National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: December 27, 2010

In reply refer to: A-10-159 through -168

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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 (H-44),[1] located at an elevation of about 6,000 feet in mountainous terrain near Weaverville, California. The pilot-in-command, the safety crewmember,[2] and seven firefighters were fatally injured; the copilot and three firefighters were seriously injured. Impact forces and a postcrash fire destroyed the helicopter, which was being operated by the U.S. Forest Service (USFS) as a public flight to transport firefighters from H-44 to another helispot. The USFS had contracted with Carson Helicopters, Inc. (CHI), of Grants Pass, Oregon, for the services of the helicopter, which was registered to CHI and leased to Carson Helicopter Services, Inc. (CHSI), of Grants Pass.[3] Visual meteorological conditions prevailed at the time of the accident, and a company visual flight rules flight plan had been filed.

The National Transportation Safety Board (NTSB) determined that the probable causes of this accident were the following actions by Carson Helicopters: 1) the intentional understatement of the helicopter's empty weight, 2) the alteration of the power-available chart to exaggerate the helicopter's lift capability, and 3) the practice of using unapproved above-minimum specification

[1] (a) The National Transportation Safety Board's full report, Crash During Takeoff of Carson Helicopters, Inc., Firefighting Helicopter Under Contract to the U.S. Forest Service, Sikorsky S-61N, N612AZ, Near Weaverville, California, August 5, 2008, Aviation Accident Report NTSB/AAR-10/06 (Washington, DC: National Transportation Safety Board, 2010) will be available online at <http://www.ntsb.gov/publictn/A_Acc1.htm>. (b) According to the U.S. Forest Service, a helispot is a natural or improved takeoff and landing area intended for temporary or occasional helicopter use.

[2] The safety crewmember was a U.S. Forest Service (USFS) inspector pilot who was giving the pilot-in-command a flight evaluation in the S-61 and simultaneously acting as the required cabin safety crewmember.

[3] CHI and CHSI are separate legal entities and at the time of the accident, each company held its own Federal Aviation Administration (FAA)-issued operating certificates. However, both companies have the same president and share facilities in Grants Pass. In this report, the term Carson Helicopters is used to refer to both companies, and the acronyms CHI and CHSI are used if it is necessary to specify the legal entity.

torque in performance calculations that, collectively, resulted in the pilots relying on performance calculations that significantly overestimated the helicopter's load-carrying capacity and did not provide an adequate performance margin for a successful takeoff; and insufficient oversight by the USFS and the Federal Aviation Administration (FAA).

Contributing to the accident was the failure of the flight crewmembers to address the fact that the helicopter had approached its maximum performance capability on their two prior departures from the accident site because they were accustomed to operating at the limit of the helicopter's performance. Contributing to the fatalities were the immediate, intense fire that resulted from the spillage of fuel upon impact from the fuel tanks that were not crash resistant, the separation from the floor of the cabin seats that were not crash resistant, and the use of an inappropriate release mechanism on the cabin seat restraints.

As a result of this accident investigation, the NTSB is issuing 10 safety recommendations to the USFS that address oversight, flight crew performance, accident survivability, weather observations at helispots, and flight recorder requirements. These recommendations are derived from the NTSB's investigation and are consistent with the evidence found and the analysis performed. Information supporting these recommendations is discussed below. The NTSB would appreciate a response from you within 90 days addressing the actions you have taken or intend to take to implement our recommendations.

Background

On the morning of the accident, the pilot-in-command (PIC) completed performance calculations to ascertain whether the helicopter could hover out of ground effect (HOGE) at the density altitudes that were expected. The USFS requires helicopters operating at helispots to have HOGE capability because a helicopter that cannot HOGE cannot make a vertical takeoff. Without HOGE capability, takeoff is only possible if a sufficient clear area exists for the helicopter to move forward while remaining in ground effect until translational lift is achieved. In completing the calculations, the PIC relied on weight documents and performance charts that had been altered by Carson Helicopters to give the appearance of higher payload capabilities; as a result, the pilots believed that the helicopter had the performance capability on the accident takeoff to HOGE with the manifested payload when, in fact, it did not.

During the accident takeoff and during the previous two takeoffs from H-44, the main rotor speed (N_R) decreased (drooped) while the engines were producing maximum power, with the most severe N_R droop occurring during the accident takeoff. The similarities between all three takeoffs indicated that, during each takeoff, the power required to maintain N_R exceeded the power available from the engines. This condition could have resulted from either a deficiency in power available due to engine malfunction or from excessive power demands associated with attempting to lift more weight than possible given the conditions.

The NTSB ruled out a deficiency in power available based on evidence from the cockpit voice recorder sound spectrum study, which indicated that the engines were running at their

topping (maximum) speed,[4] and evidence from teardowns and examinations, which indicated that both engines and their fuel control units were functioning normally throughout the accident flight. The accident takeoff was unsuccessful because the helicopter was loaded with more weight than it could carry in a HOGE given the ambient conditions. The PIC was unable to maintain clearance from trees and terrain while attempting to gain enough airspeed to achieve effective translational lift.

During the two previous departures from H-44 on the day of the accident, the pilots had the opportunity to realize that the helicopter was not performing in a manner consistent with the load calculations. However, neither pilot called attention to the discrepancy between the predicted and actual performance of the helicopter or suggested postponing further flight until the discrepancy could be resolved. The USFS inspector pilot also had an opportunity to notice and comment on the helicopter's marginal performance but failed to do so.

Oversight

The USFS had opportunities during its review of Carson Helicopters' bid package, submitted in April 2008, its carding inspection of the accident helicopter on June 26, 2008, and its evaluation of the PIC on the day of the accident to discover that the company was using improper helicopter weight and performance charts and unapproved procedures for load calculations but failed to detect these discrepancies. When reviewing Carson Helicopters' bid package, the contracting officer did not detect that the takeoff (5 minute) power available chart submitted had been altered to indicate that 2.5-minute power was available for normal takeoff operations. Because the 2.5-minute power available chart provides the maximum power approved for use in an emergency when one engine fails, it reflects higher power capability than the takeoff power available chart. This chart should have received specific scrutiny since the USFS was aware that Carson Helicopters was opposed to its 2006 decision disallowing the use of emergency (2.5 minute) power for contract bidding and actual load calculations. Also, because the USFS uses load carrying capacity as a criterion for evaluating and awarding contracts, it must ensure that the weight and performance charts submitted by bidders are accurate and applicable. The USFS only attempted to verify the weights of Carson Helicopters' aircraft after the accident, at which time the majority were found to be over their contract weights.

During the carding inspection, if the USFS maintenance inspector had compared the entries on the weighing records with the maintenance logbook entries, his comparison would have shown that the 1,090-pound Fire King tank was checked off as installed on the helicopter when it was weighed on January 4, 2008, but it was not shown on the maintenance logbook entry and the Form 337 as installed until March 25, 2008. If the maintenance inspector had noted this conspicuous error, he could have required Carson Helicopters to weigh the helicopter in his presence and verify that it met the contract requirements; however, this verification did not occur. Further, the USFS missed a last opportunity to detect that Carson Helicopters was violating approved procedures when, on the day of the accident, the inspector pilot failed to notice that the PIC was using above minimum-specification (min spec) torque when he completed the load calculations. (The inspector pilot's performance is further discussed below.)

[4] "Topping" refers to operating at the maximum gas generator speed limit, corresponding to the maximum power output of the engines.

If these discrepancies had been detected, the USFS would have required Carson Helicopters to correct them, which could have prevented the accident. The NTSB concludes that the USFS's oversight of Carson Helicopters was inadequate, and effective oversight would likely have identified that Carson Helicopters was using improper weight and performance charts for contract bidding and actual load calculations and required that these contractual breaches be corrected.

The NTSB notes that the USFS has made a number of changes in response to this accident investigation, including validating the weight of each aircraft awarded a contract and instituting checks to determine that contractors are in full compliance with the contract during the contract award period. Although the NTSB is encouraged that the USFS has already implemented changes as a result of the accident, the NTSB believes that further oversight improvements are necessary.

The NTSB previously identified a similar lack of effective USFS oversight of its contractors during its investigation of the in-flight breakups of three firefighting aircraft. In an April 23, 2004, safety recommendation letter, the NTSB recognized that the USFS did not have the infrastructure in place to provide independent oversight of the continuing airworthiness and maintenance programs for its air tanker fleet and issued Safety Recommendations A-04-29 through -31 to the USFS. These recommendations, respectively, asked that the USFS develop maintenance and inspection programs specifically for aircraft used in firefighting operations, require the use of these programs by its contractors, and conduct appropriate oversight to ensure the programs were followed. Since these recommendations were issued, the USFS has made substantial progress towards their implementation. Safety Recommendation A-04-31 was classified "Closed—Acceptable Action" on February 13, 2007, and Safety Recommendations A-04-29 and -30 are currently classified "Open—Acceptable Response." The findings from this investigation demonstrate the need for the USFS to address its oversight of firefighter transport operations in a manner comparable to that of the air tanker fleet.

An underlying reason for the USFS's failure to provide effective oversight may have been its belief that its requirements for all contractors who transport passengers to hold a 14 *Code of Federal Regulations* (CFR) Part 135 certificate and comply with their operations specifications and all portions of 14 CFR Part 91 would ensure a greater margin of safety. However, once an aircraft is under contract to the USFS, it operates as a public aircraft and is not subject to FAA oversight of those operations. Therefore, the USFS cannot rely on the FAA to ensure that its contractors are in continuous compliance with Part 135, and it must take responsibility for overseeing the safety of public firefighting flights such as the accident flight. Further, the USFS acknowledged that, at times, its contractors may not be able to fully comply with Part 135 regulations because of firefighting mission-specific requirements. For example, helitack crews routinely rappel from the helicopter to the ground, and hazardous materials are often carried on firefighter transport missions; neither of these operations would be allowed on a Part 135 flight. Thus, no FAA safety standards exist that can be applied to determine how these operations should be conducted. The NTSB concludes that, although the USFS attempted to provide for safe operations by contractually requiring that the operator comply with Part 135, these requirements without effective oversight were not adequate to ensure safe operations. Therefore, the NTSB recommends that the USFS develop mission-specific operating standards for firefighter transport operations that include procedures for completing load calculations and verifying that actual

aircraft performance matches predicted performance, require adherence to aircraft operating limitations, and detail the specific Part 135 regulations that are to be complied with by its contractors. In addition, the NTSB recommends that the USFS require its contractors to conduct firefighter transport operations in accordance with the mission-specific operating standards specified in Safety Recommendation A-10-159. Further, the NTSB recommends that the USFS create an oversight program that can reliably monitor and ensure that contractors comply with the mission-specific operating standards specified in Safety Recommendation A-10-159.

Role of U.S. Forest Service Inspector Pilot

The USFS inspector pilot who was evaluating the PIC reviewed the load calculations the PIC had prepared but apparently did not notice that the PIC had used above-min spec torque when completing the load calculations, which is a procedure that the USFS does not allow. If the inspector pilot had noticed this improper procedure and required the PIC to correct the load calculations, the allowable payload for the 6,000 foot pressure altitude and 32° C condition would have been reduced by 760 pounds, which may have reduced the actual payload manifested for the accident takeoff.

During the first and second takeoffs from H-44, the inspector pilot had an opportunity to notice the helicopter's marginal performance. Although the inspector pilot was seated in the cabin facing rearward, he could see out the side windows and observe the helicopter's height above the ground. Therefore, he had the opportunity to note the same indications of marginal performance reported by the firefighters on board the helicopter during the first takeoff from H-44, such as the helicopter feeling "heavy, slow and sluggish" and being "below the treetops for quite a while." However, according to the cockpit voice recorder (CVR) transcript, he never questioned the PIC about the helicopter's performance. Given the inspector pilot's extensive flight experience of more than 11,500 hours of flight time in turbine helicopters, it is difficult to understand why the inspector pilot did not notice the helicopter's marginal performance and express concern about it. However, although the inspector pilot had prior experience evaluating pilots in the S-61, he did not hold an S-61 type rating, had never flown as PIC of an S-61, and did not have an approval on his U.S. Department of Agriculture/U.S. Department of the Interior Interagency Helicopter Pilot Qualification Card for the S-61.

The USFS does not require PIC time, a type rating, or carding for USFS inspector pilots in each type of helicopter in which they perform evaluations. According to the USFS, a type rating is not required for inspector pilots because they never act as PIC during evaluations. Further, the content of a USFS evaluation is significantly different from that of an FAA evaluation in that the inspector pilots do not reevaluate the tasks that the FAA typically evaluates, and the USFS evaluations do not determine competency to act as a pilot. The inspector pilot's primary function is to ensure that a pilot is competent in demonstrating his or her abilities for "special use" operations, which include USFS-specific missions such as long-line vertical reference and water/retardant delivery. Specifically, on the day of the accident, the inspector pilot was evaluating the PIC on his ability to perform passenger-transport missions in a fire environment.

Although the inspector pilot was not expected to duplicate an FAA evaluation, he was tasked with performing a mandatory evaluation of the PIC in a helicopter with which he was

unfamiliar. He had received no specific training from the USFS in the performance of S-61 load calculations or in normal operating procedures for this helicopter. It is evident from the fact that the inspector pilot failed to notice the PIC's incorrect usage of above-min spec torque that his lack of knowledge specific to S-61 load calculations hampered his ability to perform an adequate evaluation of the PIC. Additionally, familiarity with normal operating procedures for the S-61 would have helped him recognize that the helicopter was being operated in an unsafe manner on the first two takeoffs from H-44. The NTSB concludes that the USFS's inadequate training of the inspector pilot led to the inspector pilot's failure to correct the PIC's improper usage of above-min spec torque and contributed to the inspector pilot's failure to identify the helicopter's marginal performance on the first two takeoffs. If the inspector pilot had received specific training in S-61 performance calculations and operating procedures, his ability to perform an adequate evaluation of the PIC would have been enhanced. He might have then detected the unsafe practices that occurred during the previous departures from H-44 (reaching topping) and intervened before the accident occurred. Therefore, the NTSB recommends that the USFS provide specific training to inspector pilots on performance calculations and operating procedures for the types of aircraft in which they give evaluations.

Flight Crew Performance

As a result of the lessons learned from this accident, the USFS added two new tasks—a HOGE Power Check Task and a Special Use Passenger Transport Task—to its pilot carding evaluations to determine whether pilots possess the skills and knowledge to properly perform a HOGE power check before landing at or departing from helispots located in confined areas, pinnacles, or ridgelines. The task objectives state that, when transporting passengers, HOGE power must be available or the mission cannot be conducted. As specified in these tasks, a before-takeoff HOGE power check is performed by ascending vertically to and maintaining an out-of-ground-effect hovering altitude and then descending vertically back to the ground. Performing this check demonstrates that the power required does not exceed the power available and thus ensures that the helicopter's performance is sufficient to safely complete the takeoff. If the pilots had performed a HOGE power check before attempting the first H-44 takeoff, they would have determined that HOGE power was not available, which would likely have led them to acknowledge that the helicopter was not performing in a manner consistent with the load calculations and to take action to address the discrepancy. The NTSB concludes that the performance of a HOGE power check before takeoff from helispots located in confined areas, pinnacles, or ridgelines would increase flight safety.

In its party submission to the NTSB, the USFS stated that its inspector pilots are now required to evaluate helicopter pilots on their performance of these two tasks during flight evaluations. However, the NTSB believes that a pilot's ability to properly perform a HOGE power check should not only be evaluated by inspector pilots, but should also be a standard operating procedure performed by pilots flying for the USFS before every takeoff carrying passengers from helispots located in confined areas, pinnacles, or ridgelines. Therefore, the NTSB recommends that the USFS require a HOGE power check to be performed before every takeoff carrying passengers from helispots in confined areas, pinnacles, and ridgelines.

Accident Survivability

The USFS required that all persons traveling in helicopters wear flame-resistant gloves.[5] The firefighters on board the accident helicopter were wearing firefighting leather gloves made of medium-weight leather, which are more rigid than the thin Nomex flight gloves that flight crewmembers wear during flight. Although the survivors reported that they did not remove their leather gloves during their numerous attempts to release their rotary restraints,[6] investigators found that it was significantly easier to release the rotary restraints with their bare hands than when they were wearing the same type of leather gloves worn by the survivors. The inflexibility of the firefighters' occupational leather gloves made the operation and release of the restraints difficult and cumbersome. The NTSB concludes that the leather gloves worn by the firefighters decreased their dexterity, which hampered the release of their restraints after the crash. Therefore, the NTSB recommends that the USFS review and revise policies regarding the type and use of gloves by firefighting personnel during transport operations, including, but not limited to, compatibility with passenger restraints and opening emergency exits.

The USFS required Carson Helicopters to install an "FAA approved shoulder harness integrated with a seat belt with one single point" release mechanism for each passenger seat because 14 CFR 29.785(c) states that "each occupant's seat must have a combined safety belt and shoulder harness with a single-point release." Although this regulation applied to rotorcraft certificated with seats that met 14 CFR Part 29, the USFS interpreted this regulation to mean that the installation of a shoulder harness on any seat with only a lap restraint would be an improvement to the crashworthiness of the seats. Carson Helicopters complied with this contractual requirement by replacing the original two-point lap belts on the passenger seats with four-point restraints and attaching the shoulder harness to the lower cross tube of the non-locking folding seatbacks. However, when installing the four-point restraints, Carson Helicopters failed to complete FAA Form 337 as required for a major alteration and failed to document the installation in a maintenance logbook.

The installation of a shoulder harness should provide additional protection for the occupant; however, because the seatbacks folded forward, the shoulder harness provided no safety improvement for the occupant beyond that which was provided by the lap belt only. As the seatback folded forward during longitudinal loads, the shoulder harness moved with the seatback, thereby providing no upper body protection for the seat occupant. In fact, adding a shoulder harness to the seatback increased the overturning moment of the seat[7] and increased the compression loads on the occupant's spine. Typically, the installation of a shoulder harness is an improvement to occupant protection; however, in this case, because of the designated

[5] (a) Chapter 72, Exhibit 01, of the Forest Service Handbook 6709.11, states that gloves (flame-resistant fabric or leather, USFS–approved) are required personal protective equipment for rotorwing air travel. (b) *Health and Safety Code Handbook*, FSH 6709.11 (Washington, DC: U.S. Department of Agriculture, U.S. Forest Service, 1999), p. 70-13.

[6] Carson Helicopters installed and the USFS approved a rotary buckle on the passenger seats in the helicopter. The accident flight was the first time the firefighters had used a rotary buckle, and they all experienced difficulty in releasing their restraints. They had previously only used a lift-latch buckle similar to those on commercial airline flights and on other USFS aircraft.

[7] With a rigid seatback, the increase in overturning moment would be even greater.

engineering representative's failure to consider the entire seating system design, the shoulder harness installation actually increased the risk of injury to the occupant.

The NTSB concludes that the USFS contract requirement for Carson Helicopters to install shoulder harnesses on the passenger seats did not provide improved occupant protection because Carson Helicopters installed the shoulder harnesses on seats with non-locking folding seatbacks. Therefore, the NTSB recommends that the USFS review and revise its contract requirements for passenger transport by aircraft so that the requirement to install shoulder harnesses on passenger seats provides improved occupant crashworthiness protection consistent with the seat design.

Weather Observations at Helispots

No weather observations were available at H-44 other than a rudimentary wind indicator that consisted of ribbons tied to several trees about 5 to 6 feet above ground level near the landing zone. The CVR indicated that the pilots were told that the wind was 3 to 5 knots out of the south before their third landing at H-44. However, meteorological analysis, supported by witness statements and photographs, determined that the wind was calm for the accident takeoff.

The CVR indicated that, as the helicopter approached H-44 for the last landing before the accident takeoff, the copilot stated that the outside air temperature (OAT) was 20° C. The CVR also indicated the pilots were referring to an OAT gauge reading of 20° C while discussing the helicopter's performance capability before the accident takeoff. However, the NTSB's approach and landing study calculated a temperature on the ground at H-44 of 22° C, which was within 1° of the 23° C temperature determined by meteorological analysis. Although more accurate wind and temperature readings taken at H-44 and available to the pilots immediately before the accident likely would not have changed the outcome, this accident highlights the importance of accurate recorded data—including weather data—in all aspects of high-altitude, heavy-helicopter operations. Although substantial safety margins are incorporated into performance calculations, this accident demonstrated that these safety margins may be significantly eroded by a variety of errors or omissions. For example, the calculated takeoff weight may be inaccurate because of math errors, an extra passenger that is boarded, or less-than-expected fuel burn. Another source of potential error is insufficient or inaccurate meteorological information, such as temperature, pressure altitude, and wind direction and speed. As highlighted in this investigation, small differences in temperature and wind values can have a significant effect on a helicopter's performance capability.

Although it is unlikely that the availability of more accurate weather data would have prevented this accident, accurate information about all factors that affect the takeoff performance of a helicopter must be available if expected safety margins are to be maintained. The USFS already uses a standard manifest form that is routinely completed by helitack crewmembers for each flight. This form could be revised to provide a place to record basic weather information, and helitack crewmembers could be trained to obtain and record the information as part of their preflight duties. Weather observations by a trained ground crew could provide independent, accurate, and recorded weather information.

Basic weather instrumentation capable of reading wind, temperature, and pressure is currently available at low cost, and helitack crewmembers could be taught during their annual training to use this instrumentation to obtain and disseminate weather information to flight crews. The NTSB concludes that making accurate basic weather information available to flight crews operating at remote helispots would increase flight safety. Therefore, the NTSB recommends that the USFS require that helispots have basic weather instrumentation that has the capability to measure wind speed and direction, temperature, and pressure and provide training to helitack personnel in the proper use of this instrumentation. Further, the NTSB recommends that the USFS modify its standard manifest form to provide a place to record basic weather information and require that this information be recorded for each flight.

Flight Recorder Systems

The helicopter was equipped with a Penny & Giles Multi-Purpose Flight Recorder that combined a CVR and a flight data recorder (FDR) in one self-contained unit. The solid-state unit was capable of recording 2 hours of digital cockpit audio and at least 25 hours of flight data. The CVR operated properly; however, the FDR did not. Although NTSB investigators were able to extract N_R and engine operating parameters from the CVR sound spectrum analysis, an operating FDR would have provided a direct recording of N_R, as well as engine torque, gas generator speed, and turbine inlet temperature for each engine. Additionally, an operating FDR would have provided parameters such as airspeed, altitude, and flight control positions that would have allowed a precise reconstruction of the helicopter's takeoff flightpath. The NTSB concludes that an operating FDR would have provided detailed information about the accident scenario and thus would have aided the NTSB in determining the circumstances that led to this accident.

The NTSB notes that, while the accident helicopter was not required to have an FDR installed, it would have been required to have an FDR or a cockpit image recorder had the FAA implemented Safety Recommendations A-06-17 and -18. Safety Recommendation A-06-17 asked the FAA to require, among other things, that transport-category rotorcraft manufactured before October 11, 1991, operating under 14 CFR Parts 91 and 135 be equipped with either a CVR and an FDR or a cockpit image recorder. When the NTSB issued this recommendation, it stated that transport-category helicopters should be equipped with flight recorders[8] to gather data critical to diagnosing safety deficiencies in the passenger-carrying helicopter fleet. The accident helicopter was a transport-category rotorcraft manufactured in 1965, and, although it was operating as a public aircraft at the time of the accident, it was listed on CHSI's Part 135 operations specifications. The USFS contract required its contractors to operate in accordance with their operations specifications and with Part 91. On November 29, 2006, the NTSB classified Safety Recommendation A-06-17 "Open—Unacceptable Response," and, on November 13, 2009, the NTSB reiterated the recommendation following its investigation of a September 27, 2008, accident involving a transport-category helicopter manufactured in 1988 that was not equipped with an FDR or a CVR.[9] This accident provides additional support for

[8] The term "flight recorders" refers to all crash-protected devices installed on aircraft, including, but not limited to, FDRs, CVRs, and onboard image recorders.

[9] See Crash During Approach to Landing of Maryland State Police Aerospatiale SA365N1, N92MD, District Heights, Maryland, September 27, 2008, Aircraft Accident Report NTSB/AAR-09/07 (Washington, DC: National Transportation Safety Board, 2009). < http://www.ntsb.gov/publictn/2009/AAR0907.pdf >.

Safety Recommendation A-06-17, as it again demonstrates the need for flight recorders on all transport-category rotorcraft.

Safety Recommendation A-06-18 asked the FAA not to permit exemptions or exceptions to the flight recorder regulations that allow transport-category rotorcraft to operate without flight recorders and to withdraw the current exemptions and exceptions that allow transport-category rotorcraft to operate without flight recorders. This recommendation was issued, in part, to address 14 CFR 135.152(k), which allows an exception to the FDR requirement for certain rotorcraft models manufactured before August 18, 1997. The S-61N is one of the models listed in section 135.152(k). Therefore, although the accident helicopter was listed on CHSI's Part 135 operations specifications, it was not required to be equipped with an FDR. On November 26, 2009, the NTSB classified Safety Recommendation A-06-18 "Open—Unacceptable Response" pending FAA removal of the exceptions in section 135.152(k).

On February 9, 2009, the NTSB issued Safety Recommendation A-09-11, asking the FAA to require that all existing turbine-powered, nonexperimental, nonrestricted-category aircraft that are not equipped with an FDR and are operating under Parts 91, 121, or 135 be retrofitted with a crash-resistant flight recorder system. This recommendation is currently classified "Open—Acceptable Response." As a turbine-powered, transport-category aircraft listed on CHSI's Part 135 operations specifications, the accident helicopter would be covered by this recommendation.

The NTSB believes that the USFS should not wait for the FAA to require the installation of flight recorders but should take action now. Therefore, the NTSB recommends that the USFS require all contracted transport-category helicopters to be equipped with a CVR and an FDR or a cockpit image recorder with the capability of recording cockpit audio, crew communications, and aircraft parametric data.

Therefore, the National Transportation Safety Board recommends that the U.S. Forest Service:

> Develop mission-specific operating standards for firefighter transport operations that include procedures for completing load calculations and verifying that actual aircraft performance matches predicted performance, require adherence to aircraft operating limitations, and detail the specific 14 *Code of Federal Regulations* Part 135 regulations that are to be complied with by its contractors. (A-10-159)
>
> Require its contractors to conduct firefighter transport operations in accordance with the mission-specific operating standards specified in Safety Recommendation A-10-159. (A-10-160)
>
> Create an oversight program that can reliably monitor and ensure that contractors comply with the mission-specific operating requirements specified in Safety Recommendation A-10-159. (A-10-161)
>
> Provide specific training to inspector pilots on performance calculations and operating procedures for the types of aircraft in which they give evaluations. (A-10-162)

Require a hover-out-of-ground-effect power check to be performed before every takeoff carrying passengers from helispots in confined areas, pinnacles, and ridgelines. (A-10-163)

Review and revise policies regarding the type and use of gloves by firefighting personnel during transport operations, including but not limited to, compatibility with passenger restraints and opening emergency exits. (A-10-164)

Review and revise your contract requirements for passenger transport by aircraft so that the requirement to install shoulder harnesses on passenger seats provides improved occupant crashworthiness protection consistent with the seat design. (A-10-165)

Require that helispots have basic weather instrumentation that has the capability to measure wind speed and direction, temperature, and pressure and provide training to helitack personnel in the proper use of this instrumentation. (A-10-166)

Modify your standard manifest form to provide a place to record basic weather information and require that this information be recorded for each flight. (A-10-167)

Require all contracted transport-category helicopters to be equipped with a cockpit voice recorder and a flight data recorder or a cockpit image recorder with the capability of recording cockpit audio, crew communications, and aircraft parametric data. (A-10-168)

The NTSB also issued 11 new safety recommendations to the FAA and reiterated 1 previous safety recommendation. In response to the recommendations in this letter, please refer to Safety Recommendations A-10-159 through -168. If you would like to submit your response electronically rather than in hard copy, you may send it to the following e-mail address: correspondence@ntsb.gov. If your response includes attachments that exceed 5 megabytes, please e-mail us asking for instructions on how to use our secure mailbox. To avoid confusion, please use only one method of submission (that is, do not submit both an electronic copy and a hard copy of the same response letter).

Chairman HERSMAN, Vice Chairman HART, and Members SUMWALT, ROSEKIND, and WEENER concurred in these recommendations.

[Original Signed]

By: Deborah A.P. Hersman
Chairman