

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



ERA23LA011

SURVIVAL FACTORS

Group Chair's Factual Report

October 4, 2023

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ACCIDENT

Location: Fort Myers, FL
Date: October 8, 2022
Time: 1800 Eastern Daylight Time (EDT)
2300 Universal Time Coordinated (UTC)
Helicopter: Bell Textron Canada LTD 505, N5DF

SURVIVAL FACTORS GROUP

Group Chairman	Amanda Taylor National Transportation Safety Board Washington, DC
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SUMMARY

During an approach to a landing zone (LZ) at a fire station in Fort Myers, Florida to drop off three passengers, the helicopter entered an uncommanded right yaw at a height of about 150 feet above the ground. The helicopter then pitched up and rolled violently. The pilot was unable to regain control and the helicopter crashed in a ditch near the LZ.

DETAILS OF THE INVESTIGATION

On January 18, 2023, the survival factors specialist, representatives from the FAA and Bell Textron convened at Florida Air Recovery located in Fort Pierce, FL to

conduct a wreckage examination of seats, restraints, and aspects of the airplane related to survival factors.

1.0 Helicopter Configuration



Figure 1. Pre-accident photograph of the accident airplane (Source: Flightaware.com).

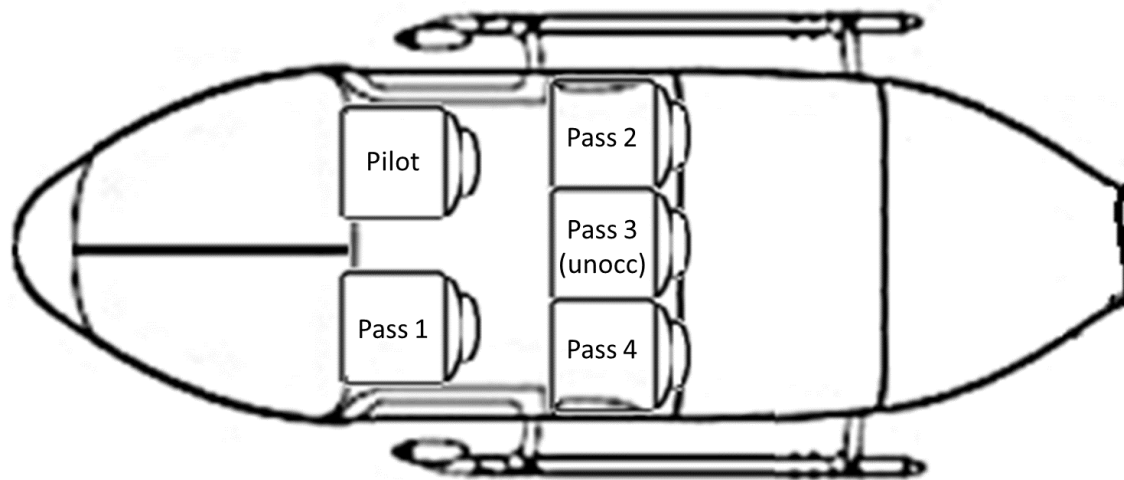


Figure 2. Diagram showing the seating locations.

The helicopter was equipped with five seats in the cabin, two floor-mounted front pilot seats, and three bulkhead-mounted rear passenger seats. There was a private pilot and three passengers on board.

2.0 Overall Exterior

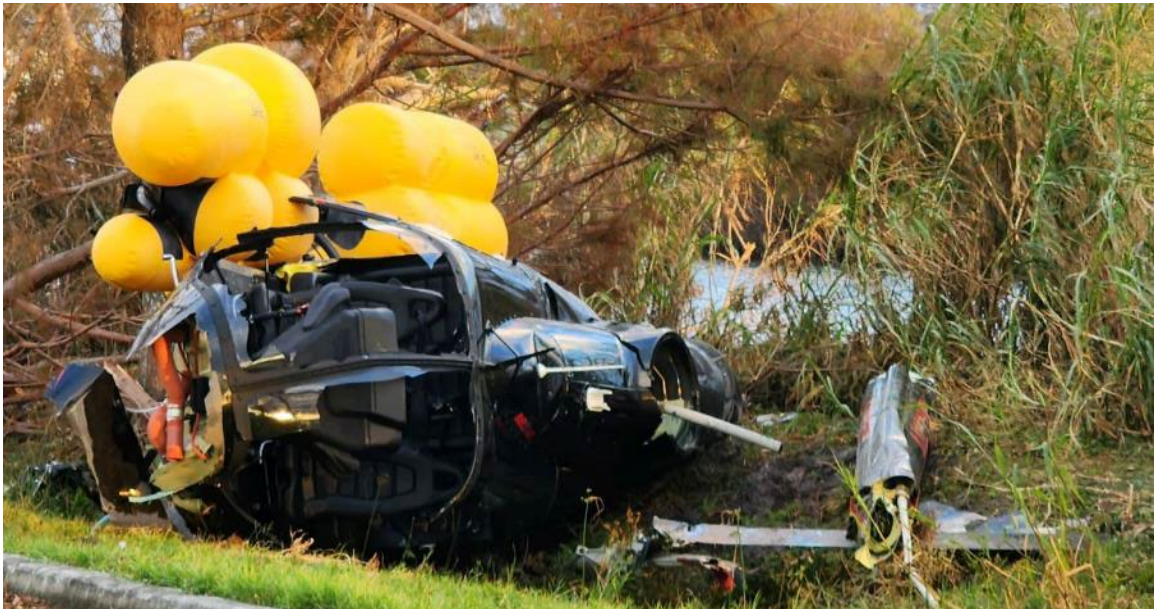


Figure 3. N5DF at the accident site after firefighters had extricated all occupants. [Source: FAA]

The helicopter was found resting on its left side by the FAA inspectors. The main transmission and engine remained attached to the airframe. The tail boom, main rotor hub and blades had separated, and there was damage to the front of the helicopter (see figure 3). The left side skid broke off during the accident sequence and was located across a small road. The floats on the right-side skid were deployed. The mid fuselage composite skin panel surrounding the fuel bladder was partially fractured and delaminated on its left-hand side and on its belly. First responders reported a fire around the engine area which was put out with a fire extinguisher.



Figure 4. Left side view of N5DF during post-accident inspection.



Figure 5. Right side view of N5DF during post-accident inspection.

2.1 Doors

The helicopter was equipped with three cabin doors. On the left side of the helicopter there were two doors that operated together as a clamshell exit. The forward-hinged door rotated open toward the front of the helicopter. The rear door was rear-hinged and rotated open toward the rear of the helicopter. On the right side of the helicopter there was a single forward-hinged that rotated open forward. The doors were attached to the helicopter during the accident flight. However, they were no longer attached at the salvage facility.

The helicopter was missing the front left pillar. Measurements were taken from the floor to the bottom of the door trim on both the right and left side of the accident helicopter, and in an exemplar helicopter¹. Additionally, the cabin was measured across at the center of the aisle for the rear passengers. The measurement locations are shown in figure 6, and measurements in figure 7.

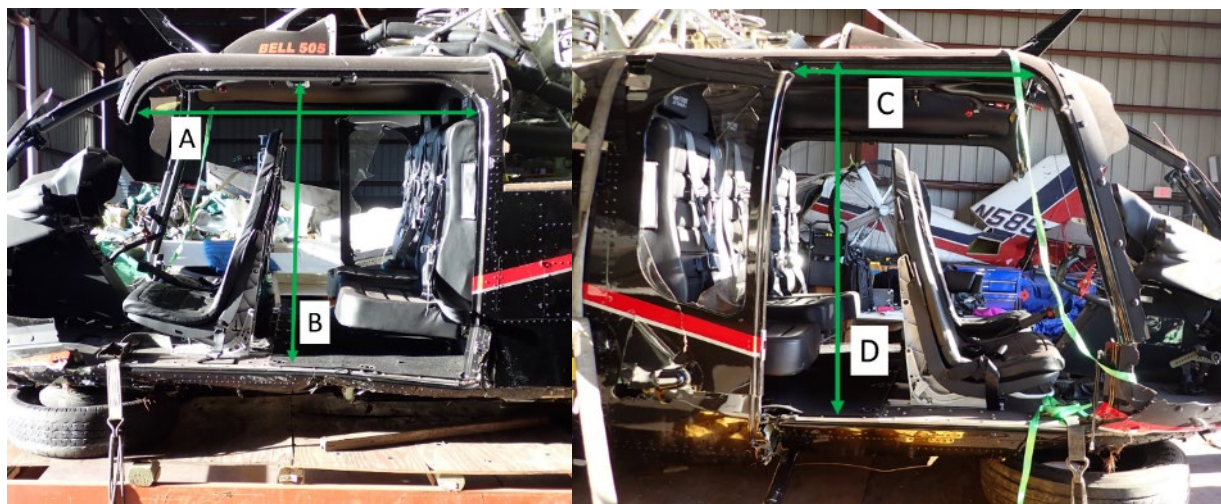


Figure 6. Door measurement locations of N45DF.

Measurements (inches)	Exemplar Helicopter	Accident Helicopter
Width of left door opening (A)	49.0	51.0
Height of left door opening (B)	48.0	44.8
Width of right door opening (C)	32.0	32.5
Height of right door opening (D)	48.0	46.1
Width at the center of the rear aisle	56.4	52.0

Figure 7. Measurements from the exemplar and accident helicopters.

3.0 Overall Cabin Interior

After the carpet and three rear bulkhead mounted seats were removed, it was noted that there was floor disruption beneath the rear seats. There was an approximately 16-inch crack extending from the right edge of the floor inward, and 20 inches from the bulkhead forward (see figure 8). The distance from the top to

¹ Exemplar measurements were provided by Bell.

bottom attachment points, and bottom attachment points to floor were measured (see figure 9 and 10).

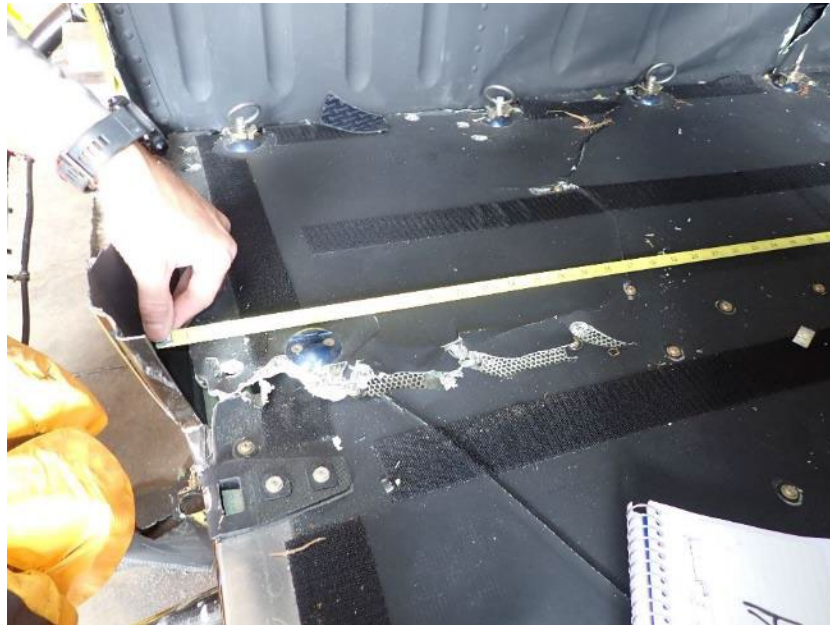


Figure 8. Floor crack beneath passenger seat two.

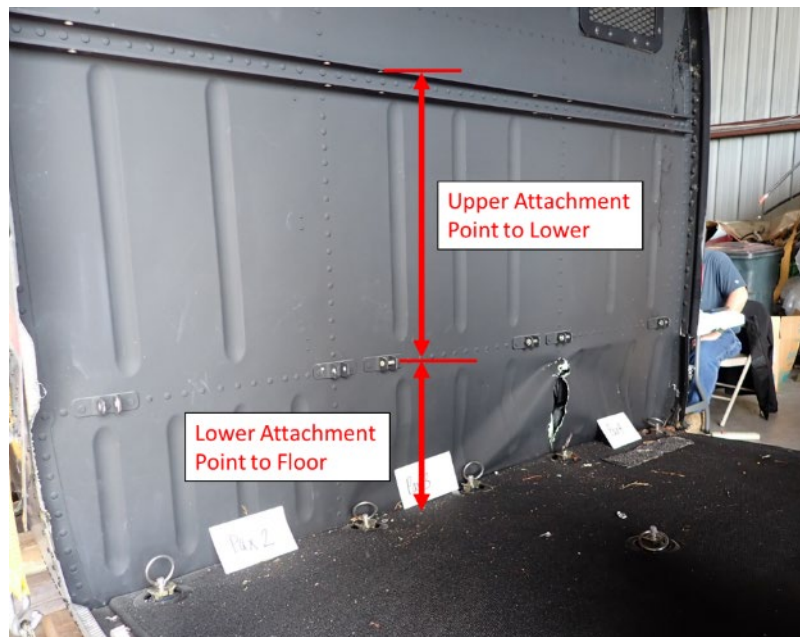


Figure 9. Bulkhead measurements.

Seat Place	Top seat attachment point to lower seat attachment point		Lower seat attachment point to floor	
	Left	Right	Left	Right
Pass 2	19.2	19.2	11.60	11.40
Pass 3	19.2	19.2	10.90	11.45
Pass 4	19.2	19.0	11.25	10.80

Figure 10. Measurements taken along the bulkhead.

4.0 Seats

The helicopter was equipped with five seats all of which were energy attenuating. Two front seats were floor mounted crew seats, and the three aft seats were bulkhead mounted passenger seats.

4.1 Front Crew Seats

The floor mounted front crew seats were manufactured by Safran Seats and labeled "Crew Seat Bell SLS." Both seats had a label below the manufacturing labels that said, "THIS TSO ARTICLE IS MODIFIED PER BELL HELICOPTER SLS TYPE CERTIFICATE." They were both part number 1591718-44, had a date of manufacture of 02/2020, and MFR F0465. The serial number was 20T0585 for the pilot seat and 20T0390 for passenger seat.

Both seats consisted of a composite bucket affixed to two machined frames (see figure 11). The lower portion of the frames contained absorption devices that deformed to absorb vertical energy to meet the requirements referred to in 14 CFR sections 27.785 and 27.562. The upper portion of the frames contained a sliding mechanism that guided the bucket downwards while the lower absorption devices are deformed (see figure 12).

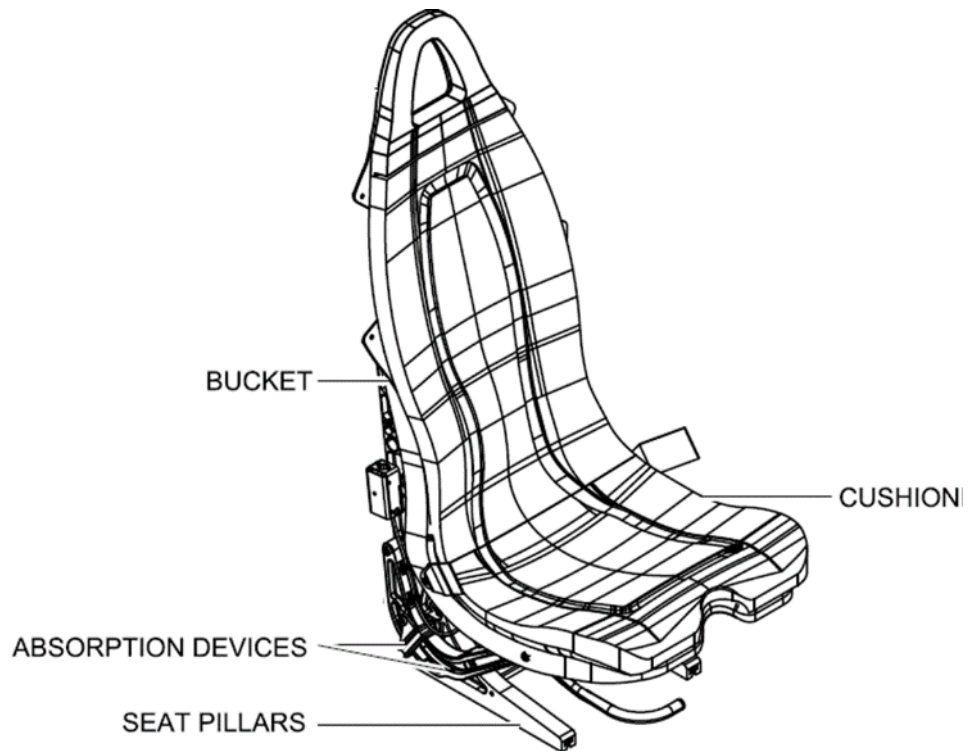


Figure 11. Elements of the seat, including the frame and bucket.

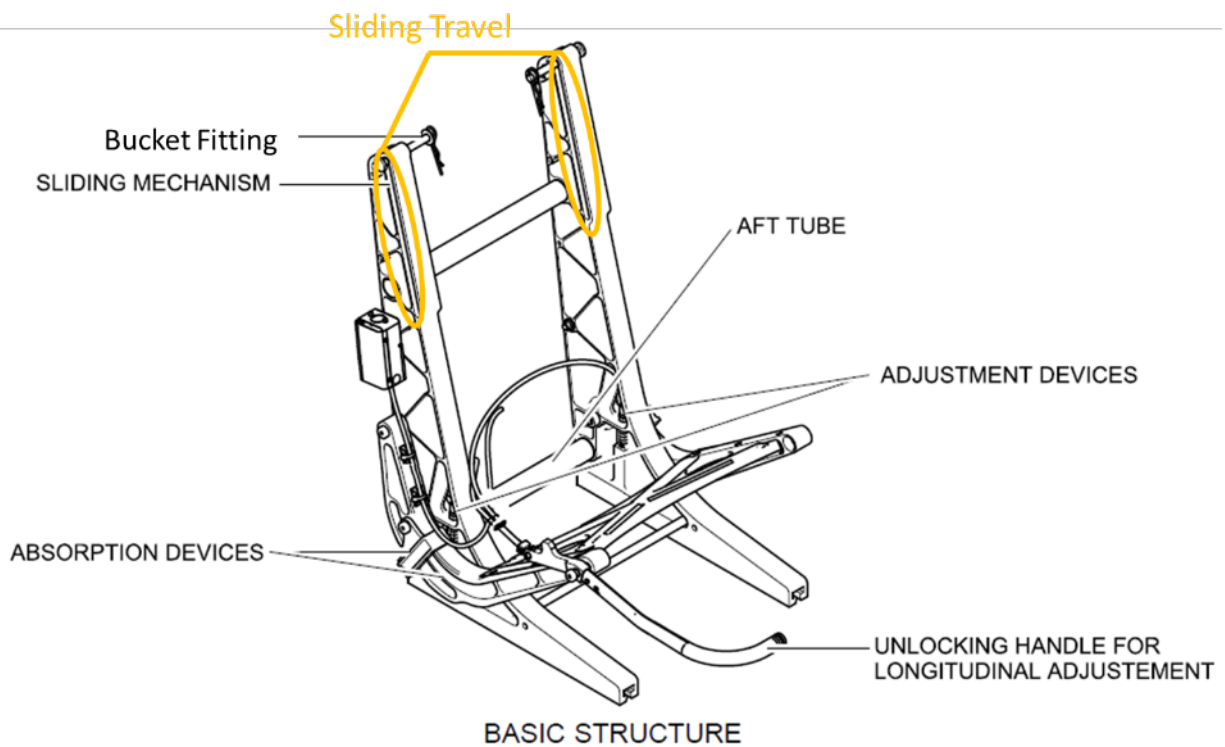


Figure 12. Areas of sliding travel during vertical energy absorption.

All seats were equipped with a Pacific Scientific four-point restraint system with a rotary buckle, adjustable lap belt segments and an inverted Y- yoke shoulder restraint that routed over the seat back and downward into an inertia reel which was secured to the seat bucket.

4.1.1 Front Right Seat (Pilot)

The pilot was located on the right side of the helicopter (see figure 13). The seat was found stroked downward (see section 4.1.3). The seat bucket was structurally undamaged but a scratch on the seat bucket was noted just above marks on the floor (see figure 14). There was an impact mark on the right seat leg directly below the EA attachment bolt (see figure 15). There was fretting noted between the right-hand seat leg and the EA device (see figure 16). The Bose headset kit electrical wire under the seat bucket was bent. The seat was in the forward and locked position for flight. The anti-torque pedals were set to the farthest forward position. The unlocking handle for fore/aft adjustment did not function when tested.



Figure 13. Pilot seat at the salvage facility.



Figure 14. Marks on the seat and the floor.

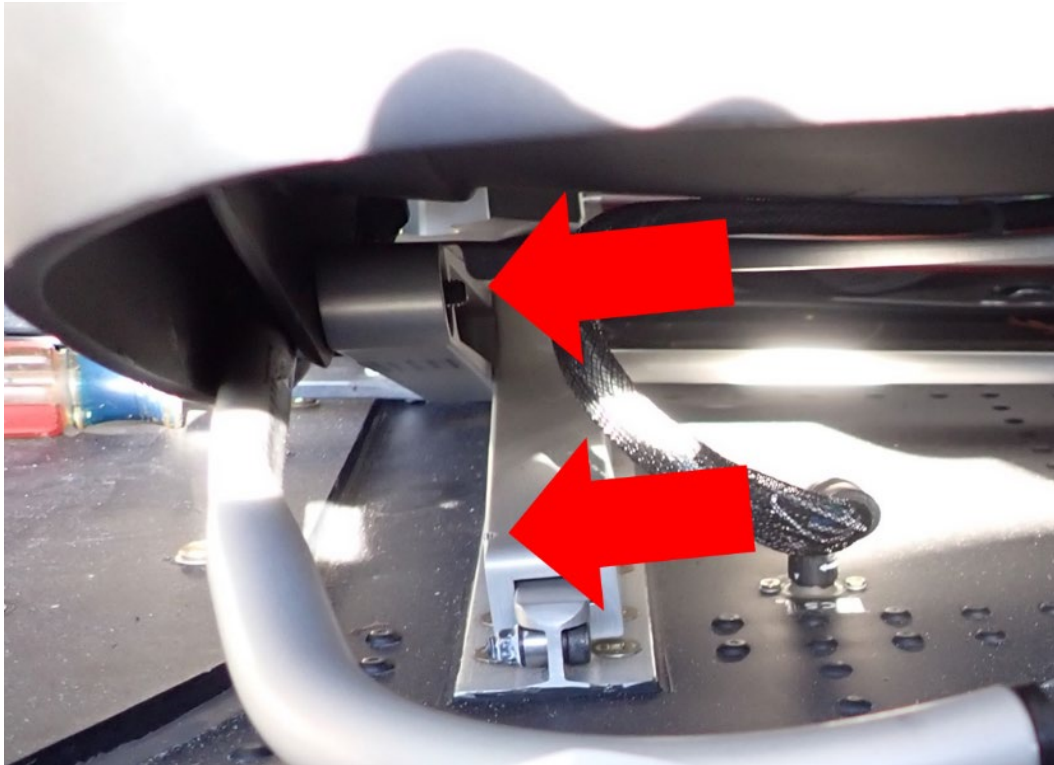


Figure 15. EA device attachment bolt, directly above marks on the pilot seat leg.



Figure 16. Fretting marks between the pilot right hand seat leg and EA device.

The right lap belt was adjusted to measure 20.5 inches, and the left lap belt was adjusted to measure 20.9 inches as found at the salvage facility. The lap belt and rotary buckle were manufactured by Pacific Scientific. The rotary buckle was functional and was labeled 1111475-01, manufactured 09/19. The lap belt was labeled P/N 20000115-213, FA 20000115-101, date of mfg 09/19, and a rated strength of 2500 lbs. The Pacific Scientific inertia reel was functional and was still secured to the seat bucket. The cushion was manufactured by Safran, order batch ref: VF1925, date of manufacturing February 20, TSO P/N 159700-1, reference F209731, and complies with ETSO/TSO-C127a.

The seat measured 19 inches from the seat back to the cyclic, and 44 inches from the center of the seat bottom cushion to the overhead structure.

The absorption devices in both sides were deformed (see figure 17). The clamp along the right-side absorber had fractured and the broken piece was found near the seat at the salvage facility. The clamp on the left side had bent but not fractured. The seat bucket sliding mechanism slot was widened on both sides.

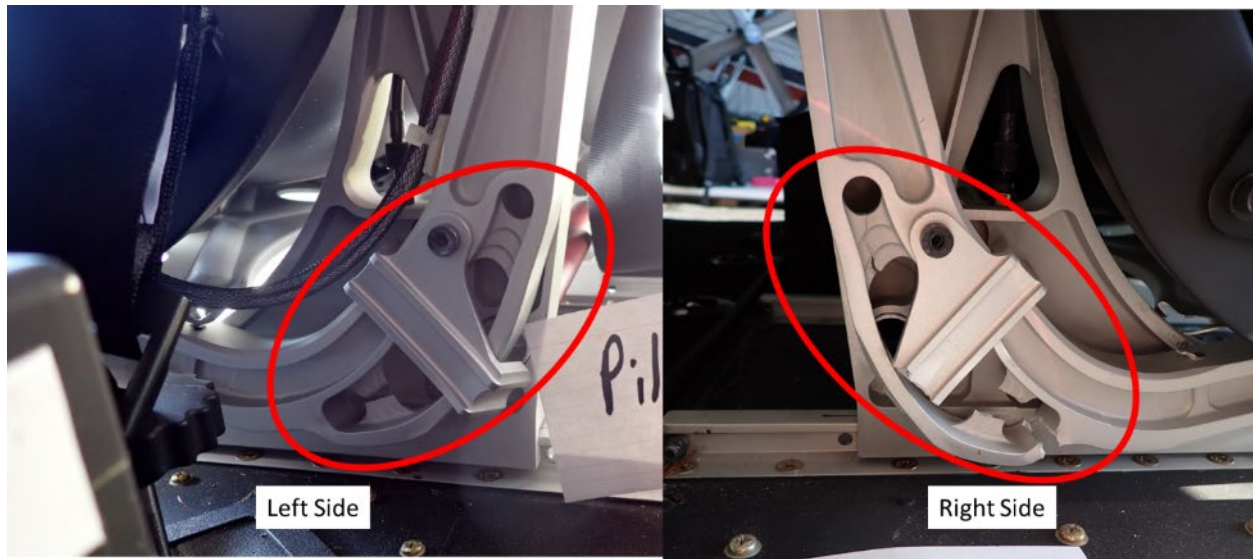


Figure 17. Pilot seat bottom absorption devices left and right sides.

4.1.2 Front Left Seat (Passenger 1)

While the seat was a crew seat, there were no controls installed in front of it (see figure 18). The seat was found stroked downward. The seat bucket was structurally undamaged. The seat was in the forward and locked position for flight. The unlocking handle for the fore/aft adjustment was functional.



Figure 18. Passenger seat 1 at the salvage facility.

The Pacific Scientific inertia reel was functional and was secured to the seat bucket. The belts were also manufactured by Pacific Scientific. According to first responders the belts were all cut by first responders during the extrication of the occupants. There was a label on the insert tab portion lap belt webbing that read P/N 20000115-213, FA 20000115-101, with a date of mfg 09/19, and a rated strength of 2500 lbs. The rotary buckle and attached webbing were not found at the salvage facility.

The seat measured 31.5 inches from the front of the seat back to the glare shield, and 42.7 inches from the center of the seat bottom cushion to the overhead structure.

The absorption device on the left and right were activated (see figure 19). Neither of the clamps on the absorption devices had fractured. The sliding mechanism slot was widened on both sides.

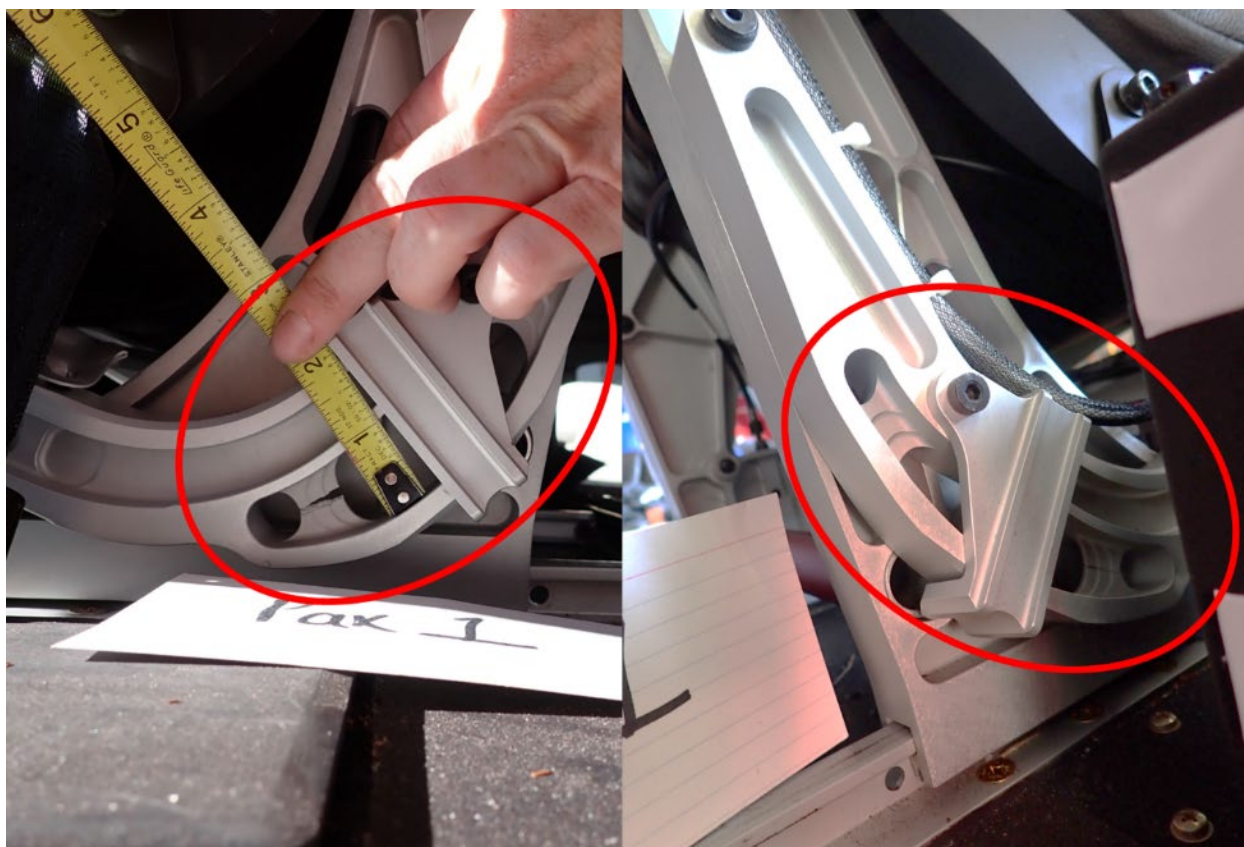


Figure 19. Passenger seat 1 seat bottom absorption devices left and right.

4.1.3 Front Seats Downward Displacement

To document the seat downward permanent displacement of the seat during the accident, measurements were taken at locations on the bottom and side of the seat: the bucket along the front (points 1-3), the belt anchor at the back (points 4 and 5), and from the center of the seat bucket guide pin to the arc at the top of the slot above it. Additionally, there were also angle measurements taken at the floor and across the seat pan (see figure 20 and 21). With a positive angle being clockwise and negative being counterclockwise.



Figure 20. Five points measured on the seat bucket bottom and vertical displacement of seat bucket guide pins.

Seat	1 (in)	2 (in)	3 (in)	4 (in)	5 (in)	Floor angle (deg)	Seat pan angle (deg)	Left vert disp (in)	Right vert disp (in)
Pilot	4.7	6.3	5.5	4.9	5.9	-1	4	3.4	4.2
Pass 1	7.5	8.4	6.9	7.6	5.9	-1	-7	2.7	1.7

Figure 21. Measurements from the front crew seats.

4.2 Rear Passenger Seats

The three rear bulkhead mounted seats were “crash attenuating VIP Seats”, manufactured by East West. They were each labeled as customer part number 403D101-4, seat part number 403D101-101, cushion part number 403D180-401, and dated 3Q19. The serial number was 1025 for passenger seat two, 1026 for passenger seat three, and 1027 for passenger seat four.

The seats were composed of an aluminum frame and seat bottom (see figure 22). The vertical tubes of the frame were designed to transmit the load of an occupant to the helicopter structure. The seat bottom was an aluminum pan attached to a tubular frame that included cables on each side and a rigid set of fasteners at each aft area that transmitted loads to the vertical tubes. The seat was designed to attenuate energy through downward displacement, where metal strips on the rear part of the frame were deformed over a set of rollers to meet the requirements referred to in 14 CFR sections 27.785 and 27.562. There were indicators (arrows) located on the side of the seat that indicated whether the seat was stroked (see figure 23).

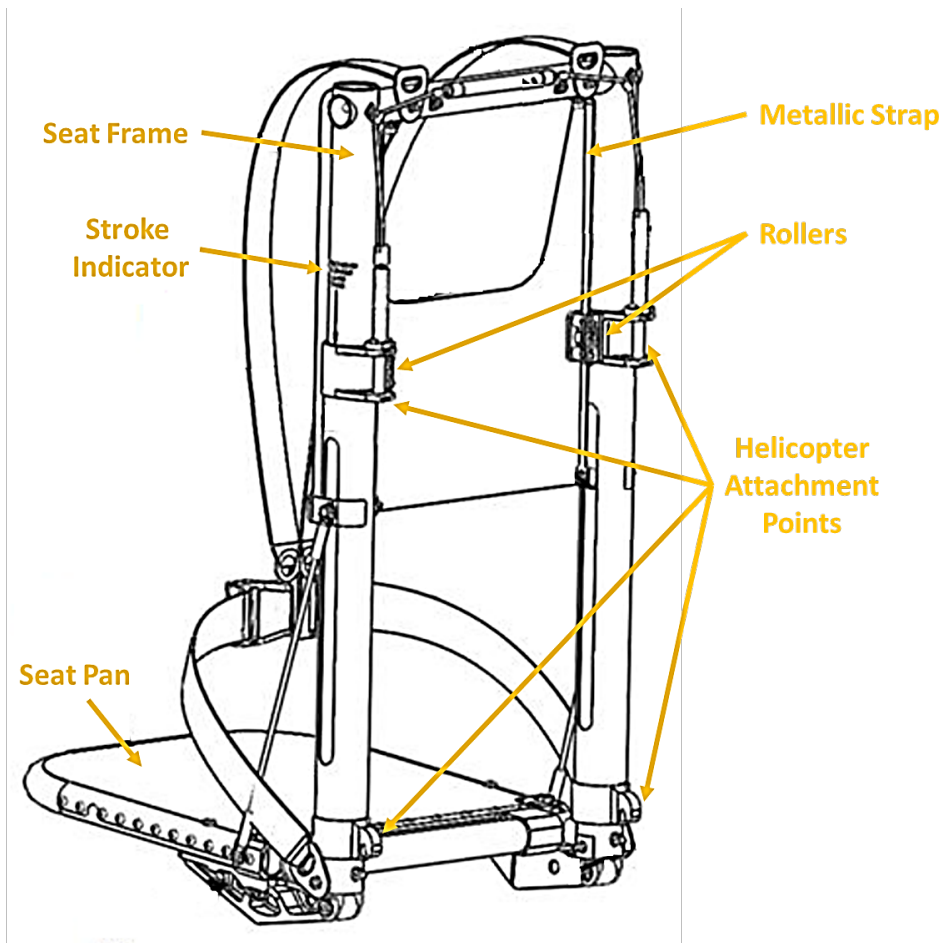


Figure 22. Elements of the seat (excluding cushions), including the frame and seat pan.

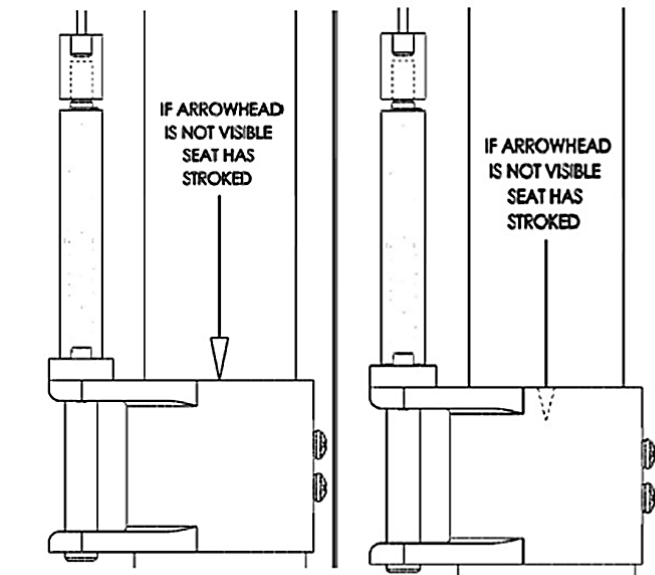


Figure 23. Stroke indicator located on seat frame.

All seats were equipped with a four-point restraint system with a lift latch buckle and adjustable lap and shoulder belt segments. The right lap belt and shoulder belt were permanently secured to the buckle tang side, and the left belts were secured to the buckle side. The restraints were secured directly to the seat frame. All three seat belts were manufactured by AmSafe, PNR 4118-2-041-2396, MFR 35FB9DMF, Assy 403D160-103, and SO S404278-1.

4.2.1 Rear Right Seat (Passenger 2)

Both the left and right-hand EA devices were activated. Fretting marks on left-hand side EA device strip and bending of its flange at the upper connection were observed (see figure 24). There was deformation in multiple places on the seat pan tubular frame. The frame was fractured on both sides forward of the bottom reinforcing frame at the seat back bottom interface (see figures 25 and 26). The lower right seat frame hook was no longer attached to the pin that secured it to the bulkhead (see figure 27). Fretting marks were observed on the lower right-hand hook seat attachment fitting.



Figure 24. EA device strip showing flange bending at the top and fretting marks towards the bottom.

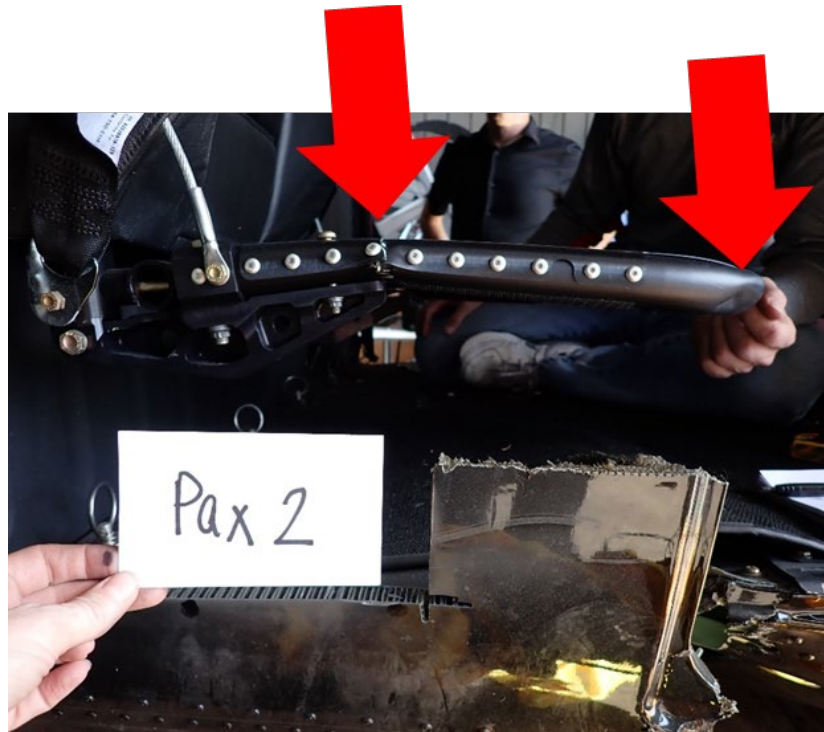


Figure 25. Side view of the passenger 2 seat frame.



Figure 26. Bottom of passenger seat 2 showing tubular fractures forward of the reinforcing structure.

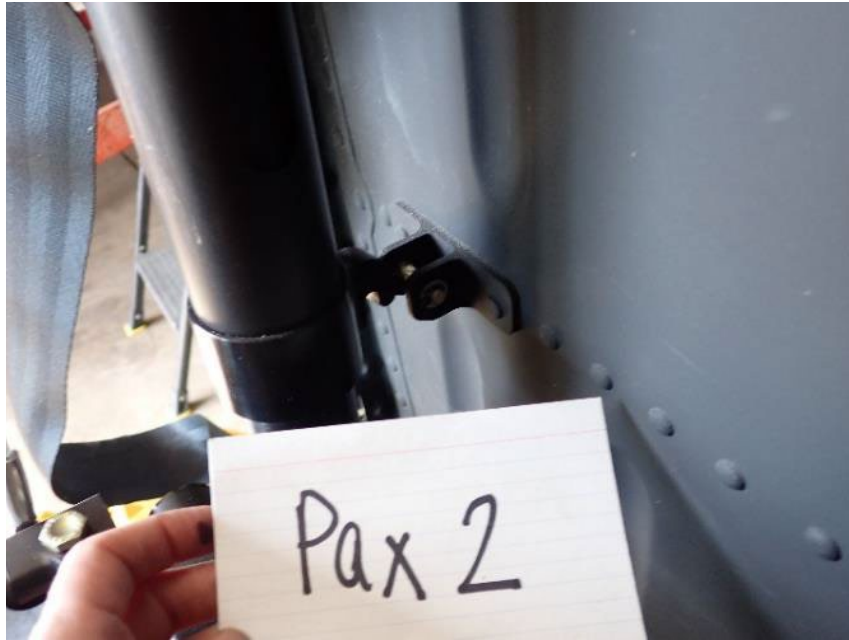


Figure 27. Passenger seat lower right seat frame hook off its pin.

The right lap belt was adjusted to measure 29.8 inches and the right shoulder belt 22.6 inches. The left lap belt was adjusted to measure 24.9 inches and the left shoulder belt 22.2 inches.

4.2.2 Rear Center Seat (Passenger 3)

The seat was not visibly stroked downward. The seat was unoccupied during the accident flight. The center of the seat pan to overhead structure measured 37.3 inches.

4.2.3 Rear Left Seat (Passenger 4)

The seat was stroked downward. Both the right-hand and left-hand EA devices were activated. The LHS EA Device strip was found bent at its upper connection and its lower portion was found buckled (see figure 28). The seat pan was undamaged. The seat pan to overhead structure measured 38.8 inches. The right lap belt was adjusted to measure 24.7 inches and the right shoulder belt was 22.9 inches. The left lap belt was adjusted to measure 20.2 inches and the left shoulder belt was 23.4 inches. According to the written statement of passenger 4, which included photographs from his phone, his body rotated outboard after the first impact with the ground as the helicopter rebounded into the air. For additional information see the written statement in the NTSB docket.



Figure 28. EA Device strip flange bending at the top and buckling below the rollers.

4.2.4 Rear Seats Downward Displacement

To document the seat downward permanent displacement during the accident, measurements were taken at locations on the bottom and side of the seat: the seat pan along the front (points 1 and 2), the belt anchor at the back (points 3 and 4). To measure the stroking of each of the energy attenuating mechanisms, a measurement was taken from the top of the upper roller to the bottom of the top rail of the seat frame on the left and right side of the seat. Additionally, there were also angle measurements taken at the floor and across the seat pan (see figure 29 and 30). With a positive angle being clockwise and negative being counterclockwise.



Figure 29. Measurement points of the rear seat.

Seat	1 (in)	2 (in)	3 (in)	4 (in)	Left Displacement (in)	Right Displacement (in)	Floor angle (deg)	Seat pan angle (deg)
Pass 2 ²	6.1	6.3	7.5	6.9	6.70	6.95	-1	0 fwd/ -4 aft
Pass 3 ³	8.6	9.0	8.4	9.0	8.50	8.50	-2	0
Pass 4	7.9	7.9	7.6	7.7	7.00	7.20	-2	-2

Figure 30. Measurements of the rear passenger seats.

5.0 Emergency Equipment

A fully charged fire extinguisher was secured in its cradle to the floor between the front seats. An ACK Technologies 406 MHz Emergency Locator Transmitter (ELT) was still secured in its cradle in the aft fuselage section of the helicopter (see figure 31). The battery had an expiration date of June 21, 2024. The ELT's switch position could not be determined due to significant structural damage in the area.

² Angle measurements were taken at the forward and aft edges of the seat pan.

³ Passenger seat three was unoccupied during the accident flight.



Figure 31. The ACK Technologies 406 MHz ELT.

6.0 Narrative of Event⁴

According to passenger 4 about 1800 the helicopter started to approach the landing zone at the fire station. As the helicopter descended, the passenger 4 described the motion as "starting to spin clockwise out of control," and he briefly heard the engine noise "pitch up for a split second" before it then began to pitch down as if the engine was "struggling and about to stall." He then felt a few "back-and-forth jolting movements" of the cabin while they continued to spin in the air. He braced himself for the impact by bending his elbows and knees and grabbing the front seat to brace for impact. When they hit the ground, the left side doors opened, and passenger 4 rotated outward with his feet dragging the ground. The helicopter then bounced back up in the air two times before coming to rest on its left side.

Passenger 4 was able to remove his seat belt, exit the helicopter, and run toward the fire station. Passenger 2 reported that his Apple watch had a crash detection feature that activated during impact. It notified his emergency contacts and called 911 at 1804. He remembered struggling to unbuckle his harness but eventually got it unbuckled. He then got out of the helicopter (but did not remember how) and was helped to a nearby curb where his injuries were examined.

A sheriff's deputy observed the helicopter descend behind the fire station. He and others ran out to the wreckage and notified Lee County dispatch. They assisted two occupants out of the helicopter; however, a third occupant was unresponsive and trapped inside (passenger 1). The officer noted that the person's head was pinned behind his seat, his chest was moving, and his seat belt appeared wrapped around his neck. The deputy cut the seat belt, climbed into the helicopter, and moving the occupant into a position for extrication. The deputies lifted the helicopter up which

⁴ This narrative was created from statements provided by law enforcement, a statement the pilot verbally gave to his lawyer which was then passed onto the IIC, and records of conversation that occurred between the IIC and passengers two and four, for details see the NTSB docket.

allowed the third passenger to be removed. The occupant was responsive, and emergency medical services took over his care.

7.0 Injury Information

The pilot and all passengers sustained serious injuries⁵. According to statements all occupants were transported via ambulance to Gulf Coast Hospital Trauma Center. All occupants had serious injuries. The pilot, passenger 1 and 2 all sustained fractured vertebra, and Passenger 4 sustained fractured ribs. For detailed injury information see attachment 1.

7.1 Injury table

Type of injury	Crew	Passengers	Total
Fatal	0	0	0
Serious	1	3	4
Minor	0	0	0
None	0	0	0
TOTAL	1	3	4

LIST OF ATTACHMENTS

Attachment 1: Detailed injury information

Submitted by:

Amanda M Taylor

Senior Survival Factors Investigator

⁵ Multiple attempts were made to gather detailed medical information. Summarized medical information was provided by the pilot, and passengers 2 and 4.