Aviation Investigation Final Report

Location:	Galliano, Louisiana	**Accident Number:**	CEN23FA071
Date & Time:	December 29, 2022, Local	**Registration:**	N595RL
Aircraft:	Bell 407	**Aircraft Damage:**	Substantial
Defining Event:	Dynamic rollover	**Injuries:**	4 Fatal
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled		

Analysis

The on-demand passenger flight was departing from an offshore production platform when, upon liftoff, the helicopter entered an abrupt right roll and crashed into the helideck and then descended into the water. Recorded parametric data indicated that shortly after liftoff, about 2 ft above the helideck, the helicopter was in a 32° right roll with a right roll rate of about 68 degrees per second when the device stopped recording.

A review of the helicopter's in-cockpit video camera revealed that the pilot did not land the helicopter in the center of the helideck during the landing that preceded the accident takeoff. Additionally, the pilot did not reposition the helicopter before the accident takeoff. Based on video evidence, the position of the helicopter on the helideck resulted in the aft portion of the right skid to be adjacent to a helideck perimeter light. Examination of the helideck revealed impact gouges in the helideck surface that matched the bolt head pattern of the helicopter's right skid tube. These gouges likely were created when the helicopter was in a steep right bank angle. The location of the impact gouges in the helideck surface further supports that the aft portion of the right skid tube was in contact with the helideck perimeter light at takeoff. The perimeter light housing, whose attachment hardware to the helideck was not frangible, was found significantly deformed. Based on the physical and video evidence, the helideck perimeter light became the pivot point for a dynamic rollover to occur during takeoff.

The helideck perimeter lights were 2 inches higher than the construction standard of 6 inches. However, because the helicopter's right skid was already in contact with the perimeter light before the takeoff, the out-of-compliance height of the perimeter light, by itself, did not contribute to dynamic rollover.

Examination of the helicopter wreckage found no evidence of preimpact failure of the airframe, the main and tail rotor systems, or the engine. The main rotor blades and hub exhibited

signatures of powered impact damage consistent with engine power delivery to the rotor system when the blades impacted the helideck. Additionally, the recovered engine control unit data confirmed that the engine was functioning normally up until the main rotor blades impacted the helideck. Examination of the flight control system found no evidence of preimpact fractures, disconnections, or restrictions. The lateral hydraulic servo actuator, which controls the helicopter in the roll axis, exhibited normal functionality during bench testing.

A review of the pilot's previous takeoffs revealed that he typically did not follow company policy to bring the helicopter into a 3-5 ft hover check before continuing with the takeoff. The pilot's improper takeoff technique (without a brief 3-5 ft hover check) would have decreased his ability to identify and react to any anomalies during the takeoff, including the onset of a dynamic rollover.

All three requirements for a dynamic rollover (thrust exceeding helicopter weight, a pivot point other than the helicopter's center of gravity, and a rolling moment) were present during the accident takeoff. Based on the video evidence, the pilot was likely unaware the helicopter's right skid was in contact with the helideck perimeter light before takeoff.

Toxicological testing of pilot's samples detected low levels of ethanol in blood and vitreous fluid, high ethanol levels in liver tissue, but no ethanol in urine. This ethanol pattern is not consistent with consumption and is likely from postmortem production, as the levels vary significantly amongst specimens and there was no ethanol detected in the urine. Therefore, the detected ethanol did not contribute to the accident.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The pilot's failure to ensure the helicopter was clear of obstacles before takeoff from the helideck, which resulted in the helicopter's right landing skid pivoting about a helideck perimeter light during takeoff and a dynamic rollover. Additionally, the pilot's improper takeoff technique likely contributed to the development of dynamic rollover.

Findings

Personnel issues	Aircraft control - Pilot
Personnel issues	Use of policy/procedure - Pilot
Aircraft	Lateral/bank control - Not attained/maintained
Personnel issues	Incorrect action performance - Pilot
Environmental issues	Runway/taxi/approach light - Effect on operation

Factual Information

History of Flight

Takeoff	Dynamic rollover (Defining event)

On December 29, 2022, about 0832 central standard time, a Bell 407 helicopter, N595RL, was substantially damaged during takeoff from an offshore platform in the Gulf of Mexico. The pilot and 3 passengers were fatally injured. The helicopter was operated as a Title 14 *Code of Federal Regulations* (CFR) Part 135 flight.

According to a review of Federal Aviation Administration (FAA) Automatic Dependent Surveillance-Broadcast (ADS-B) track data and video/parametric data recovered from a cockpit recorder, about 0748, the helicopter departed the Rotorcraft Leasing Company LLC (RLC) base located at South Lafourche Leonard Miller Jr. Airport (GAO), Galliano, Louisiana, for a visual flight rules (VFR) passenger flight to the West Delta 106 (WD-106) offshore production platform in the Gulf of Mexico. The direct flight path to WD-106 was 51.3 nautical miles southeast of GAO.

A review of the cockpit video and recorded parametric data established that the 38-minute flight from GAO to WD-106 was uneventful. About 0826, the helicopter landed on the platform's helideck on a magnetic heading of about 145° and then the engine power reduced to about idle. The pilot landed on a southeast heading. The 4 passengers exited from the left side of the helicopter, retrieved their baggage and a 70-lb box, and then proceeded below the helideck, where they had a short discussion with the platform workers scheduled to return to the mainland. Then 3 platform workers boarded the helicopter for the return flight to GAO. Based on the cockpit video footage, the pilot remained in the helicopter and there was no evidence of any mechanical abnormalities with the helicopter from the time the inbound passengers exited the helicopter to when the outbound passengers subsequently boarded the helicopter.

About 0831, the helicopter was still on the helideck with the aiming circle visible through the helicopter's pilot-side chin bubble. The aiming circle intersected the lower section of the instrument panel. Additionally, the helideck's south perimeter light was visible through the lower-portion of the pilot-side windshield.

At 0832:18, the pilot began to advance the engine throttle for takeoff. About 20 seconds later, the dual tachometer indicated 100% for engine and main rotor speed, and all engine and system instruments were within their normal operating ranges. At 0832:46, the helicopter began to move, consistent with getting light on the skids, and the engine torque began to increase. About 5 seconds later, the south light disappeared from view as the helicopter's nose

appeared to move right in conjunction with an increase in right roll. At that time, the engine torque was between 50-60%.

Between 0832:51 and the end of recorded video/parametric data at 0832:53, the helicopter continued to increase in right roll while the engine torque increased to about 75%. The camera's view of the instrument panel was obscured during the final moments of the video, but the parametric data indicated that the helicopter was about 2 ft above the helideck, rolled right about 32°, with a right roll rate of about 68 degrees per second when the device stopped recording.

One of the passengers used his mobile phone to capture video during the takeoff. The passenger, who was seated in the forward-facing seat on the left side of the passenger cabin, took the video looking out the left side of the helicopter. A review of the video footage revealed that the helicopter remained stationary while the engine and rotor RPM noise increased, consistent with engine and rotor speed increasing from idle to takeoff power/speed. The helicopter began to ascend with no apparent drift left or right nor forward or back. However, about 1.5 seconds after the helicopter began to ascend, the left skid appeared in the view as the helicopter entered a right roll. There were fragments of what appeared to be main rotor blade material visible in the air during the final moments of the passenger video.

There were no eyewitnesses or surveillance video of the helicopter departing the WD-106 helideck; however, there were several individuals inside the galley who reported hearing the helicopter operating on the helideck above their position. The individuals stated that the helicopter's engine continued to run after it landed, and that they heard the engine noise increase for takeoff and then the sound of items hitting the platform. None of the individuals interviewed witnessed the helicopter contact the platform or its descent to the water. However, one individual stated that he and others exited the galley within seconds and saw bubbles rising from the water and the helicopter floating upside down. Three of the employees manned the platform's enclosed survival craft and were lowered to the water to reach the helicopter and render assistance to the four occupants who remained inside the fuselage; however, due to concerns about debris in the water, the survival craft did not reach the helicopter before it sank.

Pilot Information

Certificate:	Commercial	**Age:**	32,Male
Airplane Rating(s):	None	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	4-point
Instrument Rating(s):	Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	Helicopter; Instrument helicopter	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	February 23, 2022
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	September 28, 2022
Flight Time:	1668 hours (Total, all aircraft), 1344 hours (Pilot In Command, all aircraft)		

The pilot was hired by RLC on September 12, 2022. When he submitted his resume for employment, the pilot reported a total flight experience of 1,512 hours in helicopters, of which 1,188 hours were flown as PIC. He previously worked for five helicopter operators, and had flight experience in Robinson, Guimbal, Bell, and Sikorsky helicopters.

On September 28, 2022, the pilot completed his RLC initial ground training and initial flight training, and then was subsequently assigned as a VFR pilot-in-command (PIC) in the Bell 407 helicopter. The training included the pilot's initial pilot testing (per Title 14 CFR Part 135.293) , PIC instrument proficiency check (Part 135.297), and PIC line check (Part 135.299).

Flight grade slips dated September 13, 18, 19, 20, and 23, 2022, evaluated the pilot as satisfactory in the task "Dynamic Rollover (Oral)." Additional grade slips dated September 19, 20, 24, and 27, 2022, evaluated the pilot as satisfactory in "Pinnacles or Platform."

The pilot's total flight experience in helicopters, including the 155.8 flight hours flown while employed by RLC, was 1,667.8 hours, of which 1,343.8 hours were flown as PIC. A review of RLC flight records revealed that the pilot had operated to and from WD-106 a total of 23 times.

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	**Registration:**	N595RL
Model/Series:	407	**Aircraft Category:**	Helicopter
Year of Manufacture:	2004	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	53595
Landing Gear Type:	High skid	**Seats:**	7
Date/Type of Last Inspection:	December 2, 2001 AAIP	**Certified Max Gross Wt.:**	5250 lbs
Time Since Last Inspection:	60 Hrs	**Engines:**	1 Turbo shaft
Airframe Total Time:	16722 Hrs at time of accident	**Engine Manufacturer:**	Rolls-Royce
ELT:	C126 installed, not activated	**Engine Model/Series:**	250-C47B
Registered Owner:	TVPX Aircraft Solutions Inc Trustee	**Rated Power:**	650 Horsepower
Operator:	Rotorcraft Leasing Company, LLC	**Operating Certificate(s) Held:**	On-demand air taxi (135)

According to the RLC Director of Training, after considering the weights of the pilot and passengers, their seating arrangements in the helicopter, the weight of their personal baggage, and the estimated fuel quantity remaining at the time of the accident, the helicopter was loaded in accordance with the General Operations Manual (GOM).

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	DLP,119 ft msl	**Distance from Accident Site:**	17 Nautical Miles
Observation Time:	08:35 Local	**Direction from Accident Site:**	1°
Lowest Cloud Condition:	Scattered / 8500 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	12 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	140°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30.09 inches Hg	**Temperature/Dew Point:**	
Precipitation and Obscuration:			
Departure Point:	Gulf of Mexico, LA	**Type of Flight Plan Filed:**	Company VFR
Destination:	Galliano, LA (GAO)	**Type of Clearance:**	None
Departure Time:	08:32 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	West Delta 106 (WD-106) PVT	**Runway Surface Type:**	
Airport Elevation:	100 ft msl	**Runway Surface Condition:**	Dry
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

The WD-106 offshore production platform was owned by Walter Oil and Gas, Houston, Texas, and operated by Island Operating Company, Lafayette, Louisiana. WD-106 was equipped with a 24 ft by 24 ft helideck located on the south corner of the platform and about 100 ft above the water. According to Walter Oil and Gas, the platform's helideck, when constructed in 1994, was built in accordance with American Petroleum Institute (API) 2L 3rd edition standards.

The helideck was outlined with eight lights of alternating amber and blue color. The light assemblies were guarded, with no exposed wiring, and were located outboard of the flight deck. The light assemblies, whose attachment hardware to the helideck were not frangible, measured about 8 inches tall. The helideck deck was painted white with a black border. A 10-ft-diameter black aiming circle was painted in the center of the helideck. The words "WALTER" and "WD-106" were painted inside the aiming circle, along with a painted gray and black "W" icon. The stairwell for the helideck was in the southwest elevation and had a red border around it. A metal perimeter safety skirting outlined the helideck. Except for the eight perimeter light assemblies, no objects were elevated or stood proud on the helideck, as shown in Figure 1.

Figure 1. Photo of an exemplar Bell 407 helicopter on the WD-106 helideck.

Note: Helideck perimeter amber lights are circled in amber, and perimeter blue lights are circled in blue. The white arrow points to the light significant to the accident.

The API 2L 3rd edition standards stipulate, in part:

> *For night use, perimeter lights should be used to delineate the heliport flight deck. Alternating yellow and blue omnidirectional lights of approximately 30-60 watts should be spaced at intervals to adequately outline the flight deck. A minimum of eight (8) lights are recommended for each heliport.*

The API further stated, in part:

> *Flight deck lights should be outboard of the flight deck and should not extend over six (6) inches (15cm) above the deck surface. They should be guarded, have no exposed wiring, and be located so as not to be an obstruction. Any inboard lighting should be flush mounted.*

The WD-106 perimeter lights were installed outboard of the physical helideck surface.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	3 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	4 Fatal	**Latitude, Longitude:**	28.83167,-89.55783

Examination of the WD-106 production platform after the accident revealed composite debris scattered throughout the multiple levels of the platform. The scattered debris was consistent with the internal materials used in helicopter main rotor blades. A majority of one main rotor blade, identified as serial number A-1532, was located on the cellar deck, two levels below the helideck, resting against a metal handrail. The handrail exhibited a downward bend near the location the blade. Three pieces of lead weight, consistent with blade weights, were also found on the cellar deck near the blade. Multiple pieces of dark tinted acrylic, consistent with the cabin roof windows of the helicopter were found in the same location. The acrylic shards exhibited red color transfer consistent with the red paint of the stairwell. The helicopter's upper hydraulic servo cover, normally located above the cockpit, also exhibited the same red color transfer. Sections of the tail rotor were found on the main deck below the helideck. No specific object on the platform could be conclusively identified as the contact point with the tail rotor.

Further examination of the helideck revealed that the center blue light assembly on the northwest elevation of the helideck was damaged but still attached to its 6 inch by 6 inch light mount. Although the light remained installed on the mount, its blue glass globe was fragmented and the metal protective guard for the globe was significantly deformed and bent toward the stairwell, as shown in Figure 2. After the accident, a platform employee removed the damaged light assembly from the mount out of concern for safety during future use of the helideck. The amber light, located on the west corner of the helideck, near the stairwell, separated from its mount and was not recovered. The remaining perimeter lights appeared undamaged.

The red paint around the stairwell exhibited scratches and gouges. The safety skirting that bordered the stairwell (northwest and southwest sides) was damaged. There were multiple impact marks on the metal frame of the helideck around and below the area of the damaged safety skirting and stairwell.

Two areas of gouges in the paint on the helideck were present. The first area was a row of nine irregularly spaced but inline gouges, as depicted in Figure 3, located inside the aiming circle and adjacent to the "W" icon logo painted on the helideck. The second area was a group of five irregularly spaced gouges, found in the black paint of the aiming circle, near the northeast side and near the damaged center light. Figure 4 is an illustration showing the location of the two areas of paint gouges and the damaged light assembly.

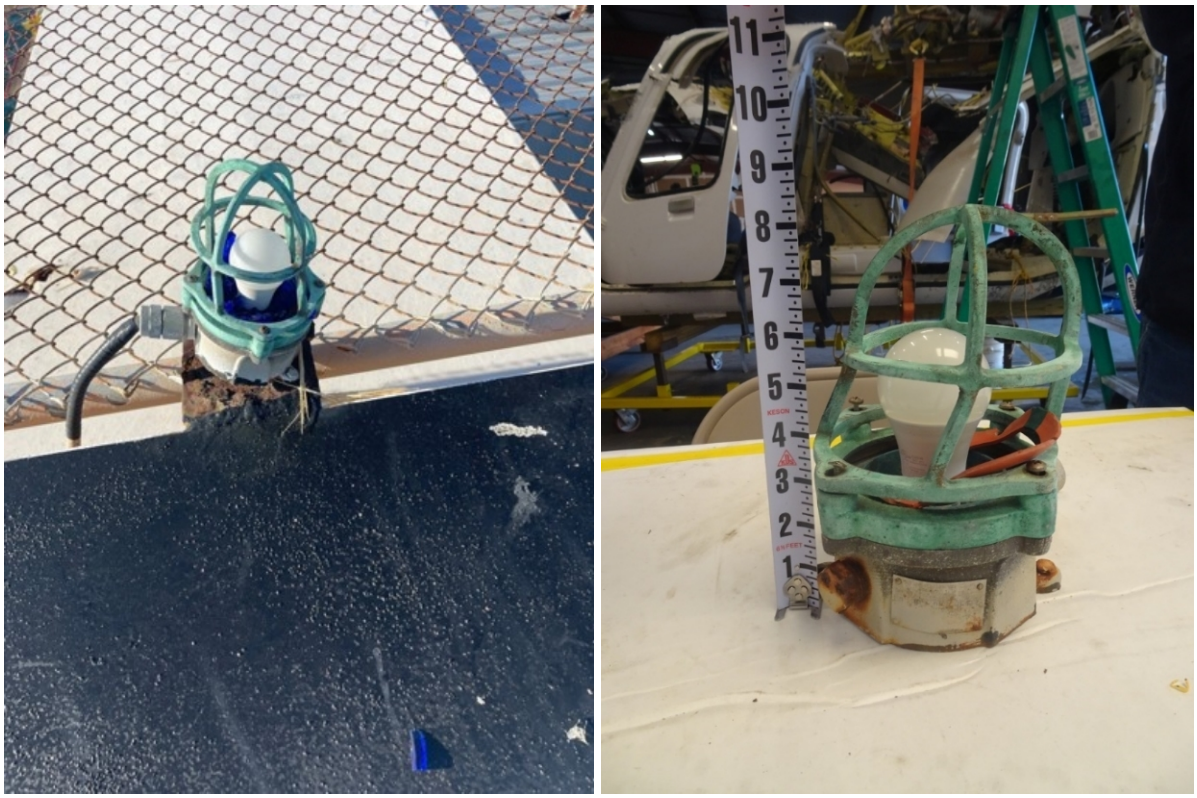

Figure 2. Photo (left) of the damaged center perimeter light shortly after the accident (Source: Walter Oil and Gas). Photo (right) of the same light assembly after it was removed from the helideck (Source: NTSB).

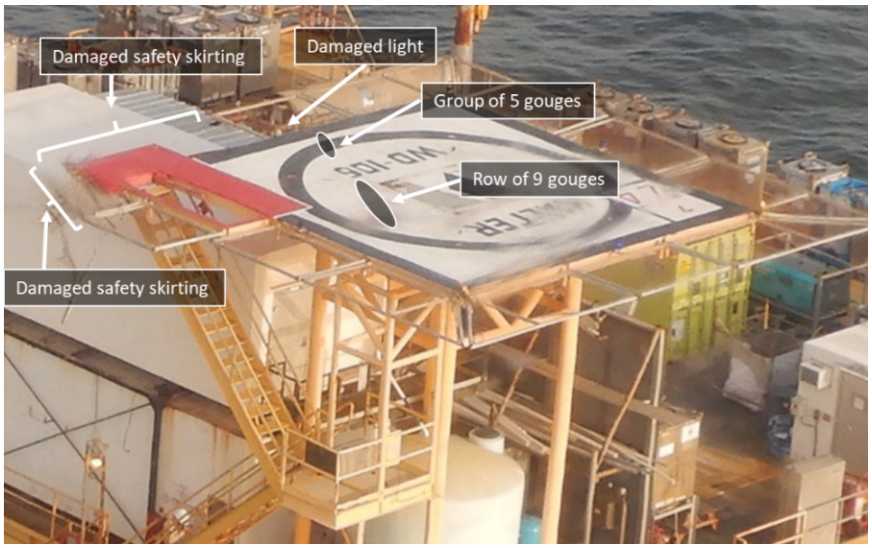

Figure 3. Image identifying some of the damage to the helideck.

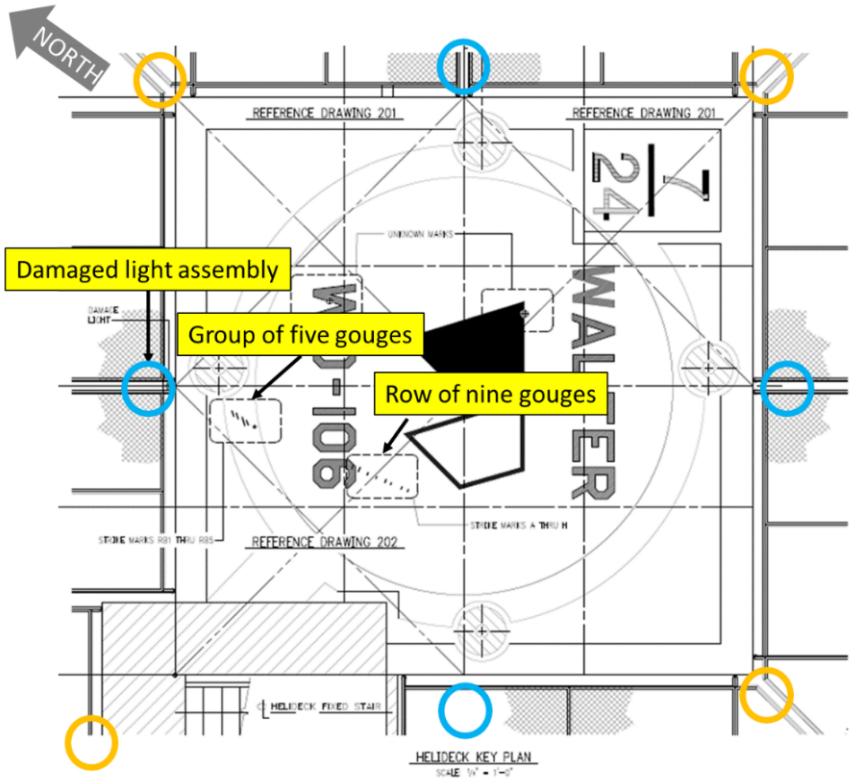

Figure 4. Illustration depicting the location of the two groups of gouges in the helideck paint and the location of the damaged perimeter light assembly.

During a subsequent examination, an exemplar Bell 407 helicopter was used to determine the before-takeoff position of the accident helicopter on the WD-106 helideck. The exemplar helicopter's Appareo video recorder field of view (FOV) was calibrated to match the accident

helicopter's Appareo FOV. The exemplar helicopter was flown to WD-106 and parked in the center of the 10-ft-diameter aiming circle on a magnetic heading of 145°. With a camera placed alongside the Appareo recorder, a photo was captured to show the view of the aiming circle from the right-side pilot's chin bubble. The aiming circle was positioned under the anti-torque pedals, as shown in Figure 5.

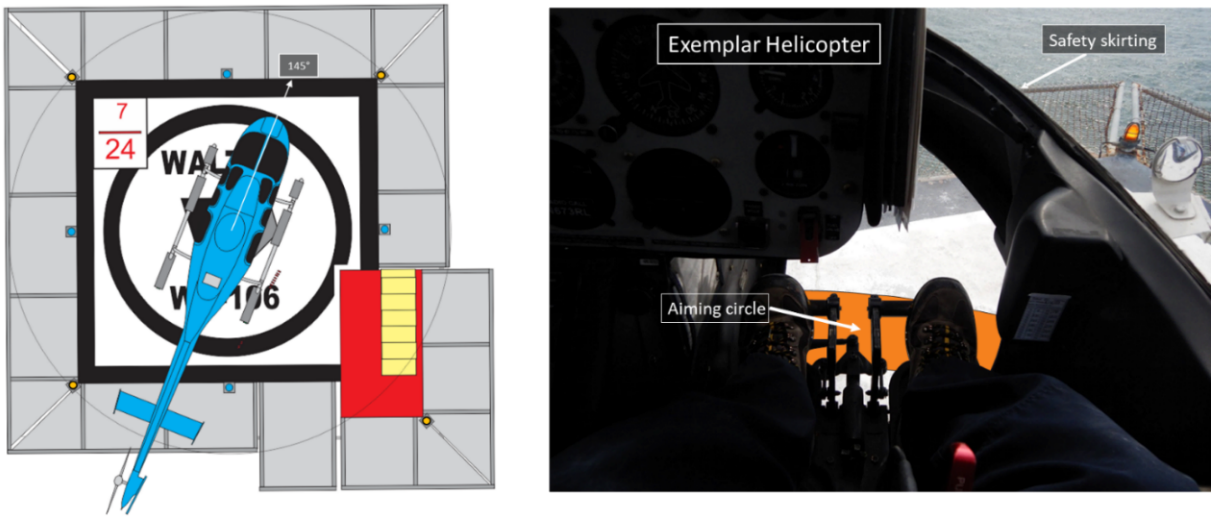

Figure 5. Photo (right) captured while the exemplar helicopter was in the center of the aiming circle and showing the right-side chin bubble and the location of the aiming circle, highlighted in orange, under the anti-torque pedals. The illustration (left) depicts the exemplar helicopter's position and orientation on the helideck.

The exemplar helicopter was then repositioned straight aft on the helideck to match the accident recorder's FOV before the takeoff, as shown in Figure 6.

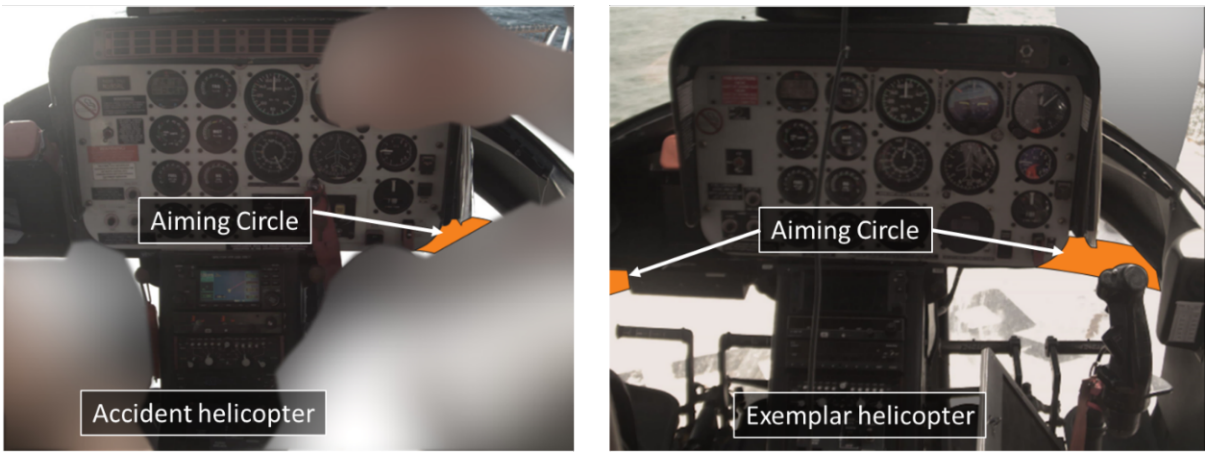

Figure 6. Side-by-side comparison of the accident helicopter's Appareo FOV (left) and the exemplar helicopter's Appareo FOV (right). Aiming circles are highlighted in orange.

Moving the exemplar helicopter straight aft to match the accident FOV resulted in the right skid extending past the edge of the helideck, while the left skid remained completely on the helideck, as shown in Figure 7.

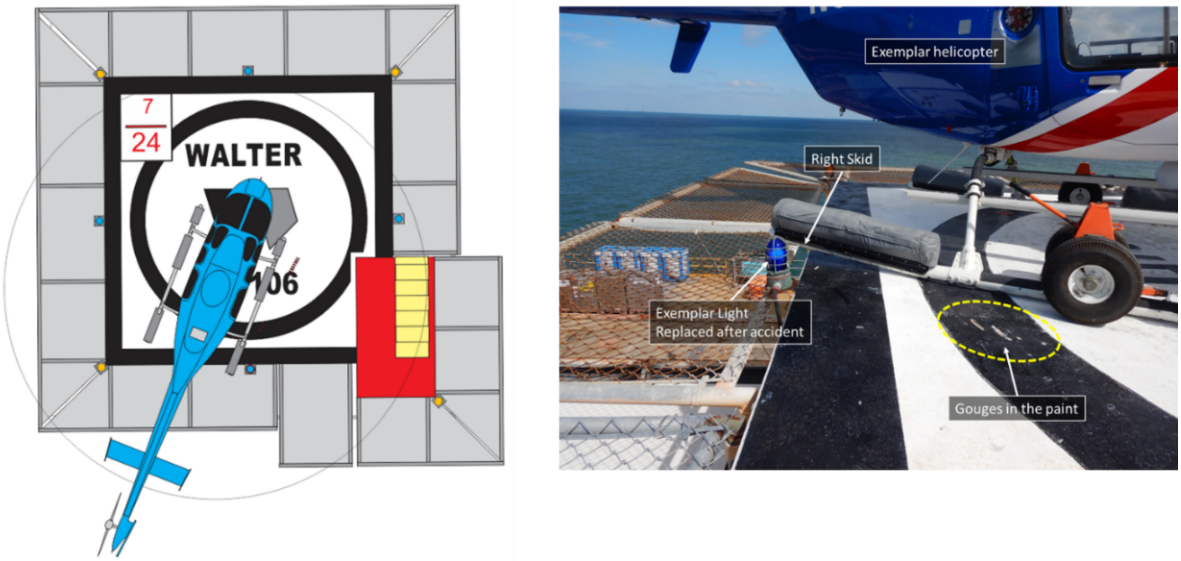

Figure 7. Photo (right) showing the aft section of the exemplar helicopter's right skid beyond the edge of the northwest side of the helideck. The illustration (left) depicts the exemplar helicopter's location on the helideck.

When compared to the group of five gouges in the aiming circle, the exemplar helicopter's five wear shoe mounting bolts were near the gouges and matched the spacing between the gouges, as shown in Figure 8.

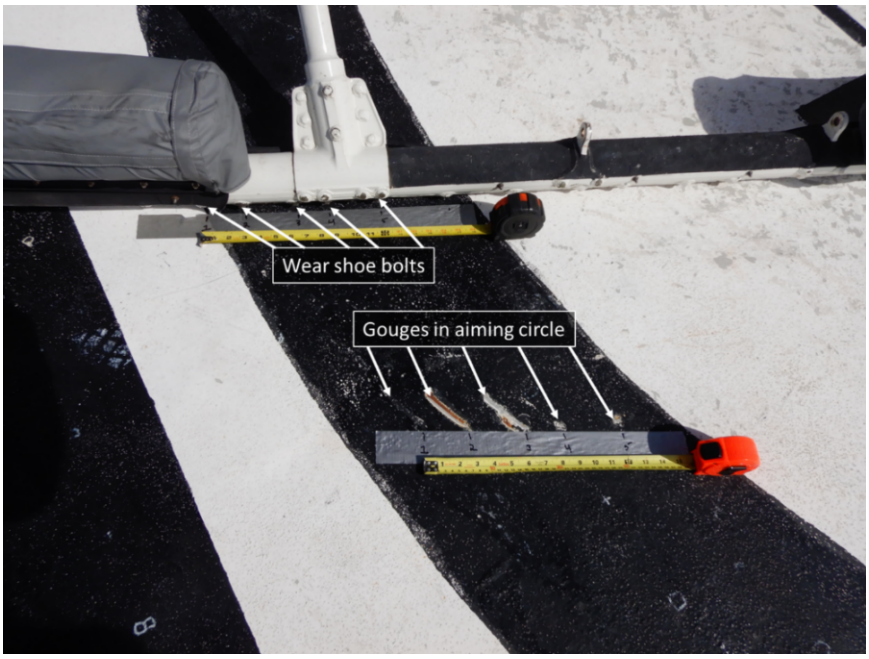

Figure 8. Photo of an exemplar helicopter's right skid showing the five wear shoe mounting bolts that matched the spacing of the group of five irregularly spaced gouges in the helideck paint.

With the exemplar helicopter still in the position that matched the accident helicopter's FOV, the middle section of the right skid was compared to the row of nine irregularly spaced but inline gouges to the helideck paint. A section of nine wear shoe mounting bolts were near the gouges and matched the spacing of the gouges, as shown in Figure 9.

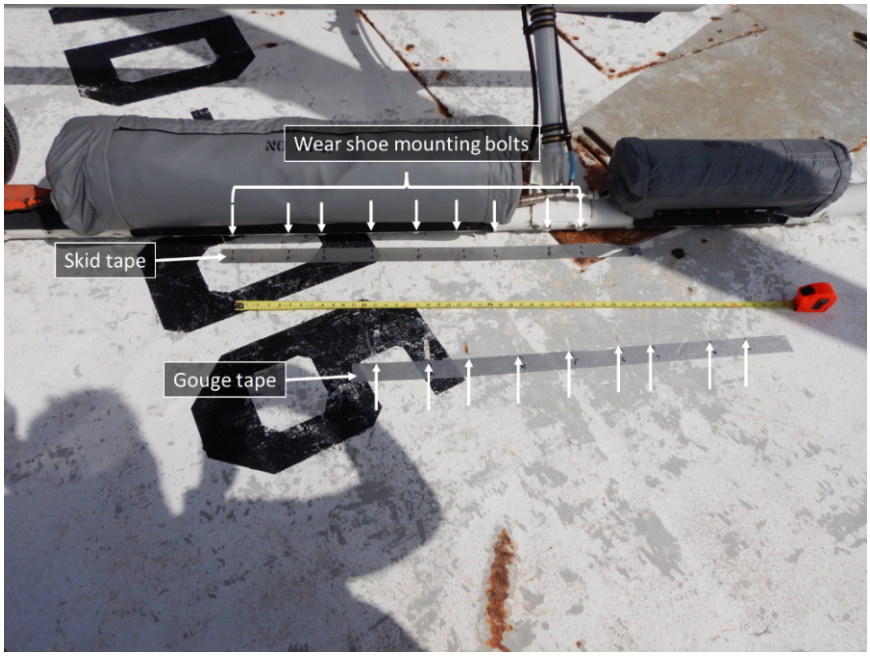

Figure 9. Photo showing the row of nine irregularly spaced but inline gouges in the paint alongside the matching wear shoe mounting hardware.

Examination of the recovered helicopter wreckage found no evidence of preimpact failure of the airframe, the main and tail rotor systems, or the engine. The main rotor blades and hub exhibited signatures of powered impact damage consistent with engine power delivery to the rotor system when the blades impacted the helideck. Additionally, the recovered engine control unit data confirmed that the engine was functioning normally up until the main rotor blades impacted the helideck. Examination of the flight control system found no evidence of preimpact fractures, disconnections, or restrictions. The lateral hydraulic servo actuator, which controls the helicopter in the roll axis, exhibited normal functionality during bench testing.

Medical and Pathological Information

The autopsy of the pilot was performed by the Jefferson Parish Forensic Center, as authorized by the Lafourche Parish Coroner. According to the autopsy report, the cause of death was multiple blunt force injuries with subsequent drowning. The manner of death was accident. According to the autopsy report, extensive head and facial trauma was present. The autopsy did not identify significant natural disease.

At the request of the Jefferson Parish Coroner's Office, NMS Labs performed toxicology testing of the pilot's postmortem liver tissue. Ethanol was detected at 0.11 g/dL. Caffeine was also presumptively positive in liver tissue.

The FAA Forensic Sciences Laboratory completed postmortem toxicological testing of specimens obtained during the pilot autopsy. Ethanol was detected in cavity blood at 0.042 g/dL and vitreous fluid at 0.029 g/dL but was not detected in urine. Isopropanol was detected in cavity blood at 0.004 g/dL but not in vitreous fluid or urine. N-propanol was detected in cavity blood and vitreous fluid but not urine. N-butanol was detected in cavity blood but not vitreous fluid or urine. The cavity blood specimen was unsuitable for carboxyhemoglobin testing.

Ethanol is a type of alcohol. It is the intoxicating alcohol in beer, wine, and liquor, and, if consumed, can impair judgment, psychomotor performance, cognition, and vigilance. FAA regulation imposes strict limits on flying after consuming ethanol, including prohibiting pilots from flying with a blood ethanol level of 0.04 g/dL or greater. Alcohol consumption is not the only possible source of ethanol in postmortem specimens. Ethanol can sometimes be produced by microbes in a person's body after death. Postmortem ethanol production is made more likely by extensive traumatic injury and can cause an affected toxicological specimen to test positive for ethanol while another specimen from the same person tests negative.

Isopropanol is an alcohol commonly found in in disinfectants, anti-freeze, and window cleaners. Isopropanol can also be found in postmortem specimens due antemortem or postmortem sources. Postmortem production of isopropanol is a byproduct of the decomposition process due to microbial activity.

N-propanol and particularly n-butanol are other alcohols that can be produced by microbes in a person's body after death. Their presence in a postmortem specimen is potentially indicative of postmortem microbial activity in the specimen but does not reliably indicate that postmortem ethanol production occurred.

Caffeine is a central nervous system stimulant that is commonly ingested, including in coffee, tea, soft drinks, and chocolate, and is also an ingredient in certain anti drowsiness medications and headache medications. Caffeine is not generally considered impairing.

Additional Information

RLC General Operations Manual (GOM), Maneuvers Guide and Training

The RLC GOM states, in part,

> *Anything less than rotor diameter will be considered a restricted category helideck, and the pilot may have to reduce load to operate safely. All approaches and landings shall be made to the center of the available landing area when landing to a restricted category helideck. The mast of the helicopter is to be as close to the center of the helideck as possible.*

According to the Bell 407 Pilot Operating Handbook, the main rotor diameter is 35 ft and, as such, would place the WD-106 helideck (24 ft by 24 ft) within the restricted category.

The RLC GOM referenced the Helicopter Safety Advisory Conference (HSAC)-Recommended Practices No. 93-3, which states, in part,

> *The recommended practices also requires that helicopters operating on offshore helidecks must land or park the helicopter with a skid/wheel assembly no closer than 3 feet from the helideck edge.*
>
> *Pilots in command of the aircraft will be responsible for complying with HSAC Recommended Practice 93-3 and must verify safe landing room before approaching helideck to land.*

The RLC Maneuvers Guide contained standards for takeoff and landing to platforms and identified the FAA Helicopter Flying Handbook (FAA-H-8083-21) as a supporting reference. The Maneuver Guide identified the standards for an approach to a platform as:

> *As into the wind as possible.*
> *High reconnaissance at 500 ft agl or above.*
> *Floats armed prior to descending below 300 ft agl.*
> *Arrive at the center of the available area with a 3-5 ft hover.*

The RLC Maneuvers Guide identified the standards for takeoff from a platform as:

> *Float pin shall be removed for all over water flights.*

Departures must always begin from a stabilized hover and be as into the wind as possible.
Apply slight increase in collective, note positive rate and engine performance.
Apply forward cyclic to transition into forward flight.
As the helicopter moves out of ground effect, maintain altitude, and accelerate to no less than 60 knots.
Do not lose altitude after clearing the platform.
Once 60 knots is achieved, set cruise power, and climb to cruise altitude.
The aircraft may be turned toward, but not away from the wind until 300 ft agl.

The FAA Helicopter Flying Handbook (FAA-H-8083-21) describes a takeoff from a hover as:

> *A vertical takeoff to a hover involves flying the helicopter from the ground vertically to a skid height of two to three feet, while maintaining a constant heading. Once the desired skid height is achieved, the helicopter should remain nearly motionless over a reference point at a constant altitude and on a constant heading. The maneuver requires a high degree of concentration and coordination.*

RLC Director of Training (DoT) Description of Takeoff/Landing Pilot Training

According to the RLC DoT, company pilots are trained to land to the center of a helideck, regardless of the size of the helideck. For helidecks with a visible aiming circle, determining if the helicopter is in the center of the aiming circle is done via visual cues from within the cockpit and is demonstrated and trained during initial flight training. According to the DoT, his technique for determining if a helicopter landed in the center of an aiming circle is based upon his specific seated height and his own sight picture. However, the DoT explained that if the anti-torque pedals are over the aiming circle upon landing, the helicopter is in the center of the aiming circle.

The DoT further explained that during training, he instructs the pilot under training to develop their own sight picture that ensures the helicopter is in the center of the helideck or aiming circle. The DoT stated that this practice included encouraging the pilot to open the door after landing to visually verify that the helicopter is in the center of the helideck or aiming circle.

The DoT explained that the company trains pilots so that a takeoff is not a singular event, but rather a multi-stepped process that begins with:

> Apply power until the helicopter is light on the skids.
> Bias the weight on the heels of the skids.
> Find equilibrium.
> Lift straight up to a 3-5 ft hover check and stop.
> The pilot would then glance at the gauges, and then lift off or reposition.

The DoT explained that if the helicopter is lifted in the multi-step process, lateral drift is not a concern during the takeoff phase.

Dynamic Rollover

According to the FAA Helicopter Flying Handbook (FAA-H-8083-21), a helicopter is susceptible to a lateral rolling tendency, called dynamic rollover, when it is in contact with the surface during takeoffs or landings. For dynamic rollover to occur, some factors must first cause the helicopter to roll and/or pivot around a skid or landing gear wheel, until its critical rollover angle is reached. The angle at which dynamic rollover occurs varies based on helicopter type. Then, beyond this critical angle, main rotor thrust continues the roll and recovery becomes impossible. Additionally, after this critical angle is achieved, the cyclic does not have sufficient range of control to eliminate the thrust component and convert it to lift. If the critical rollover angle is exceeded, the helicopter rolls on its side regardless of the cyclic corrections made by the pilot.

Dynamic rollover begins when the helicopter starts to pivot laterally around its skid or wheel. For dynamic rollover to occur the following three factors must be present:

A rolling moment
A pivot point other than the helicopter's normal center-of-gravity
Thrust greater than helicopter weight

A dynamic rollover can occur for a variety of reasons, including the failure to remove a tie down or skid-securing device, or if the skid or wheel contacts a fixed object while hovering sideward, or if the gear is stuck in ice, soft asphalt, or mud. Dynamic rollover may also occur with an improper landing or takeoff technique or while performing slope operations. Whatever the cause, dynamic rollover is possible if a pilot uses an improper corrective technique. The FAA Helicopter Flying Handbook stipulates that the correct recovery technique is to remove thrust and lower the collective control before the helicopter enters a dynamic rollover.

Review of Previous Takeoffs and Landings

RLC provided cockpit videos that were reviewed to evaluate the pilot's takeoff and landing techniques on offshore platform helidecks. For the purposes of the review, a flight was described as a takeoff-and-landing cycle and only those flights operating from an offshore platform were evaluated. Of the 27 flights reviewed, two takeoffs showed a pause with the helicopter established in a 3-5 ft hover check, as directed by RLC policy. The remaining takeoffs revealed a continuous ascent and departure from the helideck (without a 3-5 ft hover check) and, thus, were not in compliance with RLC policy.

All reviewed landings were made into the wind except one. In the one example of an apparent tailwind landing, the wind speed could not be determined, but the pilot displayed no difficulty controlling the helicopter during the landing. Landings were generally within the aiming circle on the platforms. However, based on video footage alone, the review was unable to determine

with certainty if the pilot landed to the center of those helidecks without a painted aiming circle (aiming circles aided with the determination if the pilot landed at the center of the helideck).

For comparison, the cockpit videos of flights flown by three additional RLC pilots were reviewed to evaluate their takeoff and landing techniques on offshore platform helidecks. Of the six takeoffs reviewed, only one did not show a pause with the helicopter established in a 3-5 ft hover. All reviewed landings were flown in accordance with RLC procedures.

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