U.S. Department of Homeland Security

United States Coast Guard

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5830

MEMORANDUM

FINAL ACTION OF MAJOR INCIDENT INVESTIGATION REPORT INTO THE CIRCUMSTANCES SURROUNDING THE CRASH OF AIRSTA SITKA MH-6016

The report of the Major Incident Investigation Board President, conducted under the provisions of the Major Incident Investigation Manual, COMDTINST M5830.4 (series) and CG PACAREA memo 5830 of 15 NOV 2023, that investigated the circumstances surrounding the crash of AIRSTA SITKA MH-6016 on 13 NOV 2023, complies with applicable regulatory guidance. Accordingly, this report is approved.

A. J. Tiongson, VADM
CG PACAREA (PAC-00)

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United States Coast Guard

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5830
22 Jan 2024

MEMORANDUM

(b) (6)

From: Maurice D. Murphy, CAPT
Major Incident Investigation Board President

23JAN24

To: Andrew J. Tiongson, VADM
CG-PACAREA (PAC-00)

Andrew J. Tiongson VADM USCG

Subj: MAJOR INCIDENT INVESTIGATION (MII) INTO THE CIRCUMSTANCES SURROUNDING THE CRASH OF AIRSTA SITKA MH-6016 ON 13NOV23

Ref:
(a) Major Incident Investigation Manual, COMDINST M5830.4
(b) Safety and Environmental Health Manual, COMDTINST M5100.47D
(c) Organization Manual, CGASINST 5000.1M
(d) Seventeenth District Search and Rescue Plan, CGD17INST 16130.2A
(e) Coast Guard Air Operations Manual, COMDTINST M3710.1I
(f) Risk Management (RM), COMDTINST 3500.3A
(g) AIRSTA Sitka Air Operations Manual, CGASINST 3710.1U
(h) Flight Manual U.S. Coast Guard Series MH-60T Helicopter, CGTO 1H-60T-1
(i) U.S. Coast Guard Model MH-60T Helicopter Maintenance Manual, CGTO 1H-60T-2-V3
(j) MH-60T Common Avionics Architecture System (CAAS) Pilot Vehicle Interface
(k) Flight Deck Operational Requirements (FDOR) for US Coast Guard (USCG) MH-60T Avionics Upgrade, CGTO 1H-60T-8-3
(l) USCG ACMS MPC 00000.5
(m) Aircraft Flight Data User's Process Guide, CGTO PG-85-00-1560-A
(n) Administrative Investigations Manual, COMDTINST M5830.1A
(o) Sitka Bernie Book, 2021 Edition
(p) U.S. Coast Guard Addendum to the United States National Search and Rescue Supplement (NSS) to the International Aeronautical and Maritime Search and Rescue (IAMSR) Manual, COMDTINST M16130.2G
(q) Department of Defense Human Factor Analysis and Classification System (HFACS) 8.0 Handbook

1. **Action of the Convening Authority:** As of the date of this memorandum, the Convening Authority has neither taken nor directed any corrective action.

2. **Executive Summary:** At 22:52[1] on 13 November 2023, United States Coast Guard helicopter CG6016 (MH-60T) crashed on the shore of Read Island approximately 20 miles north of Petersburg, Alaska. CG6016, from Coast Guard Air Station Sitka (AIRSTA Sitka), was responding to a MAYDAY radio transmission from Lydia Marie (LM), a 44-foot fishing vessel taking on water in the vicinity. There were four Coast Guard service members aboard the

[1] All times within this report are Alaska Standard Time (AKST) written in 24 hour format (hh:mm or hh:mm:ss).

aircraft, two suffered serious injuries and two suffered minor injuries. CG6016 sustained significant structural damage, including the partial severing of the tail section and catastrophic damage to the transmission and all four main rotor blades.

This report finds by clear and convincing evidence that the mishap was caused by controlled flight into terrain. This report also finds by clear and convincing evidence that spatial disorientation, environmental factors, inadequate visual and instrument scans, and an inadequate real-time risk assessment were substantially contributing factors. In addition, this report finds by a preponderance of the evidence that fixation and a visual illusion also substantially contributed to the mishap.

3. **Preliminary Statement:**

a. **Authority:** The Coast Guard Pacific Area Commander, Vice Admiral Andrew Tiongson, convened this MII in accordance with reference (a). The Convening Order, dated 15 November 2023, and appointing memos for additional board members are enclosure (1) of this report.

b. **Purpose:** This is an investigation convened to inquire into the facts and circumstances surrounding the Coast Guard mishap involving CG6016, to prepare a publicly releasable report, and to gather and preserve all available evidence for use in any litigation, claims, disciplinary actions, administrative proceedings, and for other purposes.

c. **Investigation Composition:** The MII Board consisted of Captain Maurice Murphy as the MII Board President with Commander (b) (6), (b) (7)(C) as Legal Advisor and Lieutenant Junior Grade (b) (6), (b) (7)(C) as Recorder. Captain (b) (6), (b) (7)(C), Commander (b) (6), (b) (7)(C), and Lieutenant (b) (6), (b) (7)(C) served as subject matter experts and Lieutenant Commander (b) (6), (b) (7)(C) served as an additional board member. Mr. (b) (6), (b) (7)(C) from the United States National Transportation Safety Board (NTSB) served as a technical advisor to the board.

d. **Conduct of the Investigation:** The MII Board met at AIRSTA Sitka from 17-20 and 23-28 November 2023. While in Sitka the board collected documentary and physical evidence and conducted witness interviews. The MII Board traveled to Petersburg and Read Island, Alaska to conduct a witness interview and assess and document the crash site on 21-22 November 2023. Two members of the MII Board met in Seattle to conduct witness interviews on 29 and 30 November 2023. The MII Board requested and was granted a 15-day extension to the 60-day report submission deadline on 19 December 2023. Seventeen witness interviews were conducted; all witnesses were cooperative and openly discussed the mishap under investigation. Due to scheduling conflicts and travel logistics some interviews were conducted over the phone. All in-person interviews were conducted in a private setting, ensuring members had the opportunity to freely express observations and discuss the available evidence. All interviews, in-person and over the phone, were recorded via Coast Guard Microsoft Teams.

On 08 December 2023, Lieutenant (b) (6), (b) (7)(C) provided subject matter expert input to the MII Board; later that same day the MII Board President released Lieutenant (b) (6), (b) (7)(C) from MII Board duties. The MII Board's subject matter expert from the NTSB reviewed the relevant evidence with a member of the MII Board on 11 December 2023. Prior to the MII Board's arrival and during the MII Board's time in Sitka, the Commandant-directed Mishap Analysis Board conducted a concurrent analysis of the mishap. The MII Board interacted with the Mishap Analysis Board during the investigation in accordance with references (a) and (b). On 11 December 2023, the Mishap Analysis Board provided the MII Board a Mishap Analysis Report Part A, which included factual non-privileged information.

4. **Table of Contents:**

5. **Findings of Fact:**

a. **Accident Summary:** CG6016 crashed on the shore of Read Island, Alaska on 13 November 2023, at 22:52. CG6016 was responding to a MAYDAY radio transmission from LM, a 44-foot fishing vessel taking on water in the vicinity. The crew of LM, Alaska State Troopers and volunteer Petersburg Search and Rescue personnel all responded to the crash and assisted at the crash site. All four mishap crew (MC) onboard CG6016 were airlifted to Petersburg, Alaska by a second AIRSTA Sitka helicopter, CG6015. After initial treatment in Petersburg, the MC was flown to Seattle via United States Coast Guard Air Station Kodiak (AIRSTA Kodiak) fixed wing airplane CG2004 (C-130J) on 14 November 2023. All four members of the MC were treated at Harborview Medical Center in Seattle, Washington: two for serious and two for minor injuries. CG6016 sustained significant structural damage including the partial severing of the tail section and catastrophic damage to the transmission and all four main rotor blades.

b. **Background:**

United States Coast Guard Air Station Sitka, Alaska (AIRSTA Sitka)

(1) AIRSTA Sitka is a Seventeenth Coast Guard District shore unit within the Pacific Area of the U.S. Coast Guard. The unit operates three MH-60T helicopters in support of Maritime Homeland Security, Search and Rescue (SAR), Enforcement of Laws and Treaties, Marine Environmental Protection, and Aids to Navigation. "The exercise of command and staff organization of Air Station Sitka are derived from the Coast Guard Organization Manual, COMDTINST 5400.7 (series) and the Coast Guard Air Operations Manual, COMDTINST M3710.1 (series)." (Reference (c))

United States Coast Guard District 17

(2) Reference (d) identifies Commander Seventeenth District as the Federal Search and Rescue Coordinator, with primary responsibility for the initiation and prosecution of all SAR incidents within the Juneau Search and Rescue Region. The Juneau Search and Rescue Region Search and Rescue Coordinator has delegated Sector Commanders, including Sector Southeast Alaska (SEAK) and their designated staff members, authority for SAR mission planning and response as SAR Mission Coordinators within their assigned SAR Areas of Responsibility.

Risk Management (RM): Commandant and Unit Policy

(3) Commandant policy addresses responsibilities for risk management. "Operational commanders, Commanding Officers, and Aircraft Commanders shall carefully weigh the urgency of each mission and assess the benefits to be gained versus the risks involved. For all missions, potential risks to the aircraft and crew shall be weighed against risks to personnel and/or property if the mission is not undertaken. Additionally, the effects of exposing personnel to the additional risks associated with flight operations shall be considered. This is an ongoing process that shall continue until the mission is complete." (Reference (e))

(4) Commandant policy also addresses real-time risk assessments. "In addition to deliberate assessments, all units shall use GAR 2.0 to conduct a real-time risk assessment prior to engaging in operations or activities that expose personnel to hazards and conduct updates throughout execution phases if conditions change... The GAR 2.0 results shall be used to conduct the mission brief and are intended to promote discussion among members regarding potential hazards, mitigation strategies, and roles/responsibilities during the mission. As the mission or activity unfolds, members monitor for change (e.g., crew fatigue, mission characteristics, and environmental conditions) and consider if/how the changes affect the GAR 2.0 elements. This continuous monitoring may be informal, where the crew discusses potential changes, their impacts on GAR 2.0 elements, and actions necessary to mitigate and control risk." ((Reference (f))

(5) AIRSTA Sitka policy addresses risk management and real-time risk assessments for Pilots in Command (PIC). "PICs are responsible for the safe and efficient execution of the assigned mission. PICs shall assess the risk against the gain as missions evolve to arrive at a logical mission resolution. Appendix A of the U.S. Coast Guard Operational Risk Management Assessment Guide is the starting point for a PIC and their aircrew's mission briefing and risk management process. This RM Assessment Model (or the accompanying Sitka Crew Brief Job Aid) shall be used prior to takeoff on all missions and should stimulate and guide discussion of factors that shape the overall risk analysis for a mission." (Reference (g))

MH-60T Systems and Operation

(6) "The MH-60T is a class 1B, single main rotor, twin-engine helicopter, manufactured by the United Technologies Corporation, Sikorsky Aircraft Division. The helicopter is configured with a 20-degree tractor-type canted tail rotor, a controllable stabilator, conventional fixed landing gear, an external cargo hook, a rescue hoist, and pylons for carrying external stores." In addition, it is equipped with two searchlights. The MH-60T's main rotor system's blade pass frequency is 17.2 Hertz, a medium frequency system. (Reference (h), Exhibit 7-Figure 1)

(7) The tail drive system transmits power from the main gearbox to the tail rotor. It is comprised of six drive shaft sections each mated with flexible couplings, viscous damper bearing supports, an intermediate gearbox, and a tail gearbox. (Reference (i), Exhibit 7-Figure 2)

(8) Searchlight: "The dual-white/Infrared (IR) searchlight is mounted underneath the right bottom of the nose section and is controlled from either collective. The searchlight can be moved forward through a 120-degree arc from the stowed position. It can also be turned 360-degree in either a right or left direction on its axis...There is no dimming feature for the dual-white/IR searchlight." (Reference (h))

(9) Trakkabeam: "The Trakkabeam® A800 Airborne searchlight" is a high-intensity searchlight system that is separate from the MH-60T searchlight. "The optical elements focus a high energy light beam with energy concentrated towards the outer edge to ensure the best possible search capability while an integrated optical filter system provides six different configurations." The Trakkabeam is mounted to the exterior of the MH-60T aircraft and is operated by using a controller located in the cabin. (Reference (h))

(10) Hover Coupler: The hover coupler is part of the aircraft's Automatic Flight Control System. When engaged it provides longitudinal and lateral ground speed control and automatic altitude retention. (Reference (h))

(11) Ground Speed Indicator: Ground speed is always represented on the Primary Flight Display for each pilot by a ground speed digital readout located at the 4:30 position just outside the arc of the airspeed indicator. (Reference (j))

(12) Hover Display: When selected, the hover display is automatically configured when ground speed drops below 50 knots and is removed when ground speed increases to above 55 knots. The hover display includes longitudinal and lateral drift velocity scales, heading and drift velocity error bars, and a velocity vector corresponding to the direction and magnitude of the aircraft ground speed. The hover display uses heading and drift velocity data received from the currently selected Embedded Global Positioning System/Inertial Navigation System. (References (h), (k), Exhibit 7-Figure 3)

(13) Aircraft Diagnostic and Vibration Management System: This system is a Honeywell Health Usage Monitoring System that is permanently installed for rotor smoothing and machinery health monitoring. It is designed to monitor component vibration and make recommendations for corrective actions to maintain vibration at a minimum and maximize component life expectancy. This system will record whenever a limit has been exceeded and recommend a corrective maintenance action based on current approved maintenance manuals. (Reference (l))

(14) Voice and Flight Data Recorder: The Voice and Flight Data Recorder is located on the Extended Avionics Rack, behind the pilot's seat. The Voice and Flight Data Recorder records up to 25 hours of flight parameter data and four hours of four-channel audio monitored from the pilot, copilot, and aircrew Intercommunication System (ICS) stations, in addition to an area microphone located on top of the Extended Avionics Rack. Voice and Flight Data Recorder operation in the MH-60T is automatic and will record whenever the aircraft battery is switched on. (References (h), (m))

(15) Hoist Brief: Reference (h) requires aircrews to conduct a Hoist Brief prior to conducting the flight's first hoist and stipulates the brief should be accomplished once on scene to identify hazards and a suitable hoisting area. This brief includes a requirement to complete a

hazard analysis. "Hazard Analysis- Potential gain of a successful evolution versus specific risks observed. Risk evaluation should include the entire crew and consider the following items, although each item need not be verbalized if not applicable." This portion of the brief includes "Obstacles/Hazards/Clearance (stated in ft)." (Reference (h))

(16) Rescue Checklist: The Rescue Checklist prompts crews to ensure a careful consideration of all factors involved in a recovery. "The Rescue Checklist is divided into three parts. Part 1 should be accomplished at altitude before the approach to a hover. Part 2 is completed after the helicopter is established in a hover. Part 3 is completed after securing all hoist evolutions." Rescue Checklist Part 2 includes a Rescue Brief which shall be accomplished prior to commencing hoist or rescue swimmer operations to ensure that the entire crew understands how the evolution will proceed. The Rescue Brief includes: "1. Hazard Analysis - Reassess, As required," "2. Type of recovery/deployment, rescue equipment to be used, and hoisting area," "3. Desired heading, altitude," and "4. Any questions/comments." (Reference (h))

(17) Water Hoists: "Hoists from the water are conducted using standard hoisting procedures and phraseology. Lack of a hover reference over open water may make position keeping difficult, especially at night. To assist position keeping, pilots may use the hover bars on the associated Primary Flight Display for drift information. Use of an altitude hold and/or coupled hover is recommended." (Reference (h))

(18) Indirect Dewatering Pump Delivery: This procedure entails dropping one end of a line to the boat's crew, then securing the other end of the line to a dewatering pump located in the cabin of the aircraft, dropping the dewatering pump into the water, and instructing the boat's crew to haul the pump aboard their vessel via the line. (Reference (h))

Line of Duty

(19) "Line of Duty determination authorities shall presume that a Coast Guard member's death (on active duty), disease or injury was incurred in the line of duty and not due to misconduct unless clear and convincing evidence shows otherwise." (Reference (n))

(20) "Death, injury or disease is the result of a member's misconduct if it is either intentionally incurred or is the result of willful neglect that demonstrates a reckless disregard for the foreseeable and likely consequences of the conduct involved. Simple or ordinary negligence or carelessness, standing alone, does not constitute misconduct. The fact that the conduct violates a law, regulation, or order – or the fact that the conduct is engaged while the individual is intoxicated – does not, of itself, constitute a basis for a determination of misconduct." (Reference (n))

c. **Sequence of Events:**

Mission Tasking

(1) At 20:06 Sector SEAK received a MAYDAY call from the 44-foot fishing vessel LM near Farragut Bay in position 57°06.0785'N, 133°14.106'W. LM reported they were taking on water at a rate of two feet per hour and needed a pump. The crew of LM were equipped with immersion suits, a life raft, and an Emergency Positioning Radio Beacon that was expired and not registered to LM. At 20:12, LM informed Sector SEAK that a pump on board had slowed the flooding. (Exhibit 1)

(2) As required by reference (d), Sector SEAK assumed responsibility for coordinating the SAR response, assigned a SAR Mission Coordinator, and began case prosecution. (Exhibit 3)

(3) At 20:19, after gathering the required information and receiving approval from District 17, Sector SEAK contacted AIRSTA Sitka and requested the launch of an MH-60T helicopter to assist LM. (Exhibits 3, 4)

Overview of Flight, Crash and Response

(4) CG6016 departed AIRSTA Sitka at 20:54:12 and followed a unit-defined Global Positioning System route at 500 feet Above Ground Level (AGL) and 120-143 knots. CG6016 transited westward through Sitka Sound, south along Baranof Island, around Cape Ommaney, north in Chatham Strait, and eastward through Frederick Sound to Farragut Bay. The MC conducted a satisfactory test of the Trakkabeam as part of the startup check. (Exhibits 5, 6, 7-Figure 4, 10, 11, Reference (o))

(5) CG6016 departed this path in the vicinity of Whale Bay but returned to the route after limited visibility prevented using Whale Bay and Gut Bay to shorten the transit. (Exhibits 2, 6)

(6) When in the vicinity of Farragut Bay, CG6016 departed the unit-defined Global Positioning System route a second time and proceeded toward the position of LM provided by Sector SEAK prior to launch. The MC then spotted LM's sodium lights, descended to 300 feet AGL, and navigated visually toward the vessel's new position at 57°07.710'N, 133°11.843'W. (Exhibits 1, 2, 6, 8, Reference (o))

(7) CG6016 arrived in the vicinity of LM at approximately 22:18. LM was anchored approximately 200 yards north of Read Island. The island was forested with trees in the immediate area that reached up to 140 feet AGL. (Exhibits 2, 7-Figures 5-7, 9)

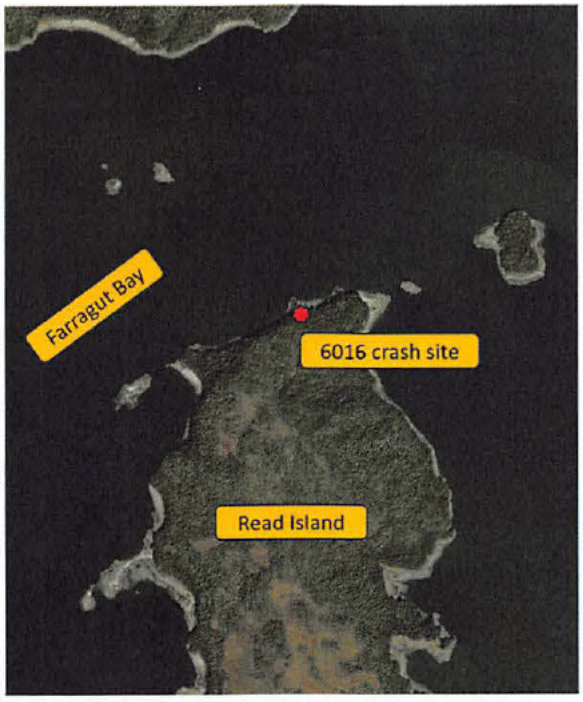

Exhibit 7 - Figure 5

(8) After arriving on scene, CG6016 remained north of Read Island in the immediate vicinity of the vessel, primarily downwind, southwest of LM. CG6016 remained in a hover with the exception of two left turn patterns to the north and northwest of the vessel. Hover altitudes varied between 37 (target altitude 50) and 180 (target altitude 150) feet AGL. (Exhibits 2, 5, 6, 8)

(9) Once on scene, both the Flight Mechanic (FM) and Rescue Swimmer (RS) donned gunner's belts and removed their five-point harnesses to prepare the cabin for hoisting evolutions. The FM and RS did not use the five-point harnesses in the cabin crew seats for the remainder of the flight. (Exhibits 2, 10, 11)

(10) While on scene the MC tested various lighting configurations of both LM and CG6016 and discussed their plan to provide assistance. The MC had initially planned for the RS to assist LM with dewatering and considered two delivery options for the dewatering pump, either directly to LM or indirectly using a trail line. At the time of the crash the MC had decided to indirectly deliver a dewatering pump to LM without deploying the RS. (Exhibits 2, 6, 8, 10)

(11) Approximately 33 minutes after arriving on scene, while the MC was attempting to reenergize a failed Trakkabeam, CG6016 began a steady right slide toward Read Island and left yaw. Over one minute later the aircraft was still sliding right and yawing left while the MC discussed the Trakkabeam and their plan to deliver the dewatering pump. At that time the area microphone in the cabin of CG6016 recorded medium frequency thuds (~17 Hertz) and the aircraft flight data recorder recorded abnormal vibrations. (Exhibits 2, 5, 12)

(12) The aircraft began an immediate descent and six seconds after the start of medium frequency thuds came to rest inverted on the shore of Read Island. The total flight time for CG6016 from takeoff to crash was approximately 1 hour and 59 minutes. (Exhibit 5)

(13) The crew of LM alerted Sector SEAK to the incident and then provided assistance to the MC. Local responders, including the Petersburg Fire Department and Alaska State Troopers coordinated volunteers who also assisted the MC at the crash site. The MC was recovered by a second AIRSTA Sitka helicopter, CG6015, and landed in Petersburg, Alaska at 02:50. After initial treatment in Petersburg, the MC was flown to Seattle via AIRSTA Kodiak fixed wing airplane CG2004 (C-130J) and treated at Harborview Medical Center. (Exhibits 13, 14, 15)

LM Lighting and MC use of Night Vision Googles (NVGs)

(14) LM's installed sodium lights were energized when CG6016 arrived on scene and the MC worked with LM to test visual conditions with the sodium lights both secured and energized. When energized the sodium lights provided improved visibility of the surrounding area, however the MC found it difficult to see the vessel itself through the glare of these lights. The Pilot Not in Command (NPIC) recalled there was only one visible light, on the mast of LM, when the sodium lights were secured. The NPIC tested visibility both with and without the use of NVGs. (Exhibits 2, 6, 8, 10, 11)

(15) At 22:30:38, more than 21 minutes before the crash, LM's sodium lights were secured for the last time during the flight. (Exhibit 2)

(16) For at least the last 11 minutes before the crash both pilots were using NVGs. The FM and RS did not use NVGs during the flight. (Exhibits 2, 6, 8, 10, 11)

Use of Aircraft Trakkabeam

(17) At 22:40:31, after LM's sodium lights were secured for the last time and while hovering in the vicinity of LM, the MC energized the Trakkabeam. The MC tested several modes before settling on the yellow filter as the preferred operational mode. The Trakkabeam then failed at 22:47:29, after less than seven minutes of use. After the failure the NPIC expressed that the Trakkabeam, "really helped me out." The PIC added, "it was helpful for me too." The RS began troubleshooting the Trakkabeam and continued to do so for the remainder of the flight. (Exhibits 2, 6, 8, 10)

(18) CG6016 crashed approximately four and a half minutes after the Trakkabeam failed. (Exhibit 2)

Use of Aircraft Searchlight and Anti-Collision Lights

(19) Within the first three minutes of the flight the MC discussed and de-energized both the searchlight and anti-collision lights due to their negative impact on visibility when used in precipitation and in conjunction with NVGs. (Exhibits 2, 5)

(20) At 22:19:00, during the Approach to Water Checklist as CG6016 approached LM, the PIC stated that the use of the searchlight was the NPIC's choice; the searchlight remained off following this checklist and the MC did not discuss the searchlight again for the remainder of the flight. (Exhibits 2, 5)

(21) At 22:23:36, while hovering in the vicinity of LM and with the NPIC at the flight controls, the searchlight energized for a one second period and was then de-energized for the remainder of the flight. (Exhibits 2, 5)

MC Actions and Aircraft Motion in the Final Three Minutes of Flight

(22) At 22:49:15, less than two minutes after the Trakkabeam had failed, the FM asked the NPIC, who was seated in the right seat, if they had called for Rescue Checklist Part 2. The NPIC confirmed that they had not yet called for Rescue Checklist Part 2, then called for the checklist. Immediately after calling for the checklist the NPIC expressed uncertainty about their ability to maintain a stable hover. (Exhibit 2)

(23) At 22:49:55 the FM called for the final step in Rescue Checklist Part 2, the Rescue Brief. Before the NPIC could begin the brief, the RS provided an update on the Trakkabeam and noted that it was still not working. The NPIC then stated they would delay the Rescue Brief. (Exhibit 2)

(24) A few seconds after the NPIC delayed the start of the Rescue Brief, there was approximately six seconds of audible squeals on the ICS, referred to by the MC as "tin-canning." This was the third and longest instance of "tin canning" during the flight. Immediately after this instance of "tin-canning" stopped, the FM stated that the RS's ICS cord was the cause and the RS had disconnected from the ICS. (Exhibit 2)

(25) At 22:50:25 the NPIC noted that LM was moving and stated an intention to follow it to the right. The aircraft did not yet move right. (Exhibits 2, 5)

(26) Ten seconds later, at 22:50:35, the NPIC noted that they had the terrain on the right (Read Island) in sight and they would look at the terrain instead of the boat while moving right. The aircraft did not yet move right. (Exhibits 2, 5)

(27) About 20 seconds later, at 22:50:53 with the aircraft heading stable at 082[2], the NPIC indicated they were initiating a right slide of the aircraft. The aircraft then began a right slide and at the same time the aircraft heading began a steady left yaw. (Exhibits 2, 5)

(a) The aircraft continued sliding right and yawing left for the next 69 seconds until the area microphone recorded medium frequency thuds. The aircraft moved in a southeasterly direction during the 69 second slide, which also included periods of aft-right motion. Aircraft ground speed averaged 6.6 knots and twice reached a maximum of 11 knots. The heading changed 104 total degrees at an average rate of over 1.2 degrees per second, from 082 at the start of the slide to 338. The aircraft radar altimeter maintained between 66 and 80 feet during this time period. (Exhibit 5)

(b) During this continuous right slide over 69 seconds, the MC did not verbalize an intent to maintain a prolonged right slide or initiate a heading change, nor did the MC acknowledge the aircraft's ground speed or heading. (Exhibit 2)

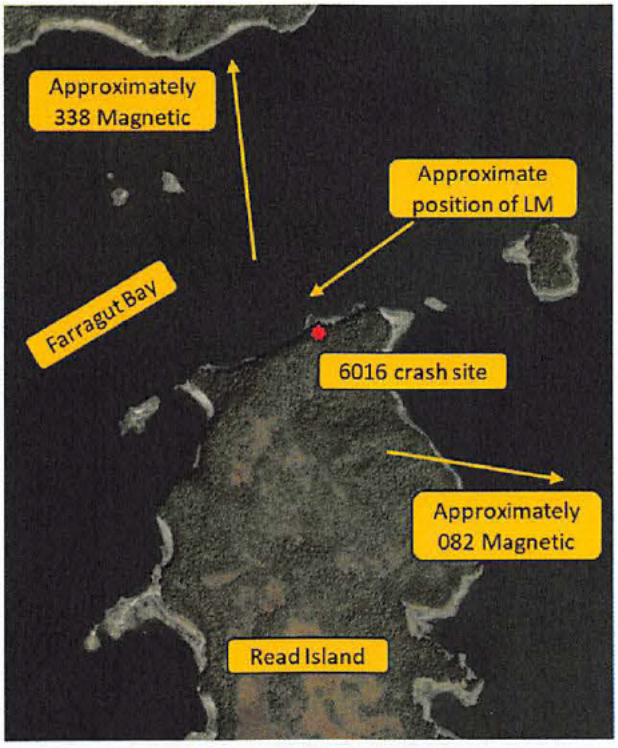

Exhibit 7- Figure 8

[2] All bearings and headings within this report are magnetic compass bearings.

(28) At 22:51:09, 16 seconds after the start of the slide and 53 seconds before the area microphone recorded medium frequency thuds, the RS now back on ICS, provided an update on the Trakkabeam and noted that it was still not working. (Exhibit 2)

(29) At 22:51:18, 25 seconds after the start of the slide and 44 seconds before the area microphone recorded medium frequency thuds, at a ground speed of 9 knots and yawing left past heading 045, the NPIC noted that they had both the terrain and LM in sight. (Exhibit 2)

(30) At 22:51:32, 39 seconds after the start of the slide and 30 seconds before the area microphone recorded medium frequency thuds, at a ground speed of 5 knots and yawing left through a heading of 021, the NPIC stated they would keep the boat "right on the dash." The PIC verbally concurred with this plan. (Exhibits 2, 5)

(31) At 22:51:41, 48 seconds after the start of the slide and 21 seconds before the area microphone recorded medium frequency thuds, at a ground speed of 8 knots and yawing left through a heading of 011, the RS stated the Trakkabeam was still giving an error message and expressed doubt that they would be able to fix it. The NPIC acknowledged the update and then asked the PIC what they thought. (Exhibits 2, 5)

(32) At 22:51:52, 59 seconds after the right slide began and 10 seconds before the area microphone recorded medium frequency thuds, at a ground speed of 7 knots and increasing, while yawing left through a heading of 358, the PIC discussed their concern for losing visual references while delivering the trail line to LM during the upcoming evolution. During the 10 seconds the PIC spoke, ground speed increased to 11 knots and the left yaw continued at a rate of more than 1.5 degrees per second. The radar altimeter remained between 70 and 75 feet for these 10 seconds. (Exhibits 2, 5)

(33) At 22:52:02, 69 seconds after the right slide began, at a ground speed of 10 knots and yawing left at a heading of 338, the aircraft area microphone recorded medium frequency (17 Hertz) thuds. Immediately following these thuds, the aircraft experienced severe abnormal vibrations, a decrease in rotor rpm (Nr), a matching decrease in engine power turbine speed (Np), and an increase in torque. (Exhibits 5, 12)

(34) The aircraft began an immediate vertical descent and within six seconds of the medium frequency thuds the aircraft came to rest at position 57°07.622'N 133°11.823'W, on the ground of Read Island at a heading of 358, inverted at an angle of 128° left wing down. (Exhibits 5, 12, 16)

(35) Following the crash, the PIC and NPIC egressed the aircraft and assisted the FM and RS until additional assistance arrived. (Exhibits 6, 8, 10)

(36) Both the PIC and NPIC expressed confusion about the helicopter's proximity to terrain at the time of the crash. (Exhibits 2, 6, 8)

Risk Management (RM): This section includes the information concerning mission risk and gain that was available to the MC, MC discussions of hazards, risk and gain, those portions of the checklists performed by the MC that included risk and gain, and flight details related to hover stability. This section is organized chronologically.

RM: Pre-Flight Brief

(37) In accordance with reference (g) the MC conducted a Crew Briefing and Operational Risk Management Brief in the hangar prior to getting into the aircraft. (Exhibits 6, 8, 10, 11)

(38) During this pre-flight brief the MC determined the mission was medium risk. The medium risk was due to weather and planning since they did not yet know what LM looked like and how best to assist. (Exhibits 2, 6, 8)

(39) During this pre-flight brief the MC determined the mission was high gain. The MC believed the vessel to be taking on water at a rate of two feet per hour with no dewatering pumps and felt strongly that the crew of LM was in imminent danger. (Exhibits 6, 8)

(40) The MC did not explicitly change this pre-flight mission assessment of medium risk and high gain during the flight. (Exhibits 2, 6, 8)

RM: Enroute Before the Hoist Brief

(41) At 20:57:37 Sector SEAK updated CG6016 on the status of LM via radio transmission. The update included that LM was keeping up with the rate of flooding. (Exhibits 2, 6, 8)

(42) After this radio call from Sector SEAK the MC discussed LM's improved circumstances and the "stark difference" between the initial report and this update. The RS noted that LM's situation was "mildly under control," and the PIC noted that they would like to help LM but did not want to scare themselves in the attempt. (Exhibit 2)

(43) At 21:09:50 the MC elected not to transit through Whale Bay and Gut Bay due to poor visibility and darkness. (Exhibits 2, 6, 10)

(44) At 21:16:59 the MC received an update from Sector SEAK via radio transmission that LM had anchored in the vicinity of Read Island. (Exhibit 2)

(45) The MC noted their environment's extreme darkness on three occasions during this phase of the flight. (Exhibit 2)

RM: Enroute Hoist Brief

(46) At 21:18:43 the MC conducted a Hoist Brief while enroute to the vessel's position. The PIC stated they would only discuss specific portions of the Hoist Brief and would provide an update once they arrived on scene. (Exhibit 2)

(47) When discussing the "obstacles/hazards/clearance (stated in feet)" portion of the Hoist Brief, the PIC stated that the vessel was not one they were familiar with and that the crew would maintain a "25-foot safety buffer." There was no mention of other known or potential on-scene obstacles or hazards during the Hoist Brief. (Exhibit 2)

(48) When discussing the "risk versus gain" portion of the Hoist Brief the PIC asked if they were assuming more risk than they had discussed during their pre-flight brief. The MC agreed that they had mitigated risk with their choice of route. The MC did not discuss gain or any revised assessment of gain during the Hoist Brief. (Exhibit 2)

(49) The MC did not explicitly update the Hoist Brief later in the flight. (Exhibit 2)

RM: Enroute to Scene After the Hoist Brief

(50) At 21:30:40 the PIC commented on the darkness and the NPIC noted that they had not flown on such a dark night in a while. (Exhibit 2)

(51) At 21:43:40 the MC discussed how the Coast Guard would assist LM throughout the night. They noted that there was a Coast Guard cutter stationed in Petersburg, Alaska but did not know the status. They also noted that the pump they planned to deliver could last four to five hours or longer if LM carried gasoline. The RS noted that since LM's pumps were keeping up with the flooding, the crew of LM could delay turning on the delivered pump until it was needed. (Exhibit 2)

(52) At 22:07:08, approximately 11 minutes before arriving on scene, the MC overheard a conversation between LM and Sector SEAK on Very High Frequency (VHF) radio. LM provided an update on their situation, that they were in calm waters, and keeping up with flooding. Two minutes later, at 22:09:39, the MC began direct radio communications with LM who confirmed they were keeping up with the flooding. (Exhibits 2, 6)

(53) At 22:17:05, as CG6016 approached Farragut Bay, the RS used the Electro-optical/Infrared system to estimate the distance from LM to the shore of Read Island. The RS estimated that LM was approximately a quarter mile from shore. (Exhibit 2)

RM: Approach to Water Checklist

(54) At approximately 22:18:07, as CG6016 initially approached LM, the NPIC asked if they should descend to 150 feet; the PIC agreed and CG6016 began a descent from approximately 300 feet AGL. (Exhibits 2, 5)

(55) When CG6016 was at 200 feet AGL the PIC began a rapid briefing of the Approach to the Water Checklist for an NVG Aided Approach to a Controlled Hover. (Exhibits 2, 5)

(56) During the "NAV to Final: Terrain/Obstacles/Wind" portion of the checklist, the PIC did not discuss terrain or obstacles. (Exhibit 2)

(57) Before the PIC could move to the next step of the checklist the RS announced 140 feet on the radar altimeter. CG6016 descended to 130 feet before stabilizing at approximately 150 feet. (Exhibits 2, 5)

(58) The PIC then resumed the Approach to the Water Checklist at a less hurried pace and completed the remaining items on the checklist. (Exhibit 2)

(59) During the checklist both pilots verbally acknowledged arming their hover display. (Exhibit 2)

(60) During the "Search light, Hover/Rescue light, and Trakkabeam® - As required" portion of the checklist the PIC reminded the NPIC that the searchlight was available but did not discuss the Hover/Rescue light or Trakkabeam. (Exhibit 2)

RM: On Scene with LM

(61) During their time on scene with LM the MC noted downdrafts on seven occasions. They attributed these downdrafts to turbulent winds present on the downwind side of Read Island.

(a) On two occasions the MC stated that they observed cat's paws, a visible indication of a downdraft, on the surface of the water. (Exhibits 2, 5, 6, 8)

(b) On five other occasions the MC verbalized instances of brief downdrafts impacting the aircraft. On each of these occasions, CG6016 momentarily descended before regaining altitude. These five brief descents were indistinguishable from the continuous altitude deviations recorded throughout the period spent hovering on scene. (Exhibits 2, 5)

(62) On three different occasions after arriving on scene (22:19:49, 22:21:53 and 22:32:29) CG6016 moved to an unannounced location, relative to LM, that prompted pilot action. (Exhibit 2)

(a) The first instance occurred immediately after arriving on scene when CG6016 hover taxied past LM. The NPIC kept the controls, executed a left turn, and returned to a position southwest of LM. (Exhibit 2)

(b) On both the second and third occasions, the NPIC passed the controls to the PIC after maneuvering into a position where the NPIC lost visual contact with LM. On each of these occasions the PIC maneuvered the aircraft to regain visual contact. (Exhibits 2, 6, 8)

(c) On the first two occasions LM's sodium lights were energized, the Trakkabeam had not yet been energized, and the NPIC was using NVGs. On the third occasion, LM's sodium lights were secured and the Trakkabeam had not yet been energized. The NPIC was not using NVGs during this third occasion. (Exhibit 2)

(63) In a 14-minute span between 22:28 and 22:42, the MC discussed the challenging on-scene conditions on six occasions pertaining to their ability to maintain a stable hover in the vicinity of LM and Read Island. (Exhibit 2)

(a) At 22:28:00, with LM's sodium lights energized and before the Trakkabeam was energized, the PIC commented on the elevated difficulty and advanced skillset required to accomplish the proposed evolution. (Exhibit 2)

(b) At 22:31:57, with LM's sodium lights secured and before the Trakkabeam was energized, the PIC and NPIC noted downdrafts, crosswinds, and how difficult it was to hover. Following this comment the RS suggested altering their operational plan to only deliver the dewatering pump instead of the RS and the pump. The RS was interrupted by the NPIC passing control of the aircraft to the PIC at 22:32:29, as noted above. (Exhibit 2)

(c) At 22:33:48, with LM's sodium lights secured and before the Trakkabeam was energized, the MC noted that LM was anchored close to Read Island making hoisting in that vicinity difficult. (Exhibit 2)

(d) At 22:34:31, with LM's sodium lights secured and before the Trakkabeam was energized, the RS stated, "trying to weigh the pros versus cons...right now they're stable...with how much we're struggling to hold a hover right here," during a discussion of possible hoisting

evolutions. This comment prompted a MC discussion of the risk imposed by putting the RS in the water or on the boat. Following this conversation, the MC decided to attempt an indirect pump delivery without putting the RS in the water. (Exhibits 2, 10)

(e) At 22:39:52, with LM's sodium lights secured and before the Trakkabeam was energized, the NPIC commented on the lack of adequate hovering references. (Exhibit 2)

(f) At 22:42:04, with LM's sodium lights secured and with the Trakkabeam now energized, the PIC commented on the difficulty of maintaining a stable hover. In addition, the PIC indicated they were at their own maximum comfort level and that as a result, the MC would only make one attempt to get the trail line to the boat. (Exhibits 2, 6, 8)

(64) At 22:43:23 the PIC stated that they were about to enter Instrument Meteorological Conditions (IMC) and were concerned about losing visual references. The PIC asked the NPIC to engage the Hover Coupler and the NPIC did so. During the PIC's request the first instance of "tin canning" occurred. (Exhibits 2, 6, 8)

(65) Between 22:43:44 and 22:44:22, with the Trakkabeam energized, the PIC asked the NPIC to confirm that the NPIC had "references on the right" three different times while passing control of the aircraft to the NPIC. On each occasion the NPIC responded in the affirmative. After the last affirmative response the PIC stated, "I can see it now too." (Exhibit 2)

(66) At 22:44:33 the MC discussed the distance to the terrain on their left (to the northwest). During this discussion the RS used the Electro-optical/Infrared system to determine a range of 0.6 miles to that terrain. (Exhibits 2, 6, 10)

(67) At 22:45:40, while the MC discussed the indirect pump delivery, the second instance of "tin canning" occurred; the RS attempted to clean their ICS cord to resolve the issue. (Exhibit 2)

(68) At 22:46:34, with the Trakkabeam still energized, the PIC interrupted a radio call to LM to alert the NPIC, who was controlling the aircraft, that the aircraft was drifting forward. At the time of the PIC's statement the aircraft had been drifting forward for 11 seconds at a ground speed of four to six knots. The forward drift stopped following this statement. (Exhibits 2, 5)

(69) At 22:49:12 the MC noted a downdraft for the last time during the flight. (Exhibits 2, 5)

(70) In the final three minutes of flight, after failure of the Trakkabeam, the MC expressed concern twice about their ability to maintain a stable hover in the vicinity of LM.

(a) At 22:49:24 the NPIC indicated that the evolution might not be possible based on hovering difficulty. (Exhibit 2)

(b) At 22:51:52 the PIC commented on their concern for losing hoisting references during the proposed hoisting evolution. (Exhibit 2)

(71) The MC did not discuss the height, the aircraft distance to, or other characteristics of the trees on Read Island during the flight. During a post mishap interview, the PIC stated they knew the aircraft was close to Read Island while hovering near LM and estimated that distance to be less than a quarter of a mile. (Exhibits 2, 6)

Crash Site Information

(72) Following the crash multiple trees in the vicinity of CG6016 showed evidence of recent damage. (Exhibit 7-Figures 7, 9, 10, 12)

(73) One tree, approximately 20 feet north of where CG6016 came to rest, showed evidence of fresh damage to the trunk from approximately 65 to 75 feet AGL. (Exhibit 7-Figures 7,9)

Exhibit 7 – Figure 9

Exhibit 7 – Figure 10

(74) The Federal Aviation Administration Visual Flight Rules (VFR) Juneau Sectional Aeronautical Chart, displayed in the cockpit of CG6016 and used by the MC while navigating to LM, did not depict an accurate location of Read Island. The chart depicted Read Island offset to the east-southeast of its actual position. (Exhibits 14, 17)

(75) The MC did not use the VFR Juneau Sectional Aeronautical Chart as a primary reference for aircraft position while on scene. (Exhibits 2, 6)

(76) There is no evidence to suggest the MC used the VFR Juneau Sectional Aeronautical Chart while on scene to remain clear of or gauge the aircraft's distance to Read Island. (Exhibits 2, 6)

d. **Maintenance:** The MII Board reviewed all applicable maintenance records including aircraft maintenance logbooks, recent aircraft discrepancies and trends, Maintenance Due Lists, Significant Component History Reports, the Aircraft Configuration Report, Aircraft Diagnostic and Vibration Management System data, weight and balance records, quality assurance records, ground support equipment, and the aircraft toolbox inventory.

(1) CG6016 was manufactured by Sikorsky Aircraft Corporation and accepted into service on 01 December 1991. CG6016 was transferred to AIRSTA Sitka on 01 February 2022, with 17,104.6 hours following Programmed Depot Maintenance at the Aviation Logistics Center. (Exhibits 16, 18)

(2) The aircraft had approximately 18,230 hours on the airframe at the time of the incident. There were no previous mishaps that caused any significant structural or other damage to this airframe. All applicable Time Compliance Technical Orders were completed for the aircraft. (Exhibits 16, 18, 19)

(3) Weight and balance on the aircraft was competed on 22 July 2023, and found to be within standards. (Exhibit 16)

(4) Prior to dispatch for the mishap flight, CG6016 was in a "Safe For Flight" (Up) condition and provided a Fully Mission Capable Status. CG6016 maintenance records showed typical in-service discrepancies and corrective actions. The aircraft was current on scheduled calendar and non-calendar maintenance in accordance with the aircraft Maintenance Due Lists and special inspections. This included a navigational database update on 02 November 2023. (Exhibits 16, 19, 20, 21, 22)

(5) The trail rotor was satisfactorily balanced in accordance with maintenance procedure card 64004.5 on 04 November 2023, after a 14-day Aircraft Diagnostic and Vibration Management System review showed the tail rotor balance in the exceedance range. After completing this maintenance, the final recorded vibrations were 0.09 Inches Per Second, (which is safe for flight), with the balance point at 0.2 Inches Per Second or less. (Exhibits 22, 23)

(6) During the previous 31 days leading up to 13 November 2023, the oil cooler fan shaft, a component of the tail rotor drive system, had transgressed in and out of the yellow caution range. A vibration level in the caution range is above minimum but deemed safe for continued flight. (Exhibit 24)

(7) NVG history reports showed typical in-service discrepancies and corrective actions. (Exhibit 25)

e. **Airframe Systems:**

Pre-Mishap Condition

This section covers condition of the aircraft prior to the medium frequency thuds recorded by the area microphone.

(1) There is no data to suggest that the airframe or any aircraft systems were operating abnormally prior to the recording of medium frequency thuds on the area microphone. The following is a specific breakdown of relevant aircraft systems. (Exhibit 5)

(a) Airframe: There is no data to suggest an in-flight break up or failure of the airframe. The aircraft experienced normal aircraft accelerations and vibrations leading up to the point of the thuds. (Exhibits 5, 24)

(b) Flight Controls

1. There is no evidence of flight control anomalies or abnormal flight characteristics. Additionally, the MC did not discuss any binding/restriction in flight controls or abnormal flight characteristics. The aircraft did not experience any unusual attitudes in pitch, roll, or yaw or erratic aircraft movement over ground (ground track speed and direction) that would indicate flight control anomalies. (Exhibits 2, 5)

2. There is no indication of abnormal operation of the Automatic Flight Control System (degraded cautions or Stability Augmentation System malfunctions) to include the hover coupler which was in use at the time of the crash. The stabilator remained at 38 degrees trailing edge down, which is typical for this flight regime. (Exhibits 2, 5)

(c) Main rotor system

1. There is no indication of loss of main rotor drive. The main rotor head remained at 100% Nr and all aircraft electrical and hydraulic systems were operating normally (powered by main transmission). (Exhibit 5)

2. The main transmission exhibited normal oil pressure and temperature in the main transmission module. There was no indication of ferrous particles (chips) in the accessory, input, or main modules of the transmission. (Exhibit 5)

3. There is no indication of severe vibrations or accelerations indicative of a main rotor blade separation or failure in flight. (Exhibit 5)

(d) Tail rotor system: There were no indications of reduced effectiveness or loss of drive of the tail rotor system. There were no intermediate or tail gearbox cautions for ferrous particles or high oil temperature. The aircraft did not experience yaw rates consistent with a loss of tail rotor drive. (Exhibit 5)

(e) Engines

1. There were no recorded engine malfunctions or abnormal engine indications. Gas Generator Speed (Ng), Power Turbine Speed (Np), and Turbine Gas Temperature (TGT) remained in the normal range for both engines. There was no indication of low fuel quantity, low fuel pressure, or fuel filter bypass condition on either engine. (Exhibit 5)

2. The engine lubrication system for both engines remained within normal operating parameters. Neither engine showed an indication of high oil temperature, low pressure, engine chips, or an oil filter bypass condition. (Exhibit 5)

3. Prior to the crash, engine torques for each engine, as supplied to the main transmission input modules, were normal at approximately 82.2% averaged dual engine torque. (Reference (h), Exhibit 5)

Table 1: CG6016 Engine Parameters		
Parameter	**Averaged value of last 2.6 seconds prior to thuds (Engine 1, 2)**	**Normal Operating range**
Gas Generator Speed (Ng)	93.3%, 92 %	0-98% (% RPM)
Power Turbine Speed (Np)	100%, 100%	96-105% (continuous)
Turbine Gas Temperature (TGT)	673, 685 degrees C	0-810 degrees C
Engine Oil Pressure	68.2, 75.5 PSI	26-100 PSI
Engine Oil Temperature	81.5, 78.3 degrees C	-50-135 degrees C
Averaged Dual Engine Torque	81.8%, 82.6%	0-106%

(f) Hydraulic Systems: There were no recorded or reported malfunctions with hydraulics, to include hydraulic pump failures, loss of pressure at the three primary flight control servos or #1 tail rotor servo, loss of hydraulic fluid at the reservoirs, boost servo malfunctions, or Stability Augmentation System malfunctions. (Exhibit 5)

(g) Electrical Systems: There were no recorded failures of either of the two alternating current generators and their respective five alternating current buses, or either of the two direct current converters and their respective five direct current buses. (Exhibit 5)

Post-Mishap Condition

This section covers condition of the aircraft and systems after the medium frequency thuds recorded by the area microphone.

(2) The aircraft came to rest in three sections with debris, primarily from the main rotor blades, extending approximately 300 feet from the crash site. Apart from main rotor blade debris, the remaining airframe and dynamic components are localized to the crash site. The fuselage of the airframe came to rest inverted (128° left wing down) on relatively flat terrain approximately 10 feet above the high tide line. Initial estimates are that the airframe will be a complete loss, however some subsystems and individual components may be salvageable. The estimated aircraft property damage is $28,000,000. (Exhibits 5, 7-Figures 12-15, Exhibit 16)

(a) Airframe

1. The airframe was partially separated into three main sections. Section one includes the nose aft to the forward portion of the tail cone, which came to rest upside down and on the left side of the airframe supported by the main transmission and main rotor head. Section two includes a portion of the tail cone resting on the left side. Section three includes the remainder of the tail that came to rest upright. The annotated aircraft configuration report provides a detailed analysis of component damage. (Exhibit 7-Figures 16-19, Exhibit 16)

2. Section one showed airframe buckling and distortion on the right side of the fuselage, aft of the pilot door and in the transition section just forward of the tail boom. There was no visible damage to any components internal to the avionics bay. The cockpit canopies were damaged with cracks present throughout the left front windshield. Cockpit instrumentation,

panels, switches, and flight controls showed no obvious signs of damage. (Exhibit 7-Figures 17, 23-25)

3. The airframe cabin remained largely intact with damage near the main gearbox support beams that protruded into the cabin ceiling. The left side cabin windows were pushed out on the bottom portion. The cabin sliding door was open and unable to close. Troop seat bars remained intact, except for the portion near the Electro-optical/Infrared display screen. Both crew seats remained intact. The gunner's belts remained intact and did not separate from the floor or top panel where connected. (Exhibit 7-Figures 26-28)

(b) Main rotor system

1. The flight control components in the hydraulics bay area forward of the mechanical mixing unit remained largely intact. (Exhibit 7-Figure 29)

2. Three adjacent main rotor blades, Black, Yellow, and Blue, departed the main rotor head at the elastomeric bearing near the main rotor hub. The fracture surfaces of the Black and Yellow elastomeric bearings have a craggy and rough appearance. The Blue elastomeric bearing was not examined as it was underneath the aircraft and out of view during crash site analysis. (Exhibit 7-Figures 30-32, 39)

3. Substantial sections of all four main rotor blades were identified at the crash site. The high amount of fragmentation of the main rotor blades is consistent with tree and ground impact with high kinetic energy, an indication that the rotor head and blades were powered by at least one engine with continuous drive from the engine(s) to the rotor system. (Exhibit 7-Figures 30-43)

4. Of the four main rotor blades, the Yellow main rotor blade remained most intact and came to rest farthest from the fuselage. Toward the blade tip, the Yellow blade showed significant impact damage opposite the direction of rotation, to include a chordwise crack through the titanium spar. (Exhibit 7-Figures 34, 35)

5. The fiberglass skin of the top side of the Red blade remained suspended by tree branches above where the fuselage came to rest, while a substantial portion of the honeycomb core and the skin of the bottom side of the Red blade came to rest on the ground near the fuselage. (Exhibit 7-Figures 36-39)

6. The Black and Blue blades had fractures that run the full chord line located near the balance stripes. (Exhibit 7-Figures 40-43)

7. The stationary and rotating swashplates were found separated, however there is no evidence to suggest that the swashplate separated in flight. The swashplate bearing race and rolling elements do not show signs of metal smearing, over temperature, or lack of lubrication, which would be consistent with a seizure. Damage to the swashplate is consistent with damage caused by high impact forces experienced during ground contact as the aircraft came to rest inverted. (Exhibit 7-Figure 44)

8. The magnesium housing of the main module of the main transmission system showed damage in several locations consistent with very high impact forces. There was a large crack on the aft right side toward the top of the housing. The main module mounting foot was also separated towards the base of the housing. The area where the number two input module mated to the main module was also fractured. (Exhibit 7-Figures 44, 45)

(c) Tail rotor system

1. The number two, three, and four tail drive shafts showed significant damage. The number two drive shaft separated aft of its attachment to the oil cooler fan and was displaced vertically. The aft end of the number two drive shaft remained within the viscous damper bearing but the bearing support structure separated from the airframe. (Exhibit 7-Figures 46-48)

2. The number three drive shaft remained in one piece. The forward end of number three drive shaft failed at the flexible coupling and the aft end of the shaft remained mated with the forward end of the number four drive shaft. The entirety of the number three drive shaft and forward piece of the number four drive shaft departed the aircraft together and came to rest 12 feet from the aircraft. (Exhibit 7-Figures 13-15, 49-51)

3. The number four drive shaft fractured into two pieces with the forward piece remaining mated and continuous with the number three drive shaft. The aft end of the fractured drive shaft is mated normally to the number five drive shaft and remained with the tail pylon. The failure point of the number four drive shaft is co-located with the significant structural failure of the tail boom. Continuity of drive remained intact from the aft piece of the number four drive shaft through to the tail rotor blades. (Exhibit 7-Figures 51-55)

4. The number five and six drive shaft sections were intact with no damage to connection points to intermediate tail gearbox and tail gearbox. (Exhibit 7-Figures 56, 57)

5. The intermediate and tail gearboxes remained normally installed and showed no sign of thermal damage or cracks in the gearbox housing. Oil samples taken post mishap from both gearboxes showed no anomalies. (Exhibit 7-Figure 56, Exhibit 26)

6. All four tail rotor paddles (two blades) showed similar, minor damage. Each paddle showed damage near the blade tips and the tip caps for each paddle were missing. The abrasion strip on the leading edge of all the blades showed bending opposite the direction of rotation. With the exception of the Yellow tail rotor paddle, which has a chordwise fracture near the root, the overall damage to the tail rotor paddles was minimal. (Exhibit 7-Figures 57-59)

(d) Engines

1. After the medium frequency thuds occurred, both engines responded appropriately to decreasing Nr and Np by increasing Ng to attempt to drive Np and Nr back to 100%. The maximum Ng speed recorded was 101% and 99.5% for the number one and number two engine respectively. (Exhibit 5)

2. Access to the number one engine was not possible due to the resting orientation of the aircraft. The number two engine had some tree debris in the engine inlet. (Exhibit 7-Figure 60)

f. **Weather:**

(1) At 21:13 on Monday, 13 November 2023, the National Weather Service in Juneau provided the following Southeast Alaska Area Forecast Discussion:

(a) Short Term: "Through Tuesday night / Quick moving low across the northern gulf crosses inland over the north-central panhandle and dissipates. The upper-level support at 500 Mb continues headed to the SE. Rain and snow starting Monday afternoon for the panhandle,

with rain/snow line difficult to try and pin down along with any potential accumulations, especially with the mixed P-type. Precipitation is to start tapering off from the north Tuesday into Tuesday night. As the front moves inland central coastal areas and southern panhandle will see the greatest increase in winds. Gusts to 40 mph will mainly be limited to the coastal areas." (Exhibit 16)

(b) Aviation: "Our current storm is moving ashore across the northern Panhandle, with snow falling in Yakutat and Juneau areas. For the north and central regions, expect categories to switch between MVFR and IFR under heavier snow showers, with directional wind shear through the morning. Current analysis and guidance suggest impactful snow remaining north of Frederick Sound, with southern sites seeing MVFR rain. Tuesday morning MVFR across the north, with widespread snow becoming isolated snow showers, and VFR with thunderstorms likely along the coast into the southern Panhandle." (Exhibit 16)

(2) The following table contains the reported weather conditions at Sitka, en route to, and in the vicinity of the crash site on the evening of 13 November 2023.

Table 2: Mishap Weather (Exhibit 16)			
Location/Time	**Sitka (Departure Station) - 2053L/0553Z**	**Kake (En Route Station) 2156L/0656Z**	**Petersburg (Nearest Station) 2256L/0756Z**
Briefed By/ Source	PASI METAR, NTSB Weather Report	PAFE METAR, NTSB Weather Report	PAPG METAR, NTSB Weather Report, FFIA2 NOAA Buoy, NOAA GFS27 Model
Period of Day	Night	Night	Night
Meteorological Conditions	IMC	VMC	IMC
Ceiling	Overcast 1,600' AGL (PASI METAR)	Broken 1,400' AGL (PAFE METAR)	Overcast 1000' AGL, Varying Between 700' AGL and 1200' AGL (PAPG METAR)
Visibility	1 ¾ Statute Miles (PASI METAR)	9 Statute Miles (PAFE METAR)	2 Statute Miles, Varying Between 1 ¼ Statute Miles and 4 Statute Miles (PAPG METAR)
Obstructions to Visibility	Heavy Rain, Mist (PASI METAR)	Light Rain (PAFE METAR)	Light Snow, Mist (PAPG METAR)
Wind	From 130 degrees at 09 knots gusting 22 knots, peak winds from 160 at 28 knots at 2018L/0518Z (PASI METAR)	From 110 degrees at 11 knots gusting 21 knots, peak winds from 120 at 27 knots at 2104L/0604Z (PAFE METAR)	From 300 degrees at 03 knots (PAPG METAR, 21NM SE) From 153 degrees at 29 knots (Station FFIA2 Buoy, 16NM NW) From SE at 8 knots, peak winds 14 knots (NOAA GFS27 Model)
Extreme Weather	No Reported Extreme Weather	No Reported Extreme Weather	No Reported Extreme Weather
Precipitation	Heavy Rain (PASI METAR)	Light Rain (PAFE METAR)	Light Snow (PAPG METAR)
Air Temperature	+6° C (PASI METAR)	+3° C (PAFE METAR)	0° C (PAPG METAR)
Relative Humidity	81%	93%	100%
Dew Point	+3° C (PASI METAR)	+2° C (PAFE METAR)	0° C (PAPG METAR)
Icing Conditions	No Known Icing at 1000' AGL (NTSB Weather Report)	Trace Icing at 1000' AGL (NTSB Weather Report)	Light Icing at 1000' AGL (NTSB Weather Report)
Altimeter Setting	29.58 (PASI METAR)	29.64 (PAFE METAR)	29.70 (PAPG METAR)
Water Temperature	Not Reported	Not Reported	44° F (NOAA GFS Model)
Sea Condition	Not Reported	Not Reported	Less Than 1' (NOAA GFS Model)
Horizon	Not Reported	Not Reported	Not Reported

(3) Tides: The following table includes the tide predictions for Portage Bay, approximately 10 miles to the south of the crash location, and the closest prediction location available. At the time of the crash, the tide was rising, approximately 65% through the cycle from low tide to high tide. (Exhibit 27)

Table 3: Portage Bay Tides			
Date	**Time (LST/LDT)**	**Predicted (ft)**	**High/Low**
11/13/2023	12:31 AM	14.87	H
11/13/2023	6:17 AM	2.82	L
11/13/2023	12:11 PM	17.58	H
11/13/2023	6:47 PM	-1.89	L
11/14/2023	1:08 AM	14.91	H

(4) Moon Phase: The phase of the moon on 13 November 2023, was a New Moon with 0% of the moon's visible disk illuminated. (Exhibit 28)

g. **Crew Qualifications:**

(1) Pilot in Command (PIC)

(a) The PIC was qualified for the assigned mission and current in all required training. (Reference (e), Exhibit 16)

(b) The following tables summarize the PIC's relevant training, qualifications and experience. (Exhibit 16)

Table 4: PIC Training and Qualifications	
Crew Position / Duty	Pilot in Command (PIC)
Pilot Flying / Pilot Monitoring	Pilot Monitoring
Seat Occupied	Left Seat (Copilot)
Current Designation	Aircraft Commander
Qualifications	Instructor Pilot Alaska Aircraft Commander Advanced SAR, Vertical Surface
Specialized Experience	High Altitude Aviation Training Site
Night Vision Goggles (NVG) in Use	Yes
Months at Parent Command	27.5
Last Specialized Training/Check	Cold Weather Survival School: 12/03/2021 Area Hazards Training: 12/07/2022 Crew Resource Management: 9/26/2023 Shallow Water Egress Training: 9/28/2023
Days Since Last Night Hoist	127
Date of Last Flight Before Mishap	11/04/2023

Table 5: PIC Hours				
Experience	**Total**	**Prev 30 Days**	**Prev 60 Days**	**Prev 90 Days**
Total Flight Hours	1,676.4			
Flight Hours in Type / System	1,433.1	15.8	30.7	39.8
Night Hours	320.4	3	8.6	13.7
NVG Hours	210.6	2.5	7.9	13

(2) Pilot Not in Command (NPIC)

(a) The NPIC was qualified for the assigned mission and current in all required training. (Reference (e), Exhibit 16)

(b) The following tables summarize the NPIC's relevant training, qualifications and experience. (Exhibit 16)

Table 6: NPIC Training and Qualifications	
Crew Position / Duty	Pilot Not in Command (NPIC)
Pilot Flying / Pilot Monitoring	Pilot Flying
Seat Occupied	Right Seat (Pilot)
Current Designation	Aircraft Commander
Qualifications	Advanced SAR, Vertical Surface
Specialized Experience	High Altitude Aviation Training Site
Night Vision Goggles (NVG) in Use	Yes
Months at Parent Command	5
Last Specialized Training/Check	Land Survival Training: 10/24/2022 Crew Resource Management: 3/22/2023 Area Hazards Training: 7/24/2023 Shallow Water Egress Training: 10/11/2023
Days Since Last Night Hoist	14
Date of Last Flight Before Mishap	11/04/2023

Table 7: NPIC Hours				
Experience	**Total**	**Prev 30 Days**	**Prev 60 Days**	**Prev 90 Days**
Total Flight Hours	1,669.4			
Flight Hours in Type / System	394.5	24.6	53.3	83.3
Night Hours	407.4	2.3	8.7	15.1
NVG Hours	257.3	0	4.4	9

(3) Flight Mechanic (FM)

(a) The FM was qualified for the assigned mission and current in all required training. (Reference (e), Exhibit 16)

(b) The following tables summarize the FM's relevant training, qualifications and experience. (Exhibit 16)

Table 8: FM Training and Qualifications	
Crew Position / Duty	Flight Mechanic (FM)
Current Designation	Basic Aircrew
Qualifications	FM, Vertical Surface
Specialized Experience	N/A
NVG in Use	No
Months at Parent Command	28
Last Specialized Training/Check	Crew Resource Management Refresher: 3/01/2022 Shallow Water Egress Training: 7/14/2022 Land Survival Training: 10/07/2022 Area Hazards Training: 12/07/2022
Date of Last Flight Before Mishap	11/09/2023

Table 9: FM Hours				
Experience	**Total**	**Prev 30 Days**	**Prev 60 Days**	**Prev 90 Days**
Total Flight Hours	596.3			
Flight Hours in Type / System	204	18.2	18.2	33.9

(4) Rescue Swimmer (RS)

(a) The RS was qualified for the assigned mission and current in all required training. (Reference (e), Exhibit 16)

(b) The following tables summarize the RS's relevant training, qualifications and experience. (Exhibit 16)

Table 10: RS Training and Qualifications	
Crew Position / Duty	Rescue Swimmer (RS)
Current Designation	Currently in MH60T RS Transition Syllabus
Qualifications	RS, Vertical Surface
Specialized Experience	Advanced Helicopter Rescue School Cardiopulmonary Resuscitation/Automated External Defibrillator Quality Assurance
NVG in Use	No
Months at Parent Command	4.5
Last Specialized Training/Check	Crew Resource Management Refresher: 3/04/2023 Area Hazards Training: 7/19/2023 Land Survival Training: 10/17/2023 Shallow Water Egress Training: 10/17/2023
Date of Last Flight Before Mishap	11/10/2023

Table 11: RS Hours				
Experience	**Total**	**Prev 30 Days**	**Prev 60 Days**	**Prev 90 Days**
Total Flight Hours	2,023.6			
Flight Hours in Type / System	1,392	12.8	29.3	55.2

h. **Medical:**

(1) The MC were medically qualified for flight. (Exhibit 29)

(2) The MC obtained adequate crew rest prior to the mishap. (Exhibits 6, 8, 10, 11, 29)

(3) The MC had not exceeded any duty period or flight hour limitations at the time of the mishap. (Reference (e), Exhibits 6, 8, 10, 11)

(4) Toxicology samples were taken on 14 November 2023, while the MC was at Harborview Medical Center in Seattle, Washington. The MC toxicology screenings results did not indicate any alcohol, illegal or non-prescription drug use. (Exhibit 29)

(5) According to an initial medical assessment obtained at Petersburg Medical Center on 14 November 2023, the PIC sustained the following injuries: (Exhibit 29)

(a) Left Clavicle Fracture.

(b) Right Hand Bruise.

(c) Right Hand 5th Digit Strain.

(6) According to an initial medical assessment obtained at Petersburg Medical Center on 14 November 2023, the NPIC sustained the following injuries: (Exhibit 29)

(a) Upper Back Strain.

(b) Neck Strain.

(c) Left Thigh Abrasion.

(d) Concussion, with brief loss of consciousness.

(7) According to an initial medical assessment obtained at Petersburg Medical Center on 14 November 2023, the FM sustained the following injuries: (Exhibit 29)

(a) Pelvic Fracture, non-displaced Iliac Wing.

(b) Right Femur Fracture.

(c) Intracranial Hemorrhage (6mm), Right Frontal Lobe.

(d) Left Upper Lobe Pulmonary Contusion.

(e) Cervical Spine Fracture (C6-C7 Hyperflexion injury), with facet subluxation.

(f) Cervical Anterolisthesis (C6-C7), 3mm.

(g) Thoracic Spine Compression Fractures (T5-T7, questionable T4).

(h) Closed Left Comminuted Acetabular Fracture, including Hematoma.

(i) Pneumothorax (small), left-sided.

(j) Sternal Manubrial Dissociation, Closed Fracture, mildly displaced.

(k) Mediastinal Hematoma, secondary to Sternal Fracture.

(l) Hypokalemia.

(m) Acute Renal Insufficiency.

(8) According to an initial medical assessment obtained at Petersburg Medical Center on 14 November 2023, the RS sustained the following injuries: (Exhibit 29)

(a) Subtrochanteric Left Femur Shaft Fracture.

(b) Bilateral Pulmonary Contusion left greater than right.

(c) Thoracic (T3, T8) Compression Spine Fracture, including multiple left sided transverse process fracture (T1, T5, T6 T7, T8, T9, and T10).

(d) Displaced Cervical (C7) Transverse Process Spine Fracture.

(e) Left Rib Fractures (3rd-5th).

(f) Hemoperitoneum (mild), along right paracolic gutter into the pelvis.

(g) Hemothorax (small), left-sided.

(h) Questionable Perinephric Hematoma, left-sided.

(9) All members of the MC were on active duty at the time of the mishap. (Exhibit 30)

(10) Active duty base dates for the MC: (Exhibit 30)

(a) PIC: 06 October 2009

(b) NPIC: 08 January 2014

(c) FM: 03 August 2015

(d) RS: 04 November 2008

i. **Operations and Supervision:**

(1) Sector SEAK Command Center: Upon receiving LM's initial MAYDAY radio transmission, and in accordance with references (d) and (p), Sector SEAK assumed the responsibilities of SAR Mission Coordinator. Sector SEAK's designated SAR Mission Coordinator began to carry out all aspects of planning, coordinating, and managing the response for the SAR case and obtained approval from District 17 to request a launch of CG6016. (Exhibits 3, 31, 32, 33)

(2) AIRSTA Sitka: Upon notification of a request to launch from Sector SEAK, and in accordance with reference (g), the AIRSTA Sitka Operations Watch Stander alerted the MC, passed pertinent information to the PIC, and contacted the Assistant Operations Officer who was the officer taking Operations Officer calls on the day of the mishap. In accordance with references (c) and (g), the Assistant Operations Officer contacted the Executive Officer who was the acting Commanding Officer on the day of the mishap. The Executive Officer approved the launch in accordance with reference (e). (Exhibits 4, 34, 35)

j. **Human Factors Analysis:** Section 6.d of this report includes an analysis of those factors that the MII Board President found to be substantially contributory to the mishap by at least a preponderance of the evidence.

6. **Statement of Opinion:** As per enclosure (1), the below opinions include only those factors which I find to be causative of the mishap by clear and convincing evidence or substantially contributory to the mishap by at least a preponderance of the evidence.

a. **Cause of the Mishap:** I find by clear and convincing evidence that the mishap involving CG6016 on 13 November 2023, was caused by controlled flight into terrain. At 22:52:02 the main rotor blades of CG6016 struck trees on Read Island causing loud medium frequency thuds that were recorded by the area microphone. This impact damaged the main rotor blades, immediately reducing lift, precipitating a sudden and irrecoverable loss of altitude, and resulting in CG6016 contacting several more trees and the ground. I also find by clear and convincing evidence that CG6016 was mechanically sound and the MC was controlling the aircraft prior to impact with the trees on Read Island. (Facts 5.b(6), 5.c(11), 5.c(12), 5.c(27)(a), 5.c(72), 5.c(73))

b. **Substantially Contributing Factors:**

(1) Spatial Disorientation:

Reference (q) defines spatial disorientation as a condition where, "the individual failed to correctly sense a position, motion, or attitude of the aircraft or themself within the fixed coordinate system provided by the surface of the Earth and the gravitational vertical position."

I find by a clear and convincing evidence that the MC experienced spatial disorientation that substantially contributed to the mishap.

The pilots were acutely aware that they were close to Read Island. When approaching LM, the RS used the Electro-optical/Infrared system to estimate the distance between LM and the island to be a quarter mile. In addition, once on scene the MC had repeated discussions concerning their ability to see the island on the right side of the aircraft; the PIC confirmed they saw Read Island while hovering and the NPIC confirmed they had Read Island in sight on multiple occasions, including 44 seconds before impact with the trees. (Facts 5.c(26), 5.c(29), 5.c(53), 5.c(65))

The MC did not intend for the aircraft to enter a prolonged right slide or left yaw immediately prior to the crash. In the 69 seconds before impact CG6016 experienced a continuous and at times excessive right drift and left yaw, twice reaching 11 knots of ground speed and yawing through 104 degrees of heading change. Although the NPIC initiated a right slide 69 seconds before impact, the MC did not verbalize an intention to maintain a prolonged right slide and never verbalized an intention to initiate any heading change. (Facts 5.c(25)-(32))

In the final moments of the flight the PIC and NPIC were not task saturated. During the last 22 seconds before impact the PIC and NPIC were not distracted by any aircraft malfunction or alarm, acknowledged and responded to the RS Trakkabeam update, and engaged in a conversation about a concern for losing situational awareness during a future hoist evolution. In the final moments of the flight both pilots had the adequate time and mental capacity to consider their immediate circumstances. (Facts 5.c(31), 5.c(32), 5.e(1))

At the first indication of impact both the PIC and NPIC believed CG6016's position to be over the water. The PIC and NPIC expressed confusion about the presence of terrain both immediately following the crash and during their post mishap interviews, indicating they did not realize they were moving so close to Read Island in the moments prior to impact. (Fact 5.c(36))

Considering the above, and since the pilots expressed no concern for or executed any control input to arrest the closing distance to the island, I conclude they did not know the extent of their right slide, the magnitude of their left yaw, or the aircraft's proximity to Read Island before impact. The MC was not aware of the aircraft's motion or their position relative to their surroundings and as a result I find that the MC was spatially disoriented. (Fact 5.c(27)(a), 5.c(27)(b))

I find that environmental conditions, fixation, a visual illusion, and a breakdown of visual scans and instrument crosschecks contributed to the MC's spatial disorientation.

(2) Environmental Conditions:

I find by clear and convincing evidence that environmental conditions affected the MC's vision and substantially contributed to their spatial disorientation and the mishap.

The MC repeatedly addressed the lack of visual references and extreme darkness throughout the flight, had difficulty maintaining a stable hover once on scene, and engaged the Hover Coupler out of a concern for controlling the aircraft in limited visibility. A lack of on-scene illumination (moon, vessel, aircraft, and shore-based lighting) combined with on-scene precipitation, limited the MC's peripheral visual cues and hindered their ability to obtain adequate visual references to hold a stable hover and maintain visual separation from the trees on Read Island. (Facts 5.c(22), 5.c(43), 5.c(45), 5.c(50), 5.c(61)-(64), 5.c(68)-(70))

(3) Breakdown of Visual Scans and Instrument Crosschecks:

I find by clear and convincing evidence that the PIC and NPIC experienced a breakdown of visual scans and instrument crosschecks that substantially contributed to the MC's spatial disorientation and the mishap.

The pilots' heading indicators, ground speed indicators and Hover Displays were operating normally and should have provided the MC important instrument indications of right drift and left yaw. In addition, the NPIC reported having Read Island in sight and was using the island as a visual reference 44 seconds before the crash. Since adequate instrument and visual references were available, and the pilots did not arrest a prolonged right slide or significant left yaw, I conclude that the PIC and NPIC experienced a breakdown of their visual and instrument scans in the moments before the crash. (Facts 5.b(11), 5.b(12), 5.c(26), 5.c(27)(b), 5.c(29), 5.c(33), 5.c(65), 5.e(1))

(4) Fixation:

I find by a preponderance of the evidence that during the last 30 seconds of the flight, the NPIC fixated on LM, substantially contributing to the MC's spatial disorientation and the mishap.

This fixation on LM was at the expense of maintaining visual contact with the terrain of Read Island and conducting an adequate instrument scan. By maintaining a tight focus of attention on LM in order to keep the boat in the same relative position (on the dash), the NPIC excluded available instruments and visual cross checks that should have alerted them to the excessive and prolonged aircraft movement. (Facts 5.c(30))

(5) Visual Illusion:

I find by a preponderance of the evidence that the NPIC experienced a visual illusion that substantially contributed to the MC's spatial disorientation and the mishap.

The NPIC attempted to keep LM at a fixed location from the right seat pilot perspective; the NPIC maneuvered the aircraft to keep the sight picture of LM directly on top of the aircraft instrument panel dashboard. With this fixed perspective, a left yaw of the aircraft in conjunction with a right slide gave the illusion of an unchanging aircraft position. The fixation on a single reference (LM) while yawing left and sliding right, without the assistance of any other visual cues, created the illusion that the aircraft was in a relatively stationary hover. (Fact 5.c(30))

(6) Inadequate Assessment of Risk Versus Gain:

I find by clear and convincing evidence that the MC did not adequately reassess risk and gain during their flight, substantially contributing to the mishap.

The MC repeatedly discussed their perception of elevated mission risk. This included discussions of the extreme darkness, difficulty in maintaining a stable hover, enroute and on scene winds, the elevated difficulty of the proposed hoist, and the PIC reaching the extent of their personal comfort level. Moreover, the MC made decisions based on these risks including the route taken to scene, their choice of the planned hoisting evolution, and the PIC's decision to only attempt the planned hoisting evolution one time. However, the MC did not adequately reevaluate risk following the Trakkabeam failure or identify the hazard of Read Island. (Facts 5.c(5), 5.c(22), 5.c(43), 5.c(45), 5.c(48), 5.c(50), 5.c(61)-(64), 5.c(68)-(70))

Despite the fact that the PIC had already reached their comfort limit, the MC did not execute a timely reevaluation of the additional risk imposed by the Trakkabeam failure. The MC continued with their operational plan and began Rescue Checklist Part 2, even while the RS continued to troubleshoot the Trakkabeam malfunction. (Facts 5.c(17), 5.c(22), 5.c(23), 5.c(63), 5.c.(70))

The MC also failed to appropriately account for the hazard imposed by Read Island. While the PIC and NPIC were aware that Read Island was relatively close to the right side of the aircraft and repeatedly discussed having visual contact with the island, the MC never discussed the relevant details of the hazard once established in a hover, including their proximity to the island, the presence of trees on the island or CG6016's altitude in relation to the tree height. This lack of a detailed understanding of the hazard significantly contributed to the MC's failure to adequately account for the risk it imposed or employ mitigating strategies to reduce that risk. (Facts 5.c(56), 5.c(71))

In addition to the discussions of increased risk that did occur, the MC also received updated information at multiple points during the flight concerning the urgency of LM's distress. These updates came from Sector SEAK, directly from the crew of LM, and through the MC's own observations of the vessel. At the time of the crash the MC knew LM was stable, close to shore and had been keeping up with flooding for at least an hour and 55 minutes. After the Sector SEAK update the MC specifically acknowledged a significant reduction in the urgency of LM's situation as compared to their pre-flight brief. (Facts 5.c(41), 5.c(42), 5.c(51)-(53), 5.c(63))

However, the MC did not adequately discuss or make deliberate risk-based decisions considering the changing gain of the mission. The MC only indirectly addressed risk in the context of gain twice during the flight. The first instance occurred while enroute after learning LM was keeping up with the flooding; the PIC noted they wanted to help LM but did not want to scare themselves. The second instance occurred while in a hover on scene; during a discussion of their hoisting options the RS stated they were trying to assess the pros and cons given that LM was stable and the pilots were having difficulty maintaining a stable hover. While this second instance prompted the crew to reconsider their specific method of pump delivery, neither of these instances spurred an adequate bigger picture discussion of mission risk versus gain. (Facts 5.c(42), 5.c(48), 5.c(49), 5.c(63)(d))

A clear reduction in the urgency of LM's level of distress, combined with the significantly increased risk acknowledged by the MC, should have prompted an explicit discussion of a revised risk versus gain analysis as required by both Commandant and local unit policy. This discussion should have led to a deliberate MC decision to either discontinue the mission or continue with their operational plan after considering more robust risk mitigating actions. (Facts 5.b(3)-(5))

(7) Procedure or Checklist Not Followed Correctly:

I find by clear and convincing evidence that the MC's Hoist Brief substantially contributed to an inadequate real-time risk assessment and the mishap.

The MC elected to conduct a Hoist Brief before arriving on scene and planned to complete it when they obtained more detailed information. However, an updated on scene Hoist Brief was never completed. A Hoist Brief conducted while on scene and as required by reference (h), should have prompted the MC to more formally discuss risk versus gain of the proposed evolution considering the specific on scene circumstances. Additionally, an on scene Hoist Brief should also have identified Read Island as a hazard and prompted mitigating actions by the crew. (Facts 5.b(15), 5.c(46)-(49))

c. **Line of Duty Determination:** The injuries of all four members of the MC were in the line of duty, not due to their own misconduct.

(1) The injuries of all four members of the MC occurred in the line of duty. All four members of the MC were on active duty on 13 November 2023, and were not absent without authority. (Facts 5.h(9), 5.h(10))

(2) The injuries of all four members of the MC were not due to their own misconduct. Clear and convincing evident does not exist to rebut the presumption of not due to misconduct through intentional injury, willful negligence or improper drug or alcohol use. (Fact 5.b(19), 5.h(4))

(3) There is no evidence to indicate the MC intentionally damaged the aircraft or caused the mishap or that the MC was willfully negligent. The MC's actions during the flight indicate they were making an attempt to appropriately complete their assigned mission at the time of the mishap. (Facts 5.c(4), 5.c(10), 5.c(36), 5.c(51))

(4) There is no evidence to show that improper drug use or alcohol consumption in any way contributed to the mishap or was a proximate cause of the injuries. There is no evidence to indicate that any of the MC consumed any non-prescription drugs or alcohol before or during the flight. Toxicology screenings conducted upon the MC's arrival at Harborview Medical Center in Seattle, Washington on 14 November 2023, did not show any evidence of improper drug use or alcohol consumption by any of the MC. (Fact 5.h(4))

d. **Human Factors Analysis**: The MII Board conducted a complete analysis of the mishap using the Human Factors Analysis and Classification System, reference (q). As per enclosure (1), the below summary of that analysis includes only those factors which I find to be substantially contributory to the mishap by at least a preponderance of the evidence.

(1) Unsafe Act 1: Over-Controlled/Under-controlled Aircraft/Vehicle/Vessel or System: AE 104 (Opinion a.1)

(a) Contributing to Unsafe Act 1:

1. Spatial Disorientation: PC 321. (Opinions 6.b(1)-(4))

2. Environmental Conditions Affected Vision: PE 101 (Opinion 6.b(2))

3. Breakdown in Visual Scan or Instrument Crosscheck: AE 105 (Opinion 6.b(3))

4. Fixation (Channelized Attention): PC 102 (Opinion 6.b(4))

(2) Unsafe Act 2: Inadequate Real-Time Risk Assessment/Action: AE 201 (Opinion 6.b(6))

(a) Contributing to Unsafe Act 2:

1. Task/Mission-In-Progress Replanning: PP 111 (Opinion 6.b(6))

2. Procedure or Checklist Not Followed Correctly: AE 102 (Opinion 6.b(7))

3. Distraction/Interruption: PC 106 (Opinion 6.b(7))

e. Under 14 U.S.C. §678 the opinion of the accident investigator as to the cause of, or the factors contributing to, the accident set forth in the accident investigation report, if any, may not be considered as evidence in any civil or criminal proceeding arising from the accident, nor may such report be considered an admission of liability of the United States or by any person referred to in such report.

7. **Attestation:** The Findings of Fact and the Statement of Opinion are those of the investigating officer and do not constitute an official determination by the U.S. Coast Guard concerning this mishap.

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Enclosure: (1) Convening Order
(2) List of Exhibits
(3) MII Witness List
(4) MII Board Members List
(5) List of Acronyms