



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

# Aviation Investigation Final Report

<b>Location:</b>	Carlsbad, California	<b>Accident Number:</b>	WPR16FA029
<b>Date &amp; Time:</b>	November 18, 2015, 16:23 Local	<b>Registration:</b>	N711BE
<b>Aircraft:</b>	Airbus Helicopters AS350B3E	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Loss of control in flight	<b>Injuries:</b>	2 Fatal
<b>Flight Conducted Under:</b>	Part 91: General aviation - Personal		

## Analysis

The private pilot and the pilot-rated passenger departed for a flight in the pilot's newly purchased helicopter. The pilot practiced several landings in a field during the flight and then flew back to the departure airport, where the approach and hover taxi to the ramp were uneventful. The pilot made a landing attempt on a dolly but landed only partially on the dolly, which caused the helicopter to pitch nose up and strike the ground with its tail. The helicopter hit the dolly with such force that the dolly broke free from the chocks securing it and spun around. The helicopter climbed and spun upwards aggressively but stabilized after rotating 270° to the right.

The pilot then landed the helicopter in an abnormal location that straddled the ramp and a taxiway. Ground crew personnel re-secured the dolly with chocks, and, after about 2 1/2 minutes, the pilot again attempted to land on the dolly, this time from the opposite direction. He made two unsuccessful attempts but was unable to maintain a stabilized approach each time. Although the pilot had the option to land on the ramp, he persisted in attempting to land on the dolly. On his third attempt, he again landed partially on the dolly, and the helicopter rocked back and forth striking the ground with its tailskid, before violently climbing and pitching nose down, while rolling right. The helicopter spun 180° to the left and pitched up steeply, and the tail rotor and vertical stabilizer struck the ground and separated. The helicopter hit the ground left side low, bounced, and rotated another 360° before landing hard on its belly. The main rotor blades continued to spin and the engine continued to operate; the helicopter spun on its belly at a rate of about one revolution per second for more than 5 minutes, while gradually sliding about 530 ft along the ramp. The tailboom and horizontal stabilizer then separated, and the helicopter violently rolled onto its side, shed its main rotor blades, and came to rest.

Onboard video showed that the pilot became incapacitated during the final ground collision. The passenger remained conscious after the impact and reached for the throttle on the pilot's collective control shortly after the helicopter started to spin, but the throttle position remained unchanged. He then attempted to brace himself against the glare shield, but he eventually became incapacitated after about 2 minutes due to his injuries, the forces imposed by the spinning helicopter, or both. He did not make any

attempt to reach up for the engine-start selector or the fuel shutoff lever.

Postaccident examination did not reveal any anomalies with the helicopter's airframe or engine that would have precluded normal operation.

In the weeks preceding the accident, the pilot had expressed concern to multiple flight instructors that he was having difficulty adjusting to the flight characteristics of the helicopter. In particular, he found dolly-landings challenging.

Although the pilot had many years of experience flying a Bell 407 helicopter, there were two significant differences between the Bell 407 and the accident helicopter. First, their main rotor systems rotated in opposite directions; therefore, the foot pedal inputs required to counteract changes in torque during takeoff and landing were opposite. (The pilot's difficulty adapting to this difference was evidenced during most of the previous takeoffs captured by the onboard video when the helicopter yawed significantly after lifting off.) Second, the tips of the landing skids, which were used as a visual reference during landing, were forward of the pilot in the Bell 407 but just aft of the pilot in the accident helicopter. This change in visual reference would have been particularly significant during dolly landings, which require landing on a specific point directly below the pilot's field of view.

The pilot had received about 11 hours of flight instruction in the helicopter, and, despite the fact that his instructors advised him not to fly without an instructor, he opted to fly with a passenger instead of an instructor on the accident flight. Although the passenger held a helicopter rating, he was not an instructor or professional helicopter pilot and had about 180 hours total in helicopters. Furthermore, it was likely that he had little or no experience in the accident helicopter make and model.

The pilot's instructors reported a mobility problem with the pilot's left arm that affected his ability to reach overhead, but this problem likely did not contribute to the accident, because he had no need to reach overhead during landing. Postmortem toxicology testing identified amlodipine, valsartan, and rosuvastatin as well as diphenhydramine at 0.538 ug/ml and alprazolam at less than 0.05 mg/l in the pilot's blood. The pilot had heart disease and hypertension and used amlodipine, valsartan, and rosuvastatin for their treatment; however, these conditions and medications most likely did not contribute to the accident as they do not affect judgment or decision-making. Alprazolam is a significant central nervous system (CNS) depressant with the lower end of the therapeutic range at 0.0060 mg/l. The exact amount of alprazolam in the pilot could not be determined by testing and may have been very low.

The therapeutic range for diphenhydramine is 0.0250 to 0.1120 ug/ml. However, diphenhydramine undergoes postmortem redistribution, and postmortem central blood levels may increase by about three times. When divided by three or four, the pilot's postmortem level suggests that he had therapeutic levels at the time of the crash. Compared to other antihistamines, diphenhydramine causes marked sedation and is also a CNS depressant. In addition, it may cause altered mood and impaired cognitive and psychomotor performance. The use of two CNS depressants simultaneously typically results in cognitive impairment which is magnified well beyond the simple addition of the effects, even when the amount of one of them may be low. Therefore, the pilot's decision-making, judgment, and psychomotor performance were most likely impaired by the combination of CNS depressants, diphenhydramine and alprazolam.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's loss of control during landing on a dolly. Contributing to the accident were the pilot's decision to conduct the flight without an instructor despite multiple flight instructors' recommendations to the contrary, his failure to land on the ramp when he experienced difficulty landing on the dolly, and his impaired decision-making, judgment, and psychomotor performance, due to his use of a combination of two psychoactive drugs.

### Findings

Personnel issues	Aircraft control - Pilot
Aircraft	Directional control - Not attained/maintained
Personnel issues	Decision making/judgment - Pilot
Personnel issues	Total experience w/ equipment - Pilot
Personnel issues	Prescription medication - Pilot

# Factual Information

## History of Flight

Landing-flare/touchdown	Loss of control in flight (Defining event)
Landing-flare/touchdown	Landing area undershoot
Landing-flare/touchdown	Attempted remediation/recovery
Landing-flare/touchdown	Collision during takeoff/land

On November 18, 2015, at 1623 Pacific standard time, an Airbus Helicopters AS350B3E, N711BE, departed controlled flight while landing on a dolly at Mc Clellan-Palomar Airport, Carlsbad, California. The private pilot and the pilot-rated passenger were fatally injured; the helicopter sustained substantial damage. The pilot, who was the owner, was operating the helicopter under the provisions of 14 *Code of Federal Regulations* Part 91. The local personal flight departed Carlsbad at 1412. Visual meteorological conditions prevailed, and no flight plan had been filed.

The purpose of the flight was for the pilot to gain familiarity with the helicopter, which he had recently purchased. The entire accident sequence was captured on a series of airport security cameras and the mobile phone cameras of multiple witnesses.

About 2 hours before the accident, the helicopter departed from its dolly on the east end of the Premier Jet fixed base operator (FBO) ramp, which was located midfield on the south side of runway 6/24. After departure, line crew moved the dolly to the west end of the ramp.

Upon returning, the helicopter approached the airport from the northeast and was cleared to land on runway 24. It descended to midfield, turned left at taxiway A3, and approached the ramp in a low hover via the parallel taxiway A. The helicopter then began an approach to the dolly from the east, directly toward the sun. The helicopter landed short of, and partially on, the dolly with the center of its skids contacting the dolly's aft edge. The helicopter immediately rocked back, pitching nose up, and its tailskid struck the ground. The helicopter then began a series of fore and aft oscillations, and the dolly broke free from its front left chock, rotated to the right, and pivoted around its rear right wheel. The helicopter spun rapidly with the dolly for the first quarter of the turn and then quickly spiraled upward 270° to the right. The dolly came to rest to the north, having rotated 180°. The pilot repositioned the helicopter and landed it on the ground, straddling the ramp and taxiway A. Just before landing, the pilot was queried by the air traffic control tower controller and responded, "yeah, they didn't chock my cart, and I was like a skateboard out here," The tower controller then requested that the pilot switch to the ground control frequency.

During the next 2 1/2 minutes, the line crew re-secured the dolly, installing chocks on three of the four wheels. The pilot then took off and climbed the helicopter to about 20 ft while it yawed to the left, and he repositioned it for an approach to the dolly now from the west. During the next 4 1/2 minutes, the pilot made three landing attempts, getting the helicopter to within about 5 ft vertically of the dolly on the first two attempts. After the first attempt, the pilot repositioned the helicopter by circling back around

the dolly. After the second attempt, the pilot performed a hovering climb and backed the helicopter into position. A video of the third and final landing attempt was captured by a witness, who was located about 130 ft to the south. The witness was initially watching the helicopter from his airplane on the ramp, but he was concerned that the helicopter might crash, so he exited the airplane and positioned himself behind a car at the corner of the FBO's hangar.

The video revealed that the helicopter hovered over the dolly for about 60 seconds and then landed short, teetering on the aft edge of the dolly (Image 1). The tailskid almost struck the ground, and the helicopter then rapidly pitched forward (Image 2) and then aft again. The tailskid then struck the ground (Image 3), and the helicopter pitched forward, rolled right (Images 4 and 5), and climbed out of view behind the hangar. Security cameras revealed that the helicopter then spun 180° to the left, and the nose pitched up to a 45° attitude. The tail rotor and vertical stabilizer assembly then struck the ground and separated, and the helicopter hit the ground left side low, bounced, and rotated another 360° before landing hard on its belly. Once on the ground, the main rotor blades continued to spin, while the helicopter started spinning on its belly, as the engine continued to operate (Image 6).

The helicopter continued spinning at a rate of about one revolution per second for the next 5 minutes while incrementally sliding about 530 ft east along the ramp. The tailboom and horizontal stabilizer then separated, and the helicopter rolled onto its side, shedding the main rotor blades. The engine continued operating for another 30 seconds while the fire crew doused the helicopter. White smoke billowed from the engine's exhaust after the helicopter came to rest, but there was no fire.



Image 1 - Helicopter Landing Short of the Dolly





Image 2 - Helicopter Landing Short of the Dolly



Image 3 - Helicopter Tail Striking the Ground



Image 4 - Helicopter Rolling Right over the Dolly



Image 5 - Helicopter Spinning 180 degrees, with Tail Striking the Ground



Image 6 - Helicopter Spinning after Ground Collision



## Pilot Information

<b>Certificate:</b>	Private	<b>Age:</b>	65, Male
<b>Airplane Rating(s):</b>	Single-engine land; Single-engine sea; Multi-engine land	<b>Seat Occupied:</b>	Right
<b>Other Aircraft Rating(s):</b>	Helicopter	<b>Restraint Used:</b>	4-point
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	Yes
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>	Class 3 With waivers/limitations	<b>Last FAA Medical Exam:</b>	January 19, 2015
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>	(Estimated) 25000 hours (Total, all aircraft), 10.8 hours (Total, this make and model)		

## Pilot-rated passenger Information

<b>Certificate:</b>	Private	<b>Age:</b>	60, Male
<b>Airplane Rating(s):</b>	Single-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	Helicopter	<b>Restraint Used:</b>	4-point
<b>Instrument Rating(s):</b>	None	<b>Second Pilot Present:</b>	Yes
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>	Class 3 Without waivers/limitations	<b>Last FAA Medical Exam:</b>	May 29, 2014
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>	(Estimated) 179.6 hours (Total, all aircraft), 0 hours (Total, this make and model)		

The pilot was seated in the front right seat, and the pilot-rated passenger was seated in the front left seat.

### Pilot

The pilot held a private pilot certificate with ratings for airplane single-engine land and sea, multiengine land, instrument airplane, and rotorcraft-helicopter. He also held a type rating for the Cessna Citation Jet (CE-525S).

The pilot held a third-class medical certificate issued on January 19, 2015, with the limitation that he must have available glasses for near vision.

No personal flight records were located for the pilot. At the time of his last medical application, he reported a total flight time of 25,000 hours, with 200 hours logged in the last 6 months. The pilot reported the same numbers on three other applications over the 5-year period preceding the accident, and 25,400 hours total time on his application dated January 18, 2011. His helicopter rating was issued in May 2001, at which time he reported on his rating application a total flight time of 14,000 hours in airplanes.

The pilot had previously owned and flown a Cessna Citation business jet airplane and a Bell 407 helicopter. His 2001 helicopter checkride flight took place in a Bell 206B3. At the time of the accident, he was receiving recurrent training for the Citation, with the most recent flight 2 days before the accident. The pilot purchased the accident helicopter on October 29, 2015, and had flown demonstration and familiarization flights in it since September 20. According to the helicopter's flight logs, those flights totaled about 8.8 hours and were all conducted with a flight instructor present. The pilot then flew the helicopter with another instructor for an additional 2 hours on November 13.

According to the two instructors who had flown with the pilot for the familiarization flights and the flight instructor who provided training in the Citation, the accident flight was the first time the pilot had flown in an AS350 without an instructor present. All had recommended that the pilot gain further instruction before flying without an instructor, and the pilot had concurred.

The three instructors shared similar insights into the pilot's flying skills, reporting that, while he appeared to have extensive flying experience, he was anxious about the handling characteristics of the AS350 compared to the Bell 407, particularly during landing. The pilot said that he was having difficulty anticipating flight control forces because the helicopter controls felt "backwards" due to the opposing rotor direction of the AS350 compared to the Bell 407. Furthermore, he was having trouble landing on the dolly partly because the tips of the skids were just behind his seating location in the AS350, as opposed to the Bell 407, where he could see the skids just forward and below. Both helicopter instructors reported performing multiple dolly and simulated dolly landings with the pilot, stating that, although the pilot was not completely at ease, he was able to ultimately land on the dolly unaided. The pilot told the Citation instructor that, although he had practiced many landings in the helicopter, he still did not feel proficient and thought that the helicopter was very unstable close to the ground, especially when it was close to the dolly.

One of the helicopter instructors reported that the pilot wanted to enable the helicopter's stability augmentation system (SAS) for landings because he had been told it would help his landings. The instructor stated that he wanted the pilot to be able to fly the helicopter proficiently without the use of the SAS. However, for demonstration purposes, they did two landings with the SAS enabled. During those attempts, the pilot appeared to be "fighting" against the SAS control inputs, with unsatisfactory results, and he did not understand how to use the SAS release button on the cyclic to override the SAS control inputs. Therefore, the pilot and instructor decided to turn the system off.

Both helicopter instructors reported that the pilot appeared to have suffered an injury that restricted movement of his left arm. He could use his left arm to operate the flight controls and reach the lower sections of the flight panel, but he could not reach the upper controls, including the engine start selector panel, without the supportive aid of his right arm. One instructor stated that because of the injury, the pilot was unable to climb up onto the helicopter to perform preflight examinations of the rotor head. One helicopter instructor and the Citation instructor stated that the pilot's hands often shook and that it was particularly obvious when he held a pen, although once he grasped the flight controls the shaking stopped.

Both helicopter instructors suggested that the pilot take formal factory-approved flight training, and one instructor stated that he had declined to provide any further instruction until the pilot had taken training at the Airbus Helicopters flight school. According to Airbus Helicopters, in early October, the pilot had

signed up for a "B3 Pilot Transition Class" scheduled for November 2, but 2 days before the class he called to defer the training. No further communication from the pilot was received by Airbus Helicopters.

The Citation instructor, who had known the pilot for 6 years, reported that the pilot was becoming concerned that age was starting to affect his reaction time when flying. The instructor had observed the pilot's degrading flight performance and had conversations with him about how maintaining proficiency through regular flying could help. He stated that the pilot was no longer fully proficient in the Citation, that his reaction times were becoming slower, and that he would often let the airplane get ahead of him. As such, the instructor recommended that the pilot always fly with him. He stated that the pilot mentioned that he was going to fly the helicopter for practice with a friend on the day of the accident.

The pilot confided in all three instructors that, due to the difficulties he was having mastering the AS350, he was most likely going to sell it and buy another Bell 407. All three instructors stated that they had never seen the pilot's logbooks and had, therefore, never made any entries.

#### Pilot-Rated Passenger

The pilot-rated passenger held a private pilot certificate with ratings for airplane single-engine land and rotorcraft-helicopter. His first rating was for rotorcraft-helicopter, and it was issued in December 2004 following a checkride in a Bell 206B3. He was issued his airplane single-engine land rating in December 2014, and, at that time, he reported on his rating application a total rotorcraft flight time of 179.6 hours, including 163 solo hours.

He held a third-class medical certificate issued on May 29, 2014 with no limitations.

No personal flight records for the pilot-rated passenger were located, and his currency or recent flight experience could not be determined. At the times of issuance of his two prior FAA medical examinations in 2008 and 2012, he reported total flight times of 185 and 200 hours respectively, with no flight time in the preceding 6 months on both occasions.

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Airbus Helicopters	<b>Registration:</b>	N711BE
<b>Model/Series:</b>	AS350B3E	<b>Aircraft Category:</b>	Helicopter
<b>Year of Manufacture:</b>	2014	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	7934
<b>Landing Gear Type:</b>	Skid	<b>Seats:</b>	5
<b>Date/Type of Last Inspection:</b>	August 15, 2015 Continuous airworthiness	<b>Certified Max Gross Wt.:</b>	4960 lbs
<b>Time Since Last Inspection:</b>	21 Hrs	<b>Engines:</b>	1 Turbo shaft
<b>Airframe Total Time:</b>	35.2 Hrs at time of accident	<b>Engine Manufacturer:</b>	Turbomeca
<b>ELT:</b>	C126 installed, activated, did not aid in locating accident	<b>Engine Model/Series:</b>	Arriel 2D
<b>Registered Owner:</b>	On file	<b>Rated Power:</b>	848 Horsepower
<b>Operator:</b>	On file	<b>Operating Certificate(s) Held:</b>	None

The helicopter was manufactured in 2014 and equipped with a Turbomeca Arriel 2D engine. The helicopter had dual collective, cyclic, and foot pedal controls, with primary flight control intended from the right seat.

The helicopter was maintained under a continuous airworthiness program and had accrued 35.2 hours of total time since new when the accident occurred. The last inspection took place 20.6 flight hours before the accident on August 15, 2015.

The helicopter had undergone a series of twenty-three upgrades in May 2015, including the installation of an auxiliary side locker fuel tank, full length skid shoes, a radar altimeter, and a Genesys Aerosystems HeliSAS stability augmentation system and two-axis (pitch and roll) autopilot.

The HeliSAS system provided attitude stabilization and force feedback to the cyclic control, via electro-mechanical servo actuators connected in parallel to the flight controls. The systems technical overview documentation stated:

"The HeliSAS system is designed to be engaged at all times: "SAS" on before takeoff, and "SAS" off after landing. The "force feel" (force trim) feature enhances handling characteristics and mitigates inadvertent cyclic control inputs that could result in dangerous attitudes. The pilot may override the HeliSAS at any time with manual cyclic inputs. Only 3.5 lbs of pilot force in the pitch axis, and 3.0 lbs in the roll axis, at the cyclic control is required to override the system for pilot desired maneuvering when either the SAS or autopilot modes are engaged."

The helicopter was serviced with the addition of 70 gallons of Jet A fuel on the morning of the accident.

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	KCRQ, 328 ft msl	<b>Distance from Accident Site:</b>	0 Nautical Miles
<b>Observation Time:</b>	00:53 Local	<b>Direction from Accident Site:</b>	47°
<b>Lowest Cloud Condition:</b>	Clear	<b>Visibility</b>	10 miles
<b>Lowest Ceiling:</b>	None	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	/	<b>Turbulence Type Forecast/Actual:</b>	/
<b>Wind Direction:</b>		<b>Turbulence Severity Forecast/Actual:</b>	/
<b>Altimeter Setting:</b>	29.94 inches Hg	<b>Temperature/Dew Point:</b>	18°C / 13°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	Carlsbad, CA (CRQ )	<b>Type of Flight Plan Filed:</b>	None
<b>Destination:</b>	Carlsbad, CA (CRQ )	<b>Type of Clearance:</b>	None
<b>Departure Time:</b>	14:12 Local	<b>Type of Airspace:</b>	Class D

According to the U.S. Naval Observatory's Astronomical Applications Department, the altitude of the sun when viewed from Carlsbad at 1620 would have been 4.3°deg, with an azimuth (E of N) of 243.7°deg.

## Airport Information

<b>Airport:</b>	MC CLELLAN-PALOMAR CRQ	<b>Runway Surface Type:</b>	Asphalt
<b>Airport Elevation:</b>	330 ft msl	<b>Runway Surface Condition:</b>	Dry
<b>Runway Used:</b>	24	<b>IFR Approach:</b>	None
<b>Runway Length/Width:</b>	4897 ft / 150 ft	<b>VFR Approach/Landing:</b>	Straight-in

## Wreckage and Impact Information

<b>Crew Injuries:</b>	1 Fatal	<b>Aircraft Damage:</b>	Substantial
<b>Passenger Injuries:</b>	1 Fatal	<b>Aircraft Fire:</b>	On-ground
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	2 Fatal	<b>Latitude, Longitude:</b>	33.127223,-117.279998



Postaccident examination of the helicopter did not reveal any anomalies with the airframe or engine that would have precluded normal operation. The throttle was found in the "FLIGHT" detent, and the left and right throttle controls could both be moved in concert with each other smoothly between the control detents.

## Dolly

The primary structure of the dolly was composed of a 14-ft-wide and 12-ft-long red-painted steel frame, with two castoring wheels at the front, and two fixed wheels at the rear. A steel, V-shaped hinged tow bar was attached to the front of the dolly. The landing deck surface was about 12 inches off the ground and made of wood planks coated with light-grey non-slip paint. No manufacturer's label or data plate could be found on the dolly. Standard operating procedures dictated that the helicopter approach the dolly from the rear and land with the tow bar at the front of the helicopter, thereby allowing clearance from the towing vehicle.

Examination revealed two indentations on the rear side of the dolly frame spaced 7 ft 3 inches apart or about the width separating the helicopter's left and right landing skids. The indentations contained freshly detached paint chips that exposed shiny uncorroded steel. Crush marks were present on the wood planks adjacent to the indentations.

Security camera video footage and statements provided by the FBO line crew indicated that, for the first landing approach, the dolly's rear right and front left wheels were chocked. In the video footage, a line crewmember could be seen checking the security of the chocks after initially setting both wheels. For the accident approach, the rear right and both front wheels were chocked. The chocks were standard triangular-shaped rubber aviation chock pairs that were attached to one another with a short length of rope.

The slope of the ramp at the dolly location for the final landing attempts was about 3° down from right to left when viewed from the approach direction. The helicopter's flight manual indicated a maximum sideways landing slope of 8°.

## Seats

Both front seats were of the energy attenuating type designed to absorb vertical impact loads. The seats were equipped with four-point belt harnesses.

The front left seat did not exhibit evidence of vertical displacement (stroking). The left side of the front right seat did not exhibit evidence of stroking; the right side of the seat exhibited a vertical stroke of about 1 inch downward.

## Flight recorders

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The helicopter was equipped with an Appareo Vision 1000 flight data monitor. The unit was capable of recording video, audio, GPS coordinates, and pitch, roll, yaw and acceleration data. The unit was

mounted in the aft center ceiling of the cockpit.

The unit was sent to the NTSB Vehicle Recorders Division for data extraction, and a video group consisting of the NTSB investigator-in-charge and technical representatives from Turbomeca and Airbus Helicopters was convened to review the data.

The unit had recorded video and audio data, along with GPS coordinates for the entire flight. The field of view included over-the-shoulder video images of the forward cockpit, which included both cyclic controls and the right-seat collective and foot pedal controls, along with most of the instrument panel and a view out the lower forward portion of the windscreen. The unit did not record any radio or microphone audio. Only loud engine and transmission noises could be heard for the duration of the recording.

The video recording began at 1406:52 and depicted the helicopter stationary on the dolly at the east end of the FBO's ramp, with the engine running and the pilot configuring the avionics system. Six minutes later, the helicopter departed.

GPS data indicated that for the next 27 minutes the helicopter flew generally to the east and approached an open field at an elevation of about 4,500 ft mean sea level (msl), 4.5 miles south of the peak of Palomar Mountain. The helicopter then performed a left downwind landing approach into the field, lined up on final from the south, and landed at the far end of the field just short of the tree line. Twenty seconds after landing, the pilot turned on the SAS system. The pilot then initiated a hover, and the helicopter lifted off the ground and immediately yawed about 25° to the left, before setting back onto the ground. Thirty seconds later, the pilot began another hovering maneuver, and, after lifting off the ground, the helicopter immediately spun about 150° to the right before setting back onto the ground.

About 40 seconds later, at 1443:09, the helicopter lifted off the ground up uneventfully, and departed toward the southeast. For the next hour, the helicopter took a route toward the Salton Sea, then north along the coastline toward La Quinta, where it turned inland and began to track back to Carlsbad. During the period after departing from the field, the pilot turned the SAS system from active to standby mode multiple times and occasionally engaged the autopilot. Helicopter control was handed back and forth between the two pilots as they performed various tasks including activating the auxiliary fuel tank transfer pump, viewing their personal electronic devices, and referencing the helicopter's flight manual.

About 1610, the helicopter approached the airport from the east, conducted a straight-in approach, and crossed the threshold of runway 24 at 1612:05. The SAS system was in standby mode, and, as the helicopter approached the runway, the passenger lifted his right hand over his face in an apparent effort to shield himself from sun glare. The pilot appeared to be wearing sunglasses. The helicopter flew along the runway and then turned left, crossed the runway 6-24 hold short line, and entered taxiway A3 while in a low hover. The helicopter proceeded along taxiway A, approaching the landing dolly, which, having been relocated, was now at the west end of the FBO's ramp.

The helicopter approached the dolly, but, due to sun glare, minimal outside references were visible in the recording. Over the next 30 seconds, the occupants appeared to have been jostled in their seats, the helicopter pitched nose down, and the cockpit instruments registered a right roll of about 25°. The helicopter then yawed to the right and began maneuvering toward taxiway A and the ramp. It landed

straddling the ramp and taxiway, and the pilot then entered the ground control frequency in the avionics system. About that time, an incoming call was received on the pilot's phone; he picked up the phone, ignored the call, and put the phone back down again.

After about 2 minutes, the pilot initiated a hover, and, as soon as the helicopter broke ground, it immediately yawed about 30° to the left. The pilot maneuvered the helicopter west along taxiway A and performed a left turn, toward the east, bringing the helicopter in line with the dolly. During the following three landing attempts, the dolly passed in and out of view in the left side of the lower portion of the helicopter's chin bubble. The pilot's cyclic control inputs were pronounced as the dolly came in and out of view. On the second attempt, as the dolly disappeared from view, both occupants appeared to rock forward. The pilot then backed up the helicopter in a low hover, and the dolly came back into view.

With the dolly still visible, the helicopter again rocked back and forth and slowly descended, while both occupants again rocked forward. The needle displayed on the first limit indicator on the instrument panel dropped rapidly as the pilot quickly lowered the collective control. Comparison of the onboard video with the security camera video indicated that, about this time, the tailskid struck the ground, and the helicopter pitched up and rotated 180° before the tail again struck the ground. During this time, the pilot was still holding the cyclic and collective controls, and his feet were on the foot pedals. Both occupants then moved aggressively back and forth and from side to side, until the helicopter landed hard on its nose, and both occupants violently rocked to the right. The pilot slumped over to the right and remained motionless, and the helicopter began to spin.

As the spin progressed, the pilot-rated passenger reached down to the throttle control on the pilot's collective with his right hand. His hand remained on the control for about 3 seconds, but the control did not move out of the "FLIGHT" detent position. The passenger then moved his right hand to the glare shield lip where it remained for about the next 2 minutes. The passenger then appeared to loosen his grip on the glare shield, and he remained motionless, while the helicopter continued to spin. Eventually a loud "bang" was recorded, and the helicopter stopped violently and came to rest on its right side. Neither occupant moved as first responder personnel arrived and began the process of entering the cabin.

## **Medical and Pathological Information**

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### **Pilot**

At the time of his most recent FAA medical examination, the pilot reported hypertension and the use of medications including nebivolol (blood pressure medication), pantoprazole (heartburn medication), and rosuvastatin (cholesterol lowering medication).

According to the autopsy performed by the County of San Diego Office of the Medical Examiner, the pilot's cause of death was multiple injuries, and the manner of death was accident.

The autopsy report noted significant intracranial injuries with bilateral subdural and subarachnoid hemorrhage more pronounced on the right side and the base of the brain extending into the foramen magnum and cervical canal. Intraventricular hemorrhage without parenchymal contusions was also

noted. In addition, hemorrhage of the anterior cervical ligament associated with fractures of the body of C6 (and possibly C7) with associated subdural hemorrhage surrounding the cervical spinal cord was identified.

The pilot's heart was enlarged, and mild coronary artery disease with 50% stenosis was also described.

Toxicology testing by the medical examiner detected amlodipine (0.34 mg/l) and alprazolam (less than 0.05 mg/l) in peripheral blood.

Toxicology testing by the FAA's Bioaeronautical Sciences Research Laboratory, identified amlodipine, valsartan, rosuvastatin, and diphenhydramine (0.538 ug/ml) in heart blood. In addition, the FAA laboratory found alpha-hydroxyalprazolam (0.044 ug/ml) and salicylate in urine.

Amlodipine and valsartan are blood pressure medications and, along with rosuvastatin, are generally considered non-impairing. Alpha-hydroxyalprazolam is a metabolite of alprazolam, a potentially impairing anxiety medication. Alprazolam is commonly marketed under the name Xanax, and it carries the warning: "Because of its CNS (central nervous system) depressant effects, patients receiving alprazolam tablets should be cautioned against engaging in hazardous occupations or activities requiring complete mental alertness such as operating machinery or driving a motor vehicle. For the same reason, patients should be cautioned about the simultaneous ingestion of alcohol and other CNS depressant drugs during treatment with alprazolam tablets." Diphenhydramine is a sedating antihistamine that has been shown to significantly impair performance at routine doses.

#### Pilot-Rated Passenger

The pilot-rated passenger reported no chronic medical problems and no medications at the time of his most recent FAA medical examination.

According to the autopsy performed by the County of San Diego Office of the Medical Examiner, the pilot-rated passenger's cause of death was multiple injuries, and the manner of death was accident.

His injuries included bilateral subdural and subarachnoid hemorrhages, ligamentous instability at C1/C2, and fracture at C6/C7 with associated subdural hemorrhage but without obvious spinal cord injury. In the torso, there was a fracture of the sternum along with multiple rib fractures, some associated with retroperitoneal hemorrhage. There were widely open fractures of both bones of the lower left leg. He was found to have an enlarged heart with thickened walls and minimal coronary artery disease.

Toxicology testing by the FAA's Bioaeronautical Sciences Research Laboratory identified ranitidine (a non-impairing heartburn medication) in the pilot-rated passenger's urine.

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Simpson, Elliott
<b>Additional Participating Persons:</b>	Roger Messick; Federal Aviation Administration; San Diego, CA Philippe Mauviot; Bureau d'Enquêtes et d'Analyses; Le Bourget
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<b>Investigation Class:</b>	<a href="#">Class</a>
<b>Note:</b>	The NTSB traveled to the scene of this accident.
<b>Investigation Docket:</b>	<a href="https://data.nts.gov/Docket?ProjectID=92336">https://data.nts.gov/Docket?ProjectID=92336</a>

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