

**NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF AVIATION SAFETY**

OPERATIONS FACTUAL REPORT
WPR18MA087

A. ACCIDENT

Operator: Papillon Airways, Inc.
Location: Peach Springs, Arizona
Date: February 10, 2018
Time: 1719 mountain standard time
Aircraft: Airbus Helicopters EC130 B4

B. OPERATIONS GROUP

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C. SUMMARY

On February 10, 2018, about 1719 mountain standard time (MST)¹, an Airbus Helicopters EC130 B4 helicopter, N155GC, was destroyed when it impacted a canyon wash while on an approach to land at Quartermaster landing zone near Peach Springs, Arizona. The commercial pilot and one passenger sustained serious injuries and five passengers were fatally injured. The air-tour flight was operated by Papillon Airways, Inc. under the provisions of 14 *Code of Federal Regulations* Part 136. The helicopter departed Boulder City Municipal Airport, Boulder City, Nevada at 1642 MST and had intended to land at Quartermaster landing zone, a group of unimproved landing pads² within Quartermaster canyon. Visual meteorological conditions prevailed, and a company flight plan had been filed.

¹ Although the accident site was located in the mountain standard time zone, throughout the report the time zone used will be Pacific standard time in an effort to keep congruency with the departure information and Papillon forms.

² The area had no designated pads or marked touchdown and lift off (TLOF) zones, or any other fixed means (such as lines of rocks or marker stakes) for delineating preferred landing zones or maneuvering areas. For this report the undesignated landing areas will be referred to as “pads.” See section 6.3 for more information regarding pads.

D. DETAILS OF THE INVESTIGATION

The Operation's Group Chairman responded to the accident. Interviews were later conducted with the Federal Aviation Administration (FAA) Principal Operations Inspector (POI), numerous employees of Papillon, and additional individuals who had knowledge of the accident pilot or Papillon operations. National Transportation Safety Board investigators obtained data, records, manuals, timelines and other pertinent documents from Papillon employees, Airbus Helicopters, the FAA, the pilot, and witnesses.

1.0 HISTORY OF FLIGHT

1.1 DAY OF THE ACCIDENT

On the morning of the accident, the pilot arrived at Papillon about 1030³. After arrival, the pilot signed that day's briefing sheet⁴, which included the weather report from earlier in the morning and his assignment to the accident helicopter, Papillon 34.⁵ The pilot departed Boulder City for a landing tour⁶ at 1128 with six passengers onboard.⁷ After stopping at Quartermaster for about 30 minutes, the helicopter landed back at Boulder City at 1309.

The pilot departed for the second flight of the day, an air tour, at 1353 with six passengers on board.⁸ One of the passengers on that flight reported that their flight was one of the last of the groups to leave. She recalled that the pilot did not give a safety briefing and instead told the passengers that he did not need to give a safety briefing because they had watched the safety video.⁹ When asked to describe the pilot's behavior on the flight, the passenger stated that the pilot did not speak frequently, but when he did, he pointed out a few landmarks. She qualified his mannerisms as relaxed and that he appeared to enjoy flying. After landing at Boulder City at 1455, the passengers unbuckled their own seatbelts. The passenger recalled that the seatbelt did not seem abnormal or hard to unbuckle, and they were more robust than an automobile seatbelt.

Scheduled Flight Time	Type	Actual Departure Time	Time Entered Canyon	Landing Time
1130	Landing	1128	1156	1309
1345	Air	1353	1418	1455
1545	Landing	1542	1612	n/a

Figure 01: Overview of Pilot's Flights on the Accident Day (Landings at Boulder City)

³ See the Human Performance Group Factual Report for information about the pilot's activities prior to the flight.

⁴ See Attachment J: Morning Briefing Sheets

⁵ Refer to section 5.1 for information about the briefing sheet

⁶ Refer to section 6.1 for information about the different tour options available to passengers

⁷ The takeoff weight was an estimated 5,302 lbs and a center of gravity (CG) of 126.40 in.

⁸ The takeoff weight was an estimated 5,217 lbs and a CG of 126.26 in.

⁹ After reviewing a copy of the draft factual, a Papillon representative stated that the primary safety briefing was the video and the pilot briefing was supplementary.

The pilot stated that after the flight he took a break and then went to the pilot kiosk in the main passenger waiting area to print out his flight manifest for the accident flight.¹⁰ He recalled that the main area was busy and that the other pilots were collecting their passengers and leading them outside to the helicopter flight line. The pilot waited until most of the other groups had dissipated, which he normally would do because it made it easier to find the passengers on his manifest. He recalled that all the passengers were British, but didn't recall anything different or unusual.

The pilot further stated that he led the passengers to the helicopter and gave them a safety briefing.¹¹ The manifest displays the passenger seat assignments which the pilot helps position them in their respective seats. The helicopter departed at 1542 and was the sixth helicopter to depart from Boulder City out of a group of seven.

1.2 ACCIDENT FLIGHT¹²

The destination landing zone, Quartermaster (elevation 1,460 feet msl), was about 53 nautical miles (nm) from the Boulder City Municipal Airport (elevation 2,203 feet msl) on a bearing of about 090°.



Figure 02: Radar Data Showing Flight Path

The recorded radar data and Spidertracks location information¹³ was recovered for the accident flight. The

¹⁰ See Attachment G: Boulder City Field Notes for information about the Boulder City facilities.

¹¹ See the Human Performance Factual for information about safety briefings

¹² The pilot stated that he did not recall specifics about the accident flight because everything seemed routine and nothing was memorable or out of the ordinary until he was on approach to Quartermaster. His account of anything prior to accident sequence is referring to his normal procedures and flight paths rather than a specific memory of the accident flight.

¹³ See the Recorders Group Factual Report for information about the radar data and Spidertracks information.

radar data consisted of approximately equidistant radar returns from 1546 to 1617, totaling about 31 minutes. The data was consistent with the helicopter departing to the south and then continuing northeast passing near the Hoover Dam about 1552:30. The helicopter continued to the south of Fortification Hill, located on the south shore of Lake Mead.¹⁴ The helicopter adjoined the Grand Canyon about 1613:30 and followed the valley until the last radar hit at 1617. This track was consistent with the location the helicopter would normally descend below the surrounding canyon walls.

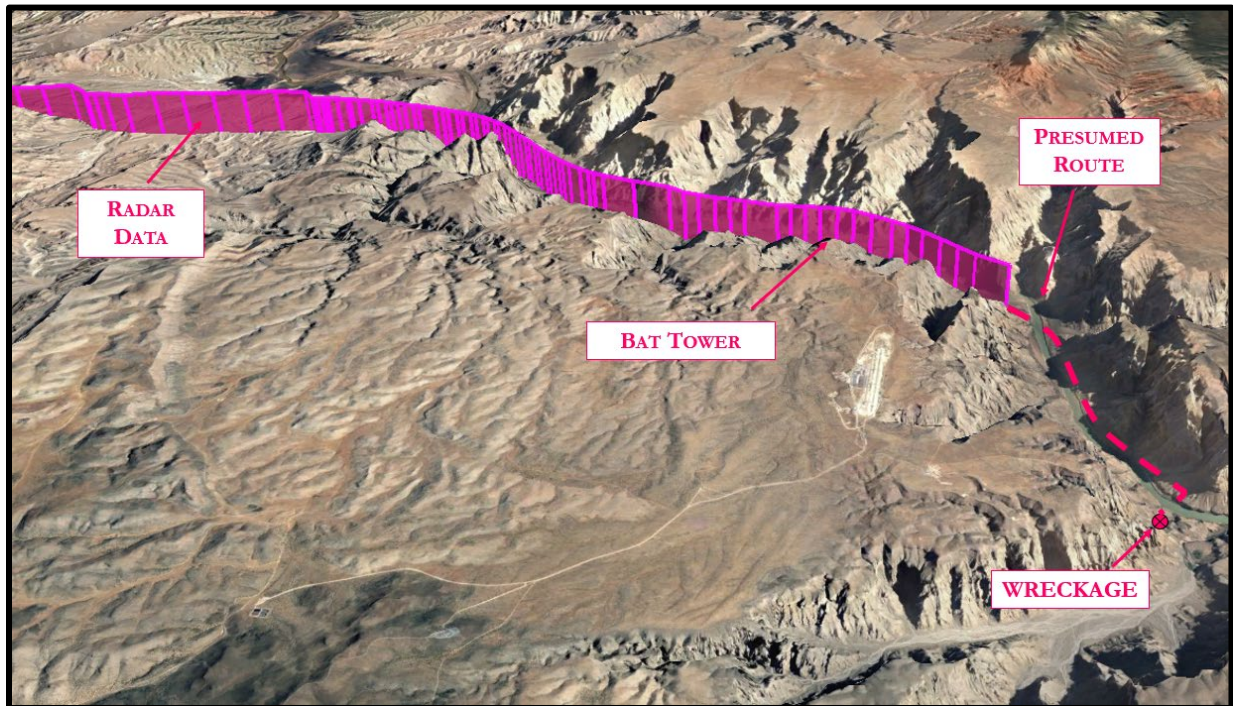


Figure 03: Radar Data in Reference to Accident Location

The pilot stated that after departure he would typically switch the helicopter's radio to the tour frequency 120.65 MHz. He would get in line with all the other tour operators converging around the Hoover Dam, and then continue east over Lake Meade with no altitude deviations. He stated that if there were turbulent/windy conditions in the canyon he would normally feel the helicopter "dip" when crossing over the hills near Pierce Ferry; he didn't recall the helicopter displaying any indications of turbulent air on the accident flight.

After entering the canyon, he would adjoin the tour route, Green Four¹⁵, and after a few minutes would arrive at the Bat Towers, which is a reporting point to announce the intention of landing at Quartermaster or continuing on an air tour. He could not recall precisely, but thought he was the last helicopter in the Papillon group. He could not recall anyone making any non-standard radio transmissions, but thought he

¹⁴ According to Papillon management, pilots are instructed to conduct an "S" turn to show passengers the Hoover Dam, followed by a route that continues south of Fortification Hill and then to Quartermaster.

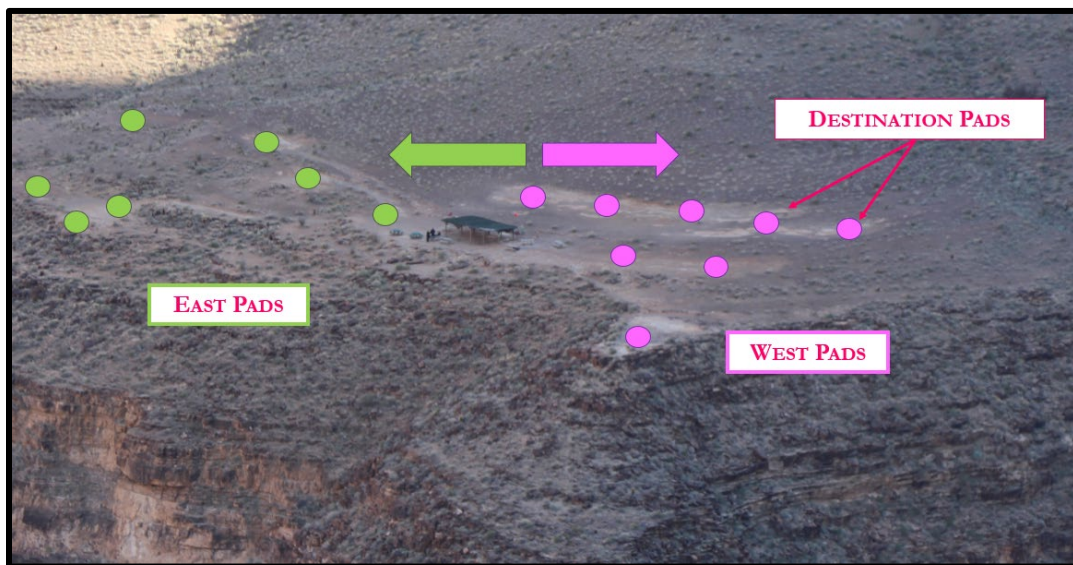
¹⁵ Refer to section 6.2 for information about the SFAR 50-2 tour route.

remembered hearing transmissions announcing that a helicopter was entering the canyon at Bat Towers and crossing the river. As he descends into the canyon, the pilot stated that he would diligently listen to all the radio traffic and maintain an altitude below 1,500 to 1,700 feet to ensure his helicopter is well under the other traffic.¹⁶

APPROACH

As the pilot approached Quartermaster, he recalled that the landed helicopters were pointing in different directions, which normally indicates variable wind conditions. He thought that the helicopters that landed immediately prior to him were pointed to the east, indicating they made an approach to the east.¹⁷ He recalled the windssock indicating wind from the north/northeast and dictating an approach to the east. He classified the windssock as wavering and waffling with the wind.

The pilot stated that based on the windssock direction, the differing directions the helicopters were facing at the landing zone¹⁸, and the unoccupied pads available on the west side of the landing zone, he opted to make an approach to the east. He was planning to land on one of the areas to the west, behind the helicopters that had landed just prior to him¹⁹. He stated that there was always room to land a helicopter at one of those pads and he has landed there in the past with up to five helicopters parked on the west pads in front of his destination pad.²⁰



¹⁶ Sundance Helicopter and Papillon air-tour traffic will operate at or below 3,000 feet when crossing over the river to land at the pads.

¹⁷ Refer to section 6.5 for a discussion about the terminology and vernacular used to describe the different approaches. The approaches will be referred to as an east or west approach which describe the direction the nose is pointing at touchdown.

¹⁸ The pilot stated that when he saw helicopters were facing to the west that generally indicates that wind was not a factor.

¹⁹ The pilot did not see the blades turning on the helicopter that landed before him and therefore it is likely that was not a factor in his approach decisions.

²⁰ Refer to section 6.3 for a discussion about the pad quantity and location.

Figure 04: Pad Quantity and Approximate Locations at Quartermaster According to the Pilot

The pilot stated that he would normally maneuver the helicopter at 200-300 feet agl as he crossed the river. He stated that he would configure his approach depending on the wind and the ground speed.

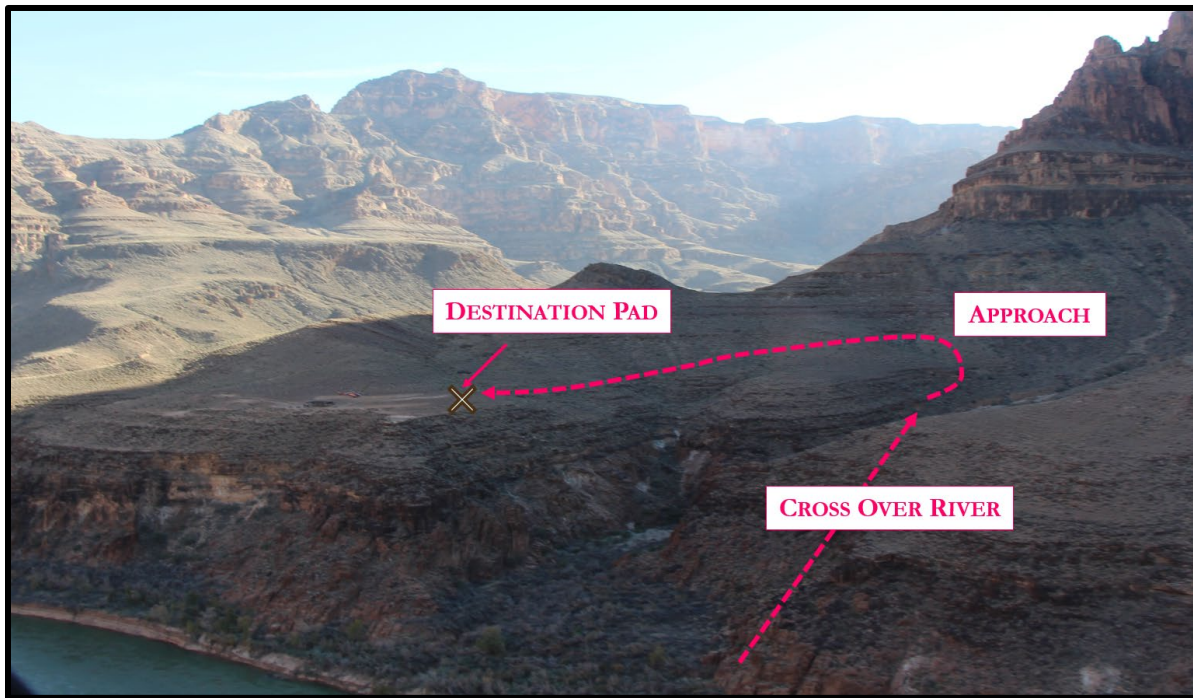


Figure 05: Pilot's Planned Approach to the Landing Pad

LOSS OF CONTROL

The pilot stated that nothing was out of the ordinary or unusual until he turned toward the landing zone. As he made a left turn, the helicopter encountered a violent gust of wind and began to spin uncontrollably. He recalled that the helicopter was equipped with enough power, but the wind was so severe and struck so quickly that he could not maintain directional control.²¹ The next memory the pilot had was being on the ground outside the helicopter.

A witness, who was also a Papillon pilot, stated that he observed the accident helicopter cross over the river and assumed the pilot was planning on landing on the west pads. The helicopter began to decelerate and then pitched to an estimated 15° nose-up attitude. As the helicopter began a left turn toward the pads, the pitch-attitude transitioned to a nose-level attitude and continued to a nose-low attitude. The helicopter began to drift aft which appeared to be from the wind, and it looked as though the pilot was attempting to gain airspeed. The left turn continued, and the nose assumed a level-attitude. The turn continued 360° and then began to descend in a level pitch attitude. The helicopter made a second 360° rotation and collided

²¹ The pilot did not remember trying to recover helicopter control or observing any lights or hearing any horns

with terrain.

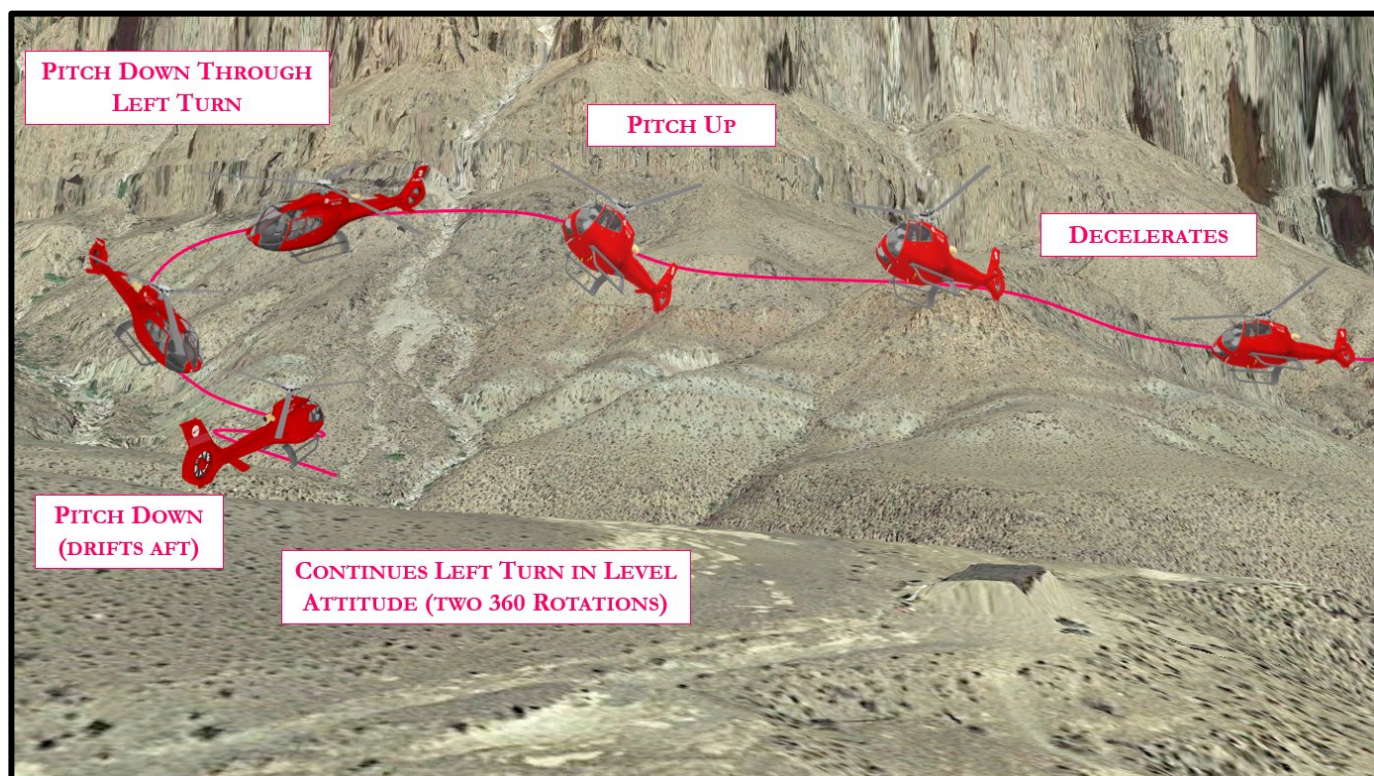


Figure 06: Visual Representation of the Witness's Observations

1.3 LANDINGS PRIOR TO ACCIDENT FLIGHT

There were 10 Papillon helicopters that were scheduled to land at Quartermaster for the afternoon flight. Although their exact landing time could not be ascertained, each pilot would report to the Flight Dispatch Base at Boulder City the time they entered the canyon. The first five pilots landed their helicopters facing to the west using an approach path that went over a saddle in the terrain known as “the notch” and thereafter making a descending 180° left turn to their selected pad.²² The next three pilots landed on the west pads using an approach path that continued up the canyon (to the west of the pads) and performing a descending left turn to their selected pad; the accident pilot was the ninth helicopter to arrive in the group and the tenth helicopter did not land. The seventh and eighth pilots to land were the most recently-hired pilots of the group; both started employment in January 2018.²³

²² Refer to section 6.3 for a discussion about the different approaches.

²³ The first pilot was hired in March 2013; The second, third and fifth pilots were hired in April 2017. The fourth pilot was hired in January 2017. The sixth pilot was hired July 2016. The seventh, eight and tenth pilots were hired January 2018.

Sequence #	Helicopter #	Departure Time	Canyon Time	Approach
1	45	15:05	15:40	East
2	41	15:10	15:46	East
3	39	15:30	16:03	East
4	10	15:35	16:02	East
5	30	15:32	16:04	East
6	50	15:35	16:08	West
7	23	15:36	16:09	West
8	53	15:38	16:10	West
9	34	15:42	16:12	West
10	40	15:39	16:13	N/A

Figure 07: Time of Pilots Entering the Canyon (Canyon Time)

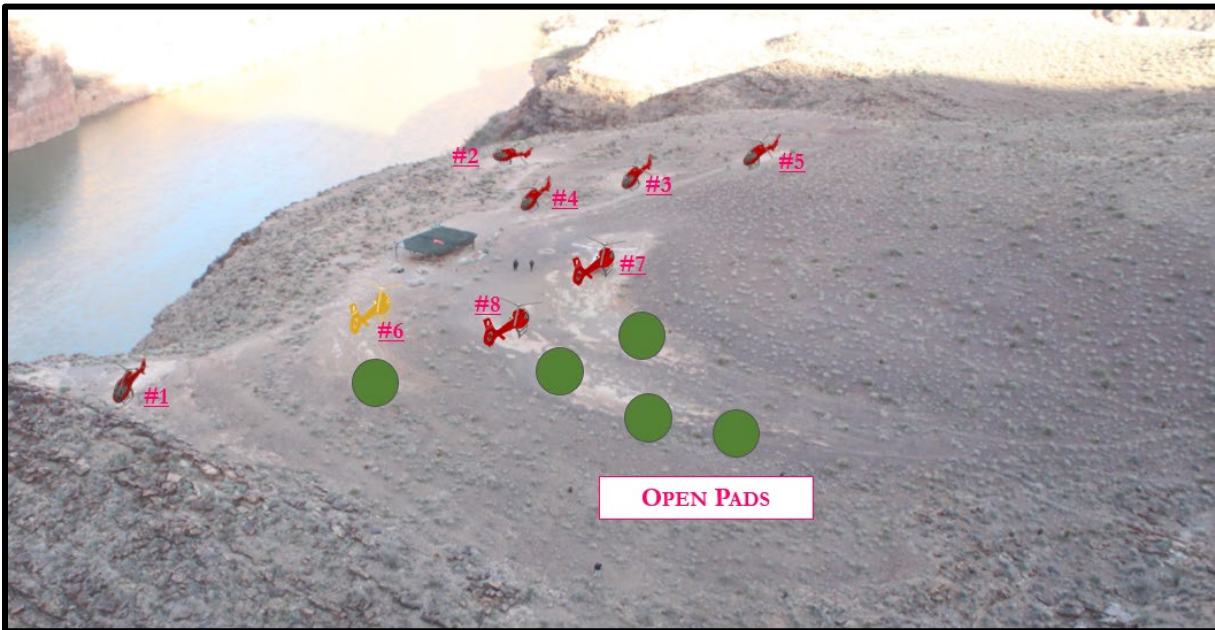


Figure 08: Helicopters' Landing Sequence and Location

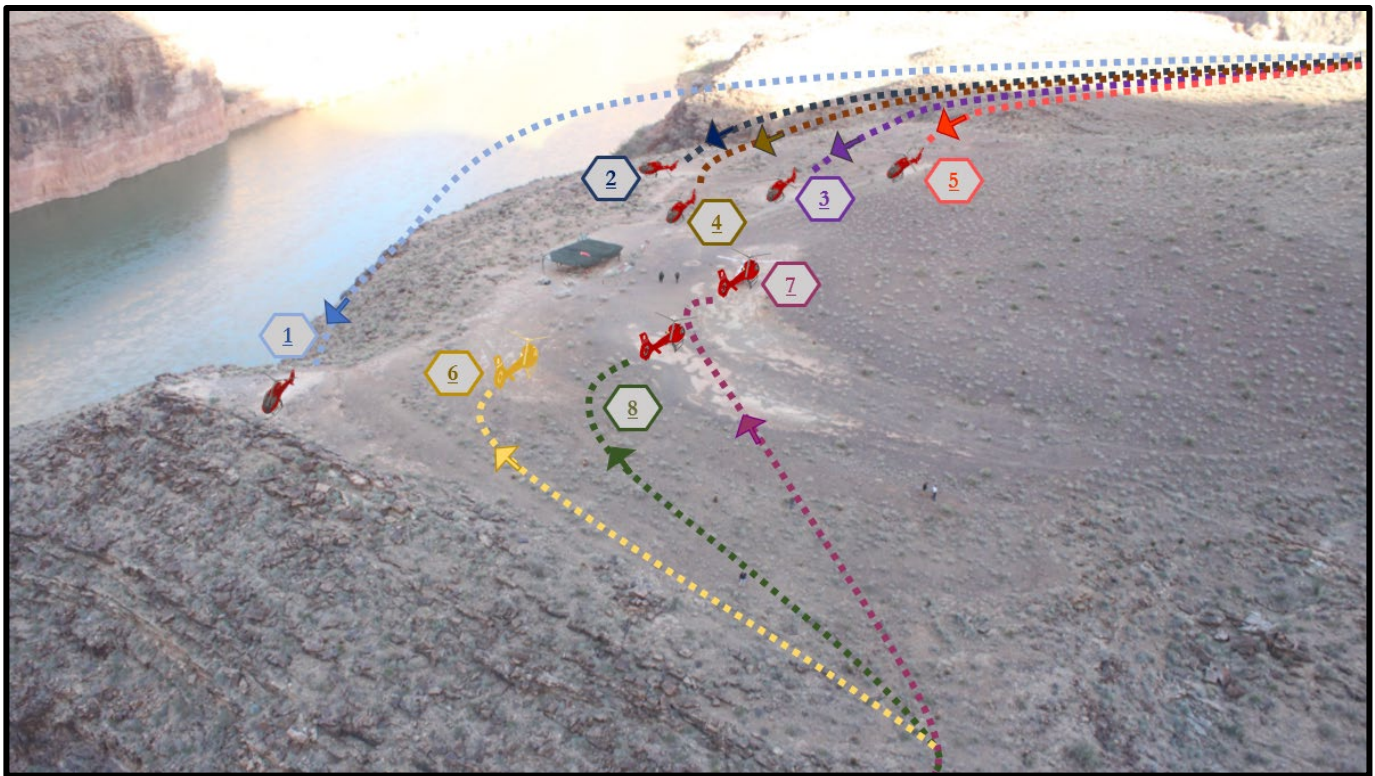


Figure 09: Helicopters' Landing Sequence and Approximate Approach Path

SECOND PILOT – HELICOPTER 41

The second pilot that landed stated that the windsock was indicating significant winds from the west. During the approach to an east pad, he felt the headwind and estimated the helicopter's airspeed was around 50 to 60 kts while his ground speed was below 40 kts.

FIFTH PILOT – HELICOPTER 30

The fifth pilot that landed stated that as he approached Quartermaster, the windsock indicated a wind from the west, and he noticed there was one spot remaining on the east pads. In response, he maneuvered the helicopter through the notch. As he maneuvered over the notch, he experienced turbulent air which he had expected. While on final approach, he noticed that there was a right quartering-headwind²⁴. He thought there were three helicopters behind him, and he communicated on the common company frequency that there was a tailwind and warned the other pilots to be careful on approach²⁵. The sixth helicopter responded that she still planned to make an approach to the west pads.

²⁴ This would be wind from the northwest.

²⁵ Most of the other pilots did not recall hearing this radio transmission, but the canyon terrain can impede transmissions.



Figure 10: Forward View from Helicopter 30 Prior to Touchdown

SIXTH PILOT – HELICOPTER 50

The sixth pilot that landed stated that the windsock was showing variable winds at a velocity of about 15 to 20 kts. She remarked that the wind was strong and some of the other pilots had concerns, but she was comfortable with those wind conditions and it didn't seem abnormal. She stated that she flew the helicopter in a wider path at a higher altitude with more airspeed to compensate for the wind. When flying to the west pads in similar wind conditions, she would typically maneuver the helicopter to the pad flying sideways (crabbed). Once she became closer to the ground and entered into ground effect, she would be able to do a pedal turn, repositioning the helicopter with the terrain. She stated that she would keep her airspeed to about 60 kts during gusty tailwind wind conditions.

SEVENTH PILOT – HELICOPTER 23

Helicopter 23 was equipped with a video camera and global positioning system (gps) that additionally recorded speed and elevation at 1-second intervals. The pilot stated that as he approached Quartermaster, he noticed that he had a tailwind and decided to land on a west pad because the east pads were taken, and he did not want to create a collision hazard.



Figure 11: Track of Helicopter 23 Landing Showing Windssock Just Prior to Touchdown

The helicopter entered into the canyon and while he was turning toward the landing zone, the helicopter's heading shifted rapidly. The tail swung around rapidly, feeling like a strong wind was pushing on the tail akin to a wind vane. With the major shift, he was immediately concerned with the helicopter's rate of descent and noted that the airspeed indicator showed 45 to 50 kts with a descent rate of about 400 feet per minute.

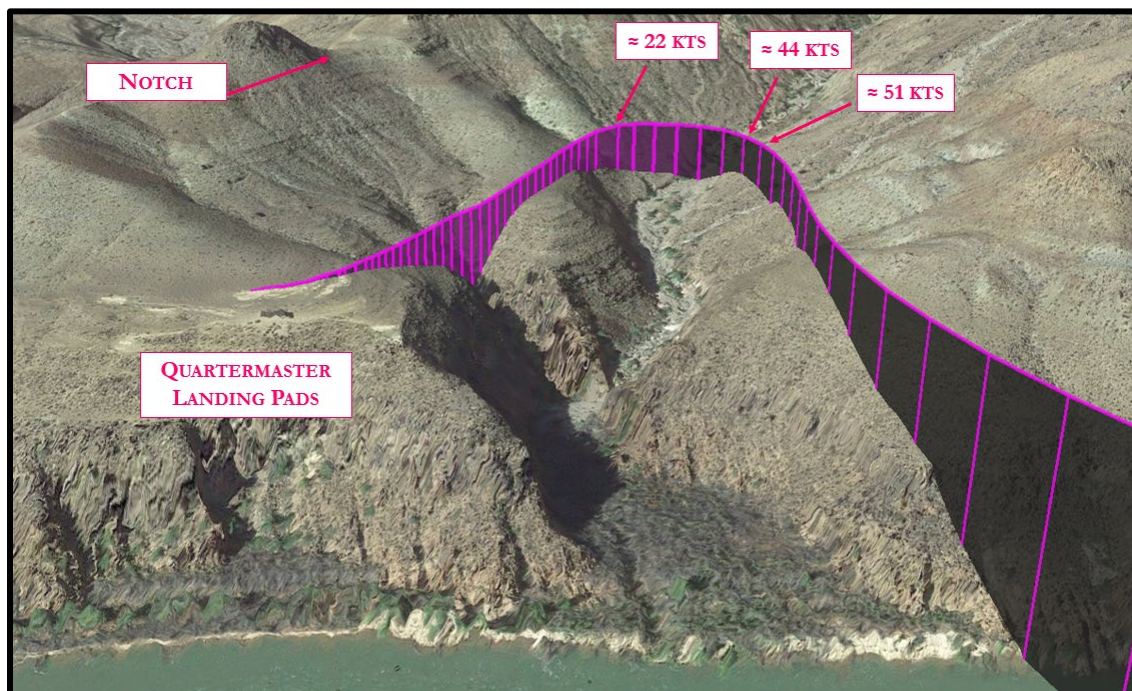


Figure 12: Track of Helicopter 23 Landing on the Pads



Figure 13: Forward View from Helicopter 23 After Experiencing the Wind Vane Event

As the helicopter continued descending toward the pads, the pilot applied a heavy application of right pedal in an attempt to keep the helicopter from turning. While on final approach, the helicopter was crabbed until reaching about 15-20 feet agl.



Figure 14: Forward View from Helicopter 23 Re-Established On the Approach

When the helicopter entered into ground-effect, the pilot was able to perform a pedal turn and touchdown on a landing pad. He further stated that there were some gusty conditions on the ground and the windsock was bouncing back and forth a little bit, which created a tailwind component.



Figure 15: Forward View from Helicopter 23 Just Prior to Touching Down

EIGHTH PILOT – HELICOPTER 53

The eighth landing occurred about two minutes before the accident. The pilot stated that he has experience flying in mountainous terrain. As he approached Quartermaster, he knew it was windy (between 15-20 kts from the east) and was anticipating wind shear on the approach into the canyon. He crossed over the river and entered into the canyon. As soon as he made his left turn toward the landing zone, he felt a strong wind hit the helicopter and swing the nose to the left about 90°. He stated that it took all his efforts to control the helicopter and the airspeed rapidly dissipated. The helicopter began to descend, and he had to pull up on the collective adding full power to arrest the descent. He was able maintain control by pushing the cyclic forward and right to increase airspeed, while applying full right pedal to keep the nose straight. As the helicopter continued to descend, the helicopter entered into ground effect and he performed a pedal turn to face east.



Figure 16: Passenger View from Helicopter 53 Just Prior to Touching Down

2.0 INJURIES TO PERSONS²⁶

Injuries	Crew	Passengers	Total
Fatal	0	5	5
Serious	1	1	2
Minor/none	0	0	0
Total	1	6	7

Figure 17: Injuries Sustained as a Result of the Accident

²⁶ There were two passengers that were transported to the hospital who succumbed to their injuries in the weeks following the accident.

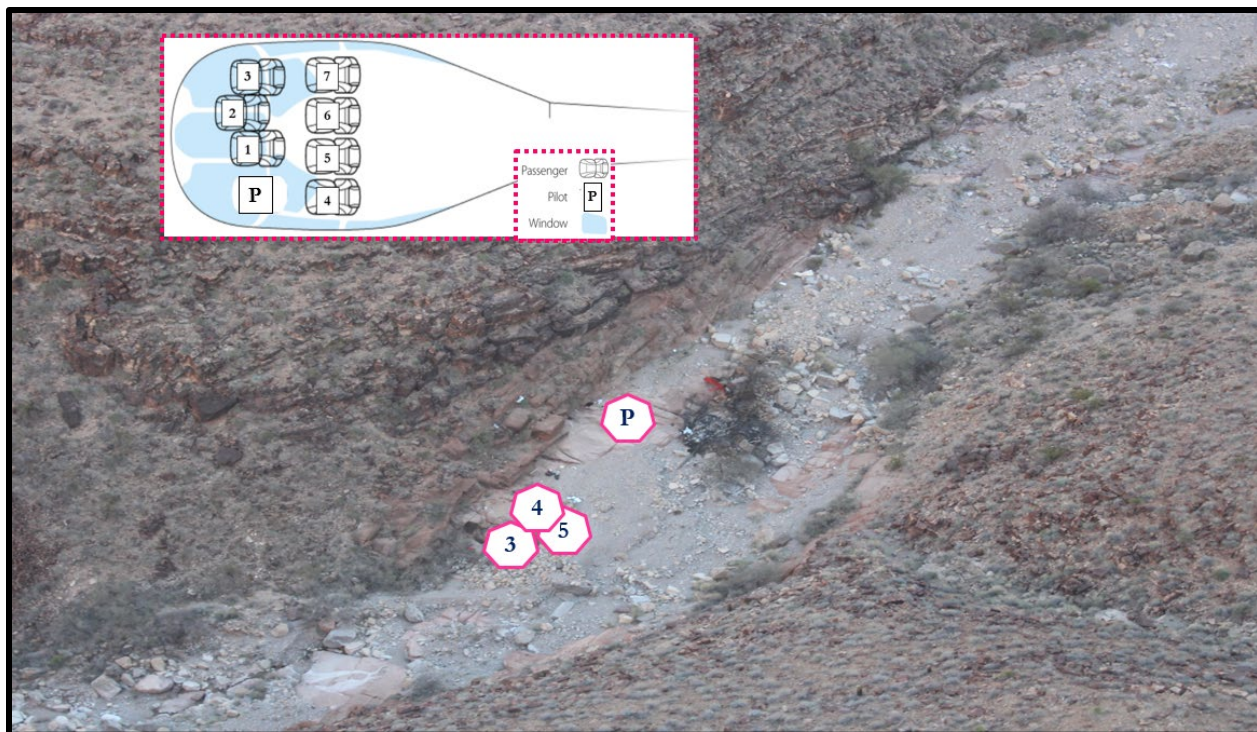


Figure 18: Depiction of Pilot and Surviving Passenger's Positions after Impact

3.0 PERSONNEL INFORMATION

3.1 PILOT-IN-COMMAND²⁷

SCOTT S. BOOTH

The pilot, age 41, was certified to fly the Airbus EC130 B4 helicopter in accordance with existing Federal Aviation Regulations (FAR). A review of the FAA Airman and Medical Records database disclosed that the pilot held a certified flight instructor (CFI) certificate and commercial rating for rotorcraft helicopter; the certificate listed no type ratings. His second-class medical certificate was issued on November 13, 2017, with no limitations.

Papillon provided documentation of the pilot's flight experience. The pilot's total flight time was 2,423 hours, of which 1,079 hours was amassed in EC 130 helicopters. The records indicated that he had 47 hours of simulated instrument time, 155 hours of nighttime and 1,239 hours of cross-country flight. The pilot had accumulated 2.1 hours in the prior 30 days, 4.7 hours in the prior 60 days; 13.7 in the prior 90 days and 117.5 in the 12 months prior to the accident. He did not fly outside of work.

²⁷ See Attachment F: Pilot Training Records and Resume

	2017	2018
Jan	24.2	2.1
Feb	1.0	n/a
Mar	4.0	n/a
Apr	17.0	n/a
May	5.9	n/a
Jun	12.9	n/a
Jul	21.3	n/a
Aug	6.8	n/a
Sep	24.1	n/a
Oct	0.0	n/a
Nov	20.8	n/a
Dec	2.6	n/a
TOTAL	140.6	2.1

Figure 19: Pilot's Hours Amassed During 2017 and 2018

The pilot detailed his flying experience, recalling that he started flying Robinson R22 helicopters as a student pilot at Rotor Aviation in Long Beach, California. After about five months, he received his private pilot certificate and started to build flight time as he worked toward acquiring his commercial pilot certificate. He took an opportunity to acquire flight time by delivering a Robinson helicopter to Brazil to help amass hours and recalled that he enjoyed operating in different types of environments and airports. He received his commercial license followed by his certified flight instructor (CFI) license, and again transported a helicopter to Brazil. After acquiring around 600 hours he moved to Missouri where he flew tours. His previous CFI and several of his friends from Long Beach were flying for Papillon, and after reaching the minimum hours required to apply, he submitted his application and was hired shortly thereafter.

The pilot was hired at Papillon on June 03, 2013, and at that time, had no time flying turbine-powered helicopters. His schedule at that time was 7 days of flying followed by 7 days off. The pilot was only qualified in the EC130 B4.²⁸ In July 2014 the pilot became interested in pursuing his other business aspirations and sent a resignation letter to the Chief Pilot. They agreed to have him continue his employment in the capacity of a part-time pilot²⁹.

²⁸ A Lead Pilot stated this was unusual, since most pilots were dual rated in the AS350B3. The pilot stated that he did not pass the AS350B3 transition training because of a difference of opinion with the Check Airman about entering into Las Vegas airspace. In response to a draft of this factual report, Papillon management stated that "Given the training outlay for transition and ongoing recurrent training, it was normal for part-time pilots to only be rated in one aircraft."

²⁹ The pilot was one of two part-time pilots at Papillon.

YEAR	HOURS
2013	279.2
2014	329.2
2015	158.9
2016	175.5
2017	140.6
2018	2.1
Total Time	2423
Total EC130	1079

Figure 20: Pilot's Hours While Employed at Papillon

Papillon stated that the pilot had no discipline reports in his personnel file. The pilot had filed one helicopter-operation related irregularity report³⁰ in April 2017. The report stated that he overflowed a golf cart because he had rushed to depart and was focused on the helicopter traffic.

EC130 B4

The pilot stated that he felt very comfortable flying the EC130 B4. As he gained more experience, he had flown into turbulence and around thunderstorms. He classified his flying abilities as on-par with the Lead Pilots, with the possible exception of emergency procedures. He thought that because some of the Lead Pilots had received their training at Airbus facilities, they may have more “muscle memory” doing such procedures where it would be more habitual. He stated that all the EC130 B4 helicopters at Papillon were similar in the way that they handle/maneuver. He would always fly with the seat in the same configuration, where he would position the seat completely aft and the pedals fully forward.

QUARTERMASTER

The pilot stated that he never felt uncomfortable landing at Quartermaster. He recalled prior instances where the windsock indicated wind was from the west and as he would proceed through the notch, he would feel a tailwind. On final approach the wind had shifted, and he had to land with a slight tailwind³¹. He stated that if the wind was from the east, he could land by flying the helicopter to the ground and then perform a pedal turn and land facing into the wind.

3.2 SCHEDULE

As a part-time employee, the pilot would try to average flying eight days per month. He would normally fill in for the full-time pilots that needed a pilot to cover their shift. Typically, the Lead Pilots would send him a list of days during the month they were low on pilots and he would cover those days. On February 9 at 0750

³⁰ See section 6.2 for information regarding Irregularity Reports.

³¹ The pilot stated that he felt both himself and the helicopter was capable of performing a tailwind landing at Quartermaster if the wind was not significant, which he classified was a maximum of 5-10 kts.

the pilot communicated with a Lead Pilot stating that he had arranged with several full-time pilots and planned on working February 10, 11, 12 shifts.³² The pilot had 2 landings scheduled at Quartermaster on the day of the accident.

Date	Purpose	Flights	Hours	Landings at QM
11/10/2017	Boulder City (Extra Day)	3	3.2	0
11/11/2017	Boulder City	3	3.1	3
11/12/2017	Boulder City	3	3.3	1
11/14/2017	Boulder City	2	2.2	0
11/16/2017	Boulder City	2	2.2	1
11/26/2017	Boulder City	3	3.4	2
11/27/2017	Boulder City	2	2.3	2
11/28/2017	Boulder City	1	1.1	1
12/17/2017	Las Vegas	2	1.4	1
12/20/2017	Flight Training	1	1.7	0
12/21/2017	Checkride	1	0.7	0
1/21/2018	Boulder City	2	2.1	2
2/10/2018	Boulder City	3	2.6	2
2/11/2018	Boulder City	-	-	-
2/12/2018	Boulder City (Extra Day)	-	-	-

Figure 21: Pilot's Recent Schedule

3.3 TRAINING³³

Pilot training records provided by Papillon revealed that he received his most recent annual FAR 135.293 and FAR 135.299 (.293 and .229) Airman Competency/Proficiency Checks in December 2017. All areas of the examination were graded as 'S' (satisfactory) and no discrepancies were noted; the flight time was 0.7 hours.

A review of the Papillon pilot schedule for December 2017 revealed that he was scheduled for flight training on December 20 and for a check ride December 22. The pilot's TR-8, Additional Flight Training Record, indicated that he received recurrent flight training on December 20, 2017 totaling 1.7 hours with a "satisfactory" completion. Additionally, on the TR-8 the Recurrent Check ride .293 and .299 was shown as completed on December 21, 2017 totaling 0.7 hours with a "satisfactory" completion. The Special Federal Aviation Regulation (SFAR) Ground Training was listed as being completed on December 21, 2017, but that entry was crossed out. The last SFAR Route Training was recorded as being completed in

³² See the Human Performance Factual for a complete review of the pilot's day.

³³ See Attachment F: Pilot Training Records and Resume

December 2016.³⁴ The TR-1, Record of Ground Training Subjects, showed the last curriculum subject complete was “Qualification” on December 21, 2017 for a total of 2.0 hours. The TR-2, Record of Aircraft Ground Training, showed the last curriculum subject complete was “Qualification” on December 21, 2017 for a total of 1.5 hours and “EC130 B4/T2 Differences” on December 21, 2017 for a total of 0.5 hours. One TR-3, Single-Line Entry Form, showed the last entries were dated December 2016 listing both TR-1 Recurrent and TR-2 EC130 Recurrent. The other TR-3 showed the last entry of December 20, 2016 where a 8410 .293 and .299 is listed as satisfactory.³⁵

An Airman Competency/Proficiency Check FAR 135 Form 8410-3 in the pilot’s file contained a crossed out date of December 21, 2017 changed to December 22, 2017; the expiration dates were December 2018.³⁶ In the remarks section there was a comment “Check ride given in lieu of Recurrent Training.” All areas were marked as satisfactory.

The Lead Pilot³⁷ that conducted the pilot’s recurrent training on December 20, 2017 recalled that the day of the training flight was very windy, with gusts up to 30 kts. After completing the 1.7-hour flight he marked the flight as “unsatisfactory” performance, which was only the second pilot he had ever failed since being employed at Papillon.³⁸ He stated that he didn’t pass the pilot because of his inadequate performance of practice autorotations. Specifically, the pilot was having difficulty with maneuvering the helicopter in wind and not having enough altitude when turning during 180-degree autorotations. After the pilot repeatedly could not perform to the Lead Pilot’s standards, the Lead Pilot prematurely ended the flight. After the flight, the Lead Pilot debriefed the Chief Pilot about the flight and informed him on the

³⁴ In June 2016 the annual requirement for an SFRA route check was modified to permit operators to conduct the check bi-annually provided the pilot had received an SFRA route check within the preceding 24 months, remained current under 135.299 and the operator had acceptable procedures for tracking pilot qualifications. According to Papillon management, the due date for the pilot’s SFRA check was manually adjusted and initialed on the 2016 SFRA 8410 to reflect this change and his next SFRA route check would have been due December 2018. Additionally, Papillon stated that the pilot’s recurrent SFRA ground training was also conducted and was in the process of being recorded on the ‘Recurrent SFAR Ground Training Track’ form. The Training Director mistakenly believed it wasn’t required at the 12-month deadline, but instead could be extended in line with the 24 month route check extension, and was incorrectly lined through.

³⁵ According to Papillon management, when the TR1 and TR2 are replaced in the records with the new TR1 and TR2 training forms, the old TR1 and TR2 information will be transferred to the TR3 and the old expired forms archived.

³⁶ According to Papillon management, there was an error in the date entry for the pilot’s .293/.299. On the TR8 the date for the recurrent check ride incorrectly showed December 21, when the flight was in fact conducted in December 22, which was shown with an initialed amended date on the corresponding 8410. Papillon additionally stated that the date correction on the TR8 was omitted along with the TR1 and TR2 which should also have been corrected.

³⁷ That Lead Pilot had been employed at Papillon for about five years and was an instructor and check airmen in both the EC130 and AS350 helicopters. He and the pilot interviewed at the same time. See Attachment O: Interview Excerpts and Attachment X: Interviews Complete

³⁸ The Lead Pilot stated that: “Typically, during the training flight you’ll have something that’s unsatisfactory. It’s not uncommon. But by the end of the flight we’ll have that squared away and taken care of, and so I can mark it as yes, we ended satisfactorily.” In response to a draft of this factual report, Papillon management stated that “Having unsatisfactory outcomes during training or evaluation is not uncommon given the number of pilots hired and trained for Initial, Recurrent and Transition Training,” and that “Unsatisfactory outcomes merely serve to highlight the fact that the training standard was being upheld and not simply given lip service.” A Papillon provided comparison of other pilot’s Satisfactory and Unsatisfactory flights is in Attachment AA: Papillon Response to Draft Factual

areas that the pilot needed to improve. He also turned in the paperwork with the failure noted.³⁹ According to the paperwork either the next day or 2 days after, the pilot flew 0.7 hours, passing his check ride with a different Lead Pilot.⁴⁰

The Lead Pilot further stated that normally if a pilot needs more than the 2 hours of allotted training, Papillon will accommodate that, and the pilot will have more training until he/she is ready (satisfactorily performing) before undergoing the check ride.

A review of the pilot's entire files revealed that he had several "unsatisfactory" marks (U) and "unsatisfactory/satisfactory" (U/S) marks on his 8410-3 forms. The following excerpts document those:

6-21-2013: Preflight Inspection (U); disapproved check

6-23-2013: Normal and Abnormal Procedures (U/S); Emergency Procedures (U/S); "procedure unsatisfactory after further training both procedures were found to be satisfactory."

12-19-2013: Autorotation (U/S); "initial autorotation was unsatisfactory. Additional training was given. Subsequent autorotations were satisfactory."

12-16-2014: Quickstops (U/S); "initial quickstop was unsatisfactory. Additional training was given. Subsequent quickstops were satisfactory."

12-4-2015: Autorotation (U/S); Tune and Track IGM VOR (U/S); Auto With Turn (U/S); "Initial autorotations and tracking to IGM VOR was unsatisfactory. Additional training was given. Remaining autorotations and tracking to a VOR were satisfactory."

Date	Evaluation	S' Totals	'U' Totals	U/S' Totals	Remarks
6/21/2013	Initial EC130		1		Failed pre-flight inspection and aircraft systems
6/23/2013	Initial EC130	28		2	Emergency Procedures re-trained
6/24/2013	SFRA 135.299	8			Initial route/line check
12/19/2013	Recurrent EC130	28		1	Base month reset. Autorotations re-trained
12/19/2013	Recurrent SFRA	8			Base month reset
12/16/2014	Recurrent EC130	26		1	Quick stop re-trained
12/16/2014	Recurrent SFRA	7			
12/4/2015	Recurrent EC130	26		3	Autorotations and VOR tracking re-trained
12/4/2015	Recurrent SFRA	8			
12/20/2016	Recurrent EC130	29			No remarks
12/20/2016	Recurrent SFRA	7			Extend to 24 month recurrent period, date changed
12/22/2017	Recurrent EC130	29			
TOTALS		204	1	7	

Figure 22: Pilot's Tallied Marks from the 8410-3 Forms

The pilot stated that he had been given ground training covering settling with power, but was never given flight training practicing a settling with power scenario.

³⁹ The Lead Pilot recalled handwriting the form and thought that possibly when someone typed up the form they mistakenly put "satisfactory" because "unsatisfactory" is so uncommon. He has marked "unsatisfactory/satisfactory" (U/S) once.

DATE	HELO	PASS	HOURS	TYPE of TRAINING
6/4-23/2013	Ground	Yes	20.5	FAR 135.331 Initial
6/6-7/2013	Ground	Yes	21	FAR 135.331 Initial
6/7/2013	Ground	Yes	5.2	SFAR 50-2 Training
6/8-20/13	EC130	Yes	14.6	Initial Flight Training
6/23/2013	EC130	Yes	1.6	EC130 Checkride
6/24/2013	EC130	Yes	1.5	SFAR Training and Checkride
7/27/2013	EC130	Yes	0.7	EC130 Night Familiarization
10/30/2013	EC130	Yes	0.6	Las Vegas / Strip Tour Training
11/19/2013	EC130	Yes	1	GCW/ UpandDown Route Training
12/19/2013	EC130	Yes	0.6	SFAR Recurrent Flight Training
12/19/2013	EC130	Yes	1.6	Annual EC130 FAR 135.293/.299 Checkride
12/19/2013	Ground	Yes	2.5	Recurrent SFAR Training
12/14/2014	EC130	Yes	1.2	Recurrent EC130 Training
12/15/2014	EC130	Yes	1	Recurrent EC130 Training
12/16/2014	Ground	Yes	2.5	Recurrent SFAR training
12/16/2014	EC130	Yes	1.5	Recurrent SFAR / Checkride
12/3/2015	EC130	Yes	0.9	Recurrent EC130 Training
12/3/2015	EC130	Yes	1.1	Recurrent EC130 Training
12/4/2015	EC130	Yes	0.5	SFAR Recurrent Flight Training
12/4/2015	EC130	Yes	1.7	Annual EC130 FAR 135.293/.299 Checkride
12/15/2015	Ground	Yes	2.5	Recurrent SFAR training
4/17/2016	EC130	Yes	1	G500 Training
5/5/2016	Ground	Yes	2	G500 and E130T2 Differences
12/10/2016	Ground	Yes	1	AS350B3 Introduction
12/17/2016	EC130	Yes	1.1	Recurrent EC130 Training
12/20/2016	Ground	Yes	1	Recurrent SFAR training
12/20/2016	EC130	Yes	0.9	Recurrent EC130 Training
12/20/2016	EC130	Yes	0.5	Recurrent SFAR / Checkride
12/20/2016	EC130	Yes	1	Annual EC130 FAR 135.293/.299 Checkride
11/9/2017	Ground	Yes	8.5	FAR 135.351 Recurrent
12/20/2017	EC130	Yes	1.7	Recurrent EC130 Training
12/21/2017	EC130	Yes	0.7	Annual EC130 FAR 135.293/.299 Checkride
12/12-21/2017	Ground	Yes	11.8	FAR 135.351 Recurrent

Figure 23: Pilot's Training Summary from Papillon's Pilot Records

4.0 HELICOPTER INFORMATION ⁴¹

Manufactured in 2010 by Airbus Helicopters, the EC130 B4 (serial number 7091), was registered as N155GC; at the time of the accident the helicopter had accrued a total time of 9,629.1 hours. The helicopter was equipped with a Safran Helicopter Engines Arriel 2B1 turboshaft engine (serial number 23056), which had a total time of about 15,505.4 hours. The helicopter's total (gross) weight at the time of the accident was calculated to be 4,904 lbs.

⁴¹ Refer to the Airworthiness Group Factual Report a complete discussion about the helicopter and engine.

A review of the EC130 B4 Flight Manual, Revision 9, revealed that the manual did not contain wind limits nor critical wind azimuth or maximum safe relative wind chart.

Airbus issued Service Letter 1673-67-04 in April 2005, issued a “reminder concerning the YAW axis control for all helicopters,” with a main rotor that rotates clockwise (such as the accident helicopter). The document stated that in a quick leftward rotation, the pilot must make immediate action of applying significant force to the right anti-torque pedal in an effort to stop leftward rotation. It urges pilots to not hesitate to push the pedal down fully to the stop and that any delay when applying this correction will result in an increase in rotation speed. It clarifies that when adequate correction is applied, the rotation will stop. Additionally, wind coming from the left or tail wind increases the helicopter rotation speed.

4.1 SETTLING WITH POWER

According to the Helicopter Flying Handbook (FAA-H-8083-21A), Chapter 11, Helicopter Emergencies and Hazards:

"Vortex ring state describes an aerodynamic condition in which a helicopter may be in a vertical descent with 20 percent up to maximum power applied, and little or no climb performance. The term "settling with power" comes from the fact that the helicopter keeps settling even though full engine power is applied. In a normal out-of-ground-effect (OGE) hover, the helicopter is able to remain stationary by propelling a large mass of air down through the main rotor. Some of the air is recirculated near the tips of the blades, curling up from the bottom of the rotor system and rejoining the air entering the rotor from the top. This phenomenon is common to all airfoils and is known as tip vortices. Tip vortices generate drag and degrade airfoil efficiency. As long as the tip vortices are small, their only effect is a small loss in rotor efficiency. However, when the helicopter begins to descend vertically, it settles into its own downwash, which greatly enlarges the tip vortices. In this vortex ring state, most of the power developed by the engine is wasted in circulating the air in a doughnut pattern around the rotor."

4.2 UNCOMMANDED LEFT YAW (ULY)

According the Airbus Operator's Manual, Uncommanded Left Yaw (ULY) is a critical, low-speed aerodynamic flight characteristic which can result in a rapid, uncommanded yaw rate, that does not subside of its own accord, and if not immediately corrected, can result in loss of aircraft control. In other helicopters, this characteristic has been described as “loss of tail rotor effectiveness” or “LTE.”

According to the Helicopter Flying Handbook, Chapter 7, Helicopter Performance:

"The wind direction is also an important consideration. Headwinds are the most desirable as they contribute to the greatest increase in performance. Strong crosswinds and tailwind may require the use of more tail rotor thrust to maintain directional control. This increased tail rotor thrust absorbs power from the engine, which means there is less power available to the main rotor for the production of lift. Some helicopters even have a critical wind azimuth or maximum safe relative wind chart. Operating the helicopter beyond these limits could cause loss of tail rotor effectiveness."

Additionally it states “Avoid tailwinds below airspeeds of 30 knots. If loss of translational lift occurs, it results in an increased power demand and additional anti torque pressures.”

The NTSB Aircraft Performance Memorandum⁴² discusses the helicopter’s flight path and possible control inputs, external disturbances, and other factors that could have affected its trajectory. In pertinent part, Airbus Helicopters performed engineering simulations to compute the control authority required to match an exemplar flight trajectory in several wind conditions. The simulations indicated that matching the target trajectory and heading in a constant 39 kts wind from 337.5° would saturate the pedal anti torque control authority. However, these are not the only conditions that could saturate the pedal control; different headings, speeds, and rates of deceleration and descent will alter the main rotor power and consequent anti-torque requirements. Different wind magnitudes and directions might also saturate the controls. Without better knowledge of the helicopter state and wind conditions during the accident, the actual amount of anti-torque control required cannot be estimated.

5.0 METEOROLOGICAL INFORMATION⁴³

Interviews with multiple Papillon pilots revealed that their primary means of assessing the weather prior to landing at Quartermaster was from the following sources: reports from pilots that had just returned from the canyon, windsocks along the river, and windsock at Quartermaster.

A windsock was located near the picnic tables at Quartermaster. There were numerous videos and pictures of the windsock during the times surrounding the accident identifying a generally north-northwest wind with some variability, but mostly at full extension⁴⁴. The wind sock observations were generally consistent with observations from the regional automated weather stations.

Based on the images and pilots’ statements, the wind was likely from the north-northwest gusting to about 20 kts at the time of the accident with some higher gusts possible. Of the nine pilots that landed prior to the accident, the last three pilots’ accounts of the weather indicated that it was progressively becoming stronger.

⁴² See the Aircraft Performance Memorandum for a complete discussion about the helicopter’s performance in different wind conditions.

⁴³ See the Meteorological Factual for a complete review of the weather at the accident site.

⁴⁴ Because this windsock fully extended at 15 kts and was located near the landing pad where helicopters are arriving and departing (potentially creating a local “artificial” wind), there are concerns with using these observations for creating an accurate quantitative measurement of the local wind condition at the landing pad.



Figure 24: Picture Showing the Wind from the North-Northwest Several Minutes Prior to the Accident

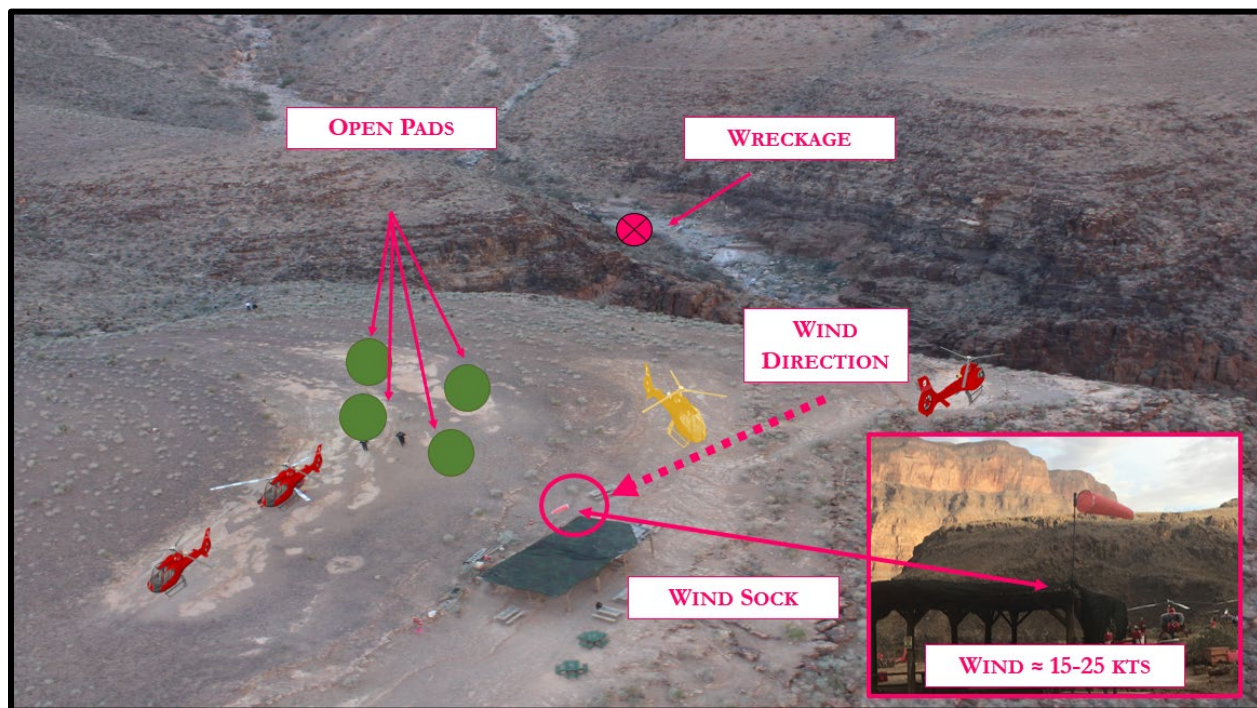


Figure 25: Picture Showing the Wind from the North-Northwest Referencing the Landing Pads

According to Papillon management, in the two years prior to the accident, 4,470 flights (from Boulder City and Las Vegas) were canceled or changed because of weather.⁴⁵

5.1 WEATHER BRIEFINGS

According to the General Operations Manual, section 3, “For flights conducted within the Local Tour Area, the Director of Operations (DO), Chief Pilot, Director of Utility Operations, or a Management Designee will determine the weather based on information obtained by an approved source⁴⁶.” The GOM further stated that “Pilot weather briefings will be conducted as part of the daily morning safety briefing and the weather information will be posted on the bulletin board in the pilot break room.”

The GOM stated that pilot briefings must include: Adverse weather advisories (SIGMET/ AIRMET); Current weather (METAR); Terminal forecasts (TAF); Area forecast (FA) Winds and temperature; PIREPS, if available NOTAMs (L,D,FDC).

According to the DO, the morning safety briefings (which include the day’s weather briefing and who has operational control of the company) are conducted by one of the Lead Pilots and usually occur around 0545 shortly after the first pilots arrive. After the morning safety briefing, a briefing sheet is posted in the pilots’ break room with the weather information and all pilots that fly that day are required to initial that they have received and understand the briefing.

The last Tour Operators Program of Safety (TOPS) yearly safety audit⁴⁷ included the finding that Papillon “uses a weather monitoring system very effectively to assist with flight coordination.”

5.2 ACCIDENT DAY WEATHER BRIEFING

A review of the morning briefing sheet provided to the pilots on the day of the accident was provided to investigators. The Boulder City (BVU), Las Vegas (LAS), and Grand Canyon West (1G4) METARS were all showing wind under 7 kts. The BVU METAR was recorded at 0515 and reported wind 100° at 5 kts. The DO was listed as the contact for operational control. The Terminal Aerodrome Forecasts (TAF) for LAS and were valid from 0400 on February 10 to 1000 on February 11. The TAF indicated temporary conditions after 1300 to be wind from 350° at 14 kts gusting to 22 kts. It further stated that after 1700, wind would be from 020° at 18 kts gusting to 28 kts. The Area Forecast stated that gusty winds from the north would spread southward.

⁴⁵ See Attachment M: Cancellations From Weather

⁴⁶ An “approved source” is defined as “sources of weather information issued by the US National Weather Service (NWS), a source approved by the NWS, or a source approved by the FAA administrator.”

⁴⁷ See Attachment V: Papillon Tour Operators Program of Safety (TOPS) Audit

WEATHER		BRIEFING #	1-800-992-7433	NO GO TIMES	
CURRENT CONDITIONS				SUNSET	17:16
BVU	10005KT 10SM FEW032 SCT041 BKN055 13/M05 A2978 RMK AO2			LANDING	16:01
LAS	20006KT 10SM FEW250 14/M06 A2976 RMK AO2 SLP063 T01441056			AIR ONLY	16:31
1G4	25007KT 10SM CLR 09/M08 A2986 RMK AO2			STRIP	18:16
TAF KLAS		AREA FORECAST		WINDS @ 6000'	
101120Z 10121118 23006KT P6SM FEW250 FM101400 VRB05KT P6SM SCT250 FM101900 35007KT P6SM BKN250 FM102100 35014G22KT P6SM BKN250 ✓ FM110100 02018G28KT P6SM BKN250 ✓ FM110900 34011KT P6SM FEW250 FM111600 04007KT P6SM FEW250 =		SYNOPSIS: Gusty north winds will spread southward today as a cold front slides across the area, with cooler temps in its wake for Sunday. Another weather system will drop south into the region early next week bringing chances for shower activity to the area. Today temperatures will be relatively warm, before cooling closer to seasonal normals Sunday into next week.		310011+13	
NOTAMS		AIRMETS/SIGMETS/PIREPS/TF		OPERATIONAL CONTROL	
IRNO 12/016 KBVU AIRSPACE UAS WI AN AREA DEFINED AS 1NM RADIUS OF BLD200005.3 (3.3NM SW BVU) SFC-400FT AGL DLY 1400-0400 1712051400-1800000400 IRNO 01/408 KBVU RWY 15 RWY END ID LGT OUT OF SERVICE 1801021802-1802281500 IRNO 02/408 BLD SVC HAZARDOUS INFLIGHT WX ADVISORY SERVICE OUTLET OUT OF SERVICE 1802060000-1802062140		AIRMET ZULU UPDT 1 FOR ICE AND FRZLV VALID UNTIL 101500 FRZLV...RANGING FROM SFC-130 ACFS AREA TANGO UPDT 1 FOR TURB AND LLWS VALID UNTIL 101500 OTLK VALID 1500-2100Z		JOHN BECKER	
				PERFORMANCE CALCULATIONS	
				BVU:	2204 FT
				Max Temp:	24 °C 75 °F
				AS350B2 IGE Wt:	MAX
				AS350B2 OGE Wt:	MAX
				EC130 IGE WT:	MAX
				EC130 OGE WT:	MAX
				EC130 T2 IGE WT:	5434
				EC130 T2 OGE WT:	5434
				AS350B3 IGE WT:	MAX
				AS350B3 OGE WT:	MAX
				GCW:	4817 FT
				Max Temp:	18 °C 64 °F
				AS350B2 IGE Wt:	MAX
				AS350B2 OGE Wt:	MAX
				EC130 IGE WT:	MAX
				EC130 OGE WT:	MAX
				EC130 T2 IGE WT:	5434
				EC130 T2 OGE WT:	5434
				AS350B3 IGE WT:	MAX
				AS350B3 OGE WT:	MAX

Figure 26: Excerpt of Morning Briefing Sheet

Other Papillon pilots recalled getting a weather briefing that morning. The accident pilot's shift did not start until 1030 which was about 4 hours after the morning briefing. He had put his initials next to his name on the briefing sheet indicating he had reviewed the weather.

According to Papillon, there was no other weather information that was documented as being disseminated that day. The DO stated that current weather conditions are available to pilots on a television monitor mounted in the Lead Pilots' office area if they choose to review the information prior to a flight. The Lead Pilots may also pass along any PIREPS if they think it is pertinent to a flight; the Lead Pilots did not, receive, nor did he disseminate any further weather information to the pilot on the day of the accident.

5.3 PILOT'S WEATHER INFORMATION

The pilot stated that the weather information for the day of the accident was provided to him on the morning briefing sheet. He reviewed that weather when he arrived about 1030. If he was solely doing tour flights in the canyon, as he was scheduled on the accident day, he stated that he would not recheck the weather because there was only a short time to turn over a flight when he arrived back at Boulder City and he had recently been there. He stated that usually pilots that landed at Quartermaster earlier in the day will relay the wind information when they return back to the terminal.

Although the pilot could not specifically remember how he assessed the weather conditions on the day of the accident, he stated that prior to landing at Quartermaster he usually determined the wind by first

referencing the windsock located at Sundance Helicopters' Grand Canyon Beach⁴⁸ and then monitoring the windsock at Quartermaster. He commented that when arriving at Quartermaster it was easiest to discern the wind direction based on the directions of the parked helicopters⁴⁹.

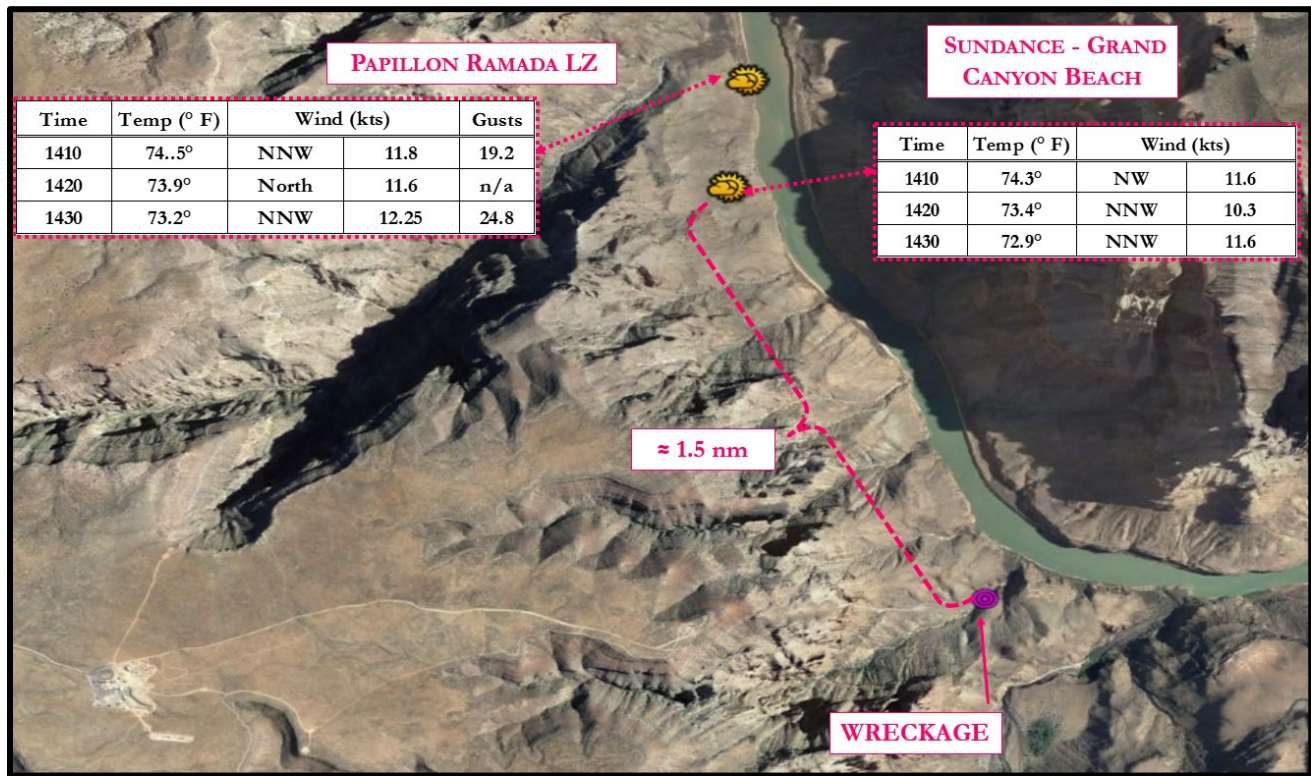


Figure 27: Windsocks and Weather at the Papillon Ramada and Sundance

5.4 WEATHER LIMITATIONS

According to the GOM, Section 3, “Weather Limitations” no helicopters can be operated in a way that violates weather limitations specified in the applicable Rotorcraft Flight Manual. It stated that the “following parameters shall be used as guidelines in determining whether internal load and passenger carrying operations should be suspended:”

1. Winds: 30-35 kts. steady, Gust Spread: 20 kts. or greater
2. Ceiling: Below 200 feet AGL
3. Visibility: Less than 1 mile
4. Turbulence: moderate to severe

Note: The decision to temporarily suspend operations will be made by the Director of Operations, Chief Pilot, or a Management Designee, based on the above criteria and PIREPS.

⁴⁸ Sundance Grand Canyon is located about 1.5 nautical miles from Quartermaster. The pilot clarified that because of the helicopter altitude when near the respective windsocks, it was easier to see the Sundance windsock than the Papillon Ramada windsock.

⁴⁹ A helicopters' nose would presumably be facing the direction of landing into the wind.

Underlined in the GOM under the limitation was the statement, “No pilot will ever be criticized for not flying in such conditions if they feel that the situation is beyond their limits of controllability or their comfort level.”⁵⁰

5.5 ASTRONOMICAL INFORMATION

According to the U.S. Naval Observatory, Department of Astronomical Applications, the phase of the moon was waning crescent with 22% of the moons visible disk illuminated. Sunset was at 1711 and dusk was at 1738. At the time of the accident the sun was about 9.9° above the horizon on an azimuth (heading) of 244°.

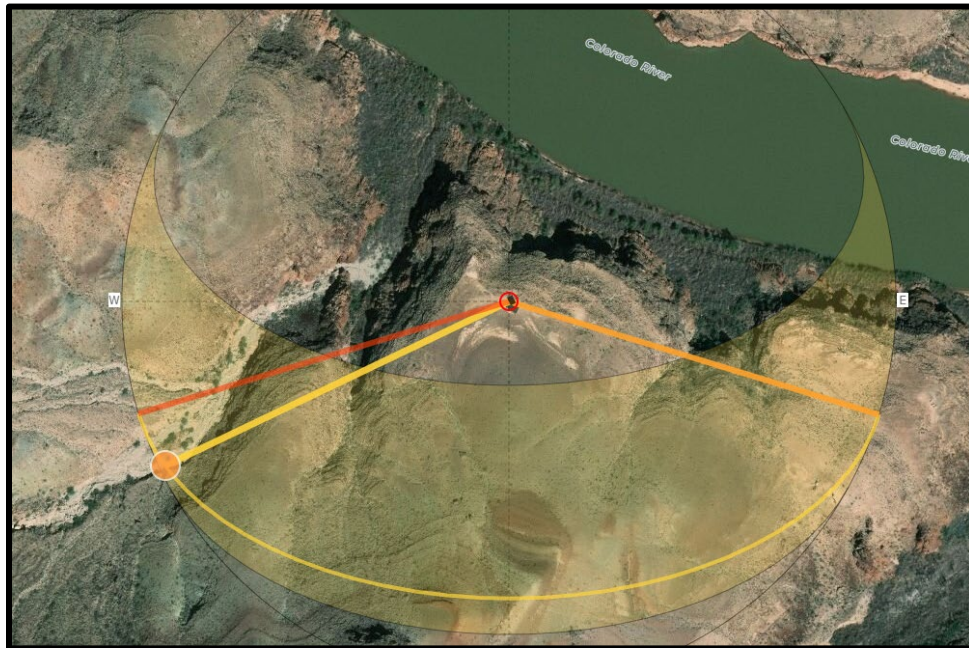


Figure 28: Position of Sun

6.0 ROUTE AND LANDING INFORMATION

Quartermaster is located in Grand Canyon West, an area of approximately 9,000 acres in the northwest corner of the Hualapai Reservation. The Hualapai Tribe has designated the Grand Canyon West area for economic development through tourism and recreational uses.

All flight tours of the Grand Canyon transited the Grand Canyon National Park Special Flight Rules Area (GCNP SFRA) Airspace.⁵¹ The FAA issued a GCNP Procedures Manual establishing policies and

⁵⁰ Pilots interviewed at Papillon generally agreed that they would feel comfortable turning down a flight because of weather.

⁵¹ See Attachment U: Grand Canyon National Park Special Flight Rules Area (GCNP SFRA) Procedures Manual

procedures for operations in the airspace which contained, in part, the following information:

- Reporting points, radio frequencies and procedures;
- Weather minimums;
- Aircraft exterior lighting requirements;
- Qualifications and training requirements;
- Routes, altitudes and procedures;
- Air tour route descriptions for the 20 authorized routes;
- Flight plans; and
- Commercial air tour limitations.

6.1 TOURS

Management at Papillon stated that some of their tours are comprised of the helicopter flight only (“air tour”), while others are a combination of the flight and a landing or ground tour. There was a complimentary hotel pickup and shuttle service that transported the passengers to the Papillon terminal 45 minutes prior to their flight. The total tour duration was advertised as being between 3.5 to 4 hours from hotel pickup to drop off.

Papillon offered two different types of tours from their Boulder City location. In 2017 Papillon took about 85,000 passengers on those tours. The Grand Celebration Tour was their most popular tour which was the same for most other helicopter operators in Las Vegas. The tour was a combination of a visual air tour with a landing at Quartermaster and a short picnic lunch. The Golden Eagle Air Tour was an air only tour following approximately the same route as the Grand Celebration tour but without the canyon floor landing. The flight times for both tours were 1.1 hours. For each Grand Celebration tour, Papillon had to pay a fee to the Hualapai for landing on their sovereign lands.

TOUR DEVIATIONS

If the Lead Pilot determines that weather may be problematic for completing a tour, then Papillon requires passengers to sign a Weather Advisory Form⁵² prior to boarding the helicopter. The form requires each passenger to acknowledge that they were informed of current weather conditions and possible delays which may affect their tour, including: in-flight turbulence due to wind or heat, visibility issues, rain showers or thunderstorms, and extensive heat warnings. The form additionally states, “if weather conditions worsen after your departure and we are unable to fulfill any portion of the tour, such as landing at the Grand Canyon, then you will return to the Boulder City Airport and will only be charged for an air tour. If you land at the Grand Canyon and your return flight is not able to operate safely due to weather conditions, you will return by bus and [the] tour will be considered complete.”

For the accident flight, the passengers did not receive the Weather Advisory Form. Papillon stated that because the weather was not in question there was no reason to issue an advisory.

⁵² See Attachment K: Passenger Weather Advisory Form

If the flight is canceled passengers are refunded to their original form of payment. If the flight is changed from a landing flight to an air-only flight, passengers are refunded the difference between the two flights.

6.2 ROUTE

The flight route in the canyon was airspace encompassed by SFAR No. 50-2.⁵³ Following departure from Boulder City, each Papillon flight toured Lake Mead and the Hoover Dam prior to entering the GCNP SFRA. When Papillon operated within the GCNP SFRA, all of its operations that departed from Boulder City were conducted on the Green 4 Route. The majority of that route traversed areas of mountainous and rugged terrain.

The Helicopter Tour Operators Route Standardization Agreement, revision 6, was a Letter of Agreement (LOA) between the operators of routes to be used. The agreement defines standardized helicopter flight altitudes, routes, and radio calls for tour flights in the Lake Mead National Recreation Area, the Hualapai Indian Reservation, and GCNP. In pertinent part, the agreement states that the pilots must make all required position reports, adhere strictly to proper radio phraseology, make no unauthorized calls (noting that unnecessary “chatter” will not be tolerated). The agreement states that Papillon pilots on the landing tour must cross the river to Quartermaster below 2,000 feet msl.

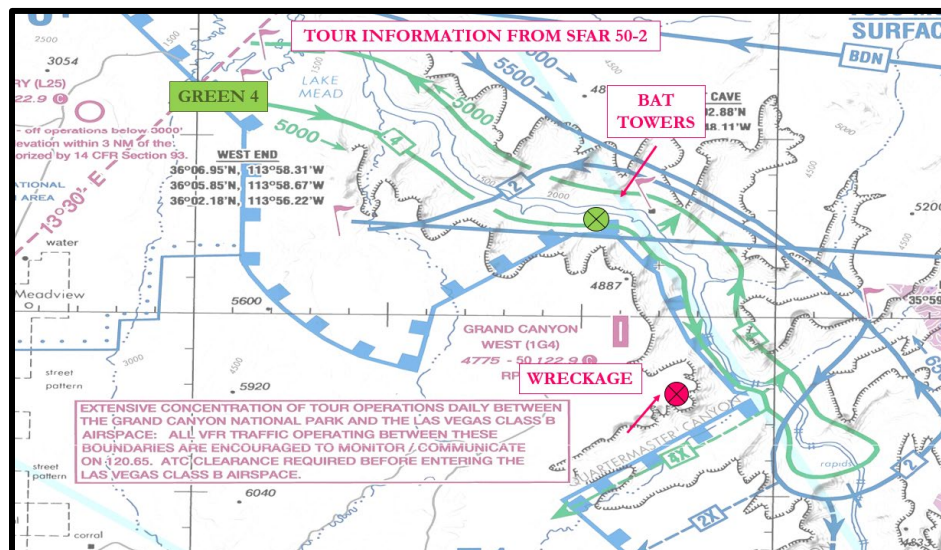


Figure 29: Green 4 Route from SFAR

⁵³ SFAR 50-2 contains special flight rules in the vicinity of Grand Canyon National Park to reduce the impact of aircraft noise on park visitors. SFAR 50-2 delineates the dimensions of the flight rules area, flight-free zones, and flight corridors; establishes reporting requirements for commercial sightseeing air carriers operating in the special flight rules area; prohibits commercial sightseeing operations during certain time periods; and limits the number of aircraft that can be used for commercial sightseeing operations.

Quartermaster landing site was located on a plateau making up the south canyon of the Colorado River. The site was in an arid region on a promontory, at an elevation of approximately 1,450 feet msl. The overall dimensions and layout⁵⁴ of the promontory allowed simultaneous accommodation of numerous helicopters. The site was primarily packed dirt/rock and/or loose rock, with sparse, low vegetation. Several wood tables and a covered area, known as the Ramada, were located in the middle. Several

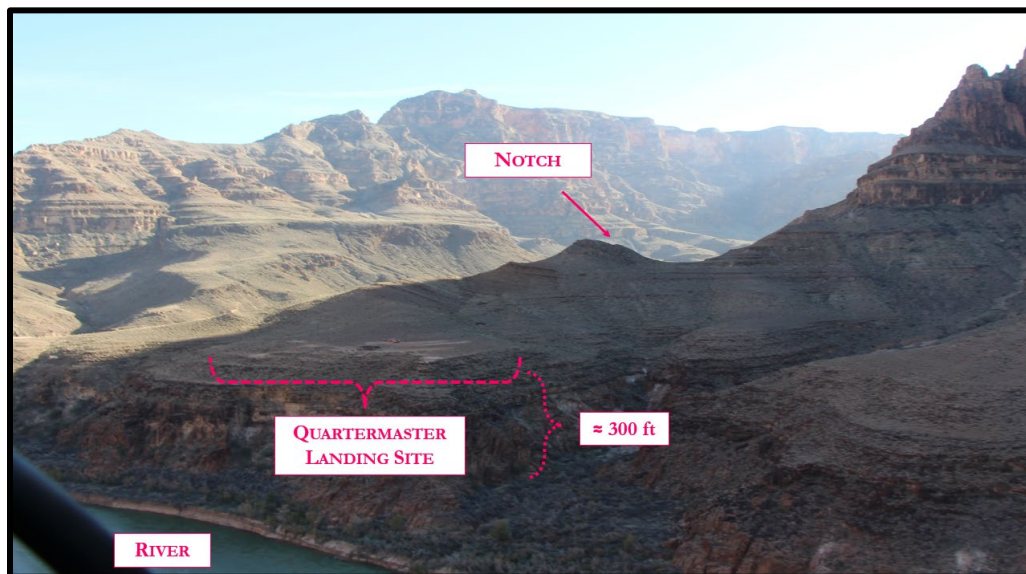


Figure 30: Quartermaster Landing Site

APPROACHES

There are two main approaches that the pilots make to the pads at Quartermaster.⁵⁵ The decision of which approach to make is determined by the location of the pad the pilot decides to land.⁵⁶

⁵⁴ The more flat area measure about 600 feet by 150 feet.

⁵⁵ The approaches are known as a downriver landing (when landing to the east pads), an upriver landing (when landing. There additionally is the option of a pilot making a straight-in approach (when landing to the west pads) where the pilot would cross the river and proceed directly to a pad without making a descending turn for an approach; this was not discussed by pilots since they almost always do one of the two main approaches. To avoid confusion, in this report the approaches are referred to as an approach to the east pads and an approach to the west pad, although a pilot could make either approach to any pad. The accident pilot repeatedly referred to the approach he took as a “straight-in” landing, but it was an approach to the west pads using the canyon to turn and descend.

⁵⁶ Refer to the “Pads” paragraphs in the this section discussing how a pilot decides which pad he/she chooses.

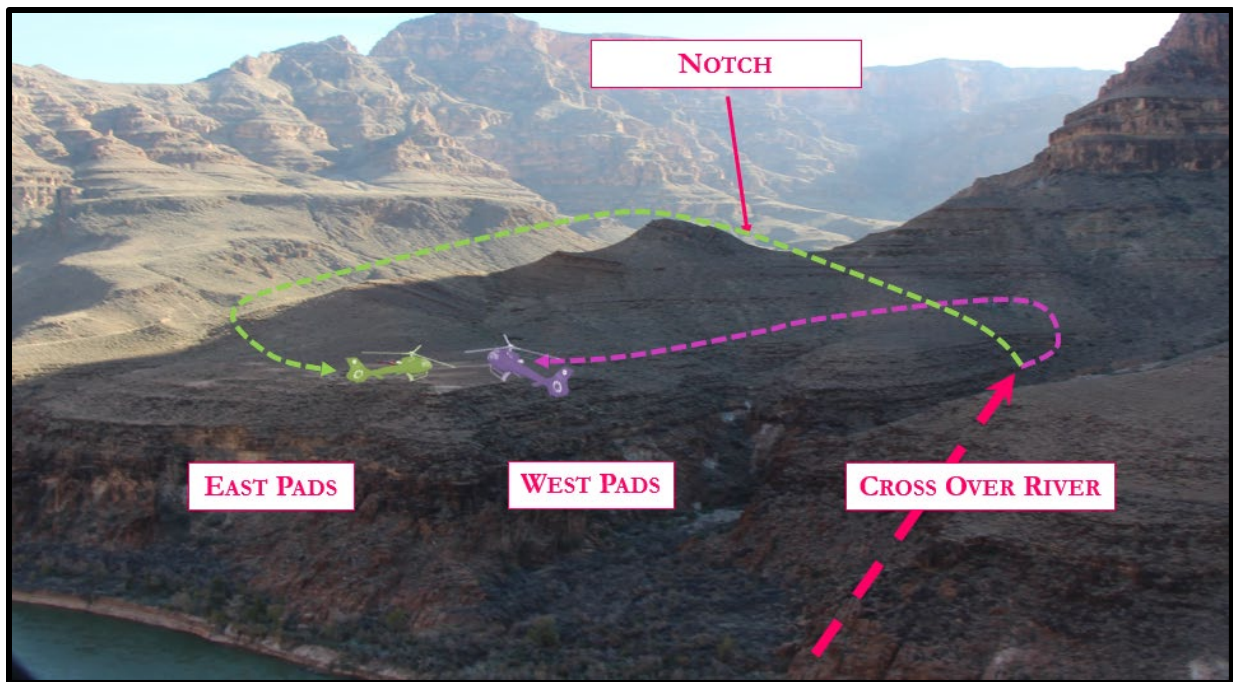


Figure 31: Main Approaches to Quartermaster

When landing on the east pads, the pilots maneuver the helicopter south over the river and continue over a saddle-shape in the terrain, referred to as “the notch.” After passing over the notch, the pilot makes a descending left turn and touches down facing to the west-northwest.

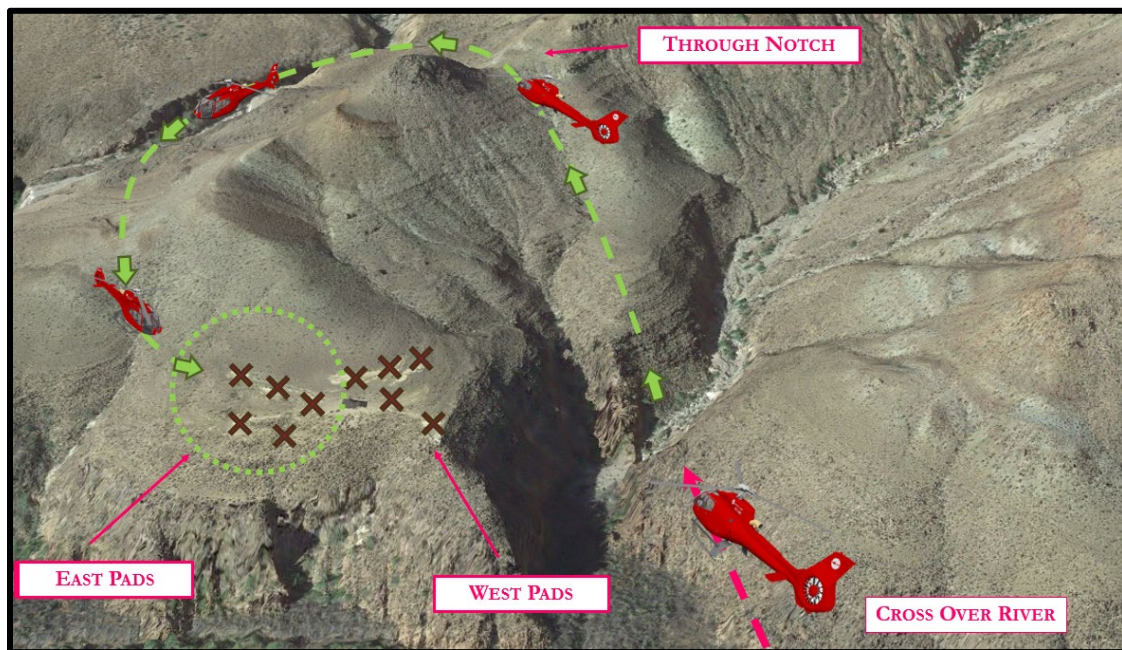


Figure 32: Approach Used to East Pads

The alternate approach, commonly used when landing on the west pads, entails the helicopter crossing over the river and entering into a 3,800-foot long box canyon; the distance back the pilot maneuvers into the canyon is determined by their assessment of the wind.

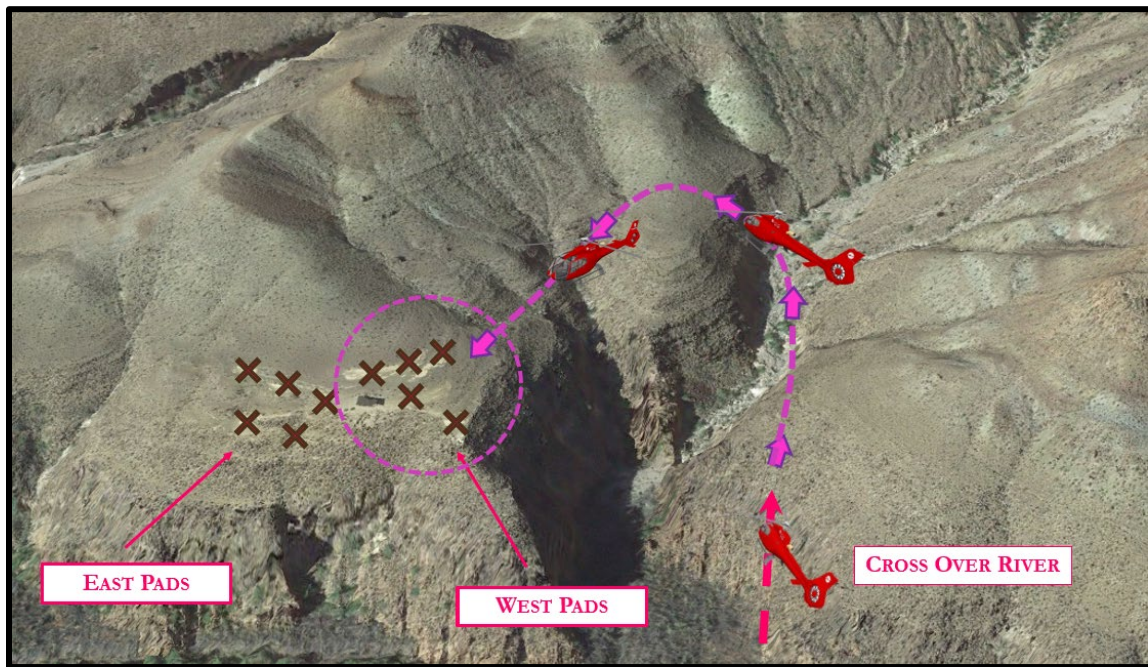


Figure 33: Approach Used to West Pads

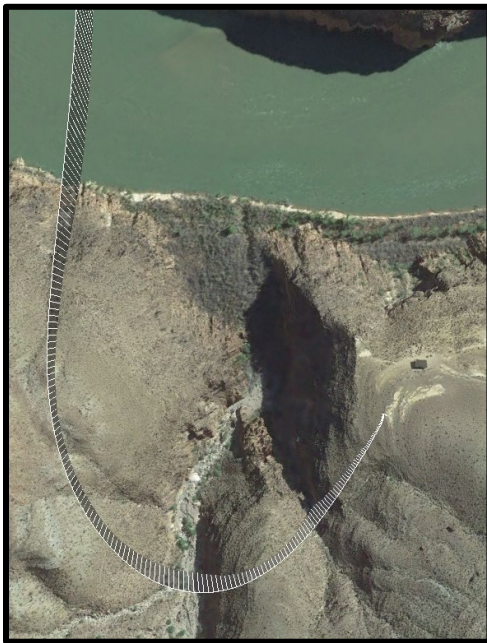


Figure 34 and 35: Papillon Reported Normal Approach Used to West Pads

PADS

The area had no designated pads or marked touchdown and lift off (TLOF) zones, or any other fixed means (such as lines of rocks or marker stakes) for delineating preferred landing zones or maneuvering areas. The pad selection process was made by each pilot as he/she arrived at Quartermaster based on availability and wind direction. The first pilots to arrive in the group would take the most forward pads (to the center), allowing the remaining helicopters in the group to park behind them. The pad locations and quantity⁵⁷ were not defined in any documents, nor was there a consensus by the Papillon employees.

According to the Airport Landing and Use Agreement⁵⁸, dated March 2017, Papillon was allotted 50,000 landings per year on 10 pads. The pads were mapped and defined on Google Earth for the agreement. One of the Lead Pilots stated that he pressed the management on multiple occasions to clarify where the landing pads were located and was told that creating specific spots would constrict the pilots. He stated that on multiple occasions there would be more than 10 helicopters landed at Quartermaster.

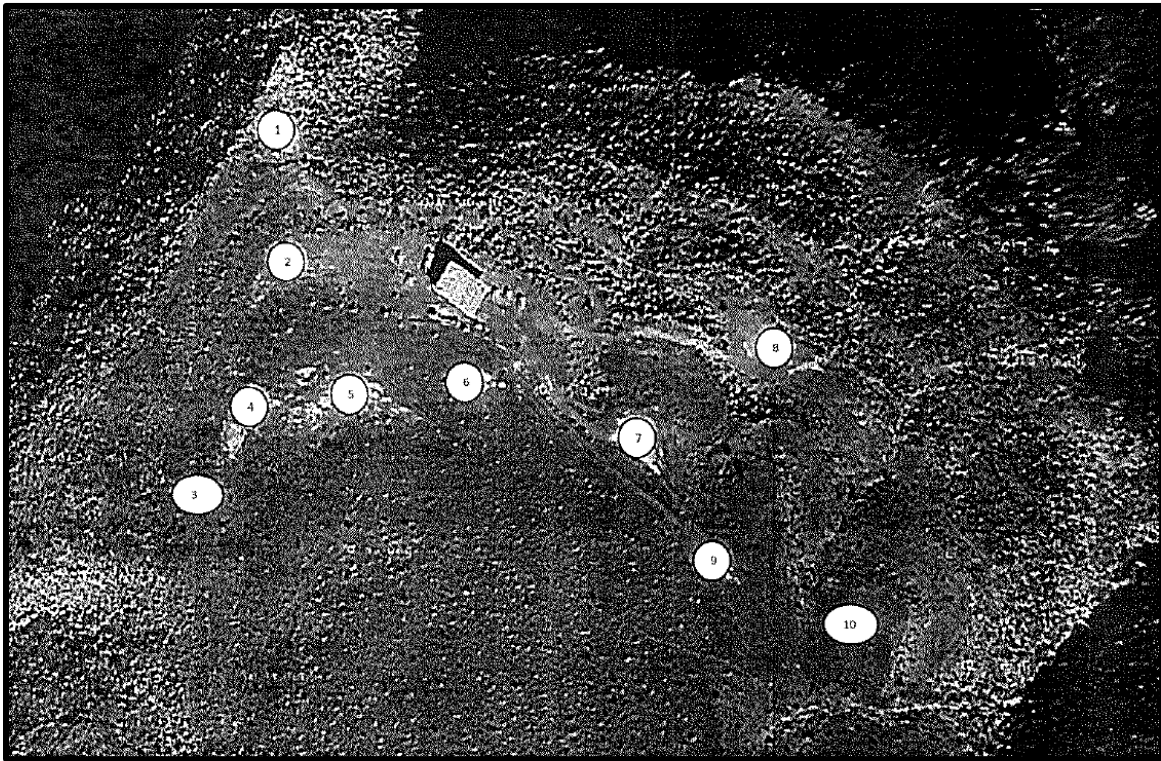


Figure 36: Excerpt of the Defined Pads in Hualapai Airport Landing and Use Agreement

When the Chief Pilot was queried as to why the pilots are not provided any guidance on which approach to make and pad to land on, he responded that because the wind conditions are unknown, he would not be able to predict which pad/approach would be favorable. He stated that “as a commercially-rated,

⁵⁷ Pilots estimated anywhere from 10-15 pads were at Quartermaster.

⁵⁸ See Attachment N: Hualapai Airport Landing and Use Agreement

instrument-rated professional pilot, they've got to have some latitude to make” a decision as pilot-in-command and “have a degree of operational control... they have the final authority... and I expect them to exercise that from time to time.” Instead he ensures that the pilots are trained to always make an approach into the wind. He thought that there were good wind indicators at Quartermaster (as opposed to the desert) where the river and the windsock at the Ramada were adequate for a commercial pilot to assess the wind conditions and land accordingly.

The initial route training and evaluation includes two hours of ground instruction (one hour during recurrent training) followed by flight training into the Canyon using the Green 4, and including approaches and landings at Quartermaster (a minimum of two familiarization flights followed by a route evaluation conducted by a check airman). A Lead Pilot stated that in the past he had arranged for newer pilots to have more favorable pads left open to assist them during periods of strong winds. He said that he told a new pilot recently, “we're going to leave this pad open for you so that you can make your approach, you're going to land with the headwind and you're not going to have to turn it sideways or with a tailwind or anything.”

The POI stated that the landing site is “natural, which is probably the way it should be for, you know, customer experience and the sacred land for the Indians.” There are other tour operators that have landing sites on Hualapai land that have markers to delineate pads (e.g., Maverick’s landing area, the Swamp, has metal stakes).

COMMUNICATIONS

The pilots do not routinely relay wind information to one another after landing, nor does Papillon require them to do so. The more senior pilots stated that they would make radio transmissions about the wind if they thought it was surprising or challenging. According to several pilots, the radio transmissions can be numerous with all the companies landing in the area, which makes them cautious of excess communication. Several pilots added that when they get back from a flight where they encountered wind at Quartermaster, they would talk to other pilots at the terminal imparting information about the wind conditions.

The accident pilot stated that if another pilot had cautioned him about the wind, he would have asked them about the direction. He additionally stated that he would likely have performed the approach at a higher speed keeping the helicopter in a better configuration to perform a go-around.

ACCIDENT PILOT

The pilot stated that when landing at Quartermaster he would be alert for wind direction shifts. He was not concerned with the space available to land and thought there was always enough room to land. He estimated about 10-12 helicopters would be able to land. Prior to crossing the river, he would normally have a spot to land selected. He would be looking for other helicopters, but his focus would normally be forward and to the left.

He stated that if wind was not a factor, he would normally land on the east pads by approaching through the notch because it would provide passengers a view of where they were going to land. He noted that if he observed anything abnormal during landing, he would perform a go-around, which he said was fairly common.

WIND

Numerous Papillon pilots stated that the wind at Quartermaster was not predictable. Specifically, that the wind direction can change while the pilot is flying the approach. Pilots additionally remarked that the terrain characteristics in the canyon adjacent to the west pads create mechanical turbulence⁵⁹. A few pilots added that they have experienced a swirl-type turbulence in that area where the helicopter will sink.

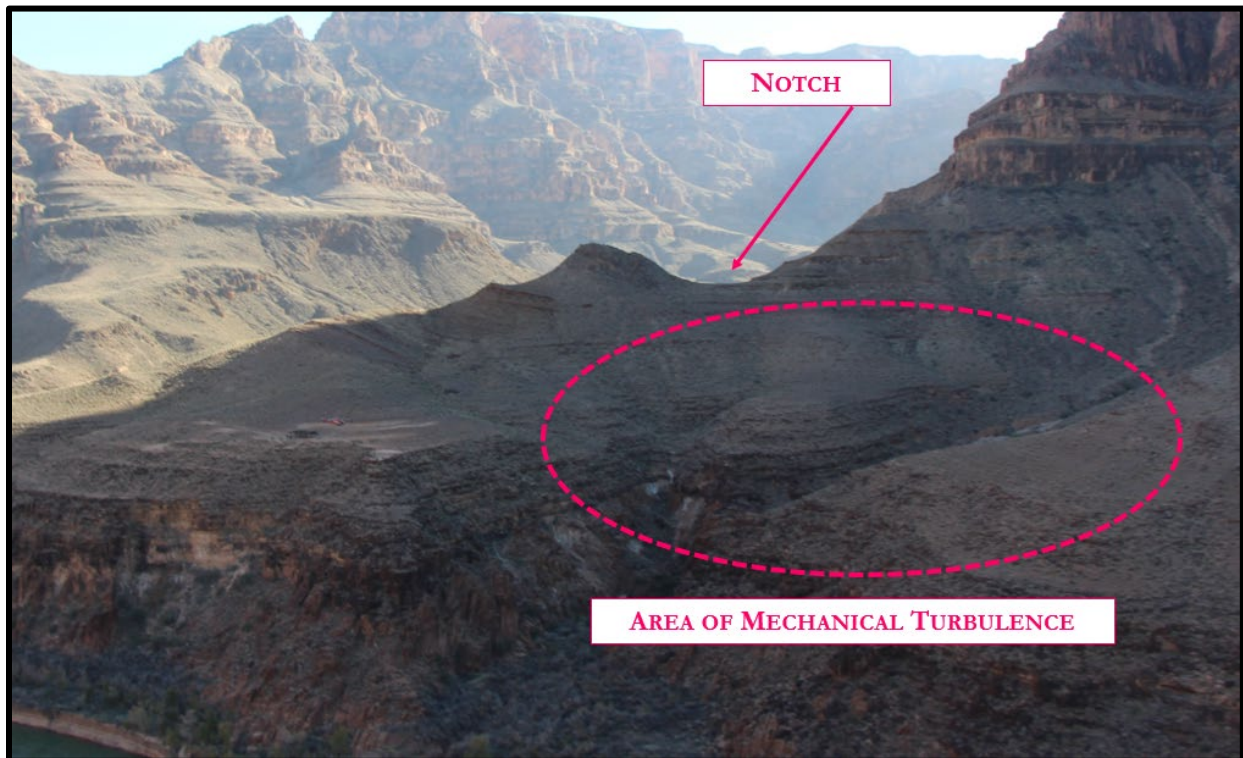


Figure 37: Area that Pilots Reported Experiencing Turbulence

Several pilots stated that if there is a northwest wind and all the east pads are taken, a pilot could still make the notch approach and maneuver the helicopter to the south to avoid overflying the helicopters. More common would be for the pilot to land on the west pads by performing an approach with a crosswind and then maneuvering the helicopter when in ground-effect (pedal turn) to align with the pad.

⁵⁹ Mechanical Turbulence is defined as when the air near the surface of the Earth flows over obstructions, such as bluffs, hills, mountains, or buildings, the normal horizontal wind flow is disturbed and transformed into a complicated pattern of eddies and other irregular air movements.

One pilot, who witnessed the accident, recalled that a few months after starting flying at Papillon he had an uncomfortable experience when landing at Quartermaster. He explained that while making the same approach as the accident flight, he experienced a sudden loss of airspeed and the helicopter decended rapidly. With that past experience, he decided on the day of the accident to do the notch approach to the east pads and avoid that area.

6.0 COMPANY INFORMATION

Papillon was established in 1965 and is one of the largest Nevada tour operators, specializing in helicopter air tours of the Grand Canyon under Operating Certificate PG9A174H. They have been a family owned and run business with the founder's grandson serving as the President. In 1997 Papillon began air tour operations in southern Nevada operating first at McCarran International Airport and then at the Boulder City Municipal Airport. Over the past 20 years Papillon has grown its southern Nevada helicopter fleet from 2 to 26 (with a total company fleet of 56 helicopters⁶⁰). In 2017, the total passengers transported from Boulder City was over 59,000 people, equating to about 26 flights per day.⁶¹ Papillon states that in total they transport an estimated 600,000 passengers each year on daily tours and employ 600 people.⁶²

In 2009, Papillon built a terminal building at Boulder City Municipal Airport which it shares with its sister company, Grand Canyon Airlines. This facility, which encompasses approximately 30,000 square feet, also serves as the corporate offices for both Papillon and Grand Canyon Airlines. In addition to flying air tour customers, Papillon also operates a courtesy bus shuttle service between Las Vegas hotels and Boulder City to connect its passengers with its flights.

The President and CEO are responsible for all matters related to Papillon. The Director of Operations (DO) maintains overall Operational Control responsibility for company aircraft operations and assists the CEO in all matters pertaining to the development and execution of company policies and procedures. The Director of Safety (DOS) reports directly to the President /CEO and works in concert with the DO for the overall implementation and supervision of the company's air and ground safety programs. The Chief Pilot reports directly to the DO and supervises all flight crew members.

The Lead Pilots report directly to the Chief Pilot and assist in the supervision of flight and ground crewmembers. The Lead Pilots may act for the Chief Pilot in his absence. The Line Pilots report directly to the Chief Pilot. The Line Pilot, the Pilot in Command, is directly responsible and is the final authority on all matters pertaining to the safe operation of the helicopter they command. There were 8 people qualified to give flight training of which 6 were additionally Check Airmen available to do check rides.

The Director of Training reports directly to the Chief Pilot and is responsible for the training of flight and ground crew members.

⁶⁰ Including Bell 206L, 206B, Airbus 350 B2 B3e, MD900, EC130 B4 T2

⁶¹ See Attachment I: Quartermaster Landings (Official Use Only)

⁶² Referenced from <https://www.papillon.com/about-papillon/company-overview> (seen March 2018).

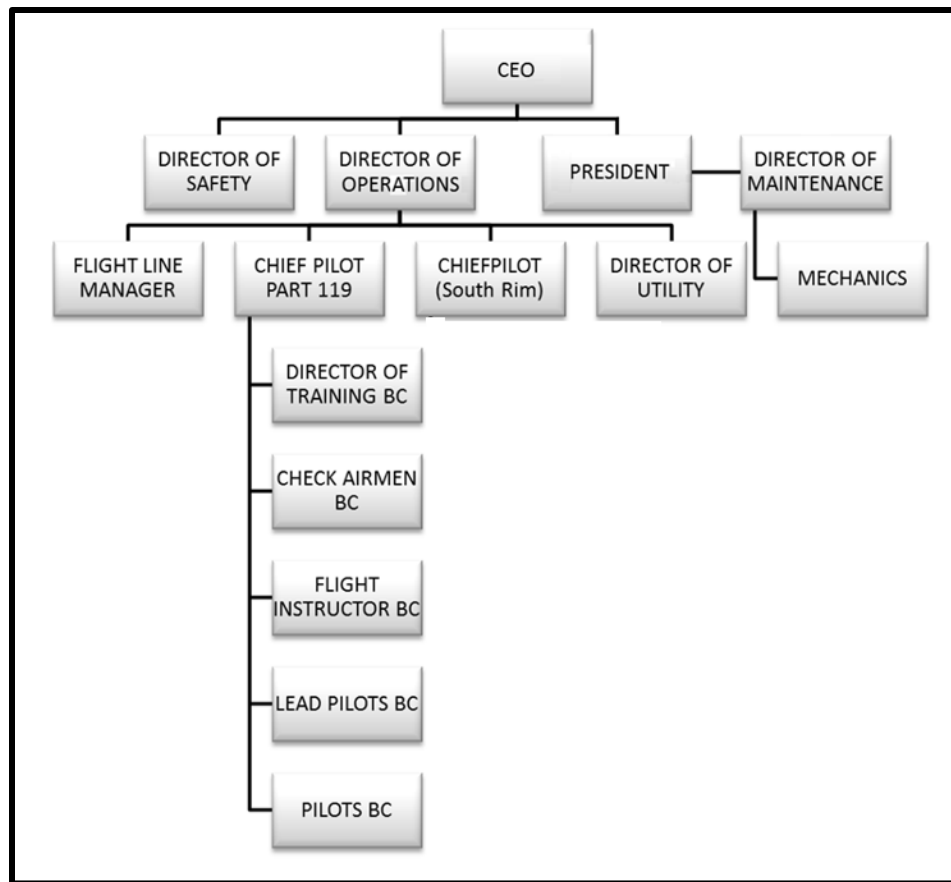


Figure 38: Operational Organizational Chart

6.1 PILOT TRAINING ⁶³

In accordance with 14 CFR Part 135.21(a), Papillon GOM identified training/currency policies.

Papillon Training Program Manual⁶⁴, revision 14, dated April 25, 2017, stated that the manual “provides a framework for the standardization of the training program, it is the standard and is directive in nature.”

After a pilot is hired, he/she will spend approximately 2.5 weeks in initial new-hire training which consists of basic indoctrination training and training for a specific aircraft type. A review of the training manual, section D, disclosed that the following curriculum segments (and hours spent covering those segments), were required:

- Basic Indoctrination: 8 hours
- General Emergency: 2 hours
- Aircraft Ground: 16 hours

⁶³ See the Human Performance Group Factual Report for information about Papillon’s training program.

⁶⁴ See Attachment D: Training Manual

- Aircraft Flight: 4 hours
- HAZMAT: 2 hours
- SFAR 50-2 Ground: 2 hours

The new-hire indoctrination material gives the following agenda:

- First week: ground training, general subjects, aircraft ground school, emergency drills, TOPS, SFRA rules and regulations. Exams at the end of the week.
- Second week: flight training, expect to fly at least once each day, sometimes twice. Keep reviewing course material, prepare for 135 oral and flight evaluation 135.293
- Third week: evaluations followed by route training. One day, complete 2 training runs followed by route check 135.299

Although the minimum flight time of 4 hours is required, pilots usually take between 5-8 hours. The pilot will then take a check ride, and upon successful completion, will begin the SFAR route training. During route training, the instructor teaches the pilots in the classroom using Google Earth. Thereafter, the pilot will have 3 ride-along flights with other pilots to observe a tour. The other pilots will show the new pilots the approaches into Quartermaster and the different landing pads. The pilot will then conduct a flight with a Lead Pilot to demonstrate his/her knowledge and proficiency with the Green 4 route, and approaches at Quartermaster.

According to the Chief Pilot, emergency training does not include settling with power nor do they train for loss of tail rotor effectiveness. Settling with power and loss of tail rotor effectiveness is only ground training.

RECURRENT TRAINING

Recurrent training is defined in the training manual as being for “personnel who have been trained and qualified by the operator and will continue to serve in the same duty position and aircraft type and must receive recurring training or checking within an appropriate eligibility period to maintain currency.”

The training manual states, in pertinent part:

Under the provisions of FAR 135.351(c), recurrent pilot flight training may be substituted by a flight check providing it is documented on the Company 8410. The Check Airman will note: “Check given in lieu of recurrent training” in the remarks section

Additionally, whenever an instructor or check airman signs any training record, certifying accomplishment of any training event, by placing their signature on the training form, they are certifying as to the trainee’s proficiency and knowledge in accordance with 135.323(c).

One purpose of this training program is to provide information and impart skills to pilots leading to the checks required under CFR 135.293, .297 or .299.

For recurrent training, the training manual Section D states that “In accordance with 135.351(c) Recurrent

flight training for pilots must include, at least, flight training in the maneuvers or procedures in this subpart, except that satisfactory completion of the check required by 135.293 within the preceding 12 calendar months may be substituted for recurrent flight training. If this is the case it will be so noted in the remarks section of the Papillon Form.”

The following Curriculum Segments were required:

- Basic Indoctrination: 3 hours
- Aircraft Ground: 4 hours
- Aircraft Flight: 2 hours
- HAZMAT: 1 hour
- SFAR 50-2 Ground: 1 hour

Aircraft Flight included: Confined Areas, Wind shear/Microburst, Loss of Anti-Torque Effectiveness, Settling-With-Power,⁶⁵ SFAR 50-2 Ground in included: Weather Minimums, Altitudes, Routing and Reporting Points. Entry/Exit Points, Communications, Other Company Operations, Aircraft Equipment.

Section D 8 in the training manual outlines the minimum events for a CFR 135.293 VFR competency check to include:

- Settling with power (oral or actual)
- Unusual Attitude Recovery
- Tail Rotor Failure (oral only)
- Anti-Torque System Failure (oral or actual)

A Lead Pilot stated that normally the pilots will receive two hours of flight training followed by a check ride within a few days. If the pilots required more training, Papillon would provide more training without recourse.

Section A of the manual states:

When this check is given by a company check airman and an event or events are found to be unsatisfactory, the check airman will notify the pilot of his unsatisfactory performance. He will then have the option to: a. terminate the check and recommend the pilot for further instruction or b. stop the check at that point, give further instruction in the deficient area(s), as a company instructor, if so qualified, then resume the check. In either case the chosen course of action will be noted in the appropriate event block and “REMARKS” section of the Papillon Form 8410.

⁶⁵ Despite the GOM listing Loss of Anti-Torque Effectiveness and Settling-With-Power in “Aircraft Flight Training,” the Chief Pilot and numerous pilots stated that these subjects areas were covered only in ground training. In a comment reviewing the draft factual of this report, Papillon management stated that pilots are trained and evaluated on emergency procedures for loss of tail rotor effectiveness as evident on the TR7 Initial Training Record under stuck pedal and anti-torque failure and the 8410 under anti-torque failure and settling with power. Papillon additionally stated that “we obviously would not create LTE in the aircraft however we train and evaluate that by practicing the emergency procedure through autorotation or run on landing,” and “whatever cannot be done in the cockpit is evaluated and documented both in the training record and or oral evaluation.”

SETTLING WITH POWER

The training manual Section E-16, discusses the flight training for settling with power:

It should be demonstrated at an altitude of at least 1000 feet AGL or, if applicable, the manufactures recommended altitude, whichever is higher upon completion of the maneuver.

To enter the maneuver, adjust the power to approximately 20% torque while maintaining altitude with aft cyclic, until the airspeed approaches 20 mph. Allow the sink rate to increase to 300 fpm or more as the attitude is adjusted, to obtain an airspeed of less than 10 mph. The aircraft will begin to shudder. Application of additional up collective will increase the vibration.

The manual then gives the two recovery methods and outlines acceptable performance guidelines for the maneuver which includes recovery within 1,000 feet of altitude.

6.2 SAFETY PROGRAMS AND CULTURE ⁶⁶

Papillon management stated that the company prioritizes professionalism and safety in terms of quality of infrastructure, equipment, aircraft maintenance and pilot training. While not required by FAA regulations, Papillon employs a full-time Director of Safety who routinely conducted audits of company operations and administers Papillon's Safety Management System (SMS) program. In addition, Papillon brought in an independent safety auditor each year to assure full compliance with FAA regulations. Papillon was a founding member of TOPS (Tour Operators Program of Safety) whose members abide by strict self-imposed regulations and was also International Standard for Business Aircraft Operations (IS-BAO) certified by meeting an international standard for operational safety.

Papillon required pilots to submit an Irregularity Report if anything abnormal occurred during ground or flight operations or any type of deviation transpired. The reports were electronically submitted on the Flight and Duty Tracker Program and were required to be submitted as soon as practical after an incident occurred, but no later than the end of the day.

☐ Part 135 Flight	☐ Flight Control Malf	☐ Air Conditioning Malf	☐ Flight Altered for Wx
☐ Part 91 Flight	☐ Fire Warning	☐ Smoke in Cockpit	☐ Flight Altered for Maint
☐ Accident	☐ Flameout	☐ Aircraft Damage	☐ Deviate from ATC Inst.
☐ PAX Injury	☐ Gauge/VEMD Malfunction	☐ Chip Light	☐ Overdue A/C
☐ PAX Death	☐ Avionics Fault	☐ Overlimit	☐ Traffic Avoidance
☐ PAX Sick	☐ Elec. Fault	☐ Property Damage	☐ General Hazard
☐ Unscheduled Landing	☐ Fuel Fault	☐ Bird Strike	☐ Inspection Overflight
☐ Landing Lake Mead	☐ Eng Fault	☐ NON-DOD Fuel Vendor	☐ Door Occurrence
☐ SFRA Deviation	☐ Drive Train Fault		☐ Ground Operations
☐ FAR Violation	☐ Hydraulic Fault		☐ MX Recovery Flight

Figure 39: Areas to Report on an Irregularity Report

⁶⁶ See the Human Performance Group Factual Report for more extensive information about Papillon's safety programs.

A review of the 242 Irregularity Reports in the two years prior to the accident disclosed that 109⁶⁷ of the reports were weather related, of which 5 of those pertained to wind. The month prior to the accident a report was filed for an over limit due to a large wind shift at Quartermaster.

The pilot stated that he has never experienced pressure by Papillon to fly when he wasn't comfortable. He felt that he would be backed up on his decisions without question.

OVER-TORQUES

In an attempt to determine if there was a systemic problem with the pilot flying out of the normal flight envelope, investigators reviewed the over-torques the fleet experienced in the two years prior to the accident.⁶⁸ Papillon provided logbook entries for two instances, one of which occurred in the Airbus AS350B3 in February 2017 and the other occurred January 18, 2018 in the EC130 B4.

7.0 FAA OVERSIGHT

Oversight of Papillon's FAR Part 135 operating certificate is accomplished primarily by the FAA Nevada Flight Standards District Office (FSDO) Las Vegas office. There was one assigned Principal Operations Inspector (POI), one Principal Maintenance Inspector (PMI), and one Principal Avionics Inspector (PAI).

The FAA's POI assigned to Papillon reported that he had served in that capacity for 5 to 6 years and been employed with the FSDO for 8 years. Prior to his employment at the FSDO, the POI was the Director of Operations at Heli USA, a tour operator.⁶⁹ He has about 9,200 hours total flight experience in helicopters. He oversees two other operators, Highroll Air, Inc. and 5-Star Helicopter Tours LLC that together have a fleet total of 5 helicopters.⁷⁰ He classified the staffing level at the FSDO as adequate and since the implementation of a "GO-team," his workload has been able to be more focused on his operators because that team handles most of the complaints, accidents, and pilot deviations that are reported to the FSDO. The GO-team will also perform random inspections of his operators.

The POI completes Safety Assurance System (SAS) Data Collection Tool (DCT) inspections, which includes surveillance action items. He stated that over the 2 years prior to the accident he had performed about 16 DCTs. He classified his relationship with Papillon as "excellent," and explained that the company was receptive to suggestions. He has never had any regulatory issues with Papillon.

The POI stated that he had been to Quartermaster on about two occasions in the year prior to the accident. He performs en-route inspections where he will fly as a passenger on a helicopter to observe the operation

⁶⁷ See Attachment R: Pilot Irregularity Report Excerpts

⁶⁸ See Attachment T: Over-torques

⁶⁹ The POI started as a helicopter flight instructor and then became a line pilot. He was promoted to a Chief Pilot and then transitioned to a DO position at Westcor Aviation.

⁷⁰ He has previously been the POI for Maverick and Sundance Helicopters.

of both the helicopter company he is flying with, and the other operators flying in the canyon.⁷¹ He feels supported by his supervisors that he can perform as much surveillance as he thinks is required and would not be questioned about allocating funds toward his requests.

The agreement for operations within the Class G area of the canyon is solely between the tour operators. The POI attends their quarterly meetings, but the agreement is more of a collection of the individual operators declaring to the group what their routing may be for ingress and egress relative to their landing sites, group collaboration of position reporting, etc.

Under FAR 93.325 each certificate holder must submit in writing the total number of commercial SFRA operations conducted for that quarter. Quarterly reports must be filed with the FSDO: (b) Each quarterly report must contain the following information.

- (1) Make and model of aircraft;
- (2) Identification number (registration number) for each aircraft;
- (3) Departure airport for each segment flown;
- (4) Departure date and actual Universal Coordinated Time, as applicable for each segment flown;
- (5) Type of operation; and
- (6) Route(s) flown.

Zoë Keliher
Senior Air Safety Investigator
July 01, 2019

⁷¹ The POI stated that at Papillon he would contact a company Customer Service Representative and get booked on a flight that day, where he would not inform the pilot he was an FAA inspector until immediately before the flight when he asks to see his/her credentials.