NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

May 9, 2016

HELICOPTER SPECIALIST'S FACTUAL REPORT

NTSB No: WPR16FA040

A. ACCIDENT

Operator:	Air Methods Corporation
Aircraft:	Airbus Helicopters AS350 B3, Registration N74317
Location:	Superior, Arizona
Date:	December, 15, 2015
Time:	1723 mountain standard time

B. GROUP

No group was formed.

LIST OF ACRONYMS

AMC	Air Methods Corporation
AZ	Arizona
CFR	Code of Federal Regulations
FAA	Federal Aviation Administration
HAA	helicopter air ambulance
IIC	investigator-in-charge
IWA	Phoenix-Mesa Gateway Airport
MST	mountain standard time
NTSB	National Transportation Safety Board
OEM	original equipment manufacturer
STC	Supplemental Type Certificate
TCDS	Type Certificate Data Sheet
TSO	Technical Standard Order
VFR	visual flight rules

C. SUMMARY

On December 15, 2015, about 1723 mountain standard time (MST), an Airbus Helicopters AS350 B3 helicopter, N74317, was substantially damaged when it impacted terrain while maneuvering near Superior, Arizona (AZ). The helicopter was registered to Air Methods Corporation (AMC) and was doing business as Native Air Ambulance under the provisions of 14 *Code of Federal Regulations* (CFR) Part 135 as a helicopter air ambulance (HAA) operation. The commercial pilot and flight nurse sustained fatal injuries; the flight paramedic sustained serious injuries. Visual meteorological conditions prevailed and a company visual flight rules (VFR) flight plan was filed for the flight. The cross-country positioning flight originated from the Phoenix-Mesa Gateway Airport (IWA) in Mesa, Arizona, at about 1705 MST with an intended destination of Globe, AZ.

Examination of the accident site revealed the helicopter impacted mountainous terrain about 10 miles north-northwest of Superior, AZ. All major structural components of the helicopter were located within the wreckage debris path, which was about 380 feet in length, oriented on a heading of about 200 degrees magnetic. The wreckage was recovered to a secure location for further examination.

On February 17, 2016, the National Transportation Safety Board (NTSB) investigator-in-charge (IIC) and an NTSB helicopter specialist, along with participants from the Federal Aviation Administration (FAA), Airbus Helicopters, AMC, and Sikorsky Aircraft Corporation, performed an examination of the helicopter's seats.

D. DETAILS OF THE INVESTIGATION

1.0 HELICOPTER INFORMATION

The Airbus Helicopters AS350 B3 has a three-bladed main rotor system that provides helicopter lift and thrust.[1] A two-bladed tail rotor system provides anti-torque and directional control. The helicopter is equipped with a Turbomeca Arriel 2B1 turboshaft engine. The AS350 B3 helicopter is type certificated under FAA Type Certificate Data Sheet (TCDS) No. H9EU. Attachment 1 contains FAA TCDS No. H9EU.

1.1 PILOT SEAT

The accident helicopter was equipped with an original equipment manufacturer (OEM) pilot seat installed on the right side of the cockpit.[2] The OEM pilot seat, manufactured by Zodiac Seats France (formerly Sicma Aero Seat) is designed to comply with FAA Technical Standard Order (TSO)-C127a, "Rotorcraft, Transport Airplane, and Normal and Utility Airplane Seating Systems." The pilot seat is attached to seat tracks mounted to the cockpit floor. The seat is adjustable in the fore and aft direction.

1.2 REAR SEATS

The accident helicopter was equipped with three aftermarket, forward-facing seats and a cargo pallet mounted to the aft vertical wall of the cabin. The rear seats and cargo pallet were installed under FAA Supplemental Type Certificate (STC) No. SR01193LA, held by LifePort,

[1] The main rotor blades rotate in a clockwise direction when looking down at the main rotor disc from top looking down.
[2] The terms "left" and "right" are used when in the frame of reference of looking forward from the aft end of the helicopter, unless otherwise specified.

Inc.[3] Each individual seat and the cargo pallet are hooked onto two lateral tracks (a upper and a lower track) and secured to the lower track with two quick release pins. The two lateral tracks are bolted to four vertical supports (also known as "straps"). The upper end of each vertical strap is bolted to a structural support that is installed on the transmission deck (by the same STC). The lower end of each vertical strap is secured to a seat belt pan, original to the helicopter structure, by a bolt and nutplate. According to the STC, three types of seats are eligible for installation: a standard AS350 seat, a round-cushion seat, and a folding utility seat. The accident helicopter was equipped with three round-cushion seats. Each seat contained a four-point seat belt restraint. The lower two restraint points were attached to the seat bottom mounting bracket, which attaches to the seat back structure. The upper two restraints are routed over the top of the seat back to an inertial reel housing that is mounted to the lower mounting plate, which attaches to the seat back structure.

1.3 SEAT DESIGN REQUIREMENTS

14 CFR 27.561 and 27.562 contains criteria for emergency landing conditions for normal category rotorcraft. The original certification requirements of §27.561(b)(3), effective February 1, 1965, for occupant safety during emergency landing conditions included the following ultimate inertial load factors:

- 1.5g upward
- 4.0g forward
- 2.0g sideward
- 4.0g downward, or any lower force that will not be exceeded when the rotorcraft absorbs the landing loads resulting from impact with an ultimate descent velocity of five feet per second at design maximum weight.

Amendment 27-25, effective December 13, 1989, modified §27.561(b)(3) to increase the ultimate inertial load factors to the following:

- 4g upward
- 16g forward
- 8g sideward
- 20g downward, after the intended displacement of the seat device

Amendment 27-32, effective June 11, 1996, added a rearward ultimate inertial load requirement of 1.5 g to §27.561(b)(3).

According to TCDS No. H9EU, the certification basis for the AS350 B3 helicopter was 14 CFR 21.29 and Part 27 effective February 1, 1965, including amendments 27-1 through 27-10 and FAA Special Conditions No. 27-79-EU-23, dated August 13, 1977. Thus, the occupant seats within the AS350 B3 are not required to meet the increased ultimate inertial load factors introduced by Amendment 27-25 and onward, nor are they required to undergo dynamic testing in accordance with §27.562. However, according to Airbus Helicopters, the OEM pilot seat for the AS350 B3 was certified to meet the requirements of §27.561(b)(3) at the load factors increased by amendment 27-25, and were tested to meet the dynamic testing requirements of §27.562. According to Sikorsky, the rear seats for STC No. SR01193LA were designed to meet the original certification requirements that TCDS No. H9EU met, §27.561(b)(3) without any amendments applied, and was not required to meet the current §27.561(b)(3) standard.

[3] LifePort, Inc. is a subsidiary of Sikorsky Aircraft Corporation.

2.0 WRECKAGE EXAMINATION

On February 17, 2016, the NTSB IIC and an NTSB helicopter specialist, along with representatives from the FAA, Airbus Helicopters, AMC, and Sikorsky, performed an examination of the helicopter's seats.

The forward section of the cabin, including the windscreen, the majority of cockpit instruments, and the cabin roof, were separated from the main fuselage (**Photo 1**). The all cabin doors except for the rear-right door were separated as well. The forward-right portion of the cabin floor was crushed aft, and the cabin floor buckled upward immediately behind the pilot seat (**Photo 2**). The pilot seat remained attached to the seat track, which remained attached to the cabin floor. However, both left and right seat tracks were fractured adjacent to the rear of the seat attachment; the fracture exhibited signatures consistent with overload (**Photo 3**). The pilot seat was angled slightly forward and to the right due to the buckled cabin floor. The pilot seat remained mostly intact with no evidence of a downward seat stroke. The stretcher remained attached to the cabin floor to the left of the pilot seat. The cargo pallet was found loose in the wreckage. The cargo pallet's lower brackets, used to attach it to the lower lateral track, were fractured from the pallet. The fractures exhibited signatures consistent with overload. The lower brackets remained attached to the lower lateral track via quick release pins.

Photo 1. The remnant cockpit and cabin.

Photo 2. The pilot seat and cabin floor buckling.

Photo 3. The pilot seat mounted to the floor tracks. The unlabeled arrow points to the seat stroking track. (Photo courtesy of Airbus Helicopters)

2.1 REAR SEAT LATERAL TRACKS AND VERTICAL STRAPS

Three of the [rear seat] vertical straps (right, center-right, and center-left positions) remained attached to the aft vertical wall. The fourth vertical strap (left position) was found loose in the wreckage. The upper portion of the left vertical strap exhibited bending deformation in the forward direction, and its upper end had fractured immediately below the attachment point to the transmission deck structural support. The left seat belt pan was found to have shifted outboard. The right vertical strap's lower attaching mount was separated from the seat belt pan. The bolt and nutplate for the right vertical strap's lower attaching mount was not recovered. The center-right vertical strap's lower attaching mount remained attached to the seat belt pan, but the upper end of the center-right strap was separated from the transmission deck structural support. Both ends of the center-left vertical strap remained attached to both the transmission deck structural support and the seat belt pan.

The upper lateral track was only attached to the center-right vertical strap via two bolts, but did not exhibit evidence of deformation or damage. The lower lateral track was found loose in the wreckage with two seats still attached to it. The lower lateral track was bent in the forward direction near the third quick release pin hole from the left. A fracture, with signatures consistent with overload, was collocated at the third quick release pin hole from the left. The first and second from the left quick release pin holes exhibited deformation near the hole edges on the forward face of the lower lateral track. **Photo 4** shows a reconstructed assembly of the lateral tracks and vertical straps on the aft vertical wall (after removal of the right and middle seats that were attached to the lower lateral track).

Photo 4. A reconstructed assembly of the lateral tracks and vertical straps.

The right, center-left, and left transmission deck structural supports remained intact. The center-right transmission deck structural support remained attached to the transmission deck sheet metal, but the sheet metal was fractured with signatures consistent with overload. The two

bolts, normally securing the center-right vertical strap to the transmission deck structural support, was fractured, with the remnant threaded shanks retained within the transmission deck structural support. The remnant threaded shanks exhibited signatures consistent with overload; the fractured bolt heads were not recovered. The remaining bolts securing the center-right and center-left vertical straps to the aft vertical wall were removed; there were no anomalous findings with the remaining mounting assemblies. The aft vertical wall generally did not exhibit significant damage or distortion (**Photo 5**).

Photo 5. The aft vertical wall after removal of the lateral tracks, vertical straps, and wall cover.

2.2 RIGHT REAR SEAT

The right rear seat back remained attached to the lower lateral track on its lower mounting plate and quick release pins. The seat bottom was separated from the seat back structure, but remained connected to the seat belt restraint, which was connected to the seat belt inertial reel assembly attached to the lower mounting plate. The seat bottom's left and right mounting brackets were fractured and exhibited signatures consistent with overload. The remnant mounting brackets remained attached to the seat back structure. The left hook (normally attached to the upper lateral track) on the seat back did not exhibit evidence of deformation, but the lower portion of the right hook exhibited deformation in the aft and slightly outboard direction (**Photo 6**). The seat cushions and covers remained installed on both the seat back and seat bottom.

Photo 6. A view of the rear of the middle and right seat backs installed on the lower lateral track. The unlabeled arrow points to the deformation on the right hook of the right seat.

2.3 MIDDLE REAR SEAT

The middle rear seat back remained attached to the lower lateral track on its lower mounting plate and quick release pins. The seat bottom was separated from the seat back structure, but remained connected to the seat belt restraint, which was connected to the seat belt inertial reel assembly attached to the lower mounting plate. The seat bottom's left mounting bracket was fractured and exhibited signatures consistent with overload. The remnant left mounting bracket was attached to the seat back structure. The seat bottom's right mounting bracket remained intact, but the attaching hardware was missing. The seat back hooks did not exhibit evidence of deformation. The seat cushions and covers remained installed on both the seat back and seat bottom.

2.4 LEFT REAR SEAT

The left rear seat back and seat bottom were found loose in the wreckage, separated from both upper and lower seat tracks. The seat bottom was separated from the seat back structure, but remained connected to the seat belt restraint, which was connected to the seat belt inertial reel assembly attached to the lower mounting plate. The lower mounting plate exhibited severe rearward deformation (**Photo 7**). Additionally, the left and right sides of the lower seat back frame was deformed inward (toward the vertical centerline of the seat) and the sheet metal back rest was deformed aft. The distance between the left and right sides of the lower seat back frame was about 11.5 inches (**Photo 8**); for comparison, the same distance was measured on the right seat (15.0 inches) and middle seat (14.8 inches). The seat bottom's left mounting bracket remained intact, but the attaching hardware was missing. The seat bottom's right mounting bracket was fractured and exhibited signatures consistent with overload. The remnant right mounting bracket was attached to the seat back structure. Both quick release pins remained attached to the seat back structure via metal wire. The seat cushion and cover remained installed

on the seat back. The seat cushion and cover was not installed on the seat bottom, but was found separately in the wreckage. **Photo 9** shows a reconstruction of the three seats and cargo pallet to the lower lateral track.

Photo 7. Rear left seat lower mounting plate deformation.

Photo 8. Measurement of the lower seat back frame deformation for the rear left seat. (Photo courtesy of Air Methods)

Photo 9. Reconstruction of the three seats and cargo pallet.

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