

National Transportation Safety Board
Office of Aviation Safety
Washington, DC 20594



WPR21FA143

OPERATIONAL FACTORS/HUMAN PERFORMANCE

Group Chair's Factual Report
October 24, 2022

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A. ACCIDENT

Location: Palmer, Alaska
Date: March 27, 2021
Time: 1835 Alaska daylight time
0235 UTC (March 28, 2021)
Helicopter: Airbus Helicopters AS350B3, N351SH

B. OPERATIONAL FACTORS/HUMAN PERFORMANCE GROUP

Group Chair Shaun Williams
National Transportation Safety Board
Denver, Colorado

Group Chair Katherine Wilson
National Transportation Safety Board
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Group Member Fabian Salazar
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Group Member Mike Newell
Airbus Helicopters
Dallas, Texas

Group Member Sabrina Woods¹
Federal Aviation Administration
Washington, DC

¹ The group chairs were notified on April 10, 2022, that Dr. Woods was no longer with FAA.

Group Member

Gregory King²
Soloy Helicopters
Wasilla, Alaska

C. SUMMARY

On March 27, 2021, about 1835 Alaskan daylight time, an Airbus Helicopters AS350-B3, N351SH, was substantially damaged when it was involved in an accident near Palmer, Alaska. The pilot and four passengers were fatally injured, and one passenger was seriously injured. The helicopter was operated under Title 14 *Code of Federal Aviation Regulations* (CFR) Part 135 as an on-demand air charter flight.

Representatives from the operator reported that the helicopter was contracted by a local lodge to transport passengers from a private residence on Wasilla Lake, Wasilla, Alaska, to the Chugach Mountain Range to conduct heli-ski operations.

D. DETAILS OF THE INVESTIGATION

Wednesday, April 7, 2021

The investigator in charge and operational factors/human performance group chairmen met for a pre-brief in a conference room at the Embassy Suites, Anchorage, Alaska. The investigators conducted an interview with the sole survivor.

Thursday, April 8, 2021

The operational factors/human performance group performed interviews in a conference room located in the Embassy Suites, Anchorage, Alaska. All interviews were recorded for transcription. The group interviewed the Alpha Aviation Director of Operations (flying near the accident location on the day of the accident), Soloy Helicopters Check Airman and Asst. Chief Pilot, Soloy Helicopters Director of Maintenance, and Soloy Helicopters SMS Manager.

Friday, April 9, 2021

The operational factors/human performance group performed interviews in a conference room located in the Embassy Suites, Anchorage, Alaska. All interviews were recorded for transcription. The group interviewed the Alpha Aviation pilot (conducted initial search for, and located, the accident helicopter), Soloy Helicopters Director of Operations, Soloy Helicopters Chief Pilot, Tordrillo Mountain Lodge flight tracker on duty, and Tordrillo Mountain Lodge co-owner (assisted with search).

² The group chairs were notified on August 24, 2022, that Mr. King was no longer with Soloy Helicopters.

The operational factors/human performance group concluded the interviews in Anchorage, Alaska, on April 9, 2021. See attachments 1 and 2 to this report.

Monday, April 19, 2021, and Wednesday April 21, 2021

The operational factors/human performance group conducted interviews of the Federal Aviation Administration (FAA) Principal Operations Inspector and Acting Front Line Manager assigned oversight of Soloy Helicopters at the time of the accident on April 19 via video conference. An interview of the FAA Principal Maintenance Inspector assigned oversight of Soloy Helicopters at the time of the accident was conducted on April 21 via video conference.

In subsequent months, additional interviews were conducted with the pilot's fiancé and persons involved in locating the accident helicopter.

Tuesday, August 22, 2022, and Thursday, August 24, 2022

The operational factors/human performance group chairmen traveled to Alaska and conducted interviews with the TML co-owner (who was also the president of the Heli-Ski US Association), and the vice president of Soloy.

Tuesday, October 18, 2022, and Wednesday, October 19, 2022

The operational factors/human performance group chairs traveled to Alaska and observed the examination of the tail section of the accident helicopter by the airworthiness group on October 18 and looked for any remaining personal effects in the wreckage. On October 19, the group chairs met with Soloy Helicopters to discuss progress on the investigation.

E. FACTUAL INFORMATION

1.0 History of Flight

Data obtained from a handheld global positioning system (GPS) unit showed that the helicopter departed Wasilla Airport about 1440 and arrived at the Wasilla Lake residence about 10 minutes later. About 53 minutes later, the helicopter departed the residence and flew toward the Chugach Mountains. The helicopter arrived at the intended operating area about 19 minutes later and subsequently flew multiple legs from 1612 and 1807.

The GPS data showed that the helicopter departed again at 1827:05 on a northwest heading and climbed to about 5,900 ft mean sea level (msl).

The data showed that the helicopter's final movements began about 1833 over a ridgeline at 6,266 ft msl (about 14 ft above ground level), at a groundspeed of 1 kt. The helicopter maintained a low altitude and groundspeed as it maneuvered over the ridgeline for the next few minutes. The data track ceased at 1836:42 near the final resting point of the main wreckage.

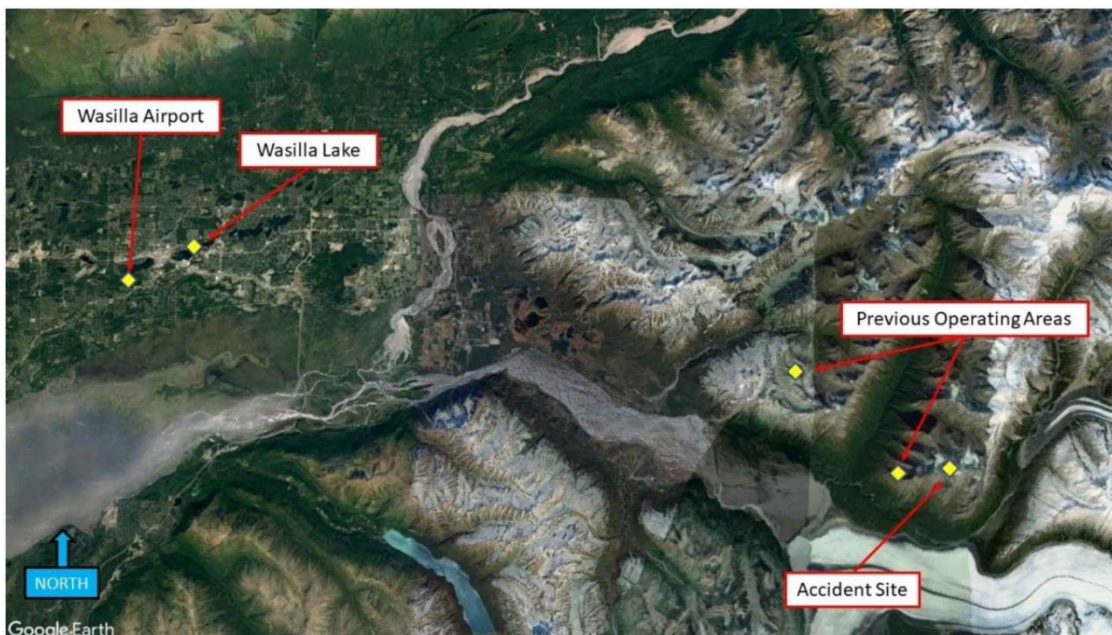


Figure 1: General flight areas from GPS data.

Between 1904 and 1949, an employee at Tordrillo Mountain Lodge (TML), who had been in contact with the accident helicopter during its operations that day, attempted to reach the helicopter with no response. Beginning at 1915, TML personnel contacted another heli-ski operator operating in the area in an attempt to reach the aircraft; at 2034, that operator requested one of its aircraft attempt to locate the wreckage. Soloy Helicopters was notified of the overdue aircraft at 2025 and activated their emergency response plan (ERP) at 2032; the US Air Force Rescue Coordination Center (RCC) was notified at 2052. The wreckage was located by helicopter at 2136.

Aerial assessment of the accident site by a NTSB investigator the day after the accident revealed that the helicopter impacted terrain about 15 to 20 ft below the top of a ridge line. The total debris field extended about 900 ft downslope from the top of the ridge line. The main wreckage came to rest within the debris field on its right side about 500 ft downslope from the initial impact area.



Photo 1: Overview of debris field.

2.0 Pilot Information

The pilot, age 33, held a commercial pilot certificate with rotorcraft helicopter and instrument helicopter ratings. A FAA first-class airman medical certificate was dated February 10, 2021, with no limitations.

A review of the pilot's training records from Soloy personnel records³ indicated that the pilot completed recurrent company training on January 21, 2021, which included the pilot competency check as required by 14 CFR 135.293 and line check as required by 14 CFR 135.299.

A review of the FAA Accident and Incident Data Systems (AIDS), Enforcement Information System (EIS), and PTRS databases indicate no records or reports of any previous aviation incidents or accidents involving the pilot. A review of the National Crime Information Center (NCIC) and National Driver Register (NDR) databases indicated no criminal convictions, and no driver's license suspensions or revocations.

2.1 Pilot's Certification Record

Private Pilot - Rotorcraft Helicopter certificate issued May 30, 2013.

Private Pilot - Rotorcraft Helicopter; Instrument Helicopter certificate issued August 30, 2013.

³ See Attachment 3: Company Personnel Records

Commercial Pilot - Rotorcraft Helicopter; Instrument Helicopter

- First attempt - Notice of Disapproval issued October 31, 2013
 - Practical Test Standards (PTS) Area of Operations VI. Performance Maneuvers
- Second attempt - Certificate issued November 11, 2013

Flight Instructor Rotorcraft Helicopter original certificate issued March 23, 2013

Flight Instructor Rotorcraft Helicopter; Instrument Helicopter

- First attempt - Notice of Disapproval issued April 15, 2014
 - PTS Area of Operations IV. Flight by Reference to Instruments
 - PTS Area of Operations VIII. Instrument Approach Procedures
- Second attempt - Certificate issued April 19, 2014
- Reissued April 26, 2016; April 21, 2018; April 21, 2020

2.2 The Pilot's Training and Proficiency Checks

Date of Hire	February 2, 2019
Basic Indoctrination Ground Training	February 6, 2019
AS350 Initial Aircraft Training	February 7, 2019
Recurrent Ground Training	January 21, 2021
AS350 Recurrent Aircraft Training	January 21, 2021
Most Recent AS350 135.293(a) & (b)	January 21, 2021
Most Recent AS350 135.299	January 21, 2021

2.3 The Pilot's Flight Times

The pilot's flight times, based on Soloy personnel records and company flight and duty records, were as follows:

Total pilot flying time	3286.4 hours
Total helicopter	3286.4 hours
SE helicopter PIC	3230.1 hours
Total AS-350	1505.8 hours
Total Alaska time	178.2 hours
Simulated Instrument	59 hours
Heli-ski	105.8 hours

2.3.1 Pilot Flight and Duty Times

Flight and duty records showed an assigned duty period of 0700-1800 from February 19 through March 23, 2021, except February 20-22 when he had an assigned duty period of 0800-1800.

From March 1-23, 2021, the records indicated the pilot flew 46 hours and his total for calendar year 2021 was 78.2 hours.

2.3.2 Pilot Recent Activities

On March 22, 2021, the pilot was working with Chugach Powder Guides (CPG) when he received the call about the job which included flying the accident flight. He was required to get a COVID test, and his fiancé thought he was home on March 25, and possibly on March 24 as well. His exact wake time on March 24 was not known but he received an incoming cellular telephone call at 0843 that lasted 11 seconds. He had an extended break⁴ in cellular telephone activity from 1007 until 1109, 1224 until 1548, 1716 until 1833, and 1902 until 2002. The last activity on his cellular phone was an outgoing text message at 2002. The time he fell asleep was unknown.

His fiancé was not sure what time he woke up on March 25, but cellular telephone records indicated an outgoing multimedia message at 0753. His activities that day consisted of getting a COVID test⁵ and running errands. There were extended breaks in cellular telephone activity from 1044 until 1148, 1200 until 1331, 1746 until 1846, and 1849 until 2001. Cellular activity ended at 2007. His fiancé thought he went to bed early, between 2130 and 2200, because he had to drive to Wasilla in the morning.

On March 26, his exact wake time was unknown, but his fiancé thought he would have gotten up by 0600 to shower and have breakfast before driving to Wasilla, which was over an hour drive. He flew that day with the same guides and passengers onboard the accident flight. Cellular activity began at 0803 with an outgoing text message. There were extended breaks in cellular activity from 0803 until 0928, 1026 until 1240, 1257 until 1455, 1456 until 1959, and 2049 until 2215. At 2016, he spoke with his fiancée and told her he was leaving work and going to his hotel room. A text message recovered from his cellular telephone indicated he had a dinner reservation at 2100. He spoke with his fiancée at 2215 and told her he was in bed. Cellular telephone activity ended at 2220.

On March 27, the pilot's exact wake time was unknown. Cellular telephone activity began at 0707 and there was a break in activity until 0811 when he called his fiancée to ask if she wanted to hang out that day because there was a weather delay; he also told her he had already performed the preflight of the accident helicopter. There were extended breaks in cellular telephone activity from 0707 until 0811, 1045 until 1342 and 1610 until 1748. His fiancé said they sat in the breakroom at the hangar and the pilot talked back and forth with the guides about the weather and he checked

⁴ An extended break in activity is defined as 1 hour or more of no outgoing phone activity (text messages or phone calls) or incoming calls lasting 30 seconds or more.

⁵ Flight and duty time records for the accident pilot provided by Soloy indicated "Covid test and Phone calls with TML, Third" on March 24, 2021.

the weather on his phone and on a computer in the breakroom. There was nothing unusual about the pilot that day. He was happy and they had a great day. The pilot departed from the Wasilla airport about 1440. She received a call from the pilot at 1748 and 1750 because their home alarm had activated. They did not discuss anything about the flight, and she thought he might have been at the bottom of the glacier when he called because it sounded "a bit windy". The last outbound cellular telephone activity was at 1754.

2.3.3 Pilot Medical and Pathological Information

Toxicology tests performed by the laboratory at FAA Forensic Sciences on specimens from the pilot tested negative for a wide range of drugs, including major drugs of abuse. For additional information, see the Medical Factors Specialist Report.

3.0 The Helicopter

The accident helicopter, N351SH, was a 2011 model Airbus Helicopters AS 350-B3. A Safran Arriel 2B1 turbo-shaft engine was installed on the helicopter.

The helicopter was configured so that the pilot flew from the front right seat. A passenger seat was in the front left seat position and there was a bench with four seating positions located in the cabin.

For more information pertaining to the helicopter, see the Airworthiness Group Factual Report.

3.1.1 Weight and Balance

No record of a completed weight and balance calculation was located with the helicopter wreckage. A screen shot of a load manifest was taken which showed the weights of the passengers and gear but did not include fuel or the weight of the pilot. Section 3 of the Soloy Operations Manual states that the PIC shall determine, before each takeoff, that the aircraft is loaded within weight and balance limits, and that it will remain within these limits throughout all flight operations.

Passenger and cargo weights were provided by the operator:

Basic Operating Weight	2873 lbs
Pilot	218 lbs
Passengers	1013 lbs
Fuel (FOB)	382 lbs (Estimate from company pilot)
Basket/Gear	135 lbs
Survival gear	90 lbs

The estimated gross weight of the helicopter at the time of the accident was 4,711 pounds.⁶

Title 14 CFR 135.63(c) requires only operators of multi-engine aircraft prepare and retain load manifests.

4.0 Company Overview

Soloy Helicopters LLC was a 14 CFR Part 135 air carrier that held rotorcraft on-demand operations specifications. At the time of the accident, Soloy Helicopters was operating 17 helicopters, as documented on Operations Specification paragraph D-085. The company employed about 20 pilots, some of which were seasonal. In addition to the Part 135 authorization, Soloy also conducted operations under Parts 133 and 137.

4.1 Operations Management

The Soloy Helicopters LLC General Operations Manual (GOM), section 1, described the company's organization, including the duties and responsibilities of managers.⁷ The GOM identified the Part 119 required management personnel. No organizational chart was contained within the GOM.

4.1.1 Director of Operations

The GOM stated that the director of operations (DO) was responsible for the flight operations of Soloy Helicopters and exercised operational control of company flight operations. Additionally, it stated that he "shall supervise and direct the chief pilot and director of maintenance," and that would assume the duties of those positions in the absence of those personnel.

In an interview, the DO stated that his duties and responsibilities included "oversight of the 135 operations" and maintaining operational control. While not directly responsible for training, he stated that he oversaw the chief pilot's duties and responsibilities, which included the execution of the training program.

4.1.2 Chief Pilot

The GOM stated that the chief pilot was responsible for training and preparing company pilots for their duty assignments. This responsibility included administering the company training program, scheduling pilots, and maintaining pilot qualification records.

⁶ See Attachment 4: Weight and Balance Information.

⁷ See Attachment 5: GOM Excerpts.

5.0 Operational Control Concepts and Procedures

5.1 Operations Specifications Paragraph A008, Operational Control

A 14 CFR Part 135 operator must have a system and/or procedures for the control of flight movements. The intent of Operations Specification A008 was to promote a mutual understanding between an operator and the FAA concerning the system and/or procedures used by that operator.

The Operations Specifications paragraph A008 (Operational Control) valid at the time of the accident was digitally signed by the FAA principal operations inspector (POI) and issued to Soloy Helicopters on February 8, 2019.⁸ Subparagraph A stated "The system described or referenced below in this subparagraph must be used by the certificate holder that conducts operations under 14 CFR Part 135 to provide operational control for its flight operations. The essential elements of operational control described in subparagraph d below must be included or described in that system." The space available on the operations specification for the system to be described or referenced was absent of any text.

FAA Order 8900.1, Volume 3, Chapter 18, Section 3, stated, in part:

The descriptions of the systems and/or procedures for controlling flight movement as described in the operator's manual and referenced in the OpSpecs, or as narratively described in the OpSpecs, should include the following information, as appropriate, to the kind of operation:

- *Methods and procedures for initiating, diverting and terminating flights;*
- *Persons or duty positions authorized to, and responsible for, exercise of operational control;*
- *Facilities and location of facilities used by the operator in the exercise of operational control;*
- *Communication systems and procedures used by the operator;*
- *Special coordination methods and/or procedures used by the operator to assure the aircraft is Airworthy; and*
- *Emergency notification procedures.*

5.2 Title 14 Code of Federal Regulations Part 135, Sec. 119.77

Title 14 CFR 135.77, Responsibility for Operational Control stated, in part:

⁸ See attachment 6: Operations Specification A008

Each certificate holder is responsible for operational control and shall list, in the manual required by §135.21, the name and title of each person authorized by it to exercise operational control.

Section 1 of the Soloy Helicopters GOM listed management personnel by name, to include the director of operations, chief pilot and director of maintenance. Only the director of operations had operational control as a listed duty, responsibility or authority under section 1.

Section 2 of the Soloy Helicopters GOM, titled *Operational Control Principle*, only discussed the director of operations having operational control. No chain of command or other list of authorized personnel was located within section 2.

When the DO was asked about a list of individuals with operational control, he stated that he was the only person on the list, but he could delegate it to the CEO, even though he said that the ability for him to accept that responsibility was not listed in the GOM or operations specifications.

One statement, located under *Flight Assignment Procedures* stated that “[a] qualified Flight Locator may accomplish these flight assignment tasks either by delegation from the DO or in the temporary absence of the DO.” The term “flight locator” was not defined within the GOM and no personnel names were associated with this position.

5.3 FAA Guidance for Inspectors for Operational Control

5.3.1 FAA Order 8900.1 Summary of Operational Control

FAA Order 8900.1, Volume 3, Chapter 25, Section 5, 3-2029, K, states, in part:

Only approved persons may exercise operational control on the certificate holder’s behalf.

The certificate holder must have adequate controls in place to ensure that officials in a position of authority over flights conducted under the certificate do so safely, and in compliance with the regulations, OpSpecs, GOM, as applicable, and accepted or approved procedures.

Management of operations should never be inattentive, distracted, or careless. Hands-off management is not a legitimate excuse for failing to maintain operational control.

5.3.2 FAA Order 8900.1 Operational Control Failures

FAA Order 8900.1, Volume 3, Chapter 25, Section 5, 3-2029, F, states, in part:

The level of severity of the failure in operational control will dictate the actions required by both the certificate holder and the FAA. Simple cases may require reinforcement or realignment of management structure or procedure. In such cases, administrative action may be acceptable. In more pronounced cases, civil penalty and/or certificate action may be appropriate.

The FAA has identified several failure modes of operational control, including at least the following basic conditions:

- 1) Loss of operational control within the air carrier—hands-off management results in inadequate controls over its own operations.*
- 2) Loss of operational control within the air carrier—exercise of operational control by an unapproved person.*
- 3) Loss or surrender of operational control externally; e.g., an air carrier's illegal renting/franchising-out the use of its air carrier certificate to one or more uncertificated entities.*

According to the POI assigned to Soloy Helicopters at the time of the accident, flight locating was a part of operational control. When asked about a list of operational control delegates and where that list was contained, she stated, "it's in their GOM" and only the individuals listed in the GOM could have operational control, with the exception of the pilot who was delegated operational control and the person with whom a company flight plan may be filed when in a remote location.

5.4 Flight Locating

Title 14 CFR did not contain a definition of "flight locating." The NTSB requested the FAA provide a definition or clarification of the term.⁹ The FAA stated that flight locating is not defined but procedures are required to be established by §135.79 for locating each flight for which an FAA flight plan is not filed. The regulation specified these procedures:

1. Provide the certificate holder with at least the information required to be included in a VFR flight plan.

⁹ See attachment 7: FAA Flight Locating Definition

2. Provide for timely notification of an FAA facility or search and rescue facility, if an aircraft is overdue or missing.
3. Provide the certificate holder with the location, date, and estimated time for reestablishing communications, if the flight will operate in an area where communications cannot be maintained.

The regulation also required that flight locating information be retained at the certificate holder's principal place of business, or at other places designated by the certificate holder in the flight locating procedures, until the completion of the flight. Further, the regulation required each certificate holder to furnish the representative of the Administrator assigned to its certificate with a copy of its flight locating procedures and any changes or additions unless those procedures are included in a manual required by §135.21. This regulation (§135.21) required that such a manual must be used by the certificate holder's flight, ground, and maintenance personnel in conducting its operations.

FAA Order 8900.1 contained guidance for determining the acceptability of a certificate holder's flight locating procedures. It echoed the requirements of §135.79 and expounded on them with regard to use of contractors and training requirements for those designated to exercise operational control.

5.4.1 FAA Order 8900.1 Flight Locating Guidance

FAA Order 8900.1 contained guidance for determining the acceptability of a certificate holder's flight locating procedures. One component of this required the operator's notification of an overdue or missing aircraft be at least as prompt as notifications provided by FAA procedures and facilities. It echoed the requirements of §135.79 and expounds on them with regard to use of contractors and training requirements for those designated to exercise operational control.

FAA Order 8900.1, Volume 3, Chapter 25, Section 5, Paragraph 3-2023 stated that when operations were conducted in an area in which radio contact cannot be maintained with ATC, the individual authorized to exercise operational control must be provided with the location, date and estimated time at which the PIC will reestablish radio or telephone communications. The Order stated that operators should maintain sufficient records to show compliance with these requirements.

This section of the Order also stated that Part 135 operators may contract with other operators or organizations to perform direct operational control functions, but the operator remains fully responsible for ensuring compliance with 14 CFR, the operator's GOM and safe operating practices. The name of each employee of the contractor authorized to perform these functions for the operator must be placed in the operator's GOM.

Regarding training, the Order stated that operators are responsible for ensuring that individuals authorized to exercise operational control are adequately trained to perform their assigned duties and knowledgeable of, and have access to, appropriate sections of the operator's GOM while performing their assigned duties.

No record was located during the investigation that showed Soloy Helicopters or the FAA requested a deviation or waiver from the requirements set forth by FAA Order 8900.1 for manual acceptance.

5.4.2 N351SH Flight Locating

The acting front line manager (FLM) for the Anchorage Flight Standards District Office (FSDO) at the time of the accident stated in an interview that his interpretation of flight locating would be "someone sitting at a screen, watching you progress through some means, whether it's radar, whether it's Spidertracks, DZM, Spot, inReach, whatever. And that is usually associated with either periodic check-ins, you know, ops normal kind of things, or an actual person sitting there watching." He defined the term flight following as someone staring at a clock, waiting for the ETA to go by and activating the "overdue aircraft sequence protocol." When asked, he stated that flight following was required by regulation.

The Soloy GOM defined remote area operations as "any operations that require the pilot to be away from the principal base of operations for more than two consecutive duty days" and requires the pilot in command to contact the principal base of operations at least once every seven days. When asked how flight locating can be performed if Soloy is only contacted every seven days, the POI said that a company flight plan could be filed with camp personnel. Although she stated that flight locating was considered a part of operational control, she said that the persons responsible in the camp performing that operational control task need not be named in operations specification A008 or the GOM.

When the DO was asked what time the accident flight was due back to Soloy, he stated that he did not have that information because the flight plan was not filed with Soloy, but rather with TML. He was then asked how Soloy conducted flight locating if he did not know when the flight was due back, to which he explained that Soloy was not conducting the flight locating for the accident flight. He stated that the flight planning was being conducted by TML, so Soloy was not conducting minute-to-minute flight locating. He compared it to an FAA filed flight plan and stated that Soloy would not conduct flight locating, but rather the FAA. He said determining if the helicopter was overdue fell to the lodge and not Soloy.

TML assigned a heliski guide to be “on radio communications and flight following for dispatch for the lodge” the day of the accident.¹⁰ The flight follower was in communication with the guides aboard N351SH throughout the day of the accident which was documented on a TML radio/event log. See attachment 8 for a timeline of events related to N351SH the day of the accident.

The DO was notified by TML about 2025 that the helicopter was considered overdue but did not notify the RCC until 2052. When asked about the delay he stated that he did not know if the helicopter was overdue per the Soloy GOM or only with TML’s flight locating.

5.4.3 Summary of Other Alaska Operators Flight Locating/Flight Following Procedures

The operational factors/human performance group chairmen visited three operators that performed heli-ski and/or remote operations in the Alaska region to better understand their flight following practices. All aircraft at all operators had a flight locating/flight following system installed but the specific system used varied. All pilots at all operators carried either a satellite phone or inReach device or both. All operators also had a SMS although none participated in the FAA’s voluntary SMS program. Regarding performing a risk assessment, pilots at operators 1 and 3 were required to complete a risk assessment for each day; pilots at operator 2 completed a risk assessment prior to each flight. Regarding flight following, operators 1 and 3 had a staff dedicated to performing active flight following duties of all flights, whether departing from base or operating remotely. Pilots at operator 1 were required to check in with base every 30 minutes as well as before every takeoff and after every landing; pilots at operator 3 did not have to check in with base every day depending on the type of operation and if the contractor was performing flight monitoring duties. Operator 2 did not actively flight follow its aircraft and pilots were not required to check in with base; most flights performed by operator 2 were no more than 2 legs and/or 3 hours in duration.

6.0 Pilot Training Program

6.1 Ridgelines

FAA Order 8900.1, paragraph 3-1255 *Part 135 PIC/SIC Flight Training (All Training Categories) - Helicopters* listed certain maneuvers that “must be conducted for satisfactory completion of each category of flight training.” It further stated that pilots in command must complete training in each training event contained in table 3-68 of the same paragraph. One area directly related to the accident was unprepared site operations: ridgelines. Training for ridgelines was listed in the Soloy training

¹⁰ See Attachment 8: Timeline of Events.

program for the Bell 205 only. Soloy did not include this required training in the AS350 and H500 training programs. The accident pilot was not qualified in Bell 205 and a review of his training records did not identify him receiving this training. FAA oversight did not identify that the required item was not included even though paragraph 3-1255(B) *Training Emphasis Considerations* stated that a POI should ensure that the certificate holder's flight training emphasized operations in various environments such as mountainous areas.

6.2 Inadvertent Instrument Meteorological Conditions (IIMC)

FAA Order 8900.1, Paragraph 3-1255(B) *Training Emphasis Considerations* stated that for all helicopter pilot training programs, emphasis should be applied to avoidance and recovery from IIMC encounters, the loss of adequate surface or horizontal reference in VFR conditions, the application of the certificate holder's controlled flight into terrain avoidance (CFIT-A) program, and avoidance of whiteout, brownout, and flat-light.

Paragraph 3-1256 *IIMC TRAINING* stated, "All helicopter pilots operating under part 135 must be trained on procedures for the avoidance and recovery from IIMC. Inspectors will evaluate the certificate holder's operational procedures for recovery from IIMC and ensure these procedures are incorporated into the certificate holder's initial, transition, upgrade, and recurrent training curriculums. Training should emphasize the identification of circumstances likely to lead to IIMC encounters and encourage the pilot to abandon a planned flightpath or route to avoid continued VFR flight into deteriorating conditions."

A review of Soloy Helicopters' FAA approved training program revealed that IIMC training was not contained within the document. Page 6-5 contained a module titled Abnormal and Emergency Procedures which contained the following elements:

- Maneuvering by Instruments - applicable when aircraft is equipped with navigational radios
- Controlled flight by reference to instruments
- Intercepting and tracking a course
- Recovery from unusual attitudes

Page F-21 (AS350) of the maneuvers guide of the approved training program had a module titled Maneuvering by Reference to Instruments and stated, "The objective is to provide practice in the methods and procedures of maneuvering the aircraft by instruments and to recognize and recover from unusual attitudes." It was applicable to cruise flight, straight and level flight, standard rate turns, navigation and unusual attitudes.

A review of the pilot's flight training records found that IIMC training was satisfactorily completed on January 21, 2020, on a H500 flight that was 1.0 hours; comments stated "T/R failures, autorotations, emergency ops" and it could not be determined what specifically was trained regarding IIMC. Additionally, the training form was signed only by the instructor, but not the pilot. There was no other record of IIMC flight training for the pilot. It was marked as "not done" during initial training in 2019.

IIMC was included in the Soloy CFIT-A manual which was not an approved document. A CFIT-A exam that covered IIMC topics that had been completed by the pilot was provided to the NTSB during the investigation. The chief pilot stated in an interview that the exam was not an annual exam, but rather it was given to a new pilot when they were first hired. After that initial exam, subsequent training was discussion based with no exam.

FAA oversight did not identify any training issues despite the fact that the program did not contain all the elements required by the FAA. The DO said in his interview that they did not accomplish CFIT-A flight training and the only IIMC flight training was unusual attitudes.

6.3 Pilot Testing Requirements

14 CFR §135.293(c) states, in part: "Each competency check given in a rotorcraft must include a demonstration of the pilot's ability to maneuver the rotorcraft solely by reference to instruments. The check must determine the pilot's ability to safely maneuver the rotorcraft into visual meteorological conditions following an inadvertent encounter with instrument meteorological conditions. For competency checks in non-IFR-certified rotorcraft, the pilot must perform such maneuvers as are appropriate to the rotorcraft's installed equipment, the certificate holder's operations specifications, and the operating environment."

FAA Order 8900.1 Paragraph 3-1256 states, in part: "Recovery from IIMC is an emergency maneuver since the pilot would be operating under VFR prior to the IIMC. The recovery from IIMC must include attitude instrument flying, recovery from unusual attitudes, navigation, ATC communications, and at least one instrument approach, if the helicopter is appropriately equipped.... IIMC training should include visual cues and unusual conditions, which should prompt pilot action to avoid an IIMC encounter and pilot reaction plans to divert, land, or initiate an emergency transition to IFR as appropriate to the situation."

According to interviews and provided documentation, Soloy used FAA form 8410-3 for the conduct of the competency check. This form was issued in 1981 and does not include more recent training requirements necessitating the instructor to document in the remarks section that the additional required training items are

completed. The POI stated that the 8410 was not a checklist, but rather a report of performance. She did state however, that the 8410 contained all the required items for the competency check and all required items in FAA Order 8900.1, Table 3-71. Documentation provided by Soloy did not indicate in the remarks section that any additional required items were performed.

The Soloy DO indicated that Soloy did not have the capability of conducting precision or non-precision approaches, so the only inadvertent IMC training that was typically conducted as part of the competency check was unusual attitudes. The chief pilot also stated that only unusual attitudes were checked on the 135.293(b) check because Soloy did not have any IFR aircraft capable of IFR approaches.

The POI stated she did not believe IMC recovery was a required item and what she described as being acceptable "maneuvers" were not being accomplished by Soloy. She further stated that IMC recovery training could be a tabletop exercise.

The acting FLM stated: "There is the whole Note 4 on Table 3-71 that is specifically addressing inadvertent IMC, and unusual attitudes is a separate task outside of inadvertent IMC. "

FAA Order 8900, Table 3-71, required IMC Recovery in the helicopter. The associated note 4 stated, "This event must include attitude instrument flying, recovery from unusual attitudes, navigation, air traffic control (ATC) communications, and at least 1 instrument (if aircraft is so equipped) approach appropriate to circumstances." The accident helicopter had the ability to conduct GPS approaches using the installed Garmin Aera 660 GPS. Although the Garmin Aera 660 was VFR only, it had IFR capabilities with instrument approach procedures in its database.

The chief pilot stated that on a previous check he did with the POI, she had him set up a GPS approach, turn the helicopter around and head toward Anchorage. During the flight, she asked about his next steps and contacting ATC.

FAA oversight and check airman observations failed to identify that the additional required items (e.g., recovery from IIMC, navigation, ATC communications and an instrument approach) were not being evaluated on the observed checkride.

No record was located during the investigation that showed Soloy Helicopters or the FAA requested a deviation or waiver from the requirements set forth by FAA Order 8900.1 for manual approval.

7.0 Flight Risk Assessment

Soloy Helicopters used a risk assessment worksheet to calculate the risk of a mission. The worksheet was accessible to the DO and chief pilot who would complete the form then discuss the risks and mitigations with the pilot when assigned to the job. According to post-accident interviews conducted with the Soloy director of safety and DO¹¹, the risk assessment worksheet was not completed daily or for each flight; for heli-ski operations, the risk assessment worksheet was completed for the season because the scope of the operation did not change daily. Any day-to-day safety determination was at the discretion of the pilot.

Reference to the risk assessment worksheet was found in the Soloy GOM but pertained to human external cargo operations; there was no reference to the worksheet in the Soloy Training Manual or Operations Specifications.

Soloy provided the following risk assessment worksheet, dated January 21, 2021, that was applicable to the accident flight. Risk values were added to provide an initial risk value and then the risk value could be reduced with control measures. According to the DO, the values used to reduce the risk were not documented on the form but were rather subjective values provided by the person completing the form because there was “no quantifiable way to say how risky some of these situations are on a 1-to-10 scale.” The NTSB noted that the initial risk value on the form provided was 82, however, the risk values when added was 68 before subtracting the risk reduction values. According to the DO, the difference in numbers was due to a formatting issue on the PDF form.

¹¹ See attachment 2 to this report.

SOLOY HELICOPTERS RISK ASSESSMENT WORKSHEET DATE: 01/21/2021 JOB: CPG PILOT: Russel

(1) CUSTOMER RELATIONSHIP	RISK	
SHORT DURATION < 1 WEEK	2	
LONG DURATION > 1 WEEK	5	

(2) MISSION PLANNING	RISK					
MISSION BRIEFING PLANNING TIME	> 12 HRS OPTIMAL	2-11 HRS ADEQUATE	< 2 HRS MINIMAL			
VAGUE	5	6	8			
SPECIFIC	1	2	3			

(3) JOB TYPE (Check all that apply)	RISK	
TRAINING FLIGHTS	1	
AIRPORT TO AIRPORT	1	
SURVEY / CREW MOVEMENTS	2	
FULL SHUTDOWN PASSENGER LOADING	1	1
HOT LOADING PASSENGERS	3	3
TOE IN OR HOVER EXIT	7	7
SINGLE PILOT	3	3
MULTI CREW CRM	2	2
MULTI HELI PROJECT	4	4
EXTERNAL LOADS NON-PRECISION	3	
EXTERNAL LOADS PRECISION	5	
FORESTRY / WATERBUCKET	5	
HELISKI	5	5
SEISMIC	5	
GAME CAPTURE	7	
HEC	8	
SHIPBOARD	8	
GEOPHYSICAL SURVEY	7	
SURVEY HEIGHT <100FT OR SPEED <40kts	5	
SURVEY TRANSIT HEIGHT >500 AGL	2	

(4) ADDITIONAL MISSION FACTORS	RISK	
SAND / SNOW / DUST	2	2
MTN OPS < 5000 FEET	2	
MTN OPS > 5000 FEET	5	5
HOVER OUT OF GROUND EFFECT CAPABLE	2	2
HOVER OUT OF GROUND EFFECT NOT CAPABLE	7	
NONHOSTILE ENVIRONMENT OGP LANDING AREA	1	
HOSTILE ENVIRONMENT OGP LANDING AREA	4	
TEMPERATURES > 0 DEGREES	3	
TEMPERATURES < 0 DEGREES	5	5
OVERWATER OPS (PILOT DUNKER / HEED)	3	
OVERWATER OPS (PILOT NOT DUNKER / HEED)	5	
HIGH WORKLOAD ENVIRONMENT (ATC)	5	
FLAT LIGHT / WHITEOUT	5	5
HIGH GROSS WEIGHT	5	5
NIGHT OPS	5	

(5) WEATHER	RISK			
FLIGHT CONDITION	> 1000 / 3		< 1000 / 3	
DAY / VFR	1	1	5	5
NIGHT / VFR	3		9	
NORMAL SEASONAL WEATHER PATTERNS	2		2	
ABNORMAL SEASONAL WEATHER PATTERNS	7			

(6) PIC EXPERIENCE LEVEL TIME IN TYPE	RISK	
< 50 HOURS	5	
> 50 HOURS	2	2

(7) REGENCY OF EXPERIENCE (TIME SINCE TASK LAST PERFORMED)	RISK	
< 12 MONTHS	2	2
> 12 MONTHS < 24 MONTHS	5	
> 24 MONTHS OR NEVER	8	

(8) FLIGHT TIME LIMITS	RISK	
OGP	2	
FAA 135	4	
FAA 133	8	

(9) DAY OFF SCHEDULE	RISK	
OGP	2	
OAS / FAA SPLIT	2	
FAA LUMPED	4	

(10) QUALITY OF REST (MIN 10 HOURS)	HOURS OF REST IN THE PAST 24 HOURS	
NORMAL QUARTERS	1	1
FIELD OR > 2 PER ROOM	5	

(11) SECURITY AND MAINTENANCE SUPPORT	RISK	
AIRPORT SECURITY OR FENCED IN PARKING	1	1
UNSECURE LOCATION FOR AIRCRAFT PARKING	4	
ONSITE MECHANIC DEDICATED TO AIRCRAFT	1	1
HANGAR SUPPORTED AIRCRAFT MAINTENANCE	3	

(13) EMERGENCY RESPONSE PROCEDURES AND FLIGHT FOLLOWING	RISK	
EMERGENCY RESPONSE < 2 HRS	2	2
EMERGENCY RESPONSE > 2 < 24 HRS	5	
EMERGENCY RESPONSE > 24HRS	7	
ACTIVE TRACKING RESPONSIBLE PARTY	2	2
FAA/CUSTOMER FLIGHT PLAN WITH ETA	4	

- 5 STEP RISK MANAGEMENT PROCESS**
1. Identify the hazard and associated risks.
 2. Assess the risks (what is the worst thing that can happen?).
 3. Identify controls to reduce the risks.
 4. Implement the control measures.
 5. Supervise the operation and assess effectiveness of the control measures.

HAZARD RISK CLASSIFICATION		
LOW: 1-4	MEDIUM: 5-7	HIGH: 8-10
LOW: 0-49	MEDIUM: 50-79	HIGH: 80+

RISK ASSESSMENT OF THIS MISSION		
ADDITIONAL CONTROL MEASURES DISCUSSED	INITIAL RISK NUMBER	82
1.		
2. second year in the local area of ops		-10
3. winter ops experience and additional training prior to		-4
4.		
5.		
6.		
7.		
REDUCED RISK NUMBER		68

I will notify either the Dir. of Ops or Chief Pilot of any recent MAJOR PERSONAL EVENTS (divorce, marriage, death, family illness, etc.) to discuss if flight scheduling should be modified to ensure maximum job safety.

SIGNATURE OF PIC Zach Russel
 LOW/MEDIUM: Chief Pilot, Dir. of Ops
 HIGH: Chief Pilot, Dir of Ops, President **TWO SIGNATURES REQUIRED**
 APPROVAL AUTHORITY Robert Gideon, John Baechler

Figure 2. Soloy Helicopters Risk Assessment Worksheet.

8.0 FAA Oversight

8.1 Principal Operations Inspector

The POI at the time of the accident had been employed with the Anchorage Flight Standards District Office since 2016 and became the POI for Soloy in 2018. Prior to her employment with the FAA, she served as the chief pilot at Soloy Helicopters when it was started in 2011 until she left the company in 2013. At the time of the accident, she was responsible for the oversight of seven Part 135 certificates.

When asked if there were any special ethics reviews prior to becoming the POI for a company she previously worked for, she stated that since she had left Soloy in 2013, there were no conflicts for accepting the assignment. She said the FAA had specific policies regarding a former employee becoming a principal inspector for that same company and thought it was 2 years at one point, but that it had been reduced to 1 year. No record of this policy was located during the investigation.

8.2 Pre-Accident Surveillance Activities

When the POI was asked about the last time she visited Soloy, she stated that she was not sure but thought about a year before, possibly for a check airman observation. She then stated that she conducted a flight operations observation, to include operational control and flight locating in December of 2020 and an operational control inspection during the 3rd quarter of 2020.

A records request was submitted to the FAA requesting any inspection records for three years preceding the accident. Safety Assurance System (SAS) records for a time frame from September 11, 2018, to June 16, 2021, revealed the completion of 13 surveillance assessments. Of those 13, 12 had a status of "AAA/Closed" and contained an assessment determination of no issues or findings. One record contained an assessment determination of "MinorNonRegulatory" and a status of "AAA/ClosedPendingAction." During the same time frame, 6 surveillance assessments listed the assessment state/status as "Complete/AutoClosed." All 6 of those had an assessment determination justification of "system automatically closed the assessment because it was overdue and not in AAA ready status." One was due September 30, 2020, three were due December 31, 2020, and two were due March 31, 2021. Additional records obtained showed that the POI visited Soloy on November 14, 2019, and again on October 30, 2020, to conduct check airman surveillance and line checks.

She stated that she had not observed any remote operations, either announced or unannounced and did not observe any heli-ski operations as a POI. When asked about the heli-ski operations, she said she observed them as an employee for Soloy, but not as POI. When asked about enlisting other FAA inspectors to conduct

surveillance of Soloy, she said she had asked other inspectors to conduct checkrides on her behalf.

Following the accident, and as of April 19, 2020, the POI said there had been no additional surveillance of Soloy and the FAA had not requested any changes to operational procedures. In addition, during her time as the POI over the Soloy certificate, she did not recall making any recommendations to Soloy for changes to their manuals or procedures.

8.3 Post-Accident Activities

The NTSB obtained email correspondence, dated June 9, between the POI and the Anchorage FSDO Office Manager in which the POI stated she met with Soloy personnel on May 28, 2021, and discussed company flight plans, standardized tracking installations and monitoring of operations, reviewed ELT installation and operation and reviewed flight locating procedures;¹² there was no additional documentation related to this visit. When asked about the visit, the Soloy vice-president did not recall meeting with the POI, the director of operations could not recall meeting with her and could not find any records on his schedule of a meeting, and the chief pilot stated that she was there, but only to introduce a new POI and that there were no discussions regarding operational control or flight locating.¹³ Soloy personnel recalled the new POI had visited and met with the DO and chief pilot for check airmen observations, but the POI was there only for introductions to the new POI.

The FAA email correspondence, dated June 9, also stated that a new POI completed SAS data collection on June 7, 2021, for areas related to operational control, operations management, onboard operations, and ground operations. A review of the detail reports for each of the aforementioned areas revealed no negative findings.

9.0 Soloy Programs and Guidance

9.1 Soloy Heli-skiing Guidance

Soloy provided Standard Operating Guidelines (SOG) for heli-skiing operations to pilots. The SOG, dated March 1, 2012, was “a guideline [emphasis original] for helicopter procedures in support of Heli-ski operations. Whenever possible the guidelines outlined within this document should be followed. Deviations from these guidelines should only be considered when operational circumstances occur that necessitate changes due to safety, unforeseen circumstances or the impracticality of any written procedure.” Guidance focused on issue areas such as weather limitations, operational concerns, crew personal conduct, passenger briefing, and training.

¹² See Attachment 9: FAA Correspondence.

¹³ See Attachment 10: Correspondence with Soloy.

SOG section 300 Weather Limitations stated, in part, "Heli-ski operations will not commence unless the wind and weather conditions are acceptable to the pilot-in-command."

SOG section 600 Operational Concerns stated, in part, "Operations will not be conducted unless the pilot has positive visual reference during all phases of flight." [emphasis original] Additional guidance was providing on staking which stated "All landings should be to previously staked areas or areas that have adequate visual reference to determine slope, surface, snow conditions, hazards, touchdown spot, abort flight path, etc. Considerations should be paid to: 1) Approaches and departures; 2) Proximity to hazards, avalanche chutes, cornice build-up, down flowing etc. 3) Prevailing wind."

SOG section 800 Passenger Briefing stated, in part, "It is the responsibility of the pilot-in-command to ensure every guest is given a comprehensive briefing prior to initial flight. Briefings may be given by another designated and trained person (i.e. guides) or a combination video/practical method, provided all aspects of a briefing are covered. The guides are essential to the briefings for many reasons, the least being language interpretation." Additional guidance was provided for topics that must be provided in an initial safety briefing, for example, operation of all doors and emergency exits, use of seat belts at all times, procedures in case of accident, and location and use of ELT and first aid kit.

SOG section 900 Training stated:

901 In addition to regular recurrent training as outlined in the COM [Company Operations Manual], specialized Heli-ski training will be conducted at the area intended for Heli-ski operations. This training will include, but not necessarily be limited to the following:

- a) Heli-ski flying techniques
- b) Snow landings;
- c) Heli-ski hazards;
- d) Staking guidelines;
- e) White out conditions;
- f) Profile landings to staked landing areas;
- g) Passenger briefings;
- h) Applicability of this Heli-ski SOG, including crew conduct;
- i) Interaction with guides;
- j) Responsibilities of Pilots, AMEs and Job Managers;

- k) Familiarization with general ski areas, location of fuel caches, weather stations and radio repeaters;
- l) Radio and flight following procedures;
- m) Familiarization of appropriate Emergency Response Plans;
- n) Low visibility operations; and
- o) Poor weather routings including hazard locations.

902 Flight training will be to the satisfaction of the designated training pilot(s) and the Job Managers and will be under the responsibility and direction of the Chief Pilot VFR. Pilots will be trained to competency rather than to any minimum flight training time.

903 Flight training will be recorded on the appropriate SHL pilot training form and submitted to the Chief Pilot's office.

904 Pilots with less experience and new to the operation should receive extensive refresher briefing and perhaps even refresher flights at the first assignment after training and also prior to conducting operations in low-density snow. This training should be documented as per 903.

905 Pilots must conduct an overlap briefing with replacement pilots regarding all aspects of the previous ski week.

9.2 Soloy CFIT-A Program

Soloy had a CFIT-A training program and associated manual. The manual, revision 1, dated December 12, 2016, outlined the CFIT-A policies and procedures and training requirements. CFIT-A was required as a part of initial and annual recurrent training. Training included CFIT-A general subjects with the following topics: company policy and procedures, white-out conditions, flat-light conditions, deteriorating visibility, inadvertent IMC, and advanced aircraft systems. Training also included ATD simulator lessons on flat-light, white-out, deteriorating visibility and inadvertent IMC, and normal and abnormal/emergency procedures in the aircraft. See attachment 11 for additional details on Soloy's CFIT-A program.

9.3 Soloy Emergency Response Plan

Soloy had an Emergency Response Plan (ERP) (Rev: 2021 season). The ERP "contains detailed instructions for Soloy Helicopters personnel in an event of an emergency situation" to include missing or overdue aircraft and an aircraft accident or incident. The ERP also noted "this plan may also be copied and made available for the utilization of customer/project dispatchers."

The Soloy ERP, pages 3-4, stated the following procedures for an overdue aircraft:

Overdue Aircraft Procedures

30 minutes Beyond Camp or FAA flight plan is Overdue!

Please use common sense to determine if the aircraft is delayed versus overdue.

First person to learn of overdue Aircraft Checklist

(Write your name here)

STEP 1

Call Director of Operations or Designated Duty Officer.

John Baechler [phone number], see page 1 for order of making calls.

Step 2

Collect information and write directly on this page

Information Needed [via table]: Type of Aircraft/Tail Numbers; Date and time of last contact (overdue) or Accident; Departure Point/Time/Destination; If Automated Flight Following Equipped; Fuel on Board; Name of Pilot; Number of Passengers.

Step 3

Initiate Search by doing the following, check off and note time when done;

1. Visually Search Ramp to see if aircraft landed without calling down.
2. Attempt to contact by radio, use other aircraft to relay if necessary. Have other aircraft go to last known position for search.
3. Contact Flight Service Station and inform of overdue aircraft. Request they check if any stations have had contact with the overdue aircraft FAA FLIGHT SERVICE 1-800-992-7433 or 1-866-864-1737.
4. Contact Soloy Director of Operations and brief information. John Baechler [phone number] or designated Duty Officer.
5. GO TO NEXT PAGE

STEP 4

Do not discuss the events with anyone except Soloy Management-Refer all calls to Soloy Director of Operations or Designated Duty Officer.

STEP 5

Continue to log times and actions taken in the space provided below. Include phone calls and conversations.

Time: Actions:

The Soloy ERP (Rev: 2021 season), pages 5-6, stated the following procedures for an aircraft accident or incident:

Aircraft Accident, Incident, Ground Accident, In-flight Medical Emergency Procedures Checklist

First person to learn of overdue Aircraft Checklist

(write your name here)

STEP 1

Call 911 and initiate EMS response if needed. Indicate type and number of injuries if known.

Call Director of Operations or Designated Duty Officer → Overhead Initiates Master ERP.

John Baechler [phone number] → Director of Operations to Call Customer

Step 2

Collect information and write directly on this page

Information Needed [via table]: Type of Aircraft/Tail Numbers; Date and time of last contact (overdue) or Accident; Departure Point/Time/Destination; If Automated Flight Following Equipped; Fuel on Board; Name of Pilot; Number of Passengers.

Step 3

Do not discuss the events with anyone except Soloy Management-Refer all calls to Soloy Director of Operations or Designated Duty Officer. DO NOT USE THE

NAMES OF ACCIDENT VICTIMS OVER THE RADIO or DISCUSS SITUATION WITH ANYONE OTHER THAN APPROVED SOLOY OR RESCUE PERSONNEL.

GO TO NEXT PAGE

STEP 4

Continue to Collect Information [via table]: Accident reported by; Phone # of Reporter; Location of accident; Description of Aircraft; Time of Report; Access; Lat/long; Weather at Site; Area/Terrain; GPS coordinates.

Continue to log times and actions taken in the space provided below. Include phone calls and conversations.

Time: Actions:

The Soloy ERP (Rev: 2021 season), page 10, provided the following overview of its plan:

1.1 Overview

The Emergency Response Plan is akin to insurance; you hope you never need to use it, but if you should, a pre-planned and tactical plan of attack (or defense) will help prepare our Company to cope with emergency situations or events that could happen. Knowing how to respond to the situation before it happens can greatly improve the chances that the situation will be handled correctly if it happens. A Master ERP is in place for the 2020 Season that will be activated by Soloy Helicopters Management as needed.

The Emergency Response Plan is a step-by-step checklist that outlines the steps to be taken, in order and the documents needed or information needed to be captured as you proceed. Do the best you can, something is always better than nothing. Write information down at every opportunity.

Refer to the tab that best describes the emergency situation that you are experiencing and follow the steps.

All company personnel should be familiar with the checklist and how to use it. Each employee will be trained annually on the plan, changes and use of the plan. Semi-annual drills will be conducted and will include routine fire drills, crash rescue drills or fuel spill drills.

9.4 Soloy SMS

Soloy had a safety management system (SMS) and accompanying SMS manual that detailed, for instance, the company's safety policy, safety reporting procedures, safety oversight, safety training and emergency response plan. The SMS was not a part of the FAA Voluntary Safety Programs. Relevant excerpts of the SMS Manual are provided in attachment 12.

The Soloy SMS Manual, dated January 2021, section 1 Safety Management Plan, subsection 1.1.1 Safety Policy Statement stated, in part:

Commitment

Soloy Helicopters understands that the strength of our company comes from everyone involved with the company; Managers, Supervisors, and Employees. The Soloy Safety Assurance commitment to a Just Culture and the reporting of unsafe conditions is encouraged with no fear of retribution but where willful violations are not tolerated. Our commitment is to provide a safe work environment for all employees, contractors, visitors and customers at our locations

Objectives for the 2021 calendar year-objectives are derived to control areas of exposure or mitigate known risks based on previous SMS reports and safety committee input.

- Improve QC for aircraft maintenance thorough focused attention to the QC process.
- Collect data on unscheduled maintenance and over-torque/over-temp events through the SMS reporting system.
- Reduce the number of one-off flight safety reports.
- Improve fatigue and stress awareness and mitigation through training.
- 2021 emphasis on eye and hearing protection.

Overview of Responsibilities

Safety at Soloy Helicopters is a shared responsibility, the following general responsibilities are essential to the overall success of our program and will be verified through our internal audit program and third party audits as needed.

Employees

- Follow the established safe work procedures.
- Wear and maintain personal protective equipment as required.
- Comply with all safety policies and procedures.
- Fulfill your health and safety responsibilities.

Managers and Supervisors

- Implement and manage the Safety Program for your area(s) of responsibility.

The Soloy SMS Manual, dated January 2021, section 2 Document Management, subsection 2.5 Inspections and Checklists stated, in part:

1. In order to maintain a high level of safety within company facilities and work sites, various inspections and checklists will be used as working tools. It is the responsibility of the immediate supervisor to ensure that employees at work sites complete the necessary inspections and check list. It is also the employee's responsibility to comply and complete the required inspections and check lists:

a) Upon arrival at a new work site, the following inspections and check lists should be conducted:

- Hazard identification report form SMS-3
- Job Handover report - SMS-12
- Fuel compliance report - SMS-1 (see Fuel Handling Policy and supporting documents)

Note: Regarding Hazard Identification, the pilot shall conduct a flight Hazard Identification report, formal or informal, and the ground crew shall conduct a ground hazard identification report if required. It is imperative that any hazard identified be corrected as soon as possible or before initial set-up of the staging area. Form SMS-3 should be submitted for both flight and ground hazards identified.

b) Daily inspections

Each work site shall be inspected daily by the pilot and the ground crew in accordance with a previously defined check list. This check list shall include a section in which the date and the signature of the person conducting the inspection shall be noted. Daily inspections may be documented physically but must be done practically.

The following is a list of the daily inspection forms available and check lists:

- Helicopter Safety Briefing Report - SMS-4 (if required)
- Fuel compliance report -SMS-1 (see Fuel Handling Policy and supporting documents)
- Daily Inspection Report -SMS-9

c) Weekly at each work site

- Weekly safety meeting (To be used when client does not provide)
- Pilot and client safety discussions -SMS-11
- Job Handover Report - SMS-12
- Inspection, report and check list -SMS-10
- SMS Reporting System (which includes) -SMS-3
- Flight Safety Report (if applicable)
- Industrial Safety Report (if applicable)
- Malfunction Report (if applicable)
- Near Miss Report (if applicable)
- Spills/Natural Disasters (if applicable)
- Hazard Identification Report (if applicable)
- Work site Report (if applicable)
- Injury Report (if applicable)

Note: All of the reports for the SMS Reporting System use Form SMS-3

Examples of Soloy's SMS forms can be found in attachment 12 to this report.

The Soloy SMS Manual, dated January 2021, section 3 Chapter 3 Safety Oversight, subsection 3.2 Reactive Safety Oversight stated, in part:

3.2.1. General

Soloy Helicopters LLC employs the following methods of acquiring information from which it may introduce measures as a result of reactive safety oversight:

- Hazard/Incident Reports
- Near Miss Reports
- Safety Meeting reports
- Weekly Meeting Reports
- Field Audit Reports
- Internal/External Audit Reports
- Verbal Reports
- Daily Hangar Meetings
- Confidential Reports

3.2.7. Internal and External Audits

All internal and external audits carried out on the company are to be evaluated by SMS and the safety committee with a view to improving operations and taking corrective action as required on any outstanding findings. The Director of Safety will be responsible for tracking and closing of findings generated by external audits on the company. The Director of Safety will work with individual department managers to correct and document findings. The Director of Safety... and DOM¹⁴... are designated auditors for Soloy Helicopters and have received formal training in auditing. The assistant DOM and Tech Record should seek to become internal auditor trained within one year of appointment.

3.2.9. Daily Hanger Meetings

Daily hangar meetings take place on the shop floor at 0800 hrs. during the working week, all company personnel less administrative staff are to attend if they are on the premises. The meeting is not specific to aircraft and may be pertinent to any active or pending company projects. It is an ideal forum for employees to raise safety issues and for management to pass on feedback from safety information. Any points raised during the meeting are recorded by the Technical Clerk which will remain with the Quality Assurance Department for future reference.

The Soloy SMS Manual, dated January 2021, section 3 Chapter 3 Safety Oversight, subsection 3.3 Pro-Active Safety Oversight stated, in part:

3.3.1 Hazard Identification

Hazard identification is the act of identifying any condition with the potential of causing injury to personnel, damage to equipment or structures, loss of material or reduction of the ability to perform a prescribed function. In particular, this includes any conditions that could contribute to the release of an un-airworthy aircraft or to the operation of the aircraft in an unsafe manner.

- Internal Reporting Mechanisms
- Internal and External Audit Reports
- Identification of new Practices
- Industry Generic Hazards

¹⁴ Director of maintenance.

3.3.1.2. Internal and External Audit Reports

An internal audit program which covers both maintenance and operations is in place and managed by QA manager and Director of Safety respectively. In addition, Soloy Helicopters is subject to external audits, specifically from FAA, Oil & Gas Clients, Mining Exploration and Forestry. All audits provide a valuable tool in identifying areas for both improvement & recognition of company strengths. The Director of Safety will work as the QA manager to identify audit findings and observations that should be subject to a formal risk analysis. Internal Audits will be conducted on the following Schedule: Maintenance and Facilities: Q2. SMS and Operations: Q4. The fourth quarter review of the SMS program will be conducted by the Director of Operations and/or the Accountable Manager. OGP standards or other checklists may be used for internal audits of the entire SMS program. Third Party External audits may be used in lieu of the IEP program.

Corrective Action Plans will be made within 30 days of Internal Audits and require department heads to comply with findings per CAP.

3.3.2. Risk Management

Once hazards have been identified from the sources listed in para 3.3.1, the risk management process begins. Risk management is an evaluation of the potential for injury or loss due to exposure to a hazard and the management of that probability. This concept involves both the likelihood of a loss and the severity. The basic elements of the risk management process are:

- Risk Analysis
- Risk Assessment
- Risk Control
- Monitoring

3.3.2.1. Risk Analysis

Risk analysis is the first element in the risk management process. It encompasses risk/hazard identification, described in para 3.3.1 and risk estimation which is conducted by the Director of Safety. Formalized risk matrix will be used as determined by each department.

3.3.2.2. Risk Assessment

Risk assessment takes the work completed during the risk analysis and goes one step further by conducting a risk evaluation. Here the probability and severity of the hazard are assessed to determine the level of risk. These factors are

determined using the risk matrix which is found on SMS 7¹⁵; also an additional system is used for risk assessment which is the "5 Steps to Risk Assessment" system which is a standalone document which supplements this element in this manual and is promulgated to all employees during initial training, updates and copies are also posted on notice boards. All risk assessments are reviewed annually by the SMS committee.

3.3.2.3. Risk Control

Risk control addresses any risks identified during the evaluation process that require an action to be taken to reduce risks to an acceptable level. Where a requirement for action is identified by the Director of Safety at the risk assessment stage, he will consult with the relevant departmental manager who will be responsible for initiating corrective action.

- If for some reason a hazard or risk is identified by an employees [sic], they shall take action to either eliminate reduce, or control the hazard or risk before commencing work at the work site. By the use of proper communication between the contracting agency and Soloy Helicopters most of these hazards and or risk can be minimized.
- In regards to all new risks involving new equipment or products. All employees shall be informed when any new items or products are brought on board.

3.3.2.4. Monitoring

Monitoring is essential to ensure that once the corrective action plan is in place, it is effective in addressing the stated issues or hazards. In the majority of cases, on-going monitoring will consist of diarized checks conducted by the safety office or the enhancement or establishment of company audit checks. The safety office will be responsible for any such monitoring requirements and will retain records of diarized checks.

The Soloy SMS Manual Appendix E Task Risk Assessment, dated February 26, 2015, outlined hazards, potential consequences, severity, probability and risk (severity x probability = risk), existing controls and actions to be taken, and residual risk of different operations performed by the company. Risk Assessment Number 2, Task to be performed "Mountainous Terrain Operations" included, but was not limited to, the following assessments:

¹⁵ SMS 7 was a reference to Soloy SMS Manual Appendix E Task Risk Assessment. Per email communication with Soloy Vice President on January 12, 2022, the appendix was used as a guide by Soloy management risk make changes to an active risk assessment.

Hazard: Unimproved landing sites - Dynamic rollover, blade strikes
Potential consequence: Severe injury, fatalities, loss/damage of equipment
Severity: High; Probability: Medium; Risk: High
Existing controls and actions to be taken: "Pilot conducts high & low recon of LZ before landing. Pilot selects ideal landing areas of 90'x90' for medium helo or 70'x70' for light helos, less than 8 degree slope, no objects or obstacles higher than 3 ft."
Residual risk: Low

Hazard: Lack of communication for flight following
Potential consequence: Severe injury, fatalities
Severity: High; Probability: Low; Risk: High
Existing controls and actions to be taken: "File a flight plan with FAA or flight follow with Operator or on site personnel. **ACTION** [emphasis original]: Carry Iridium Satellite phone onboard aircraft to mitigate lack of remote repeater sites."
Residual risk: Low

Hazard: Instrument meteorological conditions (IMC) weather
Potential consequence: Severe injury, fatalities, loss/damage of equipment
Severity: High; Probability: Medium; Risk: High
Existing controls and actions to be taken: "Observe FAR's, Soloy & Client rules on weather criteria, quarterly pilot instrument training, use operator/maritime observers when available to provide local information."
Residual risk: Low

The Soloy SMS Manual, dated January 2021, section 6 Emergency Response Plan, stated, in part:

6.1 Introduction

The following Emergency Response Plan is designed as a guideline and framework for use by Soloy Helicopters LLC. Additionally, there is a quick reference Emergency Response Plan which is available in all company vehicles and by all company telephones; also available is a comprehensive Accident Response Plan specifically for Aviation Accidents, copies can be found in all Aircraft flight bags and is distributed to all line managers. An ERP drill will be conducted annually and a post-drill review will be conducted to validate the serviceability and effectiveness of the drill, ERP and contacts/communication.

Should an accident or incident occur it is important that all personnel respond in an appropriate manner without delay. It is also important that all personnel exercise initiative, flexibility and common sense when responding to an aviation

accident or incident situation. A Master ERP is also in place for serious incidents when appropriate.

The Accountable Executive is responsible for the company's emergency response plans within company facilities. In situations where the Accountable Executive is not present, this responsibility shall be passed to a pre-designated person.

At work sites, the employees are responsible for the emergency response plan and ALL company personnel may initiate the Emergency Response Plan.

THE EMERGENCY RESPONSE PLAN SHOULD BE INITIATED UNDER THE FOLLOWING CIRCUMSTANCES:

- An overdue or missing Soloy Helicopters aircraft.
- An aircraft accident involving Soloy Helicopters aircraft.
- Any accident/incident resulting in serious personal injury or death.
- Fire at Soloy Helicopters hangar, buildings or work sites.
- Dangerous Goods Spills, Leaks, Hazardous Substances.
- Evacuation Procedures

The Emergency Response Plan is set out in a manner that will lend itself to use by Field parties, maintenance personnel and management teams. If in doubt it is always better to initiate the plan early. In many circumstances every minute counts. The sequence can always be stopped at any time if circumstances warrant.

REMEMBER TO:

- Report by the fastest means available
- Keep calm - panic or undue haste can cost lives
- Act in a responsible, professional manner
- Keep communication lines clear for emergency purposes only
- Keep notes on all communications, observations and actions

6.1.1. Initial Accident/Incident Report

For accident/incidents in the field, the reporting employee should contact Soloy Helicopters Operations using the emergency contact list Appendix A (Attempt contact in the order shown)

Provide complete and concise information using SMS 3 form as a guideline.

Following initial contact, remain available for follow up. All further steps will be initiated through Soloy Helicopters Operations.

6.1.2. Emergency Response Team

Soloy Helicopters Operations will establish an Emergency Response Team as required and assign duties to the team members. A Master ERP will be used to manage the incident and is found in the Safety Office.

6.2 Overdue and Missing Aircraft Procedures

A Soloy Helicopters aircraft is considered overdue if it is more than 60 minutes beyond its ETA or agreed upon reporting time. Personnel in the field should use 30 minutes as a guide to begin referencing the ERP. For both overdue and missing aircraft, the following procedure is to be carried out:

Procedure

- Refer to the ERP
- Contact the Operations Manager with the following details:
 - Registration of the Aircraft
 - Pilot in Command & Known passengers
 - ETA of the missing Aircraft
 - Last known position from satellite tracking
 - Last communication with the pilot
 - Nature of work
- Contact the person or agency responsible for flight watch.
- Attempt to have local agencies or other aircraft contact the aircraft on all available frequencies. (Comm. Search) Monitor 121.5 on VHF-AM and keep a radio watch on a FM portable radio.
- Initiate a phone search starting at the point of origin and along the intended flight path.
- Attempt contact with crew via cell or sat phone.
- Determine valid fuel exhaustion time
- Consider a route search with another company or local aircraft
- Contact ATIS, Clients, SAR as required
- Advise the Operations Manager of any changes in the situation. Operations Manager will be responsible for contacting Search and Rescue
- A bilateral communication between parties shall be kept at all times
- Establish and maintain an Emergency Situation Log (Appendix B)
- Soloy Helicopters Operations is to establish the Emergency Response Team and appoint a team leader and media rep.

6.10. Emergency Response Training

During initial company orientation all employees will receive training on company procedures for emergency response that are applicable to their place of work. Annual refresher training in the shape of practice exercises or verbal discussions during worksite meetings will be utilized to raise awareness of correct procedures to be carried out.

When working with clients our employees are to ensure that they are familiar with the clients' ERP.

Emergency Response Plan Simulation Exercises

The Accountable Executive is to ensure that a minimum of one tabletop exercise is carried out annually. The Director of Safety will be responsible for conducting the training, the objective is to test and evaluate for further improvement of company procedures and ensure Managers and employees are fully conversant of their roles and responsibilities.

10.0 Audits and Safety Reports

The Soloy 2020 Annual Safety Report was reviewed; the report summarized all safety reports received from January 1, 2020, through December 31, 2020. No safety issues relevant to this accident were identified.

In February 2021, a BAR¹⁶ Standard Audit was conducted of Soloy Helicopters. According to the report, "the BAR Standard Audit is an international evaluation system to assess the operational management and control systems of an air operator. Under this program internationally recognized quality audit principles are utilized in the conduct of the Audit to ensure a standardized and consistent outcome." The audit identified no (zero) significant, safety critical findings (P1), 10 P2 findings drawn from BAR Standards or aviation best practices that must be corrected to be "BARS Registered," and 4 P3 optional, non-safety critical findings. Two of the 10 P2 findings were related to flight operations but were not relevant to this accident. Four of the 10 P2 findings related to the organization as a whole. One finding that could have safety related implications stated "The Operator failed to execute the annual safety audit plan on all departments that have the potential to affect the safety of the Operator's aircraft or cause harm to personnel; the corrective action had a due date of June 29, 2021.

11.0 Soloy/TML Contract

A contract agreement was dated January 3, 2021, between Triumvirate LLC Heli-skiing [Charterer] and Soloy Helicopters [Carrier] to operate helicopters from TML or

¹⁶ Basic Aviation Risk.

Winter Lake Lodge. The agreement stated, in part, "3. The Charterer shall at its sole expense and account provide the following: ... c) Helicopter satellite tracking system can be supplied if requested to track the aircraft."

The contract agreement Schedule "B" detailed items related to Aircraft Supply agreed upon by the Charterer and Carrier, which stated, in part, "10. The Carrier plans to equip all helicopters with a Satellite tracking system that can be viewed via any computer with an internet connection for flight following purposes. Should the Charterer wish to take advantage of this value-added service, the Carrier will provide log-in information, prior to the start of the ski season."

The contract agreement Schedule "F" detailed items related to Operational Conduct agreed upon by the Charterer and Carrier, which stated, in part:

1. The Carrier shall, during the continuance of this Agreement, be responsible for all takeoffs, flying, and landing, complying with all requirements of FAA relating to the operation and maintenance of the aircraft. The Charterer agrees that the determination of safe flying and operating standards remains under the exclusive jurisdiction of the Carrier.
2. The Carrier Shall furnish crew members with the following qualifications:
 - a) Pilots who the Carrier and Charterer mutually agree, have the required experience (no minimum hours) and have demonstrated the skill required to conduct helicopter skiing operations safely.

The contract agreement Schedule "G" detailed the policies and procedures agreed upon by the Charterer and Carrier, which stated, in part,

1. The Carrier and Charter [sic] shall agree on mutually acceptable Pilots and an Alternate Pilots at the beginning of each operating season and the Charterer shall designate an On-Site Manager.
2. The Charterer's On-Site Manager and the Carrier's Job Manager will be responsible for establishing a plan to utilize the helicopters in the most efficient manner possible to ensure waiting periods for the guests are reduced to an absolute minimum.
3. All go/no-go decisions regarding weather will be communicated and discussed between the Charterer's On-Site Manager and the Carrier's Pilots. In the event a decision is made to not fly helicopters due to weather by the Carrier's Pilots, individual Pilots will not be approached by the Charterer to fly in contravention of the decision.

4. Both the Carrier and the Charterer are committed to the prevention of accidents, injuries, loss of property and/or equipment. The Carrier has established that all flights will be conducted according to FAA Regulations, the Carrier's Operations Manual and the Rotorcraft Flight Manual.
5. The Charterer has scheduled staff meetings each morning prior to skiing and each afternoon, to discuss the daily operations. Attendance at "STAFF MEETINGS" by the Charterer's crew is mandatory.
6. Crew Conduct and Dress:
 - a) The success of the Charterer's operation is dependent on service and hospitality. The Carrier's personnel will conduct themselves in a courteous, helpful and hospitable manner during their daily interactions with the Charterer's employees and clientele;
 - b) The Carrier's crews will maintain their personal appearance to a high standard;
 - c) Pilots will comply with all FAA regulations and the Carrier's Heli-Ski Standard Operating Procedures with respect to the consumption of alcohol or drugs in effect now or as amended from time to time. As a minimum standard;
 - d) No person shall act as a crewmember of an aircraft:
 - 1) Within 8 hours after the consumption of any alcoholic beverage;
 - 2) While under the influence of alcohol; or
 - 3) While using any drug that affects his facilities to an extent that the safety of the aircraft is endangered in any way;
10. The Charterer acknowledges the Carrier's crews are the final authority on all matters of aviation safety and the safety of flight and specifically agree to refrain from applying pressure to the crews of the Carrier once a decision has been made regarding any flight operation that may jeopardize safety. The Charterer reserves the right to seek a justification from the Carrier's Director of Operations, or his designate, in cases where such a decision seemed unreasonable. This justification will not be sought from individual pilots or maintenance staff.
11. Contingency Plan - In conjunction with the Carrier's personnel, the Charterer will develop an Operations Plan and an Emergency Response Plan to initiate the necessary action in the event of disabled helicopter, avalanche, or incident causing personal injury to the Charterer's clientele. This contingency plan shall determine the daily shut down time of normal heli-skiing operations allowing sufficient daylight hours to carry out the established Contingency Plan.

12.0 TML Guidance and Training

12.1 TML Guide Training

TML offered annual training to heli-ski guides working at its operation each season; training was held in January of each year. The accident guides attended training in 2019, 2020, and 2021; the guide serving as the base radio operator for the accident flight attended training in 2019 and 2020. The exact topics covered in 2021, which was conducted via Zoom, were unknown. However, 2020 training included Jackson area snowpack summary, Alaska early season summary, a review of 2019 snowpack and incidents, unloading procedures, snowpack analysis in the field, rescue procedures for beginner responders, avalanche safety and rescue scenarios, emergency response procedures, personal rope rescue kits, Morning and PM Guides Meeting, among other topics.

The following additional information related to training was provided to the NTSB via email on September 24, 2021:

Annual training includes discussions of helicopter safety, how to improve protocols and review close calls from the previous season that warrant mention. TML guides have a wealth of operational standards in the US, with guides like [one of the accident guides and another guide] bringing significant international experience. As an example, a new practice discussed during guide training and now implemented was brought up due to a near miss event and protocol changes in a New Zealand operation. When unloading the ski basket of equipment, guests will now remain in the helicopter (if only one guide is present, one designated guest may assist the guide). This is different than other US heli ski companies who allow guests to unload the helicopter while the equipment unloading is occurring. This new practice was tested by guides and although it takes a little more time to complete it reduces the risk of guests making a mistake like leaving the unloading area or lifting their arms which can be dangerous. This example is to show how annual training includes discussions of how to improve helicopter safety. The annual preseason training held in Wyoming (when Alaska is not conducive to such training), has included a Soloy pilot in the past, to promote training, represent Soloy Helicopters, and discuss helicopter safety. Part of that training is held at the Teton County Search and rescue hanger with the same Eurocopter B3 helicopter that is used by TML, for hands on training and discussion. Note that in 2021, annual training was modified for the safety of the group and the community and was held through zoom meetings. Zoom provided a great platform for discussions of improved safety, communications and systems. The hands-on components of avalanche beacon training and rope systems were performed in small groups in Alaska. Rescue resources, equipment, and response training is also part of annual training. Also attached are general agendas and attendance records for the last three years. Note that

in 2019 [the accident guides, TML flight tracker on duty the day of the accident, and TML co-owner who assisted with locating the accident helicopter] all attended training. In 2020, [the accident guides and the TML co-owner who assisted with locating the accident helicopter] were present. In both 2019 and 2020 [two guides from Third Edge Heli-ski who assisted in locating the accident helicopter] both called in for parts of training and aided in the Alaska snowpack to date conversations. In 2021, [the accident guides, TML flight tracker on duty the day of the accident, and TML co-owner and Third Edge Heli-ski guides who assisted in locating the accident helicopter] were all in attendance. Guides who work for multiple operations also participate in other heli-ski companies on site training programs in Canada and in the US, specifically at Chugach Powder Guides in Alaska. Power point slide presentations are utilized during trainings and can be provided upon request.

12.2 TML Base Radio Operator Training

In response to a NTSB request to TML regarding training and guidance for base radio operators, TML provided a summary of what is provided via email on April 17, 2021; there was no formal documentation provided. See attachment 13 to this report.

12.3 TML Drug and Alcohol Policy

In response to a NTSB request to TML regarding a drug and alcohol policy for guides, TML provided a written summary which was provided via email on September 24, 2021. The following information was provided: "Regarding alcohol and drug policy for pilots and guides. Pilots must follow the policies of Soloy Helicopters. Guides are not permitted to be under the influence of recreational drugs or alcohol while heli-ski guiding. Although there is not an employee handbook that specifically states how a breaking of this or any other rule will be handled, offences are not taken lightly and infractions of any rule, especially serious ones, will be dealt with individually and can result in termination."

12.4 TML Morning Safety Meetings

In response to a NTSB request to TML regarding morning safety meetings, TML provided a written summary which was provided via email on September 24, 2021. The following information was provided: "On a daily basis, a helicopter pilot and a fixed wing pilot are present at the AM guide meetings to help formulate a plan, discuss weather, and to discuss any items that the pilot team wishes to have conveyed. Discussions pertinent to safety are discussed that include reminders of known protocols, identifying guests who need heightened supervision due to injury or other reasons, etc. If known helicopter accidents or near misses occur at unaffiliated helicopter locations or industries, they are discussed to promote open discussion and safe practices. PM guide meetings are another daily opportunity for concerns that need to be addressed immediately to be brought to the group's attention. Throughout the

day while in the field, in addition to specific run/landing decisions, pilots and guides communicate constantly regarding plans for movement about the mountains, fueling plans, and current weather so that they can adjust the group(s) plans accordingly.”

12.5 TML Passenger Safety Briefings

In response to a NTSB request to TML regarding passenger safety briefings provided by TML guides, TML provided a written summary which was provided via email on September 24, 2021. The following information was provided: “Client safety briefings are extensive. They include an inside power point presentation provided by a guide that, in addition to other field related topics such as avalanches and mountain hazards, has a section devoted to helicopter safety. Following the inside briefing, clients complete their safety training for both avalanche rescue and helicopter safety. The helicopter briefing is done by a pilot who covers all the specifics required by his employer and the FAA. A guide is also present to re-iterate some of concepts covered by the power point such as keep your ski tips low. After both the indoor and outdoor safety briefings are complete, clients sign off on the safety briefing checklist.”

12.6 TML Emergency Rescue Plan

TML had an emergency rescue plan which provided guidance and forms to TML personnel in the event of an emergency. The TML Emergency Rescue Plan 2021 included the following instructions for dispatcher/rescue coordinator:

INSTRUCTIONS FOR DISPATCHER/RESCUE COORDINATOR

You are the incident reporter, in charge of the notification of backup personnel,
Outside agencies, medical assistance requested
and the coordination of communication with the Accident Site Commander and all support units.
You are the Dispatcher and Rescue Coordinator until relieved and should keep careful record of all events for an accident report.

Note: All forms mentioned are in this Emergency Packet

Class I -TML RESOURCES ON SITE

Obtain Information, Follow and Complete Appropriate Forms

1. Follow and complete the TML EMERGENCY RESCUE ALERT FORM type of emergency (Helicopter or Aircraft).
2. Maintain and complete a TML RADIO LOG. Record all verbal, telephone, and radio communications. Note all times.
3. Follow and complete the ACCIDENT RESOURCE MANAGEMENT FORM.
4. Assign a scribe if available.

Class II - ADDITIONAL TML RESOURCES REQUIRED

Continue to Dispatch and Coordinate Rescue

12. Contact additional rescue help as requested by Accident Site Commander: Call other helicopters and guides. Make sure that everyone reports to the designated staging area with proper equipment and clothing.
13. Prepare or secure additional requested rescue equipment for deployment: avalanche probes, extra shovels, tents, sleeping bags, food, search lights, headlamps and batteries, rescue toboggans, oxygen pack and first-aid supplies.
14. Arrange for hot drinks and food for rescuers.

Class III - OUTSIDE RESOURCES REQUIRED

Continue to Dispatch and Coordinate Rescue and Notify Outside Agencies

1. Notify outside agencies that we need a helicopter with a hoist

The TML Emergency Rescue Plan 2021 provided the following form for an aircraft emergency rescue alert:

TML AIRCRAFT EMERGENCY RESCUE ALERT

If an emergency is reported to you get the following information.

You are the base Rescue Coordinator until relieved by a TML guide or equivalent.

NATURE OF INCIDENT: CHECK BOX or FILL IN OTHER

AIRCRAFT ACCIDENT/CRASH	MISSING/OVERDUE AIRCRAFT	MECHANICAL PROBLEM
OTHER:		

DETAILS OF INCIDENT:

PERSON reporting incident:	TIME OF INCIDENT:	AM PM
ACCIDENT SITE COMMANDER:		
DISPATCHER:		
TAIL NUMBER:		
COLOR OF AIRCRAFT:		
SEATING CAPACITY:		
PERSONS ON BOARD (INCLUDING PILOTS):		
DEPARTURE POINT AND DESTINATION:		
TIMES: WHEN DEPARTED:	WHEN LAST COMMUNICATION RECEIVED:	
DESCRIPTION OF LOCATION WHEN LAST COMMUNICATION RECEIVED:		
FUEL ON BOARD IF KNOWN:		
INJURIES:		

TYPE OF RESCUE: CHECK ONE BOX

MANAGED BY GUIDES AT SITE	ADDITIONAL GUIDES AND EQUIPMENT NEEDED AT SITE	CEASE OPERATIONS ALL GUIDES AND ADDITIONAL EQUIPMENT NEEDED AT SITE	OUTSIDE AGENCIES NEEDED
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IF COMMUNICATION WITH THE HELICOPTER IS NOT ESTABLISHED BY THE END OF THE PREARRANGED OR 30 MINUTE GRACE PERIOD, OR IN THE EVENT OF A CRASH NOTIFICATION: THE FOLLOWING PROCEDURE WILL BE OBSERVED:

CONTACT: 210 TH	"WE NEED A HELICOPTER WITH A HOIST"
--------------------------------------	--

13.0 Heli-Ski US Association

According to its website¹⁷, the Heli-Ski US Association (HSUS) a nonprofit corporation based in Utah whose members “represent the very best helicopter skiing operators in the United States.” Its mission is “to promote and sustain helicopter skiing in the United States while developing and upholding the highest safety and operating standards.”

13.1 HSUS Membership

TML was listed on the HSUS website as a member at the time of the accident. According to the website, members “proudly participate in a program of safety standards that are the highest in the industry.” The “Safety Programs” page states, “the process of becoming a member of HSUS requires a minimum of three years. After signing an agreement by which they consent to be reviewed and agree to abide by the HSOG¹⁸, applicant firms are given one year to bring their programs into compliance. In the second year, HSUS sends its Performance Reviewer to evaluate the applicant firm’s safety and operations programs and make recommendations for changes and upgrades. In the final year, the Performance Reviewer and a member of the HSUS’s board of directors spend 3 to 5 days with the applicant, looking at everything from avalanche forecasting and documentation to guide resumes and certifications to emergency response packs. If the report of the Performance Reviewer and board member meets with the approval of the full board of directors, the company becomes a ‘Certified Member’ of HSUS.” Membership requires regular evaluations “for conformity to the HSOG program”, a written Operating Plan that delineates “the conditions, locations and circumstances under which the firm will operate, and a detailed Emergency Response Plan. Members must also appoint a safety officer who was responsible for ensuring operations are conducted in compliance with the HSOG and the firm’s Operating Plan, to schedule and coordinate internal training including training for the Emergency Response Plan, to inventory and control emergency response packs and assure all guide qualifications are properly documented.

13.2 Heli-skiing Safety and Operating Guidelines

HSUS developed the Heli-skiing Safety and Operating Guidelines (HSOG). HSOG section I. Introduction, stated:

These Heli-Skiing Safety & Operating Guidelines (HSOG) are intended to provide the helicopter pilot, helicopter operator, outfitter and guide with an introduction to the fundamentals of helicopter skiing operations, to help establish guidelines for standard practices within the helicopter skiing industry, to provide a framework for continuing development of training and safety

¹⁷ <https://heliskius.org/>.

¹⁸ Heli-skiing Safety and Operating Guidelines.

programs and to promote safety by identification of best practices in the industry. The HSOG guidelines should be supplemental to the helicopter operator's Part 135 certificate requirements and operations, safety and training programs. In addition, the HSOGs require that each helicopter skiing outfitter develop, adopt and implement its own Safety and Operations Plan and daily Operating Procedures. Where a conflict may exist in those requirements, mandatory operations specifications adopted as part of the Part 135 operator's operating certificate and the pilots' professional judgment should control.

Importantly, these HSOGs should not be regarded as establishing rigid standards that allow for only one method of addressing a particular safety or operations element. Operational circumstances may make variance from HSOG guidelines and the outfitter's Safety and Operations Plan appropriate. Similarly, the unique circumstances of a particular Helicopter Skiing Operation may dictate procedures that vary from those of other operations. Even careful implementation of a well-conceived Safety and Operations Plan will not eliminate the risks that are inherent in backcountry winter recreation activities. Ultimately, it is an Outfitter's successful process for addressing and mitigating the underlying risks to Clients and employees that is most important.

HSOG, section III Operating Plan, stated, in part:

At or before beginning operations for any season, the Outfitter and Operator should agree upon and then follow a safety and operations plan (as defined in this Section, "Safety & Operations Plan") and operating procedures (as defined at Section IX, below, "Operating Procedures").

- A. Safety & Operations Plan. The Outfitter should establish and implement a Safety & Operations Plan that is consistent with the guidelines set forth herein, which satisfies the requirements of the Heli Ski U.S. Performance Review checklist and which corresponds to its Emergency Manual. In addition, the Outfitter should appoint an Outfitter Safety Officer who will coordinate and oversee implementation of the Safety & Operations Plan and who should coordinate Guide-Pilot co-training with the Lead Pilot.

HSOG, section VI Ground Support Personnel and Procedures, subsection C. Flight Following, stated, in part:

1. The Outfitter shall establish a Flight Following program and a Flight Following Log should be kept during all periods in which flight operations are conducted. The Flight Following Log should include provision to note time of check in, guide or Pilot name for identification, location and intended direction of travel or destination. Flight Following check-in for all Groups and helicopters at least once each hour is strongly recommended. Pilots and/or

Guides shall also report to Flight Following personnel any time Groups or aircraft relocate to a different operating area. Flight Following personnel should be appropriately trained and Flight Following logs should be reviewed for compliance with procedures. Flight Following reference locations may be based on widely used names, map references or GPS coordinates.

2. Outfitters should work with their Operator to implement an automated GPS flight tracking system (i.e. Blue Sky or equivalent) to supplement and as a back-up for the Flight Following program.
3. Two-way radio communication should be maintained when practical. Outfitters are encouraged to utilize remote radio repeaters to expand the range of two-way radios. In addition, it is recommended that Outfitters supply at least one satellite telephone for each helicopter in service, to provide a back-up means of communication for emergencies. In the event that the Operating Area is served by cellular phone communications, the Outfitter may substitute cellular phones for satellite phones. In terrain where radio and repeater applications are not practical, an Outfitter may substitute a combination of satellite telephones and digital texting devices, provided that the flight following location is appropriately equipped to receive the calls and texts and that guides are able to communicate with each other by radio.
4. Except where a Lead Guide, Outfitter Safety Officer or guide is available at the Operations Base or Day Staging Area, implementation and coordination of the appropriate Emergency Plan will be the responsibility of Flight Following personnel. Complete, bound and tabbed copies of the Outfitter's Emergency Manual shall be kept on hand for immediate reference at the Operations Base and at the Day Staging Area. Flight Following personnel should be trained in proper use and implementation of the Emergency Plans and documentation of training should be maintained by the Outfitter Safety Officer.

HSOG, section XIII Implementation & Performance Reviews, stated, in part:

- B. Performance Reviews. To help assure the effectiveness of the HSOG Program, Heli Ski U.S. will conduct Performance Reviews of its members and their Operators for compliance with the terms hereof. Performance Reviews shall be carried out by appropriately skilled individuals (Performance Reviewers) appointed by the Review Committee and the results of each Performance Review shall be reported to the Outfitter, the Operator and the Safety and Practices Review Committee by the Reviewer(s). Each year, the Safety and Practices Review Committee shall make a report to the full

membership of Heli Ski U.S. describing Performance Reviews performed, trends in Performance Reviews and areas in which the HSOG and Performance Review Checklist may be improved.

HSOG, section IX Operating Procedures, subsection B General Requirements for Aviation Operations, stated, in part:

5. Aircraft orientations should be given prior to each Group's first flight using a briefing checklist, with instruction on loading, unloading, emergency procedures and general conduct around the aircraft. Briefings should include instruction that use and/or possession of alcohol and drugs is prohibited in and about the aircraft and during all field operations.

HSOG, section IX Operating Procedures, subsection D Landing Zone Selection and Preparation, stated:

1. Landing Zones should:
 - b. To the extent practical, be improved such that they are capable of supporting the fully loaded helicopter, in place.
 - c. Provide safe clearance for the main and tail rotors.
 - d. Be large enough to safely unload the Clients and the guide and their equipment and provide sufficient additional clearance to allow for safe, unobstructed departure of the aircraft.
 - e. The pilot may nonetheless hold power on any Landing Zone.
2. Conditions permitting, where a Landing Zone is to be re-used, it should be improved by:
 - a. Creation of a landing platform of compacted snow, large and strong enough to meet the criteria set forth at item 1, of this Section.
 - b. Installation of wind flagging (survey ribbon or other appropriate, high visibility material) securely affixed to a wand, stake or other appropriate device. Use of at least two (2) wind flags or one (1) wind flag and one fixed reference point (which may be a natural object, colored chalk, painted stake, etc.) at each Landing Zone is recommended. Specific flagging patterns may be adopted to meet Pilot preferences, but flagging practices should be consistent for all Guides and Pilots within a single Helicopter Skiing Operation.
 - c. As conditions warrant, installation of additional wind flagging on nearby terrain features.

HSOG, section IX Operating Procedures, subsection E Landing Zone procedures, stated:

1. Pilot should:
 - a. Before landing, discuss safe Pick-up Zone location and Hazards with Guide.
 - b. If conditions require, check all sides of proposed LZ for winds and cornices.
 - c. Confirm the characteristics of the LZ and approach, and then set up for short final.
 - d. On short final, confirm clearance for main and tail rotor.
 - e. Establish a reference point for departure route.
 - f. Following landing, maintain turbine rpm, unless shutting down.
 - g. Await departure signal from Guide. Pilot should disregard departure signal from Client.
 - h. Following departure, contact Flight Following to communicate location and intentions.

2. Guide should:
 - a. Before landing, assist Pilot with Hazard and PZ identification.
 - b. On short final, assist Pilot by confirming clearances to terrain features.
 - c. Upon landing, unload and secure equipment and closely direct Clients to appropriate location.
 - d. Reconfirm that all latches, doors and ski basket cover are properly secured.
 - e. Visually check aircraft for unusual conditions and/or fluid leaks.
 - f. After reconfirming location of Clients, signal aircraft to depart.

HSOG, section IX Operating Procedures, subsection H Special Procedures for Flat Light and Low Visibility, stated, in part:

Because Helicopter Skiing Activities typically require visibility equal to or greater than that required for flying, operations are rarely conducted in poor visibility and the potential for Controlled Flight into Terrain (CFIT) should be low. However, Pilots must maintain awareness for momentary reduced visibility from blowing snow, changing weather conditions and flat light. Pilots should not hesitate to terminate operations where visibility is insufficient for safe flight.

1. Reduced Visibility. Loose snow becoming airborne from rotor wash can create momentary visibility difficulties, even in periods of good visibility. Pilots should utilize fixed reference points such as LZ-PZ flagging on wands and stakes, equipment secured in place by Guide, rocks, shrubs, ridgelines, and people. Pilots should not hesitate to abort an approach to an LZ or PZ due to marginal visibility and as conditions warrant require a guide at a Pick-up Zone place additional flagging ribbon on surrounding terrain.

HSOG, section X Emergency Response Planning, stated, in part:

No matter how well conceived and executed, no Safety and Operations Plan can eliminate all risks associated with Helicopter Skiing. Risks and other hazards will always remain and accidents will occur. Outfitters must therefore have emergency plans in place to facilitate an appropriate response to an accident. However, and as alluded to in the above quote by Dwight Eisenhower, accidents do not follow scripts and will rarely occur under the circumstances an Outfitter has planned for. Emergency planning and training should, therefore, emphasize communications and the skill sets of guides and Ground Operations personnel to coordinate resources in an emergency. The ability to overcome unanticipated complications or system failures is of greater importance than any specific plan.

See attachment 14 to this report for the entire HSOG.

13.3 HSUS Performance Review

The HSUS Performance Review Checklist focused on 9 areas - Operations - General, Pilot Qualification and Training, Aircraft, Ground Operations, Snow Stability and Hazard Evaluation, Operating Procedures, Emergency Response Planning, Guides and Guide Equipment, and Guide Qualification & Experience Guidelines. Within each area were one or more items classified as essential, required or good practice. The review would then assign a "Result"¹⁹ to each item as an A (complete), B (substantially complete), or C (incomplete). The checklist indicated that the format was "based on Helicat Canada peer review process and Guidelines for Helicopter and Cat Skiing Operations. HeliSki US is an associate member of Helicat Canada."

13.3.1 HSUS Performance Review of Tordrillo Mountain Lodge

The most recent HSUS Performance Review of TML prior to the accident took place June 4-12, 2020. According to the memorandum dated September 28, 2020, summarizing the findings, "The Performance Review Checklist shows that TML has scored 'Complete' in essential and required categories. Your next review will be scheduled in 2025." Additionally, the memorandum concluded "Please see the 'Completed' Performance Review Checklist attached. Between the memo and checklist, TML runs a very solid and professional operation. It is companies like this that make Heliski US such a great organization." A review of the Performance Review Checklist indicated TML received a rating of "A" in all categories²⁰ with two exceptions

¹⁹ A - Complete: The Heli-Ski Operation's program meets all requirements for the indicated item. B - Substantially Complete: The Heli-Ski Operation's program is functional and meets most of the requirements for the indicated item. C - Incomplete: The Heli-Ski Operation's program is not functional for the indicated item or fails to meet most of the requirements for that item.

²⁰ In emails dated October 18 and 19, 2022, the performance review auditor clarified that two items left

- A result of "B" was given to the item "Documentation of Ground Crew training" (classified Required within Ground Operations area) and N/A was given to the item which stated "Coordination of operations with adjacent operators (if any) including communications plan, flight paths, safety procedures & position reporting" (classified Good Practice within Operations - General area). As of April 2022, HSUS did not conduct any additional review of TML as a result of the accident.

Submitted by:

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Human Performance Group Chair

unrated on the checklist should have received an A rating.