259 Weaverville, California
Sikorsky S-61N, N612AZ Helicopter Accident

August 5, 2008, 1941 Pacific Daylight Time

USDA Forest Service
May 26, 2010

INTRODUCTION: On August 5, 2008, about 1941 Pacific Daylight Time, a Sikorsky S-61N helicopter, N612AZ, impacted trees and terrain during the initial climb after takeoff from Helispot 44, located at an elevation of about 6,000 feet in mountainous terrain near Weaverville, California. The airline transport pilot, the safety crewmember (Helicopter Inspector Pilot) and seven firefighters were killed; the commercial copilot and three firefighters were seriously injured. Impact forces and a post crash fire destroyed the helicopter. The helicopter was being operated by the United States Forest Service (USFS) as a public use flight to transport the firefighters from Helispot 44 to another location. The helicopter was registered to Carson Helicopters, Inc. (CHI) of Grants Pass, Oregon, and leased to Carson Helicopter Services, Inc. (CHSI) of Grants Pass. The USFS had contracted with CHI for the services of the helicopter. Visual meteorological conditions prevailed at the time of the accident.

SUBMISSION ABSTRACT:

- In this document, the USDA Forest Service (USFS) will use the term CH to refer to both Carson Helicopters, Inc., (CHI) and Carson Helicopter Services, Inc. (CHSI), unless otherwise noted.

- The USFS is acting as a party to the NTSB investigation as the operator of the accident aircraft as a public use flight. The accident helicopter was under contract to the USFS by Carson Helicopters, Inc.

- The comments and conclusions in this submission are based on factual information, USFS expertise and a methodical investigation process.

- The USFS believes the probable cause of the accident was the inability of the helicopter to climb after takeoff. CH provided to the flight crew inaccurate weight and balance data and altered flight manual performance charts which, when used for performance planning calculations, produced incorrect, exaggerated performance capabilities for the aircraft. When using correct data, the accident helicopter was actually 3,296 pounds overweight at takeoff.

- The investigation did not reveal any anomalies with the helicopter or its systems.

USFS ASSISTANCE WITH THIS INVESTIGATION

The National Transportation Safety Board (NTSB) led the investigation into the Weaverville Sikorsky S61N Helicopter accident. Assisting the NTSB in their investigation are the Federal Aviation Administration (FAA), Sikorsky, GE, USFS, BAE, and Carson Helicopters.

NTSB allows parties to make submissions of finding from the evidence gathered during the course of the investigation. The USFS has responded to the NTSB request with this document, which:

- Provides an assessment of the evidence and other pertinent data
- Identifies knowledge gained and USFS actions taken as a result of the investigation
- Identifies conclusions and recommendations supported by the knowledge gained from the investigation

US FOREST SERVICE RESPONSE

The USFS concurs with all of the Group Chairpersons Factual Reports, Special Studies and Lab Reports provided to party members.

The USFS is very appreciative of all of the outstanding professional work accomplished by the Group Chairpersons and all of the Lab Technicians that provided additional testing and analysis for the individual reports.

Our agency believes that the NTSB party system has been paramount in getting factual information and has proven to be an effective way of conducting this investigation.

The USFS will remember those that perished that day and will use this opportunity to honor those lives by learning from the accident and taking actions to prevent such tragedies from happening again. The USFS looks forward to the Board's findings.

USFS SUBMITTAL TO OPERATIONS GROUP CHAIRWOMAN'S REPORT

USFS Requirements for FAR 135 Operations under Public Use Operations:
As a matter of USFS policy on all public use flights, all aircraft that carry persons other than the flight crew must comply with Part 135, and the contractor must hold a Part 135 Certificate. This is true regardless of whether the persons who are transported are qualified crewmembers, passengers, or otherwise. While the USFS had some responsibility as the public operator of the aircraft, it had exercised that responsibility in part by requiring compliance with Part 135 and other FAR's so as to ensure a greater margin of safety even though this was a public use aircraft flight.

The USFS is well aware that at times an operator may not be able to fully comply with Part 135 and the FAR's because of USFS mission requirements. However, such exceptions do not swallow the rule, and such exceptions are not pertinent to the accident flight or its probable cause. According to the contract and USFS policy, the accident aircraft was required to be Part 135 compliant and to possess a Part 135 certificate as an operator. Either CH had a valid, current Part 135 Certificate or it did not. Either the accident helicopter was Part 135 compliant or it was not.

It should be noted that the pilot retains final authority for safe operation of the aircraft and has the duty to refuse any flight or operation that the pilot deems unsafe.

Performance Planning:
The USFS was asked why helicopter operators calculate Hover Out of Ground Effect (HOGE) weight rather than Category A or B takeoff distance when doing performance planning. Category A or B are certification requirements. Flight manuals provide Category A and/or B takeoff criteria in their performance sections but FAR Part 135 does not require the use of Category A or B.

The Interagency Helicopter Operations Guide (IHOG), which is applicable to USFS helicopter operations including the accident aircraft and the USFS contract require that helicopter load calculations be completed for all flights using HOGE performance data. HOGE performance ensures that the helicopter will perform within the limitations established by the helicopter manufacturer without exceeding the gross weight for the environmental conditions where the helicopter is to be operated. Each day, the pilot calculates the HOGE performance for the highest altitude and hottest temperature that will be encountered that day. Once the HOGE computed gross weight has been determined by the pilot, that weight is reduced by an established amount to provide a protection for unknown conditions and for maneuvering the helicopter. This reduction in weight is referred to as the download or weight reduction. Operating within HOGE limitations allows a helicopter to takeoff, climb, hover, transition to forward flight, and clear all obstacles.

Engine topping and Main Rotor Blade Drooping:
It should be noted that both the CVR data and the Operations Report demonstrated the fact that the engines, on the first and second operational flights from H-44, had reached topping resulting in rotor droop and the flight crew never verbally acknowledged or expressed concern.

Based on the data collected and analyzed from the CVR, there is no doubt that the aircraft engines, in the third and fatal flight, were indeed topped and the main rotor was drooping. We know now that the flight crew had been given an inaccurate weight for the helicopter and invalid performance charts for flight planning.

Engine topping refers to maximum physical speed limit of an engine. To illustrate topping, imagine driving in your car from a flat road to an uphill grade and you apply additional gas to the engine by pressing on the accelerator to maintain speed. As the gradient increases, you will find it necessary to press down further on the accelerator to maintain speed. If the gradient becomes steep enough, you will be required to press the accelerator all the way to the floor. At that point, you will reach the maximum allowable gas flow to the engine, which will not be enough to prevent your car from decelerating.

The Sikorsky S-61helicopter operates much the same way as the car described in the previous paragraph. When the pilot raises the collective, which is linked to the fuel controls, more fuel is added to the engines to maintain engine and rotor speed. As the collective is raised, rotor blade angle of attack is increased, inducing more drag. Eventually, rotor speed will decrease once the maximum power available in the engine is reached. Slowing of the main rotor is compensated for by additional speed of the engine until the engine reaches its topping limit: there is no reserve; this is all you get. At this point, further demands of power by raising the collective will not produce any additional power in the engine (the engine is topped; has reached maximum speed). Once topped, the rotor system will begin to lose speed, which results in less lift of the rotor system. The rotor system depends on speed to produce lift, just as a fixed wing aircraft going down the runway requires speed to produce lift.

This reduction of speed of the main rotor after topping is called droop or drooping. At the point main rotor speed decays or droops, the speed is no longer sufficient to produce the lift required to sustain hover based on the weight of the aircraft and density altitude (temperature and altitude combined).

Weight and Balance:
Through the investigation, including information gathered by subpoena, it was revealed that CH had submitted a contract bid that included inaccurate weight and balance information of the aircraft. This gave CH an unfair contract advantage. The weight and balance also gave pilots and flight crews inaccurate information for performance planning.

Because of this accident, the USFS now conducts pre or post contract award weighs of aircraft to ensure contract compliance. The agency has taken additional actions in response to lessons learned in this accident. For a complete list of actions, see Post Accident Response section later in this document.

The USFS concurs with the aircraft weight findings in the Operations Report. The Chairwoman of the Operations report concluded an empty weight for the accident helicopter of 13,845 pounds and an accident gross weight of 19,008 pounds, which included the aircrew, passengers, cargo, and fuel weights. Refer to the Load Calculations in Figures A, B, and C, in the next section for performance capabilities.

Rotorcraft Flight Manual Performance Charts:
Through the investigation, including information gathered by subpoena, it was revealed that CH had submitted a contract bid that included an altered Power Available - Takeoff Power (5 min twin, 30 min OEI) (RFMS 5) performance chart for the aircraft. According to the FAA, the chart that was attached by the National Helicopter Program Manager (from CH contract bid proposal) for "Rotorcraft Flight Manual Supplement (RFMS) 5 is not the correct chart. The chart is labeled as 'RFMS 5 S-61L, N - Power Available, Takeoff Power (5 min Twin OEI), CT58-140-1, -2 engines 103% spec power' and dated Feb 7, 2008. According to our {FAA} records, the chart … provided is actually 'RFMS 8, S-61L, N -Power Available, (2 ½ min power OEI), CT58-140-1 engine 100% NR Specification power' dated February 7, 2008. The RFMS 8, Figure 1 chart is exactly the same as the Sikorsky Flight Manual Supplement 15 Figure 15-4-8. The New York Aircraft Certification Office (NYACO) did not validate the RFMS 8 Supplement, Figure 1 since this chart was validated during the certification of the S-61N." This altered performance data allowed CH to meet minimum contract specifications and win a contract award (a multi-million dollar contract). The submitted performance chart also gave pilots and flight crews inaccurate information for performance planning.

The April 7, 2010, letter from the FAA to the NTSB concluded that RFMS 7 and 8 were distributed and used by CH but not properly installed in accordance with the supplemental type certificate (STC) and Federal Aviation Regulations.

CHI, by design, required the purchase and installation of the Carson Composite Main Rotor Blade STC with the installation of the Fire King Tank STC. However, the Composite Main Rotor Blade STC states clearly "*No Change"* on performance. The Composite Main Rotor Blade STC directs the user back to the Basic Sikorsky Flight Manual performance charts for the aluminum blades (the original equipment on the aircraft). To capitalize on any additional performance of the CHI Composite Main Rotor Blades the customer would have to buy and install the STC's for RFMS 7 and 8 (applicable for the long-body S-61, and therefore the accident aircraft as well).

The FAA's letter identified a couple of key points in regards to the STC's and their use on this accident aircraft.

1) In order to use the RFMS 7, the operator would have to purchase the STC, fill out FAA form 337 (Major Repair and Alteration) and have the installations approved on this form by an FAA approved Repair Station or FAA licensed Inspection Authorization Technician and the FAA. Additionally, the major alteration would need to be recorded in the airframe logbook in accordance with the Federal Aviation Regulations (FARs). Lastly, the RFMS 7 would be installed in the aircraft's flight manual. The STC was not signed-off in the airframe logbook as being installed. The FS agrees with the FAA that the STC is a "Major Alteration" (as opposed to minor) due to the fact that by the STC's design it alters the "operational characteristics" (performance) of the helicopter thus requiring an FAA Form 337.

2) In order to use the RFMS 8 the FAA has determined in the April 7, 2010 letter that the STC for the Goodrich Rescue Hoist System and its incorporated RFMS 8 requires that the hoist be installed (as opposed to the partially installed). In other words, without the hoist installed, the RFMS 8 is not to be used. The hoist was not installed on this aircraft at the time of the accident. Thus, the operator would be required on this accident aircraft to use the Basic S-61 RFM for performance planning. The hoist was annotated as being removed on the Carson Chart "C" (a running tabulation of current weight once items are removed or installed); however, a maintenance entry was not documented in the airframe logbook of its removal.

INTERAGENCY HELICOPTER LOAD CALCULATION Electronic Version 1.0 (3/04)				MODEL	S61N		
				N#	612AZ		
PILOT(S)	[redacted]			DATE	8/5/2008		
MISSION	IA			TIME	1400		
1	DEPARTURE			PA		OAT	
2	DESTINATION			PA	6000	OAT 32	X
3	HELICOPTER EQUIPPED WEIGHT				12408		
4	FLIGHT CREW WEIGHT				440		
5	FUEL WEIGHT 343 gals X 7 lbs/gal				2400		
6	OPERATING WEIGHT (3 + 4 + 5)				15248		
		Non-Jettisonable		Jettisonable			
		HIGE	HOGE	HOGE- J			
7a	PERFORMANCE REFERENCE (List chart/supplement from Flight Manual)	RFMS#6,7,8--#6 Fig.4--#8 Fig.4,5	RFMS#8 Fig.4,5,7	RFMS#8, Fig.4,5,7			
7b	COMPUTED GROSS WEIGHT (From Flight Manual **Performance** Section)	19600	18400	18400			
8	WEIGHT REDUCTION (Required for all Non-Jettisonable loads)	560	560				
9	ADJUSTED WEIGHT (7b minus 8)	19040	17840	18400			
10	GROSS WEIGHT LIMITATION (From Flight Manual **Limitations** Section)	17800	17800	22000			
11	SELECTED WEIGHT (**Lowest** of 9 or 10)	17800	17800	18400			
12	OPERATING WEIGHT (From Line 6)	15248	15248	15248			
13	ALLOWABLE PAYLOAD (11 minus 12)	2552	2552	3152			
		OK	*OK*	*OK*			
14	PASSENGERS/CARGO						
	[HazMat: chainsaw gas, 2 gals, cargo compartment]						
15	ACTUAL PAYLOAD (Total of all weights listed in Item 14) **Line 15 must not exceed Line 13 for the intended mission (HIGE, HOGE or HOGE-J)**			0			
PILOT SIGNATURE				HazMat Onboard			
MANAGER SIGNATURE				YES		NO	

Figure A. Using altered RFMS 8 Performance Charts distributed by CH

The altered RFMS 8 was used by the flight crew (along with the inaccurate weight and balance data) to determine the performance of the aircraft for the day. This is the performance information the pilots calculated for the aircraft for the accident flight.

INTERAGENCY HELICOPTER LOAD CALCULATION Electronic Version 1.0 (3/04)								MODEL	S61N		
								N#	612AZ		
PILOT(S)	[redacted]							DATE	8/5/2008		
MISSION	Troop Shuttle							TIME	1700		
1	DEPARTURE	Trinity						PA		OAT	
2	DESTINATION	H36/H44						PA	6106	OAT 23	X
3	HELICOPTER EQUIPPED WEIGHT							13845			
4	FLIGHT CREW WEIGHT							440			
5	FUEL WEIGHT	308	gals	X	7	lbs/gal		2158			
6	OPERATING WEIGHT (3 + 4 + 5)							16443			
								Non-Jettisonable		Jettisonable	
								HIGE	HOGE	HOGE- J	
7a	PERFORMANCE REFERENCE (List chart/supplement from Flight Manual)							RFMS#6 Fig.4	RFMS#8 Fig.4,5,7	RFMS#8 Fig. 4,5,7	
7b	COMPUTED GROSS WEIGHT (From Flight Manual **Performance** Section)							18125	17550	17550	
8	WEIGHT REDUCTION (Required for all Non-Jettisonable loads)							560	560		
9	ADJUSTED WEIGHT (7b minus 8)							17565	16990	17550	
10	GROSS WEIGHT LIMITATION (From Flight Manual **Limitations** Section)							19400	19400	22000	
11	SELECTED WEIGHT (**Lowest** of 9 or 10)							17565	16990	17550	
12	OPERATING WEIGHT (From Line 6)							16443	16443	16443	
13	ALLOWABLE PAYLOAD (11 minus 12)							1122	547	1107	
								Payload Exceeded	*Payload Exceeded*	*Payload Exceeded*	
14	PASSENGERS/CARGO									2565	
	[HazMat: chainsaw gas, 2 gals, cargo compartment]										
15	ACTUAL PAYLOAD (Total of all weights listed in Item 14) **Line 15 must not exceed Line 13 for the intended mission (HIGE, HOGE or HOGE-J)**									2565	
PILOT SIGNATURE										HazMat Onboard	
MANAGER SIGNATURE										YES X NO	

Figure B. Using FAA approved RFMS 8 Performance Charts for the CH Composite Blades

Using the Interagency Load Calculation form and inputting the known weights, environmental conditions, and using the FAA approved performance charts, the allowable payload noted above in Figure B was determined. Allowable payload for HOGE is 547 pounds. The total weight of personnel and cargo on board, including the Pilot Inspector was 2565 pounds, which meant the aircraft was 2018 pounds over the allowable payload (547 – 2,565 = -2,018).

INTERAGENCY HELICOPTER LOAD CALCULATION Electronic Version 1.0 (3/04)									
					MODEL	S61N			
					N#	612AZ			
PILOT(S)	[redacted]				DATE	8/5/2008			
MISSION	Troop Shuttle				TIME	1700			
1	DEPARTURE	Trinity			PA		OAT		
2	DESTINATION	H36/H44			PA	6106	OAT	23	X
3	HELICOPTER EQUIPPED WEIGHT					13845			
4	FLIGHT CREW WEIGHT					440			
5	FUEL WEIGHT	308 gals X	7 lbs/gal			2158			
6	OPERATING WEIGHT (3 + 4 + 5)					16443			
				Non-Jettisonable		Jettisonable			
				HIGE		HOGE		HOGE- J	
7a	PERFORMANCE REFERENCE (List chart/supplement from Flight Manual)			RFM Pg.4-116C; Pg.4-19		RFM Pg.4-116C; Pg.4-17		RFM Pg.4-116C; Pg. 4-17	
7b	COMPUTED GROSS WEIGHT (From Flight Manual **Performance** Section)			17300		16272		16272	
8	WEIGHT REDUCTION (Required for all Non-Jettisonable loads)			560		560			
9	ADJUSTED WEIGHT (7b minus 8)			16740		15712		16272	
10	GROSS WEIGHT LIMITATION (From Flight Manual **Limitations** Section)			19000		19000		22000	
11	SELECTED WEIGHT (**Lowest** of 9 or 10)			16740		15712		16272	
12	OPERATING WEIGHT (From Line 6)			16443		16443		16443	
13	ALLOWABLE PAYLOAD (11 minus 12)			297		-731		-171	
				Payload Exceeded		*Payload Exceeded*		*Payload Exceeded*	
14	PASSENGERS/CARGO							2565	
	[HazMat: chainsaw gas, 2 gals, cargo compartment]								
15	ACTUAL PAYLOAD (Total of all weights listed in Item 14) **Line 15 must not exceed Line 13 for the intended mission (HIGE, HOGE or HOGE-J)**							2565	
PILOT SIGNATURE							HazMat Onboard		
MANAGER SIGNATURE							YES		NO

Figure C. Using correct RFMS CH-03 Performance Charts for metal blades

This chart represents compliance with the FAA letter dated April 7, 2010, for use with metal blades. Based upon the calculation using the correct aircraft weight, performance data, and payload (2,565), the helicopter was 3,296 lbs overweight (-731 - 2,565 = -3,296).

USFS SUBMITTAL TO AIRWORTHINESS GROUP CHAIRMAN'S REPORT

The USFS concurs with the findings submitted by the Airworthiness Group Chairman and offers the following opinion on the report:

The Input Free Wheeling Units (IFWU) are a key component of the helicopter drive train system. The bearings and the gear housing bearing bore had proven to be free of damage, excessive wear, or scoring (slippage) assuring that the IFWU's were operating as they were designed: providing power to the Main Gear Box (MGB). The bearings' operation were further evidenced in the NTSB *Hover Study Report* through sound spectrum analysis: i.e., power to the MGB.

The USFS believes that the engines were running at maximum rated speed (topping) at the time of the crash sequence based on the NTSB *Hover Study Report* sound spectrum analysis. Additional evidence of the engines running at time of impact was apparent by the foreign object materials (i.e., dirt, debris) ingested throughout the engine as revealed when the engines were further disassembled.

The USFS concurs with the analysis and conclusions of the left and right engine Fuel Control Units (FCU's). The USFS believes that the minimal contamination that was found during the analysis of the FCU filters did not affect the operation of the FCU's.

This determination is based on results of an analytical light inspection that found amounts of contamination below thresholds that would require a change in the inspection/cleaning time interval. CH did not enter any maintenance entries to change intervals of the filter inspection. The analysis of the Cockpit Voice Recorder (CVR) data documented in the NTSB *Sound Spectrum Study Cockpit Voice Recorder Report* provided further proof that the FCU's were providing sufficient fuel to maintain the engines at a maximum RPM. In addition, both engines reached "topping" after takeoff during all three flights from H-44, which provides further evidence that the FCU's were functioning properly.

USFS SUBMITTAL TO MAINTENANCE GROUP CHAIRMAN'S FACTUAL REPORT

The USFS concurs with the report from the Maintenance Group Chairman. The USFS has identified the following findings of greatest concern because they impact aircraft performance. These issues were discovered during the course of the investigation, and the following provided inaccurate information, which was critical to ensure the safety of crew and passengers:

The June 18, 2009 letter from the FAA to the NTSB, provided information that N612AZ was not properly maintained for the following reason:

- The passenger seat shoulder harness was not installed in accordance with the Federal Aviation Regulations. An FAA form 337 "Major Repair or Alteration" was not completed nor submitted to the FAA by CH for this aircraft's serial number with correct FAA approved data. (Serial numbers were listed for other CH owned helicopters on the engineer's report for the shoulder harness. However the accident aircraft's serial number was not listed).

In a letter provided by the FAA dated April 07, 2010**,** the FAA states that that there were Supplemental Type Certificates (STC's) accomplished by CHI which were not documented on FAA form 337 affecting the aircraft's "Type Design" and are "major alterations."

- CH provided performance charts (RFMS 8) that were not approved for use without the full installation of the cargo hoist
- CH provided performance charts that were not approved for use with the STC installation of their Fire King Tank (Aerial Liquid Dispensing Tank)
- RFMS 6 and RFMS 7 are major alterations not installed in accordance with the STC and Federal Aviation Regulations

In addition, the following items directly contributed to the pilots overestimating the performance of the aircraft:

- Submission of inaccurate weight & balance data in the contract bid package
- Altered RFMS 5 in the contract bid package and altered RFMS 8, submitted at a later date, provided inaccurate information for performance planning

USFS SUBMITTAL TO COCKPIT VOICE RECORDER (CVR) GROUP CHAIRMAN'S REPORT

The USFS concurs with the Report including the Sound Spectrum Analysis.

The frequency signatures depict rotational speeds of the engines and the planetary mesh gears that related to the speed of the main rotor system. This helped to determine the engines' performance and analysis of the topping events and main rotor drooping.

USFS SUBMITTAL TO HOVER STUDY

The USFS concurs with the Hover Study, which confirms the HOGE gross weight of the helicopter at the time of the accident.

USFS SUBMITTAL TO METEOROLOGICAL FACTUAL REPORT

The FS appreciates the work the Meteorological Specialist provided in his report to determine the environmental conditions at the time of the accident.

USFS SUBMITTAL TO SURVIVAL FACTORS GROUP CHAIRWOMAN'S FACTUAL REPORT

The USFS offers the following conclusions and recommendations for consideration by the board:

The USFS concludes that much of the text in this report includes a mix of information from different sources, such as interviews, team interpretations, and other factual information. The information is not well documented, often paraphrased, and presented without distinction as to source. In addition, some pertinent information is not given for all of the interviews. The interviews do not indicate dates or location and it is not clear whether any of the interviews were conducted in person or over the phone. There are limited attempts to verify interview statements or data with factual data in the rest of the NTSB factual reports. This presents conflicting information that only serves to confuse the reader.

Some examples include:

- Page 7, interview last paragraph starting at bottom of page notes the number of personnel initially at H-44. This information is not entirely correct. Where it says, "Initially there were 44 people at H-44" is not correct. Factual information contained in the Operations Report is contradictory. The Operations Report documents that there were 39 firefighters, 5 overhead fire personnel, and 7 helispot and helitack crewmembers on the helispot when the crew transport mission began for a total of 51 persons. Twenty (20) firefighters/overhead personnel were transported from H-44 in the first two flights and 10 were on the accident flight leaving a total of 21 persons at the helispot when the accident occurred. See the public docket, Attachment 87, document 422700, for personnel list at H-44.
- Pages 9, third paragraph, last sentence says there "were 7 HECMs and about 15 firefighters on the mountain when the accident occurred." We understand this information came from an interview, however, it contradicts known facts that were determined elsewhere in the investigation.
- Page 11, first paragraph, includes information from an interviewee who said the last survivor was airlifted at 9:30 p.m. The Automated Flight Following (AFF) data indicates that the last survivors departed H-44 at 8:57 p.m.
- Page 12, third paragraph beginning "The helicopter went straight up…" The witness states the co-pilot told them to duck. We know that is not correct. The CVR data shows that the co-pilot did not direct passengers to duck. One of the other surviving witnesses states that the Inspector Pilot directed the passengers to get down. The incorrect memory from the witness will mislead readers of this report and raise unnecessary questions.
- Page 31, third paragraph, beginning with the last sentence of the third paragraph states, "The Adel clamp that attached the shoulder restraint to the seat crosstube was the same hardware used to attach the restraint to civil aircraft, and Carson's helicopters were public use". Regardless of their public use status, USFS

requires by contract and by policy that the aircraft will be maintained to their 14 CFR 135 standard while under the MAP despite their public use status.

The USFS would like to recommend that the Report should:

- Document the interviewers, dates, times, and locations of interviews.
- Identify whether information provided is a direct quote or the interpretation of the interviewers.
- Ensure that information provided be consistent with factual information from the investigations. If interviewees offer conflicting information, including information that may conflict with other information or data from the remainder of the investigation, it should be noted.
- Document the source of information such as direct quotes from interviews, team interpretation of discussions, and factual data from the discovery process.

USFS SUBMITTAL TO EMERGENCY RESPONSE SPECIALIST REPORT

The USFS wishes to acknowledge those individuals on scene at the time of the accident and the efforts they made to save and protect lives. An accurate account of those events is one way of honoring those efforts.

The USFS would like to provide the board with the following Emergency Response Chronology. We believe this provides the most factual information to date.

The information in the table below was derived from radio logs from Willow Creek Helibase, Iron Communications Unit Log, Air Attack Log, Redding Emergency Communications Center Incident Card Log, and statements from participants, which are all part of the NTSB public docket. Some times noted in radio logs and statements did not match one another precisely because clocks varied. Where possible, aircraft times were verified by AFF.

Also, the USFS has submitted AFF data coordinates to the NTSB Emergency Response lead. This information may offer the Board real-time data from the actual emergency response.

EMERGENCY RESPONSE CHRONOLOGY
AUGUST 5, 2008, PDT

EMERGENCY RESPONSE

TIME	EVENT
1941	Helicopter N612AZ rotors impact trees and then terrain during the initial climb after takeoff from H-44
1941	Helispot Manager at H-44 makes radio call on the Command Frequency reporting that Helicopter 766 (N612AZ) has crashed H-44. Makes a second call a moment later and states aircraft is on fire
1941	The Helicopter Crewmembers (HECM's), Helispot Manager, and firefighters at H-44 assemble briefly near the crest of the helispot and then move quickly to the helicopter wreckage
1942	The Helicopter Coordinator (HLCO), flying in the Helicopter N90301, having heard radio call notifying downed aircraft, leaves Fire Division Delta and proceeds to accident site. HLCO also releases Helicopters N905AL and N1043T from their mission in Div. Delta and requests they also fly to the accident site
1942	Helibase Manager (HEB1) at Willow Creek (Cr.). Helibase is alerted by helibase radio operator of the accident. Assures documentation of events is occurring and then contacts Air Support Group Supervisor (ASGS) trainee (t)
1942-45	As personnel at H-44 approach the now burning wreckage of the helicopter, they begin encountering the injured personnel that have escaped. They begin administering care and first aid

1943	Helispot Manager notifies Willow Cr. Helibase that helicopter came to rest to the "east" (sic) of the helispot (not on the helispot) and that there are three injured persons
1943-1944	HEB1 with the help of HEB1(t) make notifications to helicopters in Fire Division D and request they respond (doubling the request already made by HLCO). Directs the managers of helicopter N215KA and N7HE to respond with EMTs and medical equipment. Requests N420RL, already on its way to H-44 for a passenger transport mission, to proceed to the accident and report back
1944	The Deputy IC, Safety Officer, Logistics Chief, Communications Unit Leader, and Operations Section Chief, ASGS, all meet at the Communications Unit at the Incident Command Post (ICP)
1945	The ASGS contacted the Air Tactical Group Supervisor (ATGS also referred to as Air Attack) on the ground in Redding, notifies him of accident, and request that he return to the fire and H-44.
1946	ATGS calls standby pilot to respond to the airport
1946	Medical Unit Leader notified and requested to come to the Communications Unit
1946	Helicopter N420RL arrives over H-44, establishes orbit over the accident site, and begins assessing the situation by establishing contact with ground personnel on the air-to-ground frequency. Reports back to Willow Cr. Helibase using AM VHF frequency.
1947	Trinity Helibase is contacted by Willow Cr. Helibase and notified of accident. Request that helicopter N903CH standby to respond with water bucket if needed
1949	Shasta Trinity National Forest Supervisor's Office notified of accident. Regional Aviation Safety Manager and Regional Helicopter Operations Specialist also notified of accident
1950	Division Supervisor (DIVS) on Fire Division Lima requests medivac helicopters respond to H-44
1951	N90301, HLCO, arrives over the accident site. Finds that N420RL has established itself in role of relay of information and coordination of incoming aircraft and decides he does not need to interrupt the established arrangement and remains north of area out of the way
1951	Helicopter N905AL (Tanker 761) arrives over the accident site with tank full of water and low on fuel. Makes request to drop water on burning wreckage. Is given the word that area is clear and to drop water. After delivering water departs and returns to Willow Cr. Helibase
1951	N7011M, on its way back to Willow Cr. Helibase, overhears radio traffic of accident and makes decision to divert and proceed to accident site
1952	Request from H-44 for more medics
1953	Helicopter N215KA lifts off from Willow Cr. Helibase with Helicopter Manager, two EMTs, and medical equipment on board
1956	Shasta Trinity NF Emergency Communications Center (ECC) in

	Redding is notified of accident. ECC activates crash rescue plan
1956	Helicopter N1043T arrives over the accident site. Coordinates water drop on burning wreckage through N420RL and ground personnel. Makes one water drop then departs and returns to Willow Cr. Helibase
1957	Helicopter N7HE lifts off from Willow Cr. Helibase with Helicopter Manager, two EMTs, and medical equipment on board
1958	Helicopter N7011M (Tanker 767) arrives and coordinates water drop on burning wreckage. Makes at least one additional water drop later
1959	Communication Unit at ICP clears the command frequency for emergency traffic only
1959	Medical Unit Leader requests ECC to dispatch of Jolly 91, CA Air National Guard helicopter (Pavehawk) to accident site
1959	N420RL reports to Willow Cr. Helibase that there are 4 medical transports, some with burns and back injuries, 2 of which are non-ambulatory. Advises helibase to launch at least 2 medivac helicopters with backboards
2000	Personnel at helispot have helped 4 survivors to the helispot and are providing first aid. The leadership at the helispot begin organizing a group of firefighters to help grid the area for any other survivors
2000	Medical Unit at ICP notifies local hospitals of accident and injuries
2003	Medical Unit requests Arcata ambulance to proceed and standby at H-21
~2005	Reach 5 departs Mercy Medical Center in Redding en route to H-44
2006	N9175N, an Aero Commander with the ATGS (Air Attack) on board departs Redding
2006	N903CH (H506) departs Trinity Helibase with water bucket en route to H-44
2006	Helicopter N215KA lands at H-44 to deliver EMTs and medical equipment then repositions 1/5 of mile up ridge to clear helispot for other helicopters
2009	Helicopter N7HE lands at H-44 to deliver EMTs and medical equipment. Shuts down and remains at helispot
2012	CA Highway Patrol (CHP) calls ECC and asks if they need assistance in the response to H-44
2018	N9175N, the Air Attack platform, arrives over the accident scene; makes contact with participating aircraft. Radio traffic is heavy on air-to-air and air-to-ground frequencies
2019	Helicopter N972JG departs Willow Cr. Helibase with paramedic and two EMTs on board en route to H-44
2022	H-44 reports four injured and requests more oxygen tanks and masks
2022	Sunset at Weaverville
2024	Air Attack has contact with inbound medivac helicopter from Mercy Medical Center in Redding, Reach 5
2027	Jolly 91 departs Redding en route to H-44. ETA 2040
2029	Reach 5 lands at H-44
2029	N972JG lands at H-43

2032	N972JG lifts off from H-43 and repositions helicopter closer to H-44 with intent of off-loading EMTs and paramedic
2035	N90301 departs area and returns to Willow Cr. Helibase
2039	After loading the most critical injured patient, Reach 5 departs H-44, en route to Mercy Medical Center
2040	N972JG lifts off from landing spot with intent to move to H-44. Does not get clearance to land at H-44, remains in orbit to the west of H-44
2040	Air Attack clears Jolly 91 and CHP helicopter into the incident traffic area
2043	N215KA repositions to H-44 to load two injured persons
2045	CHP helicopter is cancelled and released having no need for its services. Jolly 91 remains in orbit in area
2045	Air Attach released helicopters N420RL, N903CH, and N972JG returning them to their bases of operations
2052	End of Civil Twilight in Weaverville
2056	N7HE departs H-44 for Mercy Medical Center in Redding with one injured person on board
2057	N215KA departs H-44 en route to Weaverville Airport
2057	Jolly 91 escorts N215KA to Weaverville Airport
~2109	Reach 5 lands at a Mercy Medical Center where injured patient will be stabilized
2111	N215KA and Jolly 91 land at Weaverville Airport. The two injured persons are transferred from N215KA to Jolly 91. N215KA remains at Weaverville Airport
~2120	Jolly 91 departs Weaverville Airport en route to Mercy Medical Center in Redding
2121	Helibase reports via radio that the manifest had 10 crew and 2 pilots on board helicopter when it crashed
2122	N7HE lands at Mercy Medical Center
~2130	Jolly 91 lands at Mercy Medical Center
	Air Attack is the last aircraft on scene and remains over H-44 relaying information between H-44 and Communications
2132	Air Attack requests roll call from H-44
2147	13 unaccounted personnel is communicated to Redding ECC
2214-2234	H-44 begins relaying names of people at helispot to Air Attack which in turn is relayed to Air Operations and accounts for all remaining personnel
2308	Air Attack departs accident scene and returns to Redding
2324	Air Attack lands in Redding

It is important to remember that this accident occurred in a remote wilderness with limited access, late in the evening, with sunset approaching. Within minutes after the accident, ground and air resources were launched in response to meet the emerging immediate needs of the accident. Coordination at the accident site, in the air, and among emergency responders was swift and effective. The following summary provides a synopsis of key events.

SUMMARY

- The first EMTs from Willow Cr. Helibase arrived at H-44 (20 miles from Willow Cr. Helibase) at 2006, **25 minutes** after the accident
- The first of four injured persons departed H-44 at 2039, **58 minutes** after the accident
- The second injured person departed H-44 at 2056, **75 minutes** after the accident
- The last two injured persons departed H-44 at 2057, **76 minutes** after the accident
- The first injured person arrived at Mercy Medical Center (51 miles from H-44) at 2109, **88 minutes** after the accident
- The second injured person arrived at Mercy Medical Center at 2122, **101 minutes** after the accident
- The last two injured persons arrived at Mercy Medical Center at approximately 2130, **109 minutes** after the accident

POST ACCIDENT RESPONSE

The following are actions the agency has put into place as a result of the accident to improve safe operations.

Contract Changes include:
The USFS has already incorporated into the 2010 Heavy and Medium Exclusive Helicopters – National Standard Category Fire Support Contract the following:

- Single-lift lever latch type seat belt for heavy transport helicopters

- All seats, seatbelts and shoulder harnesses for all helicopters must either be:
  - An Original Equipment Manufacturer (OEM) installation
  - STC'd
  - Approved for installation by an FAA form 8110-3 with all Designated Engineering Representative (DER) supporting engineering substantiation documentation attached or
  - Field approved for installation with supporting FAA Form 8110-3 and all DER supporting engineering substantiation documentation attached

- Intercom System was installed for all passenger stations in all Type 1 & 2 aircraft

- Contract requirements updated to include a internal PA and a siren

- FAA approved internal cargo area net restraints or barriers which extend from floor to ceiling isolating the passenger compartment from the cargo area. The netting shall not compromise passenger ingress or egress. (Type 1)

- FAA approved internal cargo area restraints or barriers which extend from floor to ceiling isolating the passenger compartment from the cargo area (transmission wells) and sliding door area. (Type 2)

- The USFS has implemented a HOGE Effect Power Check/Special Use Passenger Transport Task during evaluation flights for all pilots to determine whether the pilot exhibits the knowledge and skills to properly perform a HOGE power check before landing at or departing from helispots located in confined areas, pinnacles, or ridgelines.

- Instituted Contract compliance team assurance checks during the contract mandatory availability period

- Instituted spot-checks which may include inspections/weighing/tests as deemed necessary to determine the contractor's equipment and or personnel currently meet specifications. This will be witnessed by USFS Maintenance Inspector.

- After proposal evaluations and prior to or post award all aircraft weights shall be witnessed and validated by agency aircraft inspectors. The objective of the second and separate weighting is to validate the contractor's proposed weight as configured to comply with the solicitation requirements.

- Clarified in the Operations Section that performance shall be based upon minimum engine specification. Performance enhancing data (power assurance checks, wind charts, etc.) shall not be used. Only FAA approved charts based upon minimum specification engine performance shall be used.

Operational Changes:
The following two actions are being implemented by the USFS and are being considered for use by our interagency partners.

A. Task: Hover Out Of Ground (HOGE) Effect Power Check

PILOT OPERATION

1) **Objective.** To determine that the applicant:
   a) Exhibits knowledge of the elements related to a vertical takeoff to a hover OGE and landing from a hover OGE.
   b) Positions the helicopter in the vicinity of the takeoff point and in the direction of takeoff.
   c) Ascends to and maintains OGE hovering altitude, and descends from OGE hovering altitude in headwind, crosswind, and tailwind conditions.
   d) Maintains RPM within normal limits.
   e) Establishes OGE hovering altitude, ±5 feet.
   f) Avoids conditions that might lead to loss of tail rotor/antitorque effectiveness.
   g) Keeps forward and sideward movement within 2 feet of a designated point, with no aft movement.
   h) Descends vertically to within 2 feet of the designated touchdown point.
   i) Maintains specified heading, ±10°.
   j) Does not exceed any helicopter operating limitation.
   k) Make smooth and coordinated control inputs.
   l) Determines that the power required does not exceed the power available.
      i) For multi-engine helicopters determine if single-engine hover capability exists
      ii) For helicopters requiring more than one pilot, the pilot not flying performs proper crew coordination functions.
         (1) Monitoring torque and operating limitations..
         (2) Warnings before exceeding any operating limitation.
         (3) Assisting with clearing the helicopter.
         (4) Offering of other appropriate assistance not requested by the pilot flying.
      iii) If helicopter performance is sufficient to complete the mission.
      iv) If sufficient fuel exists to complete the mission
      v) Ensure no helicopter operating limitations are exceeded.

vi) Uses good judgment in making a competent decision on whether the required performance is within the operation limitations of the helicopter.

m) Will not attempt the tasks or task elements listed below when HOGE power is not available and adjust the mission, as required:
   i) Special Use Passenger Transport
   ii) External load operations.
   iii) Retardant/Water dropping.
   iv) Special use flights below 500 feet AGL
   v) Decelerations below Effective Translational Lift or slowing below speeds given for any critical wind azimuths when OGE.
   vi) Confined area, pinnacle and ridgeline operations.
   vii) Any task requiring hovering flight in OGE conditions.

2) **Action.** The inspector will:
   a) Ask the applicant to explain the elements of the HOGE power check operations and determine that the applicant's knowledge meets the objectives.
   b) Ask the applicant to perform the HOGE power check operation and determine that the applicant's performance meets the objectives.

B. Task: Special Use Passenger Transport

PILOT OPERATION

1) **Objective.** To determine that the applicant, when transporting passengers in special use activities:
   a) Exhibits knowledge by explaining the elements of takeoffs from and approaches to confined area, pinnacle, ridgeline, and/or platform operations.
      i) For multi-engine and transport certificated helicopters exhibits knowledge of Category A and Category B flight operations.
      ii) For single engine and multi-engine, transport and standard certificated helicopters, exhibits knowledge of Hover-Out-of-Ground-Effect (HOGE) power check procedures and determination if power available is sufficient for power required for takeoff.
   b) Properly performs a HOGE power check before landing at or departing from helispots located in confined areas, pinnacles, or ridgelines.
      i) Prior to landing the pilot shall perform an OGE power check over a suitable area at an altitude and outside air temperature comparable to the site or greater. A positive rate of climb must be established without exceeding aircraft limitations.
      ii) Prior to takeoff the pilot shall perform an OGE power check over the takeoff area so that the helicopter can return to, and stop safely on, the takeoff area if the HOGE power check cannot be safely completed.
   c) Properly determines the landing decision point (LDP) and/or takeoff decision point (TDP) before the landing and/or takeoff is attempted.

d) Computes weight and balance, including adding, removing, and shifting weight, and determines if the weight and center of gravity will be within limits during all phases of flight.
e) Demonstrates proficient use of load calculations for the mission locations with reference to the correct performance charts and current weight and balance information.
f) Accurately describes the effects of atmospheric conditions on helicopter performance.
g) Uses good judgment in making a competent decision on whether the required performance is within the operation limitations of the helicopter.
h) Exhibits the ability to perform a thorough pre-flight briefing of passengers to include
    i) Approach and departure paths:
        (1) Always approach and depart from the down slope (lower) side as directed by Pilot/Helicopter crewmember
        (2) Approach and depart helicopter in a crouch position, do not run
        (3) Keep in pilot's field of vision at all times
        (4) Stay clear of landing area when helicopters landing or departing
        (5) Stay away from the main and tail rotors especially on sloping terrain
        (6) Do not chase any item that has become unsecured
        (7) Never go near the tail of single main rotor helicopters
        (8) How to determine the lowest portion of any operating rotor system
    ii) Helicopter doors and emergency exits
        (1) Location, emergency and normal operation
        (2) Normally do not open, wait for helicopter crewmember personnel or instructions to open
    iii) Use of seatbelts and shoulder harnesses
    iv) Emergency seating position and emergency egress procedures
        (1) Move clear of the helicopter only after the rotor blades stop or when instructed
        (2) Assist injured personnel with egress
        (3) Assess situation, follow pilot/helicopter crewmember instructions, render first aid, remove first aid kit, survival kit, radio, ELT and fire extinguisher
    v) Location of first aid kit, survival kit, fire extinguisher, ELT (Emergency Locator Transmitter), fuel and battery shutoff switch location and operation, radio operation, oxygen use (if available)
    vi) No smoking rules in and around aircraft
    vii) Tools and Equipment:
        (1) Securing of hand tools and equipment being transported
        (2) Carry tools/long objects parallel to the ground, never on shoulder, when approaching and departing the helicopter
        (3) Portable radios and cell phones turned off

2) **Action.** The inspector will:

a) Ask the applicant to explain the elements of Special Use Passenger Transport operations, and determine that the applicant's knowledge meets the objective. Ask the applicant to perform a simulated Special Use Passenger Transport operation and determine that the applicant's performance meets the objective.

RECOMMENDATION

The USFS desires to ensure a greater margin of safety even when flights are public use and therefore require that operators that transport USFS personnel be FAR Part 135 compliant. However, the USFS is well aware that at times an operator may not be able to fully comply with FAR Part 135 because of mission requirements.

Many have voiced concern over FAR Part 135 versus public use and the USFS would welcome the opportunity to work with the FAA and the NTSB to bring clarity to the issue.