# National Transportation Safety Board

Washington, DC 20594

## Safety Recommendation

**Date:** July 23, 2015

**In reply refer to:** A-15-12

The Honorable Michael P. Huerta
Administrator
Federal Aviation Administration
Washington, DC 20591

We are providing the following information to urge the Federal Aviation Administration (FAA) to take action on the safety recommendation issued in this letter. This recommendation addresses the crash resistance of rotorcraft fuel systems. The recommendation is derived from an accident that the National Transportation Safety Board (NTSB) has investigated in which the impact forces were survivable for occupants but fatal or serious injuries occurred because of a postcrash fire that resulted from an impact-related breach in the fuel tanks. Information supporting this recommendation is discussed below.

On October 4, 2014, about 0155 central daylight time, an emergency medical services (EMS) Bell 206L1+ helicopter, N335AE, impacted terrain while on approach to the United Regional Hospital helipad in Wichita Falls, Texas. The commercial pilot later reported that the helicopter was inverted at impact and quickly filled up with smoke. He punched out the windshield and evacuated the helicopter. Footage from surveillance cameras at the hospital shows a large explosion where the helicopter hit the ground about 6 seconds after impact. The pilot was seriously injured; the flight nurse and paramedic survived the impact but later died from their injuries, which included thermal injuries. The patient likely died before impact, and his death was determined to be a result of the injury sustained before the accident. The helicopter was destroyed by the postcrash fire.[1]

This helicopter was manufactured in 1981 and did not have a crash-resistant fuel system as currently required by 14 *Code of Federal Regulations* (CFR) Part 27 airworthiness standards for normal-category rotorcraft. The FAA revised these standards along with Part 29 airworthiness standards for transport-category rotorcraft on October 3, 1994, to add "comprehensive crash resistant fuel system design and test criteria" for newly certified rotorcraft.[2] The revisions included two new regulations, 14 CFR 27.952 and 29.952, "Fuel System Crash Resistance," which state, "to minimize the hazard of fuel fires to occupants following an otherwise survivable

[1] More information about this accident, NTSB case number CEN15FA003, is available at http://www.ntsb.gov/_layouts/ntsb.aviation/index.aspx.

[2] 59 *Federal Register* 50380, October 3, 1994. The revised airworthiness standards became effective on November 2, 1994.

impact (crash landing), the fuel systems must incorporate the design features of this section."[3] However, the fuel systems on newly manufactured rotorcraft with type certificates approved before October 1994 are not subject to these regulations and, as a result, may pose a hazard to occupants if the systems are breached during a crash. Although the helicopter involved in the October 4, 2014, accident was manufactured before 1994, the circumstances of the accident illustrate that the impact forces alone during certain helicopter accidents are survivable if a postcrash fire can be prevented or its severity reduced.

In an October 1994 report on the results of a research program[4] conducted to investigate crash-resistant design technologies available to US civil rotorcraft—including those for fuel systems—the FAA "reaffirmed" the following two "significant" findings from a June 1985 study on rotorcraft crash dynamics: a "large percentage" of US civil rotorcraft accidents were potentially survivable, and the predominant hazard to occupant survival was a postcrash fire. The FAA's 1994 report indicated that the rotorcraft postcrash fire hazard was not limited to US civil helicopters (although the typical impact conditions for US civil helicopters was "substantially less severe" than for US military helicopters), noting that the US Army experienced a "high incidence" of thermal injuries and fatalities resulting from aircraft accidents.

To decrease thermal injuries and fatalities, the US Army began equipping its helicopters with crash-resistant fuel systems. Doing so resulted in a 66% reduction in postcrash fires in survivable accidents and an 18% reduction in postcrash fires in nonsurvivable accidents. These systems also resulted in a 75% reduction in thermal injuries and no thermal fatalities in survivable impact conditions. The results of the FAA's research program and the US Army's experience demonstrate the importance of ensuring that newly manufactured rotorcraft comply with the current airworthiness standards for crash-resistant fuel systems regardless of when the rotorcraft were certified.

Between 1994 and 2013, the NTSB has investigated at least 135 accidents in the United States involving certificated helicopters of various models that resulted in a postcrash fire. Those accidents resulted in 221 fatalities and 37 serious injuries. Only three of the accident helicopters that experienced postcrash fire had crash-resistant fuel systems and crashworthy fuel tanks.[5] Although these accidents involved circumstances other than postcrash fire that made them nonsurvivable, this sample from the NTSB's database illustrates how few helicopters in

[3] Paragraphs (a) through (g) in both sections address, respectively, drop test requirements to simulate fuel tank rupture (with a drop height of at least 50 feet), fuel tank load factors, fuel line self-sealing breakaway couplings, frangible or deformable structural attachments, separation of fuel and ignition sources, other basic design criteria, and impact and tear resistance of fuel tanks or bladders. According to the regulations, fuel tank load factors must be sustained "without structural damage to the system components, fuel tanks, or their attachments that would leak fuel to an ignition source."

[4] The research program also examined crash-resistant design technologies for landing gear, fuselage structure, and seating systems. According to the FAA, the program resulted in crash impact design and test criteria for civil rotorcraft and an assessment of the weight penalties that would be incurred in meeting these criteria. For more information, see *Rotorcraft Crashworthy Airframe and Fuel System Technology Development*, DOT/FAA/CT-91/7 (Atlantic City, New Jersey: Federal Aviation Administration Technical Center, 1994).

[5] NTSB case number MIA00FA102 involved a McDonnell Douglas Helicopter MD600N and case number CEN12FA001 involved the inflight breakup of a Robinson Helicopter Company R66. Another accident, case number SEA04MA167, involved a Bell Helicopter B407 that was certified to an equivalent level of safety for 14 CFR 27.952 excluding paragraph 27.952(b)(1), which addresses load factors for fuel tanks in the cabin.

operation today are equipped with the critical postcrash fire-related safety enhancements that the FAA mandated for newly-certificated helicopter designs. Reinforcing the NTSB's data, as of November 2014, the FAA aircraft registry includes more than 5,600 helicopters manufactured since 1994. However, of those, according to certification data provided by the FAA, only about 850 (or 15%) are models with crash-resistant fuel systems that meet the 1994 requirements. So in the 20 years since the requirements for newly certificated helicopters were put in place, 85% of the newly manufactured helicopters still do not have crash-resistant fuel systems.

The NTSB notes that in other areas the FAA has taken action to impose requirements to improve safety standards for all newly manufactured rotorcraft to afford a higher level of safety to all occupants. Specifically, on August 16, 1991, the FAA enacted 14 CFR 27.2 and 29.2, "Special Retroactive Requirements," which required the installation of a combined safety belt and shoulder harness at all occupant seats of normal- and transport-category rotorcraft manufactured after September 16, 1992,[6] regardless of a rotorcraft's original certification date. The safety belt and shoulder harness requirements in effect at that time applied only to new rotorcraft designs and not to newly manufactured rotorcraft with previously certificated designs.

Given the significant safety benefit of crash-resistant fuel systems, the NTSB is concerned that, 20 years after needed safety improvement in the design of helicopters was mandated, such a small percentage of US-registered helicopters currently flying meet the requirement for these systems. The NTSB concludes that the implementation of crash-resistant fuel system airworthiness standards for all newly manufactured rotorcraft, regardless of original certification date, would help reduce the risk of a postcrash fire in survivable accidents involving those rotorcraft.

Therefore, the National Transportation Safety Board makes the following recommendation to the Federal Aviation Administration:

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> Require, for all newly manufactured rotorcraft regardless of the design's original certification date, that the fuel systems meet the crashworthiness requirements of 14 *Code of Federal Regulations* 27.952 or 29.952, "Fuel System Crash Resistance."

Chairman HART, Vice Chairman DINH-ZARR, and Members SUMWALT and WEENER concurred in this recommendation.

[6] Safety belts and shoulder harnesses to protect rotorcraft occupants from head injury were required at the time by paragraphs (b) and (c) of 14 CFR 27.785 and 29.785, "Seats, Berths, Litters, Safety Belts, and Harnesses," which became effective on December 13, 1989. The FAA used the authority in 14 CFR 27.2 and 29.2 to require that newly manufactured rotorcraft meet the requirements of those paragraphs.

The NTSB is vitally interested in this recommendation because it is designed to prevent accidents and save lives. We would appreciate receiving a response from you within 90 days, as required by 49 *United States Code* section 1135, detailing the actions you have taken or intend to take to implement it. When replying, please refer to the safety recommendation by number and submit your response electronically to correspondence@ntsb.gov.

[Original Signed]

By: Christopher A. Hart,
Chairman