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Helicopter Strikes Water on Approach After Pilots Lose Altitude Awareness

The controlled-flight-into-terrain (CFIT) accident, which killed a passenger and necessitated an underwater escape by the pilots, was also attributed to flight crew failure to set their altimeters correctly.

FSF Editorial Staff

A Sikorsky twin-turboshaft S-76A helicopter was returning to Cameron, Louisiana, U.S., from an offshore oil platform with two pilots and one passenger on board. After executing a Copter very high frequency omnidirectional radio range/distance measuring equipment (VOR/DME) point-in-space approach to Cameron, the helicopter crashed into the Gulf of Mexico about 3.2 kilometers (two miles) offshore from Cameron. [The U.S. Federal Aviation Regulations (FARs) Part 97.3 defines a point-in-space approach as "a helicopter instrument-approach procedure to a missed-approach point that is more than 793 meters (2,600 feet) from an associated helicopter landing area."] The passenger was drowned, and the two pilots were slightly injured. The helicopter was destroyed.

Conditions at the accident site were dark night (2021 hours local time) with 92-meter to 122-meter (300-foot to 400-foot) overcast and fog, according to the official U.S. National Transportation Safety Board (NTSB) report on the Nov. 8, 1994, accident.[1]

The helicopter was operating as an on-demand air taxi under FARs Part 91; its owner and operator, Mobil Administrative Services Co. Inc. (MASCI), also was authorized to operate under FARs Part 135.

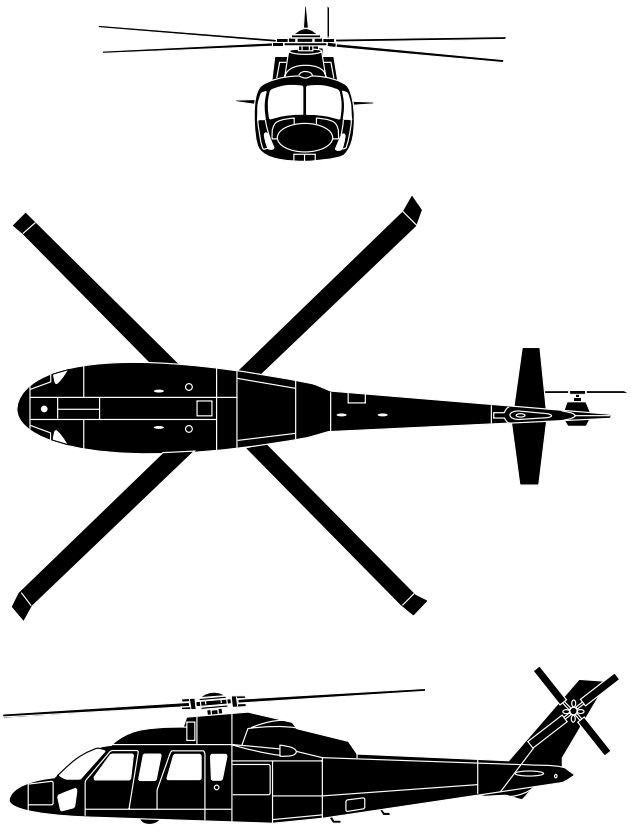
The helicopter struck the water with a slight left roll. It came to rest inverted with its rotor head on a muddy bottom in approximately 4.3 meters (14 feet) of water. Its underside remained barely above the water.

All windows on the left side of the helicopter were broken out on impact, and all windows on the right side remained in place. The left horizontal stabilizer separated at the spar root and was not recovered. The right horizontal stabilizer was intact. All four composite main-rotor blades were sheared immediately outboard of the blade-mounting cuffs, opposite the direction of rotation, and the rotor-head vibration damper exhibited permanent deformation on the damper-weight mounting arms. The tail gearbox and tail-rotor head assembly separated from their mounts and were not located.

Mud and debris were found throughout both engines and the airframe. An internal inspection of both engines revealed no mechanical or thermal distress.

The postaccident altimeter settings were found at 30.05 on the pilot-in-command's (PIC's) altimeter, and 30.12 on the copilot's altimeter. These settings would result in the PIC's altimeter indicating nine meters (30 feet) higher than the actual altitude, and the copilot's altimeter indicating 31 meters (100 feet) higher than the actual altitude.

"The altimeter setting recorded for Lake Charles [Louisiana, U.S.] at 1950, and provided to the flight by Lake Charles



Sikorsky S-76

The Sikorsky S-76 first flew in 1977. The S-76A is configured to accommodate 12 passengers and two pilots. It has a maximum takeoff weight of 4,672 kilograms (10,300 pounds), a maximum cruising speed of 145 knots (268 kilometers per hour) and a service ceiling of 4,575 meters (15,000 feet). The S-76A has a maximum range of 404 nautical miles (748 kilometers) with 12 passengers, standard fuel and 30-minute reserves. The S-76A is powered by two Allison 250-C30 turboshaft engines, each rated at 650 shaft horsepower.

Source: *Jane's All the World's Aircraft*

Approach at 2018:21, was 30.02," said the report. [An updated altimeter setting for Cameron was not available when the helicopter was inbound for landing. Landing minimums with the Cameron altimeter setting at night are 380 feet (116 meters) and one-mile (1.6-kilometers) visibility. The minimums increase to 460 feet (140 meters) and one-mile visibility at night with the Lake Charles altimeter setting.]

The helicopter was not equipped with a flight data recorder, nor was one required by the FARs. The helicopter was equipped with a cockpit voice recorder (CVR). The recording covered the final 30:57 minutes of the accident flight. The CVR was read at the NTSB laboratory, and a transcript was made of the final 15 minutes.

The voice recording of the accident flight began with general conversation during the inbound cruise portion of the flight. The recording contained good-quality audio information from three recorded channels. No challenge-and-response checklist procedures or warning signals were heard on any of the channels.

Both pilots voluntarily submitted to toxicology testing, and results were negative for alcohol or drugs.

The copilot recalled, in a postaccident interview with NTSB investigators,[2] that the first indication of anything abnormal was the realization that he was upside down and under water. He said, "I started struggling. I wasn't getting anywhere and I remembered thinking this is what it feels like to drown. And then I got ahold of myself and said, 'wait a minute, you know how to get yourself out of this thing.'"

Copilot Evacuated Through Window

The copilot told investigators that he remembered from previous underwater egress training that if he was strapped in his seat, he knew where he was, and because he was in the left seat, his exit door must be to his left. He said that he reached for the door but felt the outside of the helicopter (the window in the left door of the helicopter had broken out on impact). He then unbuckled his seatbelt and exited through the open window. Once out of the helicopter, he did not know which way to go to reach the surface. He said:

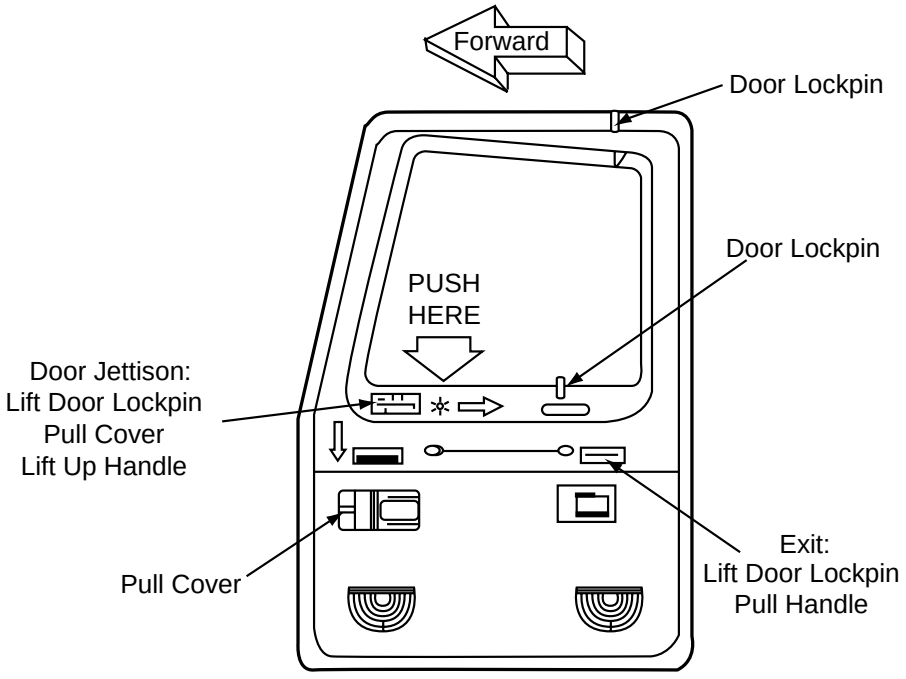
"I didn't know which way was up but ... I remembered [from] back when I was a kid in [the] Boy Scouts ... they always told you that if you get disoriented in the water, if you just stop and hold your breath, you're gonna surface, and that is what I did."

After surfacing, he climbed onto the underside of the inverted helicopter. Because no one else appeared, he said, he believed he was the only one who had escaped.

The PIC told NTSB investigators about events leading to the accident. He recalled that after telling the copilot he saw the lights of the village [Cameron], he saw [92 meters] indicated on the radio altimeter. He said that he then called Lake Charles approach control to cancel the instrument flight rules (IFR) clearance that the controller had given him.

He then looked down at the center console to change radio frequencies. He reported that he experienced no unusual sensations or noises. Then, "at the point of impact ... it was as if I had closed my eyes and ran into a brick wall. I couldn't tell you the angle, speed, anything. ... After he [the copilot flying] broke out [of instrument meteorological conditions (IMC)], he was comfortable, I was comfortable, I was doing my clean-up inside the cockpit, he was flying VFR [visual flight rules] [visual meteorological conditions (VMC)], he is [an] experienced night pilot, on the way inbound he told me how much

Sikorsky S-76A Captain's Door



Source: Sikorsky Aircraft

Figure 1

he enjoyed flying at night. ... He did an absolutely wonderful job on the instrument approach itself. It was without flaw. ... It was getting over to Mobil that it [the accident] happened, night VFR [VMC] conditions. ...

"But I never for a second experienced any unusual attitudes, G-forces, I know for an absolute fact that I was not experiencing any vertigo, and the way [the copilot was flying the helicopter], and the way he was talking, and the way he was answering, and we, our dialog, there was no indication that he was experiencing any vertigo."

The PIC's next sensation was of being upside down, under water, in pitch-black conditions, with no idea where he was.[3] He described unsuccessfully attempting to open his [right] door (Figure 1). The S-76A has a door lock-pin mechanism that must be released before the door handle will open from the inside. The PIC said that he did not remember attempting to release the locking pin. Nor did he attempt to use the emergency exit handle to jettison the door.

[The NTSB report said: a right cockpit-door emergency jettison test was conducted on an in-service S-76A in the Morgan City hangar. The door was locked. The emergency door release handle was pulled without first pulling the unlock ring or the locking button. The door fell away unimpeded with gravity pulling the door off the upper lock pin. When (the) aircraft is inverted, this pin will remain engaged.]

He said that he unbuckled his seat belt and shoulder harness, immediately became disoriented and began to panic as he couldn't breathe more air.

The PIC described what happened next: "It was completely ... black, there was mud mixed with the salt water. I had no visibility. I was able to release my seatbelt without any problem, but I felt like something was on top of me, something metal. I tried pushing my face up through it. I may have been trying to push my face through the pedals … all I could do was just keep trying to feel around for openings."

PIC Carried Emergency Breathing Air

He said that he then remembered that he carried a small portable breathing air bottle in his survival vest. The helicopter emergency egress device (HEED) is designed to provide approximately four minutes of breathing air, but the time varies with temperature and workload. The PIC said:

"I was obviously having an adrenaline rush. Fear, all confine[d], suffocation, all the other feelings that go through being underwater and not knowing which way to go … . So I did get the HEED bottle out, and I started using [it]. Like I say, it's supposed to last you four minutes … . Probably it lasted me two minutes, I'm guessing. I think I sucked on it

four or five times, but it gave me the time to stop and reflect on what was going on, and how to get out … . And so, I started moving then, and I was still stuck on something; my vest was impeding my exit. So at this point in time I had run out of air, I had sucked all of the last bit of air out of the bottle. So I took my vest off and left that behind.

"I still had no idea of how to get out. ... I used all the air I had in my lungs and I, at this point, expected that I wasn't going to make it. I had no reason to believe that I was going to make it 'cause I had no clear path to any exit. So, I recall inhaling a tremendous amount of water. Just as if I was taking a normal breath."

The PIC said that he then saw a light. "So I just swam to the light not having any idea … where the light could be coming from. [Then] I realized it was the emergency light that comes on in a crash and realized that it was on the roof of the passenger compartment, I then made a turn ... and I'm convinced I went out … one of the [broken] windows." He estimated that he was underwater for four minutes. This was confirmed by the copilot.

After surfacing, the PIC was able to crawl onto the underside of the overturned helicopter. "[The] first thing I did was sit there for about five minutes on my hands and knees and cough. ... I must have coughed all the salt water back out again. For the next couple of hours I never stopped coughing. Just kept trying to get all the salt water out of my lungs."

Both pilots had successfully completed shallow-water egress training, during which the pilot is secured by a safety belt and shoulder harness to a seat, which is then inverted underwater. The pilot then must unstrap the restraints and swim out of the seat. Several helicopter companies operating in the Gulf of Mexico voluntarily provide this training for crews. It is not required under the FARs.

The pilots then inventoried what they had that could contribute to their survival. They decided to go into the helicopter to try to retrieve the passenger, another life vest or the life raft. The PIC said that he tied his web belt to the rotating beacon located on the underside of the helicopter. The copilot held onto the belt, while the PIC "shinnied down his leg." He was successful only in retrieving the life raft and said that he had great difficulty holding his breath for more than a few seconds at a time.

Search-and-rescue Helicopters Missed Downed Pilots

About this time, the PIC and copilot said they were overflown by a U.S. Coast Guard HH-65 Dauphin search-and-rescue helicopter. The accident PIC said that the HH-65 flew directly over the mostly submerged helicopter, at an altitude of about 300 feet, but did not see them.

About 30 minutes later, another helicopter, operated by ERA Aviation Inc. (which had performed flight following and maintained radio communications for the accident flight) overflew the downed helicopter. The accident crew identified the helicopter by the sound of the engine, but they could not see it. The ERA helicopter had proceeded on the Copter approach hoping to get below the overcast to conduct a visual search for the downed S-76A, but it was unable to break out.

The crew, concerned that the helicopter might sink, decided to inflate the life raft and moor it to the helicopter. The PIC explained that it was not easy to inflate the life raft. He said, "I tried throwing it out like they teach you to do, and pulling on the painter line, and it wouldn't inflate, so there was something knotted up inside the hole [where the painter exited the uninflated life-raft package], so I got it back over ... and I basically inflated it right there in my hands."

After getting into the raft, they noticed that wave action was battering the raft against the helicopter and concluded that the raft could be punctured by one of the helicopter's broken antennas. They decided to cut the mooring line and try to float to shore. The PIC told NTSB investigators that immediately after entering the raft the copilot became "deathly ill with seasickness," and remained sick until they reached shore.

The pilots reached the shore about two and one-half hours after the helicopter struck the water.

The PIC said that strong currents were moving the raft parallel to the shore, so they decided to make a sail from their two shirts. After buttoning them together, he attached one part of the joined shirts to the raft and held the other part up in the air, creating a sail. The PIC estimated that there was about a 20-knot (37-kilometer-per-hour) breeze blowing toward shore.

The PIC said that they later saw a boat about one mile away and unsuccessfully attempted to signal it by blowing a survival whistle. The pilots reached the shore about two and one-half hours after the helicopter struck the water. They abandoned the raft and walked about a mile to ERA's Cameron base, after which they were airlifted to a Lake Charles hospital. The PIC said that both he and the copilot suffered intermittent effects of hypothermia (subnormal body temperature) for the next 18 hours.

The partially submerged and overturned wreckage of the helicopter was located at 0510 the next morning by a Coast Guard helicopter using an infrared sensor. "When [the helicopter was] recovered, the passenger was found floating free in the cabin," the NTSB said. "His seatbelt was found buckled [for a loose fit on the passenger] and intact. The passenger seats were not

equipped with shoulder harnesses." The NTSB report also noted that the passenger's body had minor injuries — lacerations and contusions — on the face and shoulder. Death was attributed to drowning.

The MASCI operations manual said, "Internal cargo may be carried aboard provided that the cargo is properly secured and does not block or impede egress to any normal emergency exit."

Found, unrestrained in the passenger cabin of the helicopter after recovery, were two 4.6- by 4.6-meter (15-foot by 15-foot) sheets of plastic, two aluminum deck plates measuring 0.9 meter by 1.2 meters (three feet by four feet), 11 life jackets and a variety of small items normally carried in the cabin.

The flight was to be the crew's final flight of the duty day. They had flown a total of five hours and 40 minutes when they accepted a routine request to transport two passengers and a 280-kilogram (617-pound) drilling tool from Cameron to an oil field located 118 nautical miles (217 kilometers) offshore in the Gulf of Mexico.

The length of the tool required it to be carried in the passenger cabin, oriented from back-right to forward-left across the cabin. Formed aluminum decking was placed on the three rows of passenger seats to protect them. The tool was wrapped in two sheets of plastic "visqueen," approximately 4.6 meters by 4.6 meters, and seatbelts were used to secure the tool. The two passengers were seated in the aft-left and forward-right seats for the outbound trip.

At 1913, the helicopter landed at the Pride-950 oil platform, where one passenger deboarded and another, who was returning to Cameron, boarded. The next stop took place after a three-minute flight to another platform, the Baltic-1, where the drilling tool and the remaining outbound passenger were offloaded.

The PIC said that before boarding the helicopter on the return trip, he instructed Baltic-1 workers, who were holding the plastic sheets used to wrap the tool, to take the loose plastic and ropes below the helideck.

The PIC said that he gave the inbound passenger a safety-and-egress briefing and told him he could move from the aft-left seat to the forward-right seat, directly behind the PIC (Figure 2). The PIC said that the passenger was told that his emergency exit was the PIC's door. While the PIC was briefing the passenger, the copilot supervised unloading of the tool. Both pilots later said that they believed that all plastic and loose gear had been removed from the helicopter.

Return Flight Began in Clear Moonlight

During the return trip, the copilot was the pilot flying, and the helicopter was cruising at 1,678 meters (5,500 feet) in clear moonlit conditions at a ground speed of 164 knots (303 kilometers per hour). The PIC said that, when they were approximately 64 kilometers (40 miles) from Cameron, he contacted ERA in Lake Charles and requested the Cameron weather. He was told that Cameron was estimating the visibility at two miles, with no ceiling observed. The PIC then

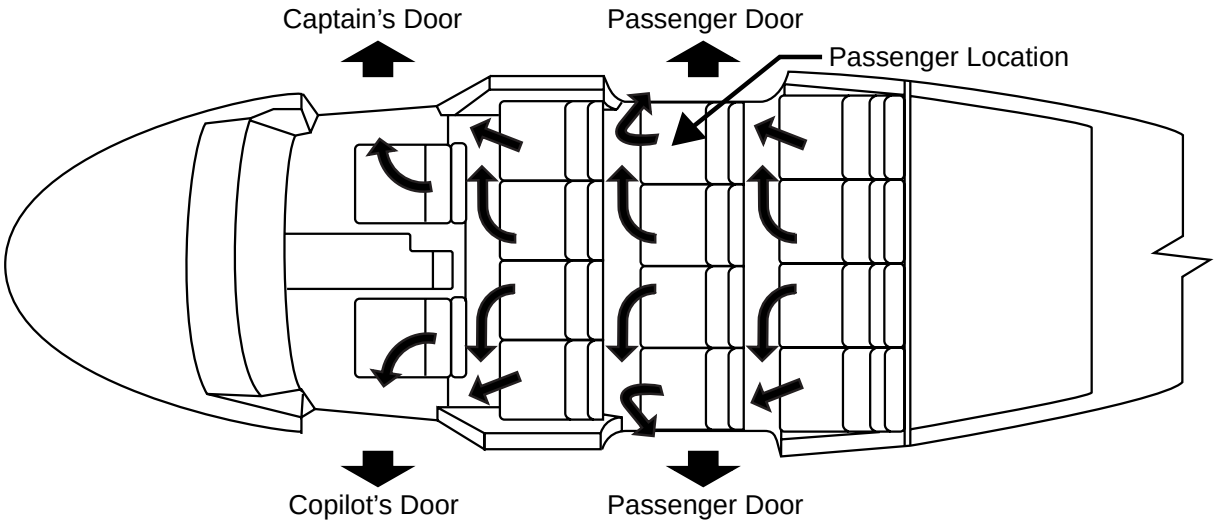
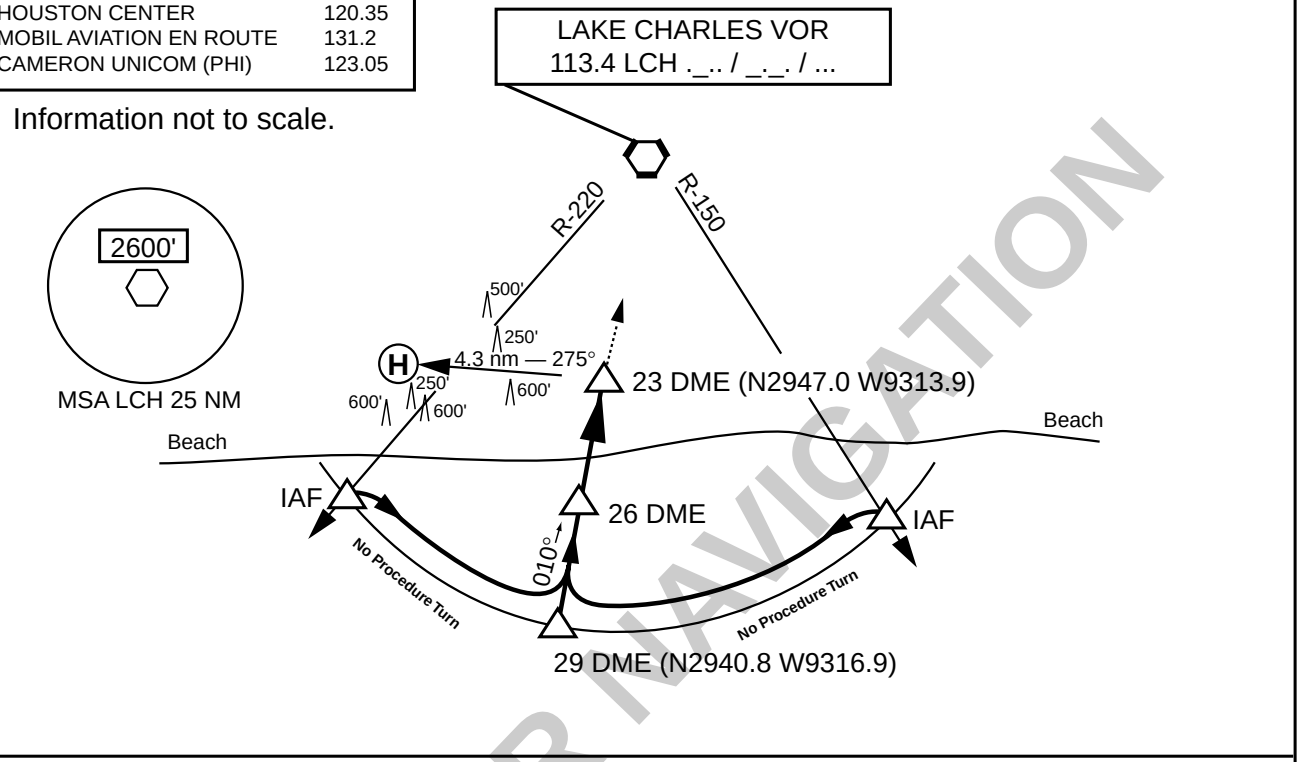


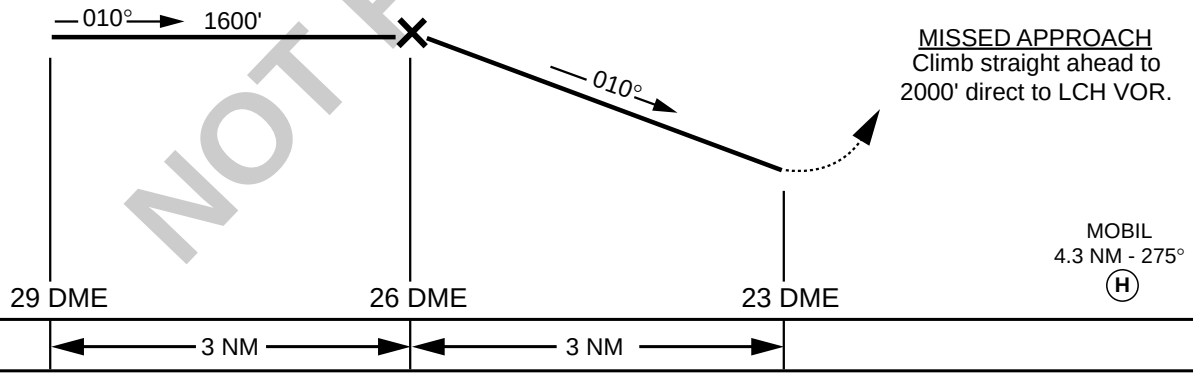
Figure 2

Cameron Copter VOR/DME 010 Approach

ATIS	118.75
LAKE CHARLES APP CON	119.8
HOUSTON CENTER	120.35
MOBIL AVIATION EN ROUTE	131.2
CAMERON UNICOM (PHI)	123.05



NOTE 1: Use 70K Gnd speed or less between LCH 190/26 and 190/23.
NOTE 2: Helicopters must proceed VFR from MAP or conduct Missed Approach.



LANDING H - 010

LOCAL ALTIMETER	LCH ALTIMETER	TAKEOFF	ALTERNATE
DAY: 380- 1/2 (380)	DAY: 380- 1/2 (380)	DAY: 1/2	N / A
NIGHT: 380- 1 (380)	NIGHT: 460- 1 (460)	NIGHT: 1	N / A

Original, 01 Jan 94 CHANGES: None, original issue.

Source: U.S. National Transportation Safety Board/Mobil Administrative Services Co.

Figure 3

Cockpit Voice Recorder Transcript of Accident Flight

Time	Source	Content
2007:46	**RDO-1**	Lake Charles approach, Mobil helicopter, Sikorsky two six two zero, good evening.
2008:28	**HOT-1**	Be nice if we could tie this thing into this flight director. # would just fly this whole route for us.
2008:52	**RDO-1**	Lake Charles approach, Mobil helicopter two six two zero.
2009: 16	**LCA**	Mobil helicopter two six two zero, Lake Charles.
2009:21	**RDO-1**	Yes sir, uh, good evening. We're uh, five zero DME on the one nine zero degree radial Lake Charles. Two thousand five hundred feet uh, we'd like to get uh, IFR clearance to uh, shoot the uh, Copter VOR DME approach into Cameron, this evening.
2009:46	**LCA**	Copter two six two zero, squawk zero four, zero one.
2010:07	**RDO-1**	Zero four zero one for uh, Sikorsky two six two zero.
2010:58	**RDO-1**	Lake Charles, this is Mobil 620.
2011:03	**ERA**	Yeah 620, go ahead.
2011:05	**RDO-1**	You know I forgot to ask you earlier but did them boys down in uh, Cameron give you an setting altimeter, sir?
2011:13	**ERA**	No sir, they sure didn't.
2011:16	**RDO-1**	OK.
2011:18	**ERA**	My altimeter setting though at uh, five o'clock. Hang on just a second. Let me see if I can **.
2011:25	**HOT-1**	#, don't think that's goin' to help me.
2011:31	**ERA**	Was uh, zero zero zero at five, I'm sorry that was six o'clock, not five.
2011:38	**RDO-1**	OK.
2011:43	**RDO-1**	Lake Charles approach this is Mobil 620. Was you calling me?
2011:49	**LCA**	Mobil 620, negative.
2011:51	**RDO-1**	OK, sorry sir.
2011:59	**HOT-1**	He said three zero zero five * at six o'clock?
2012:03	**HOT-2**	Yeah.
2012:20	**HOT-1**	That's my fault, it's tied into my altimeter.
2012:49	**HOT-1**	You can see the, the 40 DME is right on, right next to the, West Cam 110, where that rig is. But you can't see the rig.
2013:37	**HOT-1**	That's, in fact that's the rig right there. That's uh Ocean Spur right there. We just passed it. That's right out our door, amazing technology, isn't it?
2012:59	**LCA**	Two six two zero, still not picking you up sir.

contacted Lake Charles approach and requested an IFR clearance for the Cameron Copter VOR/DME 010 approach (Figure 3, page 6). The crew entered IMC.

At 2011:18, the PIC again contacted ERA, asked for the altimeter setting and was informed that the Cameron altimeter setting was unavailable but that the Lake Charles altimeter setting was, "… zero zero zero at five, I'm sorry that was six o'clock, not five." The PIC responded, "OK." A few seconds later he asked the copilot, "He said three zero zero five at six o'clock?" to which the copilot responded in the affirmative. (See sidebar CVR transcript.)

At 2017:04, the PIC stated, "… We're gonna need to slow it down because we are going to go IFR." The copilot replied, "[All right], you talk me through the mileages now." The PIC said, "I got everything taken care of. You're, you're doin' good." The crew told the NTSB investigator-in-charge that the PIC was setting up the navaids and cockpit instruments for the approach, and the copilot was visually confirming the PIC's actions during this conversation.

Crew "Went Visual" After Copter Approach Completed

The NTSB report said: "The crew went visual at the termination of the Copter approach. ... The point where the crew went visual was over the water, one mile offshore. The only visual references available were several lights on land, approximately 6.4 kilometers [four miles] ahead. ... The copilot [pilot flying] transitioned from instruments to an outside visual scan, for a transition to the landing site. The [PIC] [pilot not flying] was looking down while changing radios. Neither pilot was aware of a descent until the level impact with the water."

The PIC told the copilot that he had the lights of Cameron in sight. In his interview with the NTSB, he said that he was sure that the radio altimeter indicated 92 meters (302 feet) just before impact.

"At 2020:34 the PIC stated, 'You got [91.5 meters (300 feet)] on the [radio] altimeter. There you go. Got the village in sight,'" the NTSB report said. "At 2020:41 he stated, 'Come on down.' At 2020:46 the PIC transmitted, 'Hey Lake Charles uh, Sikorsky 2620, we just broke out here, at [122 meters (400 feet)], and uh, we got Cameron in sight. Looks like we got underneath here, we got oh about [eight kilometers (five miles)] visibility ... .' Thirteen seconds later the sound of impact was heard."

The crew's backgrounds were reviewed during the accident investigation. The PIC, 47, held an airline transport pilot (ATP) certificate with rotorcraft helicopter rating and commercial privileges for airplane single- and multi-engine land and instrument airplane. He held helicopter type ratings in the S-76,

2013:03	**RDO-1**	Mobil two six two zero roger that. We're gettin' a reply but uh, uh, in fact we got another transponder. We'll try that one.
2013:11	**LCA**	What's your altitude?
2013:16	**RDO-1**	Yeah we're still at two thousand five hundred. Ah, we're just comin' up on the 40.5 DME. Should, maybe you'll get us in another few miles.
2014:08	**RDO-1**	We's uh, uh, Lake Charles this is uh, Mobil 620. We switched transponders. Let's see if this is any better.
2014:25	**HOT-1**	Oh those lights are bright.
2014:47	**HOT-1**	Ah you can look here, you'll be comin' up on ... 29 DME, 26 DME, 23.
2015:29	**HOT-1**	You know you're in a descent, right?
2015:31	**HOT-2**	Oh, yeah.
2015:32	**HOT-1**	OK.
2017:04	**HOT-1**	Yeah, I think we're gonna need to slow it down because we are going to go IFR.
2017:23	**HOT-2**	[All right], you talk me through the mileages now.
2017:26	**HOT-1**	I got everything taken care of. You're, you're doin' good.
2016:13	**LCA**	Mobil two six two zero, still not picking you up. Only have a primary on.
2016: 18	**RDO-1**	OK. We're gettin' replied all over the airspace uh. Go back to my first uh, transponder. We're in a bit of a descent here. We're down to eighteen hundred now.
2017:32	**HOT-1**	I mean, you're still left of course on that, but uh yeah, you're OK.
2018:34	**HOT-1**	* start down.
2017:43	**RDO-1**	Lake Charles uh, Sikorsky two six two zero.
2017:48	**LCA**	Sikorsky two six two zero, Lake Charles.
2017:50	**RDO-1**	Yeah, I don't know if you ever picked us up or not uh. We're 28 DME. Doesn't look like there's any traffic out here. Is it uh, OK to go ahead and shoot this uh, uh, Copter One approach?
2018:06	**LCA**	Uh, Sikorsky two six two zero uh, I just picked you up, right when you called. Showing you at seventeen hundred feet ... and you appear to be just comin' on the final approach fix.
2018:17	**RDO-1**	Yes sir we are. We're 27 DME indicated.
2018:21	**LCA**	And Sikorsky two six two zero roger, I'll monitor you to uh, you can cancel IFR and uh, and uh, we'll just go from there. Wind at Lake Charles is, one four zero at three. Altimeter three zero, zero two and radar contact.
2018:37	**RDO-1**	OK, good deal. Radar contact.
2018:41	**RDO-1**	And we're uh, leaving final approach fix, and starting our descent to uh, 360. [The minimum descent altitude with Cameron altimeter is 116 meters (380 feet).]

Bell 206 and Bell 214. He held a flight instructor certificate for helicopters and single-engine airplanes with instrument instructor privileges in both. His first-class medical certificate was dated Dec. 1, 1993, and contained the limitation, "Holder shall wear lenses that correct for distant vision … ."

He had logged a total of 15,000 hours of flight time, 1,037 of which were in the S-76. Of these, 395 were as PIC or instructor. He passed a line evaluation as an S-76 captain in September 1993, initial check airman ground training for the S-76 on June 10, 1994, and proficiency checks under FARs Parts 135.293, 135.297 and 135.299 on July 17, 1994.

In 1994, the PIC flew 11.9 hours at night, 1.5 hours actual instruments, 5.6 hours simulated instruments and 16 instrument approaches. Of these, in the 30 days before the accident he had flown 1.9 hours at night, 1.5 hours actual instruments and 1.5 hours simulated instruments. In the four days before the accident, he had flown three instrument approaches, two of which were the Cameron Copter VOR/DME 010.

PIC's Duty Day Began at 0600

The PIC had flown eight hours during the 24 hours preceding the accident, the report said. In his postaccident NTSB interview, the PIC estimated that he had flown five and one-half hours on the day before the accident, and said that he had reported for duty at 0600 on the day of the accident.

The copilot, 56, held an ATP certificate with both rotorcraft/helicopter and airplane multiengine land ratings. He had type ratings in the Bell 206 helicopter, Cessna Citation and the IAI Westwind [fixed-wing, twin-engine jets]. He also had a certified flight instructor certificate with airplane single- and multiengine land ratings. His first-class medical certificate was issued on Dec. 31, 1993, and contained the limitation, "Must wear lenses for distant, possess glasses for near vision."

According to company records, the copilot had logged 7,973 hours of total flying time, of which 1,646 were in helicopters and 1,012 were in the S-76.

On Feb. 11, 1994, the copilot passed a line evaluation — in an S-76 — that was administered by the accident PIC as the check airman. Company records showed that the copilot had flown 2.4 hours at night and 15.6 hours in actual or simulated instrument conditions during 1994.

All major components of the helicopter, except the main rotor blades and tail-gear box/rotor-head assembly, were found. The wreckage, maintenance records, testing of components and interviews with the flight crew revealed no evidence of preexisting airframe, system, engine or flight instrument malfunction. At the time of the accident, the helicopter had a current

2018:53	**HOT-1**	OK, 26, we're goin' in to the 23 and we need to go down, thirteen hundred feet.
2019:03	**HOT-1**	And you're in a right turn… turn back to your left.
2019:18	**HOT-1**	Still in a right turn… there you go.
2019:25	**HOT-1**	Ah, you're 25 miles out and or excuse me, two miles out, and we need to get a little left pedal and ...
2019:33	**HOT-2**	Just uh ... got a hell of a crosswind.
2019:41	**HOT-1**	Well, you're, you're well turned 'bout 30 degrees to the, right here. We need to get back around to the left.
2019:53	**HOT-1**	OK, you got two miles to go, and we're at a thousand feet, so we got about, another 400 feet to go.
2020:01	**HOT-1**	Very good. Eight, 80 knots you're comin' back on course that's right. Come on around. Come on around to your left.

[The approach chart notes to use 70 knots groundspeed between DME 26 and DME 23.]

2020:08	**HOT-2**	I can't come back . * will be. That's a, that's a crosswind correction.
2020:12	**HOT-1**	OK.
2020:16	**HOT-1**	There's 600 feet.
2020:22	**HOT-1**	And you got a mile to go.
2020.24	**HOT-2**	Yeah, I'm stayin' on the VOR, I'm stayin' on the radial **.
2020:26	**HOT-1**	You look good. All right, start pullin' in your power.
2020:34	**HOT-1**	You got 300 feet on the [radio] altimeter. There you go. Got the village in sight.
2020:41	**HOT-1**	Come on down.
2020:46	**RDO-1**	Hey Lake Charles uh, Sikorsky two six two zero we just broke out here, at 400 feet, and uh, we got Cameron in sight. Looks like we got underneath here, we got about oh about five miles visibility.
2021:02	**CAM**	Sound of impact.
2021:03		End of recording.

HOT — Crew member "hot" microphone voice or sound source

RDO — Radio transmission from accident aircraft

CAM — Cockpit area microphone voice or sound source

-1 — Voice identified as the right-seat pilot [the captain]

-2 — Voice identified as the left-seat pilot flying [the copilot]

LCA — Radio transmission from Lake Charles approach control

ERA — Radio transmission from ERA Aviation Inc.

***** — Unintelligible word

— Expletive

… — Pause

[ ] — Editorial insertion

Source: U.S. National Transportation Safety Board

airworthiness certificate and was operating within weight-and-balance limitations. The helicopter was configured with 12 passenger seats and two pilot seats and was certificated as a transport category aircraft.

Although the helicopter was equipped with an autopilot system with a flight director, the PIC said that the crew did not elect to use it for the approach. "We could have put in a preselected altitude, and it could have gone down and held altitude for us," he said.

The helicopter was equipped with a radio altimeter system, with a primary altitude indicator installed in the panel in front of the PIC. A needle indicated height above the surface, and a single light illuminated when the helicopter descended below the selected decision height (DH). The copilot was provided with a DH setting and readout, which duplicated the PIC's indicator.

In answer to a question about why the radio altimeter did not sound an aural alert, the PIC began an explanation in which he said that the radio altimeter in the accident helicopter was configured as a gear warning. The PIC said, " ... On this particular approach, not that the procedure is wrong, because it is a very common procedure, final approach fix in a helicopter is gear down. But in this particular approach, if the gear had been left up, all kinds of horns and whistles would have gone off if we had gone below [61 meters (200 feet) AGL] [above ground level]. Now with the gear down, there was no red lights, no warnings, no horns, or anything to indicate your, we don't have a ground-proximity warning device, other than the [radio] altimeter."

In answer to a question about at what altitudes tones sound, the PIC responded: "At whatever you set, on your HSI [horizontal situation indicator], your ADI [automatic direction indicator] you set your [radio altimeter] there, we had it set to [61 meters]. Whatever that altitude is, if you go below that with your gear still up, and airspeed below 70 [knots] or 60 [knots] [130 kilometers per hour or 111 kilometers per hour] you'll get a gear warning horn. Now I'm not saying [it's] a guaranteed fix, I'm saying it's a contributing factor.

"That had we been at or below 60 knots, and had we had the gear still up, we would have gotten big time indications. Big light flashing. ... That's strictly a gear warning ... but it would have saved this [the accident] from ever happening. ... If I would have had the gear up, would I have noticed it, no, because, maybe not, because his [the copilot's] airspeed may have been up to [the] point where it wouldn't have gone off. But it still goes off, even at the higher airspeeds, if you get down below I think."

When asked if he was using the radio altimeter during the approach, the copilot said, "I never would use it. I'd use it as a backup, but I never looked at it. I just assumed that if I got [61 meters (200 feet)], or whatever I had, that the light would come on and I would get out of there. But as far as looking at

Search and Rescue: Vision-enhancing Technologies

The first HH-65A helicopter dispatched by the U.S. Coast Guard overflew the survivors of the Cameron accident, according to the PIC's postaccident interview. He said that the helicopter was "so close that I could have read the numbers if it had been light, and they would have split me in half if they'd had a handsaw." Nevertheless, that Coast Guard helicopter crew did not spot the accident crew.

That search-and-rescue helicopter was not equipped with forward-looking infrared radar (FLIR). Another Coast Guard helicopter, which had awaited delivery of a hand-held FLIR before launch, found the partially submerged accident helicopter at 0510 the following morning. The discovery was made using FLIR.

The accident helicopter PIC said that he had seen the search-and-rescue helicopter approaching, and that it did not have an external spotlight illuminated. The PIC assumed that the search crew were scanning with the aid of night-vision goggles (NVGs). He retrieved his copilot's survival light and waved it as the HH-65A approached, but to no avail because the searchers were not NVG-equipped. "Both survivors were confident that if the Coast Guard helicopter pilots had been provided with NVGs, ... they [the accident crew] would have been located immediately," the NTSB accident report said.

The Coast Guard conducted a series of target acquisition tests to evaluate NVGs. Findings included the following:

- The probability of detection (POD) for a person in the water, and equipped with a red safety light, is 97 percent when the helicopter flies within 0.1 mile (0.2 kilometer) and decreases to 67 percent at a range of 0.5 mile (0.8 kilometer); and,
- The POD for a person in the water, and equipped with a strobe light of the model used in the test, is 94 percent at 0.1 mile and decreases to 67 percent at 1.5 miles (2.4 kilometers).

The report on the tests added: "Given the relatively poor search condition that prevailed on the night these data were collected, it is reasonable to expect that much larger helicopter/strobe sweep widths would be achieved in clear weather."[5]♦

it, I never, I never looked at, I never took it into my scan. ... I figured it would warn me if I got altitude low."

According to MASCI general operations manual, in two-crew aircraft the radio altimeter "is set to the MDA or DH for the approach being flown."

The NTSB requested an evaluation of the radio altimeter, along with other flight instruments. A photo of the face of the instrument, taken after the case had been opened and the water drained, showed the pointer indicating an altitude of (88 meters [290 feet]). The DH indicator was set to 61 meters (200 feet).[4] "Detailed inspection, disassembly and testing were performed on the avionics, flight instruments and aircraft wiring," the NTSB said. "No discrepancies were found."

No signal was received from the helicopter's emergency locator transmitter (ELT), which failed to function. The ELT was mounted in the chin bubble and was found full of water, inoperable, after recovery of the helicopter.

The PIC received at 1643 an abbreviated weather briefing from the U.S. Federal Aviation Administration (FAA) DeRidder Flight Service Station. The weather was forecast to remain VMC for the period of the flight until after 2400. Fog was forecast after 2400. The temperature/dewpoint spreads at Galveston and Beaumont, Texas, and Lake Charles were all greater than six degrees F (3.3 degrees C).

The PIC said that at the time of the accident there was a 500-foot (153-meter) ceiling with five miles visibility, and that the weather rapidly deteriorated while they were on the water.

The recorded weather observation taken at 2055 by the Lake Charles Air Traffic Control Tower, 37 kilometers (23 miles) north of the accident, was: Ceiling 500 feet broken, three miles [4.8 kilometers] visibility in fog, with temperature and dewpoint both at 72 degrees F (22 degrees C).

When communication with the accident helicopter was lost and ERA confirmed that the helicopter had not arrived at the Cameron heliport, an ERA search helicopter was launched from Lake Charles Airport at 2118. The search helicopter crew reported the weather at Lake Charles as 500-foot ceiling with two-mile visibility in fog.

As the ERA helicopter proceeded toward Cameron, the ceilings lowered, and the crew was unable to remain in VMC at 300 feet. They flew their helicopter above the overcast and conducted the Copter VOR/DME 010 approach. They were unable to descend below the ceiling. At 2130, after descending to [116 meters (380 feet)] above mean sea level, they performed a missed approach at Cameron and returned to Lake Charles, where they landed successfully.

At 2135, the crew of the first Coast Guard helicopter to search for the accident helicopter reported on-scene visibility of one-fourth mile (0.4 kilometer) in fog. When the first Coast Guard helicopter was sighted, the survivors attempted to signal with a light from the copilot's survival vest. [See sidebar: "Search and Rescue: Vision-enhancing Technologies."] It overflew their position and departed. The copilot did not carry flares in his vest; the PIC carried flares in his personal vest, but he had abandoned it to escape from the submerged helicopter.

The primary navigation source used by the accident flight crew both outbound and inbound was long-range aid to navigation (LORAN). [The PIC also reported that he carried a personal portable global positioning system (GPS) receiver, which was attached by velcro straps to his leg during the accident flight.] The crew said that when it became apparent that low stratus clouds and fog would be present near the shoreline, they requested an IFR clearance, intending to perform the Copter VOR/DME 010 approach procedure to Cameron.

"The Copter VOR/DME 010 approach was a special instrument approach procedure approved by the FAA for use by MASCI," the NTSB said. "The approach utilized the Lake Charles ... VORTAC [VOR tactical navigation] for course guidance and is an approach to a point in space. No discrepancies were reported with the Lake Charles VORTAC, either by the local FAA facilities or by aircraft. No preaccident discrepancies with the navigation systems on [the accident helicopter] were discovered by the [NTSB] or described by the crew."

The NTSB found that the probable cause of the accident was the "copilot's failure to maintain altitude and the PIC's inadequate supervision of the operation. Factors included the dark night and low ceiling, and the flight crew's failure to set the proper altimeter setting."♦

Editorial note: This summary was adapted from the U.S. NTSB Factual Report — Aviation, file no. CHI95FA035.

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3. Summary of taped interview with the PIC of N2620 conducted by the NTSB, Nov. 11, 1994.

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Further Reading from FSF Publications

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On duty-period recommendations:

"Principles and Guidelines for Duty and Rest Scheduling in Corporate and Business Aviation," *Flight Safety Digest* Volume 14 (September 1995).

The FSF CFIT Accident–reduction Campaign

For the past three years, the Flight Safety Foundation has engaged in a campaign to drastically reduce the number of CFIT accidents. The guiding force in this work has been the FSF CFIT Task Force, which set a goal of halving the CFIT accident rate by 50 percent by 1998.

As part of the overall plan for CFIT-accident reduction, the task force has developed recommendations, many of them presented in the reports cited above from the Proceedings of the 1995 IASS. The task force made eight recommendations to the International Civil Aviation Organization (ICAO), one of which has already been adopted, with the others under consideration.

Products developed by the task force to date include the FSF CFIT Checklist, which helps pilots assess CFIT risk for specific flights; a video, *CFIT Awareness and Prevention*; and *CFIT Education and Training Aid*, a two-volume training aid produced in cooperation with the Boeing Commercial Airplane Group, which is scheduled for release late in 1996. The FSF CFIT Checklist is available from FSF free of charge, and *CFIT Awareness and Prevention* is available from FSF for $30.

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