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MEMORANDUM

A handwritten signature in black ink, appearing to read "Thad W. Allen", written over the word "MEMORANDUM".

JAN 10 2007

From: Admiral Thad W. Allen
Commandant, U.S. Coast Guard

To: Distribution

Subj: FINAL ACTION ON THE ADMINISTRATIVE INVESTIGATION INTO THE
DIVING MISHAP AND THE RESULTING DEATHS OF USCGC HEALY'S
CREWMEMBERS THAT OCCURRED ON 17 AUGUST 2006

1. **Overview:**

In the late afternoon hours of 17 August 2006, three Coast Guard divers from Coast Guard Cutter HEALY (WAGB 20) attempted to conduct two 20-minute cold water familiarization dives at 20-foot depth during an ice liberty stop in the Arctic ice approximately 490 nautical miles north of Barrow, Alaska. After one of the divers exited the water due to equipment malfunction, the other two divers continued the dive in 29-degree Fahrenheit waters. The divers quickly descended to depths far exceeding their planned 20-foot depth, one diver descending to 187 feet and the other diver descending to at least 220 feet. Once it became evident that too much tending line had paid out to support a 20-foot dive depth, the divers were brought to the water surface. The divers were recovered with no vital signs and were pronounced dead after extensive resuscitative efforts failed.

This document sets forth the facts that led to and evolved into this incident, states my conclusions, and orders certain actions designed to ensure that similar incidents and other tragic losses of life are prevented in the future.

2. **Findings of Fact and Opinion:**

The following narrative provides the key findings that inform my conclusions and actions:

On 17 August 2006, CGC HEALY was on patrol in the Arctic Ocean in support of its Arctic West Summer 2006 science operation. CGC HEALY, a Polar Icebreaker, was deployed with 119 persons onboard consisting of 84 active duty Coast Guard members and a science contingent of 35 civilians. The cutter had been engaged in continuous and sustained operations in the Arctic for over 40 days since departing Everett, Washington on 6 July 2006. CGC HEALY was under the command of Captain Douglas Russell, Commanding Officer, who had assumed command on 5 June 2006. United States Coast Guard Regulations state that the Commanding Officer's responsibility for that command is absolute.

At 1555 (local) on 17 August 2006, CGC HEALY pushed into an open water lead in the ice approximately 490 nautical miles north of Barrow, Alaska, for ice liberty following a day of science operations. While the ship was making no headway in the ice, the ship's propellers were slowly turning in order to maintain the ship's position against the ice for the liberty evolution.

The on scene weather conditions were: the sky was clear and sunny with ten miles of visibility. The air temperature was 28 degrees Fahrenheit and the sea temperature was 29 degrees Fahrenheit. The winds were out of the west southwest at eight knots. The ice conditions were nine-tenths ice coverage of a three to five foot multi-year pack. Depth beneath the keel was unobserved as it exceeded the capability of the ship's navigation fathometers. At 1558, however, a scientific cast was made of an Expendable Bathythermograph which transmitted temperature data to a depth of 1,420 meters.

While not in the plan of the day for 17 August 2006, completion of an ambitious science schedule and excellent weather conditions provided an ice liberty opportunity for the crew. LT Jessica Hill, the ship's Diving Officer, also saw it as an opportunity to conduct ice familiarization training with CGC HEALY's new divers. She had previously proposed a familiarization dive a few weeks prior during an evening science meeting, but the proposal had been denied by the ship's Executive Officer, Commander Jeffrey C. Jackson. LT Hill had also tentatively scheduled a dive fitness test and a cold water familiarization dive during CGC HEALY's upcoming port call in Dutch Harbor, Alaska, which was scheduled for 30 August 2006. Despite the upcoming training, LT Hill sought the additional opportunity to conduct cold water familiarization training to ensure the ship's divers maintained their diving currency and gained experience that might be needed during phase four of the ship's current mission, HLY 06-04 (referring to Healy Arctic West Deployment 2006-Phase 04), as well as, the 2007 mission. Additionally, LT Hill anticipated departing the ship in February 2007. As such, she sought to develop an experience base within the dive team in light of her pending departure. She also sought the chance to conduct an ice dive for herself.

LT Hill drafted a dive plan wherein all three of the ship's embarked divers would conduct a training and familiarization dive under the ice. The dive plan indicated the equipment to be used was SCUBA (self-contained underwater breathing apparatus) gear with AGA™ full face masks and drysuits. LT Hill and BM2 Steven Duque were two of the three divers listed on the dive plan to dive. Just prior to the commencement of ice liberty on 17 August 2006, LT Hill submitted the dive plan and it was routed through the chain of command, which included review by the Operations Officer and the Executive Officer. The Commanding Officer approved the dive plan. The total routing and review time of the dive plan by the chain of command was 30 minutes, with one minor change indicating that the dive team was permitted to deploy to the ice from the ship's forward brow.

At the time the dive plan was routed and signed, the Commanding Officer, the Executive Officer, and the Operations Officer were unfamiliar with the manning requirements for conducting a dive operation. The Coast Guard Diving Policies and Procedures Manual, COMDTINST M3150.1B (hereinafter "Coast Guard Diving Manual") sets forth the policy and procedures for the

administration, application and execution of diving within the Coast Guard. The Coast Guard Diving Manual is not a stand alone document and instead states that all Coast Guard diving shall be conducted in accordance with the U.S. Navy Diving Manual (hereinafter "Navy Diving Manual") except where otherwise noted and provided for specifically in the Coast Guard Diving Manual. The version of the Navy Diving Manual effective at the time of the incident was NAVSEA 0910-LP-103-8009, Revision 5, dated 15 August 2005. According to the Coast Guard Diving Manual, the safety of all diving operations is the responsibility of the Commanding Officer.

LT Hill had approached the Commanding Officer the preceding evening on 16 August 2006 to discuss conducting a dive operation sometime on 17 August 2006. The Commanding Officer directed her to discuss the issue further with her supervisor, the Operations Officer, and to put a dive plan together. LT Hill mentioned that her goal was to conduct an ice familiarization dive with the ship's other two divers, who were new divers. She indicated that all three divers would be in the water. The Commanding Officer recalls that he questioned whether dive policy and her training as a Diving Officer allowed all three divers to concurrently dive. The Commanding Officer says she replied in the affirmative. The Commanding Officer did not verify her response at the time with other members of the crew or refer to publications such as the Coast Guard Diving Manual or the ship's Diving Bill contained in the CGC HEALY Organization Manual, HEALYINST M5400.16. The ship's Diving Bill states that "operations may be conducted with not less than one Diving Officer and three SCUBA divers, provided one also serves as a Diving Supervisor."

As a Polar Icebreaker, CGC HEALY has a diving duty allowance of one Basic Diving Officer and five SCUBA divers for a total of a six-person diving team. On 17 August 2006, CGC HEALY had four permanently assigned divers, one of whom was on extended temporary duty for unrelated training. Thus, there were just three Coast Guard divers embarked in the ship for this phase of the deployment. One was trained as a Basic Diving Officer, LT Hill, and two were trained SCUBA divers, BM2 Duque and a third crewmember (hereinafter "Diver 3"). All three divers received their initial dive training at the Naval Diving and Salvage Training Center (NDSTC) in Panama City, FL. There are no primary duty divers onboard CGC HEALY and as such LT Hill, BM2 Duque and Diver 3 were all collateral duty divers. In addition to their diving duties, each was in a regular watch rotation. LT Hill's most recent watch was as Officer of the Deck from 2000-2400 on 16 August 2006. BM2 Duque's most recent watch was as the Junior Officer of the Deck from 0800-1200 on 16 August 2006.

LT Hill reported to CGC HEALY for her first afloat tour on 23 June 2004, after qualifying as a Basic Diving Officer at NDSTC on 11 May 2004. Pursuant to the Coast Guard Diving Manual, LT Hill's duties and responsibilities as the Diving Officer in CGC HEALY included ensuring the safe conduct of all diving operations by providing overall supervision of diving operations and ensuring strict adherence to procedures and precautions. The Diving Officer is further responsible for all diving-related administrative duties and record keeping, conducting the diver training and qualification program, overseeing the command diving equipment maintenance program and ensuring that he or she becomes familiar with all command diving techniques and

has a detailed knowledge of all applicable regulations. While the Coast Guard Diving Manual makes the Commanding Officer responsible for the safety of all diving operations, it also states the Diving Officer is responsible for the safety of all diving operations and retains the authority to abort diving operations when deemed necessary by risk analysis.

Prior to the dive on 17 August 2006, LT Hill had conducted approximately 24 dives during 19 dive days. Seven of the 24 dives were conducted in the Arctic Ocean during the summer of 2005; however, those dives were conducted with surface-supplied air as opposed to dives with SCUBA. This was LT Hill's first cold water SCUBA dive. The last dive LT Hill participated in prior to the one on 17 August 2006 was on 10 April 2006. With this dive profile, LT Hill was a diver with limited military dive experience.

BM2 Duque reported aboard for his first tour afloat on 25 May 2005. He later went to dive school and the NDSTC qualified BM2 Duque as a SCUBA diver on 1 March 2006. Since receiving his training, BM2 Duque had only conducted two dives in one dive day on 10 April 2006. With this dive profile, BM2 Duque was a diver with limited military dive experience. BM2 Duque had never conducted a cold water dive.

The NDSTC qualified Diver 3 as a SCUBA diver on 8 July 2005. Since receiving training, Diver 3 had only one dive day consisting of four dives on 20 October 2005. Diver 3 reported aboard for Diver 3's first tour afloat on 18 July 2006. With this dive profile, Diver 3 was a diver with limited military dive experience. Diver 3 had never conducted a cold water dive.

Of the three divers embarked in CGC HEALY on 17 August 2006, only two were up-to-date with the currency requirements set forth in the Coast Guard Diving Manual that requires four dives every six months. While LT Hill had initially qualified as a Basic Diving Officer after attending NDSTC, LT Hill's currency qualification had lapsed on 15 May 2006. CGC HEALY's previous Commanding Officer signed a diving requalification letter for LT Hill on 28 April 2006; however, two of the four dives used to substantiate this requalification were recreational dives and were not conducted in accordance with standards articulated in the Coast Guard Diving Manual. These recreational dives were not authorized to count for periodicity purposes and as such the requalification letter signed on 28 April 2006 was not valid. Therefore, LT Hill was not qualified for diving duty on 17 August 2006.

The Coast Guard Diving Manual requires a combination of semi-annual and annual training as well as periodic dives in order to maintain proficiency, adequate experience, and qualification status. Responsibility for administering an onboard training and qualification program for diving watchstations rests with the ship's Diving Officer. United States Coast Guard Regulations state that the Executive Officer shall supervise and coordinate the work, exercises, and training of the personnel of that command. The Coast Guard Diving Manual further states that Commanding Officers must ensure required training is conducted. The Coast Guard Diving Manual also states that diver training is critical to maintaining an effective dive team and shall be scheduled in the unit long-term training plan. To accomplish this, Diving Officers should be members of their

unit training board. LT Hill, however, was not a member of CGC HEALY's training board. Additionally, there was no formal dive training program established onboard CGC HEALY.

The dive plan, submitted by LT Hill and approved by the Commanding Officer on 17 August 2006, called for all three divers to dive simultaneously and conduct two 20-foot SCUBA dives for a duration of 20 minutes each. According to the submitted and approved dive plan, the dives were to be conducted consecutively and with each dive involving all three divers below the surface. The Navy Diving Manual, which is incorporated by reference in the Coast Guard Diving Manual, requires the use of paired divers (buddy diving) when diving under ice or in extremely cold waters (37 degrees Fahrenheit and below). Also required are a Standby Diver and Diver Tenders for the Primary Divers. Both manuals require a qualified Diving Supervisor who is separate and apart from the other divers. As stated above, on 17 August 2006, with only two qualified divers onboard CGC HEALY, BM2 Duque and Diver 3, CGC HEALY had an insufficient number of qualified divers for this dive.

In accordance with both the Coast Guard and the Navy Diving Manuals, the Diving Supervisor, among other things, exercises control over the actual diving operation for a particular dive and during the diving operation, is responsible for monitoring progress, debriefing divers, updating instructions to subsequent divers and ensuring the Diving Officer and Commanding Officer are advised of the progress of the dive; as well as, any changes to the original dive plan. While not specifically stated in either Diving Manual, in order to properly perform their required duties and maintain proper situational awareness, the designated Diving Supervisor cannot perform the duties required of the position unless the Diving Supervisor remains on the surface and at the dive side (a term of art for the actual location of the dive). The Diving Supervisor has the authority and responsibility to discontinue diving operations in the event of unsafe diving conditions.

Under Coast Guard policy, but not Navy policy, an otherwise qualified Diving Supervisor does not have to be a diver. Here, LT Hill, who was the only crew member qualified to serve as Diving Supervisor, could have done so even though she had not met her recurrent diving requirements. However, she could not concurrently perform Diving Supervisor duties and be a working diver.

For SCUBA dive operations, the designated Standby Diver must also remain at the surface, properly outfitted and ready to enter the water immediately. The Standby Diver receives the same briefings and instructions as the primary diver, monitors the progress of the dive, and is fully prepared to respond if called upon for assistance.

Coast Guard policy does not require the Diver Tender to be a qualified diver, but the Diver Tender must, at a minimum, have completed the Diver Tender Job Qualification Requirements contained in enclosure (1) to the Coast Guard Diving Manual prior to serving in such a capacity and must also remain at the dive side to perform line-tending duties. The Diver Tender's duties are, among other things, to exchange line-pull signals with the diver, keep the Diving Supervisor

informed of the line-pull signals and amount of diving tending line over the side, and to remain alert for any signs of an emergency.

On 17 August 2006, there were not enough qualified divers onboard CGC HEALY to conduct a cold water SCUBA dive. Despite this, the dive plan, which called for all three assigned divers to be in the water for a SCUBA dive, was submitted, routed, and approved. In the dive plan, LT Hill identified herself as the Diving Supervisor and indicated she would be diving with the team. No one on the surface was identified as Diving Supervisor and no one on the surface was identified as Standby Diver for the 17 August 2006 dive. Neither a Buddy Diver nor Diver Tenders were identified in the dive plan.

After the dive plan was approved, the ship's Operations Officer called LT Hill, who was located in the ship's Dive Locker preparing for the dive, to notify her that the dive plan was approved. LT Hill asked whether a verbal brief would be required prior to the dive operation. The Operations Officer responded that no brief was necessary as he viewed the dive as a routine operation with minimal risk. The Operations Officer stated this without conducting an Operational Risk Management analysis. The Navy Diving Manual states that "polar regions and other cold weather environments are uniquely hostile to divers," and that "awareness of environmental conditions, personnel and equipment selection, and adequate logistical support are vital to mission success and dive team safety."

During their exchange, the Operations Officer passed to LT Hill that the Commanding Officer asked him, during the routing of the dive plan, if all three divers could be in the water at the same time under the regulations. Upon hearing about the Commanding Officer's concerns, LT Hill replied in the affirmative and indicated she would brief the Commanding Officer. The Operations Officer indicated to her that he was not sure LT Hill was correct, but that he would take her word for it. The Operations Officer did not verify the accuracy of LT Hill's statement. United States Coast Guard Regulations state that the Operations Officer, as the head of a department, shall prepare and maintain the necessary bills and orders for the organization and operation of the department. Additionally, as the head of a department, the Operations Officer shall plan, direct, and supervise the work and training of personnel within the department and shall ensure that all prescribed or necessary safety precautions are strictly observed by all persons within the department and by others who may be concerned with matters under that department's control. On 17 August 2006, dive operations onboard CGC HEALY were matters under control of the Operations Department and the Operations Department was responsible for the ship's Diving Bill that addressed the number of necessary divers.

Prior to executing the dive plan on 17 August 2006, no Operational Risk Management assessment or command level safety brief was conducted as is required by Coast Guard policy contained in COMDTINST 3500.3, Operational Risk Management, and reaffirmed by Pacific Area's Operational Risk Management guidance from July 2003. Operational Risk Management is a continuous and systematic process of identifying and controlling risks. This process includes detecting hazards, assessing risks, and implementing and monitoring risk controls to support effective risk-based decision-making. The dive plan was not routed through, nor was a copy

provided to, the Engineer Officer, Engineer of the Watch, or Officer of the Deck as articulated in the HEALY Diving Bill contained in the HEALY Cutter Organization Manual, HEALYINST M5400.16, and the Navy Diving Manual.

In addition, no communications link between the Officer of the Deck, located in the pilothouse, and the dive side was established, as required by the Navy Diving Manual and the ship's Diving Bill. As a result, bridge personnel were not notified and did not track when the divers entered the water. No dive smooth log was kept, nor was anyone at the dive side keeping track of the length of time the divers were submerged. There was no Navy Diving Manual brought to the dive side which is also required by the Navy Diving Manual.

As a result of the failure to notify the Officer of the Deck, the Engineer of the Watch, and the Engineer Officer, proper equipment tag-outs did not occur. The term "tag-outs" refers to the procedure employed to prevent improper operation of systems or equipment when safety devices such as locking devices, seals, or blank flanges are installed. The process of tagging-out equipment ensures that no equipment or ship's machinery is running that could interfere with, or impact, another operation; in this case, the dive or the safety of the divers. This process also ensures that no equipment is energized and that the ship is not operated in a manner that could harm the divers while the dive is in progress. The Navy Diving Manual contains checklists which require the consideration of equipment and machinery tag-outs for diving on the ship or in the vicinity of the ship. The purpose of the checklists is to ensure that an informed decision is made regarding equipment status that may affect dive operations and/or diver safety.

At the time of the dive, the machinery plant status was: the Main Diesel Generator (MDG) #1 was on the line with MDG #4 serving as the first backup (STBY 1) and MDG #2 aligned to be the secondary backup (STBY 2). The main propulsion motors were in the standard, full power potential (12 pulse) mode. The Ship's Service Transformer (SSTF) #2 was supplying power to the non-sensitive section bus for heavy drawing pumps and motors. SSTF #1 was in standby. The Ship's Service Motor Generator (SSMG) was supplying power to the sensitive section for lighting and other sensitive loads. The propellers were turning slowly to maintain the ship's position against the ice, with the starboard shaft at approximately 10 RPMs and the port at approximately 8 RPMs. The rudder was energized. Sewage was secured because of the ice liberty and the forward sea suction was secured because the ship was in the ice and unable to take seawater in from the sea. Three sonar transducers were energized and operating, and aft sea suction was not secured. There is no evidence that the operation of these systems had any significant impact on the divers.

Prior to the ship being positioned in the ice for ice liberty, plans were underway to set up and prepare for the ice liberty evolution. The bulk of the responsibility for setup resided with Deck Department. Members of Deck Department were mustered and provided a detailed brief on safety and equipment issues associated with the upcoming liberty evolution. This included a discussion of establishing a bear watch, crane safety, deck safety, how to make proper ice checks, and general procedures for liberty on the ice. Deck Department personnel were assigned to specific locations, radios were issued, and certain personnel were directed not to consume

alcohol (i.e., crane operator and brow personnel). Once the ship was positioned, Deck Department executed the ice liberty plan. The brow was put over on the port side of the ship and the personnel departed the ship to walk the ice and mark off an area with cones. The designated ice liberty area was along the port side of CGC HEALY. Once the ice was coned off and the bear watch was in place, ice liberty was granted to authorized personnel at 1630 (local), and the crew and scientists were permitted to debark the ship and go down to the ice. The ship did have an ice liberty checklist and it was used by the Executive Officer.

In addition to the Deck Department's activities, the ship's Morale Committee began preparing for ice liberty. As part of these preparations, the Morale Committee, as authorized by the command, removed beverages from the morale locker to the ice. The beverages included: 192 containers of beer, 24 bottles of hard lemonade, and 32 cans of sodas. All were ultimately consumed by the crew and scientists over the course of the ice liberty with the exception of two bottles of beer, which were set aside for LT Hill and BM2 Duque to consume after the dive.

Ship's practice during ice liberty limited the consumption to two beers per person. This limit was never relayed to the scientists or to the crew prior to the granting of liberty. Alcohol consumption during ice liberty was typically monitored through the use of a roster indicating who received alcoholic beverages and in what quantity. During ice liberty on 17 August 2006, no roster was maintained which tracked either the disbursing of alcohol or the consumption of alcohol by the crew and scientists. Throughout the duration of this ice liberty, the Commanding Officer consumed at least one beer, the Executive Officer consumed two beers and the Operations Officer consumed two and a half beers. Additionally, two crewmembers who would later serve as Diver Tenders consumed beer. Several crewmembers and scientists who would later serve as first responders during the emergency medical situation also consumed alcoholic beverages. Neither LT Hill, nor BM2 Duque consumed alcohol prior to the dive. Diver 3 did not consume alcohol.

Crewmembers and scientists who participated in ice liberty did so by wandering and enjoying the designated ice liberty area, taking pictures, and playing football. Crewmembers and scientists also wandered into the area that was being set up for diving and would later be the location of the dive side from which the divers deployed into the water. The dive side was approximately 60 feet forward of CGC HEALY's port bow. This area was not visible from the Bridge as it was under the flare of the bow when looking from the Bridge. This area was not cordoned off to limit access to only personnel involved in the dive evolution as required by the Navy Diving Manual. Personnel engaged in liberty activities wandered in and out of this area. As personnel were bringing dive equipment to the dive side, one scientist used the tending line from a diver tender reel, tied it off to his body and proceeded to conduct a polar bear plunge into the 29-degree Fahrenheit Arctic waters. This was done in spite of a direct order from the Executive Officer that no polar bear plunges were authorized. The liberty activities that were being conducted close to and in the area being setup as the dive side changed the area from one that should have been dedicated solely to an operational dive into one indistinguishable from the ice liberty scene.

After the commencement of ice liberty, the three divers made preparations to dive. BM2 Duque arrived at the dive side around 1657, just prior to the polar bear plunge, approximately 40 minutes ahead of the other two divers. During this wait period, BM2 Duque remained at the dive side, but engaged socially with shipmates and scientists who were enjoying ice liberty and were meandering in and out of the area. The alcohol that was served during ice liberty was brought to the dive side by curious crew and scientist onlookers. BM2 Duque's dive outfit, including tank and regulator, was placed on the ice while he waited for the arrival of his fellow divers. At one point, he laid down on the ice and propped his head against his gear while he waited. The Navy Diving Manual specifically states that "while waiting to enter the water, divers should avoid sitting on or resting on the ice." Time on the surface, and exposure to the elements, should be avoided to "prevent chilling of the diver." Additionally, surface time can "cool the components of the diving gear, such as suit valves and SCUBA regulators, below the freezing point and cause the parts to ice up when the diver enters the water." During this time, the bridge attempted to establish communications with the dive side. The bridge watch directed a crewmember to verify the dive side had communications. BM2 Duque was asked if the dive team had communications with the bridge and he responded in the affirmative though communications, in fact, were never established.

Although an entry was made in the ship's log at 1715 that the dive team had deployed to the ice, LT Hill and Diver 3 actually arrived at the dive side closer to 1740. Because no dive log was maintained and no time was kept at the dive side, the times from this point on are estimates as to the sequence of events that occurred, drawn primarily, but not exclusively, from time registrations on digital photographs.

At some point prior to commencing the dive, LT Hill had asked three crewmembers to serve as Diver Tenders for the dive operation. The tender lineup on 17 August 2006 was: Tender 1 tended LT Hill, Tender 2 tended BM2 Duque, and Tender 3 tended Diver 3. There was also a fourth crewmember who was allowed to join the dive evolution after coming to the dive side. This crewmember will be referred to as Tender 4, even though not previously identified as a Diver Tender by LT Hill. Tender 3¹ had consumed one beer during ice liberty prior to assisting with the dive. Additionally, Tender 4 had consumed three beers prior to assisting in the dive evolution. Tender 4 was not specifically assigned to a diver, but assisted the divers don their equipment, conducted equipment checks on the divers and clipped in LT Hill's tending line. None of the Diver Tenders were qualified to conduct equipment checks.

Once on the ice, LT Hill held a dive side brief. In attendance were BM2 Duque, Diver 3, the three designated Diver Tenders, and Tender 4. Tenders 1 and 3 had been onboard the ship for only two months, were not qualified to serve as Diver Tenders, and were participating in their first dive evolution. The other designated Diver Tender, Tender 2, was also not qualified. While Tender 2 had tended several surface-supplied dives during the ship's Arctic West 2005 deployment the previous summer, Tender 2 had never tended a diver in a SCUBA operation. Tender 4 had also recently reported aboard and was not a qualified Diver Tender.

¹ Final Action Memorandum released on 12 January 2007 incorrectly stated "Tender 1."

The dive side brief provided by LT Hill included a discussion of the line-pull signals that would be used to communicate between Diver and Diver Tender. The designated Diver Tenders recall, with only minor variation, that LT Hill briefed the line-pull signals as follows: one pull equals "okay;" two pulls equal "give slack;" three pulls equal "take in slack;" and four or more pulls equal "trouble." Tender 4 does not recall the brief including a discussion of line-pull signals.

According to the Navy Diving Manual, a line-pull signal consists of one pull or a series of sharp, distinct pulls on the tending line that are strong enough to be felt by the diver. All slack must be taken out of the line before the signal is given. The Navy line-pull signals are defined in the Navy Diving Manual:

Table 8-3. Line-Pull Signals (extract)

From Tender to Diver	
1 Pull	"Are you all right?" When diver is descending, one pull means "Stop."
2 Pulls	"Going Down." During ascent, two pulls mean "You have come up too far; go back down until we stop you."
3 Pulls	"Stand by to come up."
4 Pulls	"Come up."
From Diver to Tender	
1 Pull	"I am all right." When descending, one pull means "Stop" or "I am on the bottom."
2 Pulls	"Lower" or "Give me slack."
3 Pulls	"Take up my slack."
4 Pulls	"Haul me up."

None of the Diver Tenders recall LT Hill stating in her brief that one pull on descent means "stop."

LT Hill's dive side brief was informal – no checklist was referred to or completed and no Operational Risk Management was conducted. Meanwhile personnel engaged in liberty activities continued to wander in and out of the dive side, commingling the liberty activities with the dive operation.

After LT Hill completed her brief on tending line signals, the divers finished suiting up. By approximately 1804 all divers were sitting at the ice edge. While donning equipment, the divers deviated from several standard Coast Guard and Navy procedures. All divers wore only a single steel-100 tank with standard breathing air, which afforded them no redundant SCUBA system in the event of an underwater emergency. The nominal capacity of a steel-100 tank is 100 cubic feet of air at standard temperature and pressure with a pressure of approximately 3400 psi when the tank is fully charged. The Navy Diving Manual states that diving in cold water must be conducted with a "redundant SCUBA system." A redundant SCUBA system is defined as being outfitted with twin tanks. Additionally, the divers decided to wear their dive mask straps under

their dive suit hood, which, while not prohibited, is not considered a safe practice in any water since the mask can not be easily removed in an emergency.

Neither BM2 Duque nor LT Hill had a low-pressure hose attached to their Buoyancy Compensator Devices (BCD) so the BCDs could not be inflated. Their variable volume drysuits were properly rigged to their air supplies so the suits could be inflated as necessary. As is recommended by the Navy Diving Manual, both divers had a second regulator as a back-up breathing apparatus for use in an emergency. It was not a redundant air supply, but rather a second regulator attached to the single tank worn by both divers. Additionally, LT Hill was equipped with an Octo+™ device on her rig which is technically a third regulator; however, it was not connected to an air supply and thus in an emergency, would not have provided air. A buddy diver would have had no way of distinguishing her working back-up regulator from her unattached regulator unless he physically tried both rigs in an emergency.

Both BM2 Duque and LT Hill donned split fins that are designed for high speed and provide only minimal thrust. Split fins are not considered appropriate for heavy diving and lack the power necessary to overcome the drag of a drysuit. Instead, they are better suited for light diving and snorkeling. Diver 3 was not wearing split fins, but instead donned standard "blade" fins which were more appropriate for a heavy equipment dive, such as this one.

None of the divers wore weight belts as required by the Navy Diving Manual. A standard diving weight belt is designed to facilitate the ability to jettison weight in emergency conditions. Instead, both LT Hill and BM2 Duque used the weight pockets integrated into the design of their buoyancy compensator devices. Additionally, they filled their BCD equipment pockets, which are secured by heavy zippers and are not easily opened, and would make an emergency jettison difficult, if not impossible. The divers initially entered the water with over 40 pounds, but returned to the side following surface checks to add more weight. BM2 Duque specifically commented that he was floating too much. Each diver eventually departed the surface with over 60 pounds of weight (including lead shot and steel tank). As a diver descends, air compresses and at a depth of 33 feet, its volume decreases by 50%. Therefore, to maintain buoyancy, the diver must add air to the BCD or dry suit during any descent. Thus, an overweighted diver may be able to control his or her buoyancy on the surface, but enter an uncontrolled descent only a few feet from the surface.

The amount of weight used by the two divers is considered excessive relative to the divers' body sizes. LT Hill was five feet two inches and weighed approximately 130 pounds. BM2 Duque was five feet eleven inches and weighed approximately 163 pounds. Experienced divers interviewed in connection with this investigation, diving with similar equipment, reported wearing typically 20-30 pounds of weight; this includes a military diver over six feet two inches tall weighing 220 pounds.

In July 2005, LT Hill had experienced a rapid ascent from forty feet to five feet while conducting surface-supplied dive operations in support of the ship's Arctic West 2005 deployment. As a result, LT Hill had expressed concern in the past of an uncontrolled ascent while diving. In

addition, LT Hill previously complained that the drysuit she used was too large. To compensate for the drysuit's ill fit and to protect against an uncontrolled ascent, LT Hill typically dove with at least fifty pounds of added weight in surface-supplied dives.

At approximately 1810 on 17 August 2006, the three divers commenced their dive. LT Hill entered first followed by BM2 Duque, and finally Diver 3. Each diver entered the water tended by their respective Diver Tenders; however, none of the tending line reels were secured to the ice as is required by the Navy Diving Manual for a cold water dive. Diver 3 entered the water initially, but was unable to continue because cold water was entering the drysuit from either a leak in the neck area or a faulty purge valve on the arm. Additionally, Diver 3 was unable to maintain buoyancy. Attempts were made by Diver 3 to activate the drysuit purge valve in both directions with negative results. Diver 3 exited the water at the dive side and sat on the ice edge to discuss the issue with LT Hill. LT Hill indicated there were no more drysuits available, but Diver 3 could go to the Dive Locker to verify this and swap out if one was found.

At approximately 1813, Diver 3 and Tender 3 departed the dive side to return to the ship. As Diver 3 was enroute to the Dive Locker, a pipe was made that liberty would expire at 1845. Given the lack of time available to swap out drysuits, Diver 3 did not suit up again and instead changed into clothes. Diver 3 returned to the dive side later.

Upon Diver 3's departure, LT Hill and BM2 Duque continued the planned dive. LT Hill remained in the water and did not exit to brief the Commanding Officer or the Officer of the Deck that one diver had aborted the dive. Both the Commanding Officer and the Executive Officer, however, did become aware that Diver 3 had aborted as a result of a drysuit malfunction. Despite this deviation to the approved dive plan, the dive continued.

In addition to the drysuit malfunction experienced by Diver 3, BM2 Duque was experiencing glove problems. At some point after 1818, he departed the water for approximately 10 minutes after complaining of cold hands and glove problems. His hands were warmed by crewmembers on the ice, and new liners were installed in his gloves after which he returned to the water. LT Hill remained in the water during this time. At this time, it became apparent that BM2 Duque's manual dexterity was affected and he was unable to make the standard diving hand signals. Because of this, LT Hill and BM2 Duque agreed to deviate from the standard diving hand signals. Instead of using the approved sign for "OK," which involves fingers to the thumb forming an "O" with the hand, LT Hill stated the diver "OK" sign would now be conducted by indicating a "thumbs up." The Navy Diving Manual states that divers shall only use the approved hand signals when diving and that a dive should be terminated upon "severe impairment of manual dexterity."

During this time, the Commanding Officer was on the ice and participating in the liberty activities. He noticed that BM2 Duque was having some type of glove or hand problem and observed others assisting him in warming his hand. The Commanding Officer did not inquire further and the dive continued.

Once BM2 Duque returned to the water, he and LT Hill conducted in-water safety checks and then submerged. The approved dive plan specified that on the first dive, the divers would submerge to twenty feet for twenty minutes and would not go under the ice. Shortly after the divers submerged, the Diver Tenders could no longer see the divers.

Tender 1 initially observed the divers at three to four feet, when LT Hill gave one pull. Tender 1 let the line pay out hand-over-hand as Tender 1 observed the divers descend. Tender 1 lost sight of the divers as they descended; and shortly thereafter, LT Hill's line started to run. As the line was running, Tender 1 gave the line a series of single line pulls, a signal which Tender 1 believed was for the purpose of asking the diver if she was "ok." Tender 1 felt a single pull after each of his line pulls, which Tender 1 believed was a confirmation from LT Hill that she was "ok." The Navy Diving Manual specifies that one line pull signal on descent means "stop," when given by the Diver Tender or Diver.

Operating off the dive signals as Tender 1 understood from LT Hill's brief, Tender 1 continued to pay out line. The spool on which LT Hill's line was wound was rolling around on the ice behind Tender 1. Upon seeing this, Tender 4 stepped in and repositioned the spool so that the line could feed properly.

Tender 1 observed that both LT Hill's line and BM2 Duque's line were paying out fairly quickly. Upon becoming aware that LT Hill's line was close to being fully paid out, Tender 1 stepped on the line to prevent it from paying out further. To Tender 1, the line appeared to be entering the water in a diagonal direction. Tender 1 then felt a single tug and continued to pay out more line. At some point Tender 4 gave two pulls on LT Hill's line and recalls receiving one pull in response.

Tender 2 initially observed the divers descend to approximately fifteen feet. At this depth, Tender 2 observed the divers start to swim away toward the opposite ice edge, but Tender 2 states visual contact with the divers was lost just prior to their appearing to go under the ice due to reflection from the sun. Initially, Tender 2 felt a moderate strain on the tending line similar to what Tender 2 had experienced the year prior when tending divers in surface-supplied dives. Tender 2 became somewhat distracted as a scientist who was participating in ice liberty accidentally stepped on a back bight of BM2 Duque's line.

Approximately two to three minutes after LT Hill and BM2 Duque submerged, Tender 2 and Tender 4 stated that the line sped out, and Tender 2 further stated it was in a fast and forceful manner which led him to ask for help. BM2 Duque's line paid out for ten to fifteen seconds then slowed slightly for a few seconds until it continued to pay out at a faster rate. Believing that about 100 feet of line had paid out, and concerned about the rapid rate the line was paying out, Tender 2, with the assistance of Tender 4, attempted to stop the line from paying out further. Tender 4 recalls that the Tenders gave pulls on the line and received no answer.

Sometime after 1835, about six to seven minutes after the Diver Tenders lost visual sight of the divers, additional polar bear plunges took place. The plunges took place about 20 to 30 feet

away from the dive side along the port side of the ship just forward of the port anchor pocket. The polar bear plunges drew a crowd of crewmembers and scientists who either participated or observed the plunge. Among the observers were the Commanding Officer and the Operations Officer. The Executive Officer, who earlier specifically stated that no polar bear swims were authorized, had returned to the interior of the ship.

Diver 3 returned to the dive side sometime after 1835. Diver 3, noting the apparent concern of the Diver Tenders, asked if they had received any line pull signals. When the Tenders responded that initially there had been pulls, but now there were no responses, Diver 3 had them give four pulls, indicating that the divers should stand by for ascent. As the Tenders and Diver 3 were awaiting a response, a senior enlisted member of the crew who was close to dive side watching the polar bear plunges observed the four pulls and grew concerned as well. He approached the dive side and recommended to Diver 3 to commence retrieving the divers.

The Diver Tenders had stopped paying out line when the supply of tending line became short on LT Hill's spool. It was later determined that approximately 200 feet of line had been paid out for both divers. The exact amount of line that was paid out is unknown as the lines were not marked off at ten foot intervals as is recommended by the Navy Diving Manual. The Diver Tenders began to pull the divers up at approximately 1845. The initial rate of retrieval was approximately one foot per second. As personnel on scene grew more concerned, the pace of retrieval increased. At approximately 40 feet of depth (visual approximation), the divers came into sight; neither appeared conscious. While small air bubbles were observed coming from LT Hill's face mask, few, if any, bubbles were observed coming from BM2 Duque's.

Both divers were then brought rapidly to the surface. The divers were pulled from the water at approximately 1848 and emergency assistance rendered to them. They were non-responsive to the attempts to resuscitate them. Both divers were brought to the sick bay. At 2001 and 2002 the divers were pronounced dead.

Depth gauges revealed that LT Hill had descended to 187 feet, and BM2 Duque had exceeded the maximum gauge reading of 200 feet, and was pegged at a maximum point on the gauge that corresponded to a depth of approximately 220 feet. The return may have omitted required decompression time, depending on the final depth reached, and bottom time. Since the surface team could not have calculated decompression with the information they had, and further could not have performed required stops with unconscious divers, their priority was to get the divers to the surface. An examination of both divers' equipment indicates that no weights were jettisoned.

The post-incident autopsies reported that both LT Hill and BM2 Duque died of asphyxia with pulmonary barotraumas with possible air embolism. The opinion of the Office of the Armed Forces Medical Examiner is that "[i]t is quite likely that the divers lost consciousness prior to or during the ascent." The air in BM2 Duque's air tank was depleted. LT Hill's air tank had a pressure of 90 psi, essentially rendering it empty. The air was tested and was good. Neither autopsy revealed significant pre-existing medical conditions that would have contributed to the cause of death. Both divers were in good physical condition prior to the dive as evidenced by

prior physical exams. Postmortem toxicology examinations for both LT Hill and BM2 Duque showed no evidence of carbon monoxide, ethanol or screened drug use.

Onboard CGC HEALY, there was no dive medical plan, no emergency evacuation plan, no pre-coordinated recompression treatment center, and no dive medical officer was identified to be available in the event of an emergency; all of which are required by the Navy Diving Manual. The location of CGC HEALY and the limitation of the range of its embarked helicopters, absent a pre-planned alternative means of evacuation, eliminated any opportunity to fly the divers off to a hyperbaric treatment facility ashore, had the divers been revivable. CGC HEALY was deployed with a civilian aviation detachment and the range of the helicopters was 100 nautical miles.

CGC HEALY did deploy with a diver Emergency Evacuation Hyperbaric Stretcher (EEHS); however, the apparatus is limited to a recompression depth of 60 feet, and is designed and intended to be used as a transportation device, not a treatment chamber. Thus, it would not have provided the capability to perform adequate recompression for this type of dive injury, which would have required a recompression depth of at least 165 feet. Required EEHS training was not conducted prior to CGC HEALY's deployment. The crew was unfamiliar with its set-up and operation, evidenced by difficulty in assembling the chamber during the medical response, their belief it could be operated as a treatment facility to 200 feet, and their plan to fill it with ship's service air during the medical response effort.

Maintenance of the dive equipment onboard CGC HEALY was lacking and not conducted in accordance with the Preventive Maintenance System (PMS) required by the Coast Guard Diving Manual. There were no discernible dive equipment PMS records found since 2002. Much of the equipment in the dive locker was not serviceable, and the unserviceable equipment was not clearly distinguishable or separate from the serviceable equipment. Finally, no centralized files or dive logs for either LT Hill or BM2 Duque could be located and CGC HEALY did not utilize the Dive Reporting System as required by the Coast Guard Diving Manual. Additionally, pictures taken before the dive show that BM2 Duque's AGA mask was missing a protective guard that should have been present on his regulator. While this guard did not contribute to this accident, its absence is an indication of improper PMS and a failure to conduct the required pre-dive equipment checklist. Pursuant to the Coast Guard Diving Manual and the ship's Diving Bill, the Diving Officer is responsible for overseeing the command dive equipment maintenance program.

Pursuant to the Coast Guard Diving Manual, dive units are required to undergo a Safety Survey and refresher training annually that is coordinated by the Coast Guard Liaison Officer at the NDSTC. CGC HEALY's dive locker had never undergone a Safety Survey or received refresher training by an outside entity. No Dive Program Safety Survey had been conducted onboard CGC HEALY since commissioning on 10 November 1999. The U.S. Navy had previously conducted all dive safety inspections on Coast Guard dive units, but in the late 1990's a shift occurred in which the Coast Guard started conducting the Safety Surveys internally.

Immediately following the events of 17 August 2006, CGC HEALY underwent two safety surveys which revealed that the onboard dive program was deficient in approximately one third of its Coast Guard mandated requirements. Pursuant to United States Coast Guard Regulations, the Executive Officer shall function as the safety officer of the command and administer the safety program.

The only additional Coast Guard specific dive training is an informal session that is added to the SCUBA Course conducted at NDSTC. This session is typically two to three days in length and covers Coast Guard specific dive operations. The course does not have a formal syllabus nor is there specific funding for it.

No one outside of the dive program receives formal dive training. Thus, the Commanding Officers and Executive Officers of diving units, and supervisors of Diving Officers typically have no formal course of instruction in diving, managing, or overseeing a dive program.

3. Findings and Directed Action:

A. I find that the deaths of LT Hill and BM2 Duque were preventable. These deaths resulted from failures at the Service, unit, and individual level.

B. I find that the deaths of LT Hill and BM2 Duque occurred in the line of duty.

C. I find that the deaths of LT Hill and BM2 Duque are attributable to a failure of CGC HEALY Command Cadre and its dive team to properly plan for and execute a standard cold water dive.

I base this finding upon the following facts:

- Conduct of the dive violated standard dive execution policy provided by Coast Guard and Navy Diving Manuals for diver safety.
- Execution of the dive resulted in the divers' unintended descent to hazardous depths far exceeding the intended depth listed in dive plan.
- The dive plan called for the simultaneous diving of three divers with no qualified Dive Supervisor or Standby Diver at the dive side in violation of standard dive policy.
- Various articles of dive equipment were either not worn in a standard manner or were replaced with non-standard equipment.
- Diver weighting was excessive for their respective body sizes.
- Onboard standing orders for CGC HEALY's dive team were not followed.
- During the dive, there was no one present on the surface with the training or experience to either discern that the dive was not going according to plan or to take appropriate measures in response.

- Unqualified personnel filled all three designated Diver Tender positions. The additional Diver Tender, Tender 4, was also unqualified.
- The unqualified Diver Tenders were allowed to conduct the pre-dive equipment checks on the Divers.
- The unqualified Diver Tenders were neither trained in nor briefed on the standard Navy dive line tending signals.
- The unqualified Diver Tenders paid out tending line in excess of the line necessary to complete the planned dive.
- The unqualified Diver Tenders allowed the tending line to pay out at a fast rate. By the time the Tenders gained control of the lines LT Hill's spool was nearly out of line.
- The initial rate of retrieval of the divers was in accordance with established Coast Guard and Navy procedures contained in the Navy Diving Manual; ultimately the retrieval rate was accelerated.
- No Navy Diving Manual was available at the dive side, as required by regulation.
- No communications link between the dive side and the Officer of the Deck was assigned in the dive plan.
- Bridge personnel were not notified when the divers entered the water.
- No dive smooth log was kept nor was anyone on the dive side keeping track of the length of time the divers were submerged.
- No Dive Medical Officer was consulted prior to the dive or during the medical treatment of the divers.

D. I find that CGC HEALY was not properly staffed to safely conduct Coast Guard dive operations in accordance with Coast Guard and Navy dive policies at the time of the mishap.

I base this finding upon the following facts:

- The Coast Guard Diving Manual specifies that CGC HEALY has a diving duty allowance for a six-person collateral duty dive team consisting of one Diving Officer and five SCUBA divers.
- While three Coast Guard divers were embarked in CGC HEALY, only two qualified divers meeting currency requirements were onboard the ship at the time of the incident. LT Hill was outside of dive qualification currency requirements.
- Per the Navy Diving Manual, a minimum of three qualified divers (one Primary Diver, one Buddy Diver, and one Standby Diver) are required to complete a cold water dive. In addition, one qualified Diving Supervisor must also be at the dive side. Under the Coast Guard Diving Manual (but not the Navy Diving Manual) the Diving Supervisor

can be a non-diver Diving Officer if properly trained. In addition, qualified Diver Tenders are required to tend the lines in a cold water dive for each diver in the water. Under the Coast Guard Diving Manual (but not the Navy Diving Manual), Diver Tenders may be non-divers as long as the Diver Tender Job Qualification Requirements have been completed.

- The dive program and Coast Guard Personnel Command only track divers currently assigned to the dive program. Neither accounts for trained divers who rotate to units that do not have diving duty allowances, even if they continue to dive and remain current. Thus, no attempt is ever made to return these divers to units with diver allowances unless the member specifically requests it. No attempt is made to keep Coast Guard diver qualifications current when they are assigned to non-diving units through either continued, refresher training, or dive opportunities. Even when members do request a dive unit, there is no formalized priority for that qualification. Most Coast Guard divers serve one tour at a unit that is allocated a collateral duty diver billet allowance. The diver is then typically transferred to a unit without diving duty allowances, upon which the qualification, investment and experience are lost.

Action: As a result of this finding, I direct:

- The Assistant Commandants for Operations and Human Resources to develop a tracking system for all Coast Guard trained divers to gain optimum use of training investment and to provide data for assignment decision criteria.
- The Assistant Commandants for Operations and Human Resources to research and analyze the reuse of diving skills and the flow of divers through different types of units, billet structure, and advancement/promotion gates, and to address the application of the Assignment Priority System to enlisted skills.
- The Assistant Commandants for Operations and Human Resources to identify staffing gaps and take appropriate action in filling dive units with the correct mix of qualified divers during Assignment Year 2007. The gaps should be displayed in a manner allowing unit commanders, operational commanders and dive program management full visibility of dive assignment shortfalls.

E. I find that LT Hill's and BM2 Duque's experience, readiness and/or training level were inadequate for this dive.

I base this finding upon the following facts:

- LT Hill qualified as a Basic Diving Officer on 11 May 2004 from the Naval Diving and Salvage Training Center after completing the four-month Basic Diving Officer Course.
- LT Hill had conducted approximately 24 dives during 19 dive days since attending Basic Diving Officer course in 2004; seven dives were conducted in the Arctic Ocean during the summer of 2005 under surface-supplied air conditions. The last dive

LT Hill participated in prior to this mishap was on 10 April 2006. This was LT Hill's first cold water SCUBA dive.

- BM2 Duque qualified as a SCUBA diver on 1 March 2006 from the Naval Diving and Salvage Training Center after completing a six week SCUBA diver course.
- BM2 Duque had previously only conducted two dives on one dive day, 10 April 2006. This dive was his first cold water dive and third Coast Guard dive since graduating from dive school.
- No one on the surface was designated as or filled the positions of Diving Supervisor or Standby Diver as directed by Coast Guard and Navy Diving Manuals.
- Both LT Hill and BM2 Duque carried excessive weight. Much of the weight was stored in locations that were non-jettisonable in conflict with direction in the Navy Diving Manual.
- Neither diver wore a weight belt as required by the Navy Diving Manual. Neither diver jettisoned weight during the dive.
- The line tending brief provided by LT Hill and understood by the unqualified diver tenders differed from the standard Navy line commands used during Coast Guard dive operations.
- LT Hill and BM2 Duque made an agreement to deviate from standard Navy dive hand signals when BM2 Duque indicated a lack of manual dexterity.
- Both LT Hill and BM2 Duque were collateral duty divers. Each of them was in a regular watch rotation.
- Several pieces of equipment for the dive were non-standard, missing or not functioning properly:
 - Both divers wore buoyancy compensator devices not attached to an air supply;
 - LT Hill was outfitted with two secondary regulators, one with an air supply and the other without an air supply;
 - Both divers wore a single steel-100 tank with standard breathing air. Diving under the ice or in cold water (water temperature below 37 degrees Fahrenheit) must be conducted with a "redundant SCUBA system" which is defined as twin tanks, per the Navy Diving Manual. The seawater temperature for this dive was 29 degrees Fahrenheit.
 - Both divers wore split fins designed for high speed, but which provide minimal thrust in heavy diving. Split fins are not considered appropriate for heavy diving, but rather for light diving and snorkeling.
 - The divers wore their dive mask straps under their drysuit hoods, not considered a safe practice in cold water.
 - BM2 Duque's AGA regulator was missing a protective guard.

Action: As a result of this finding, I direct:

- The Assistant Commandants for Operations and Human Resources to realign the qualification requirements of the Diving Supervisor to the Navy standards which require the Diving Supervisor to be a qualified diver.
- The Assistant Commandants for Operations and Human Resources to formalize, with pre-determined training objectives and syllabi, the current Coast Guard Dive Training at the Naval Dive and Salvage Training Center.
- The Assistant Commandants for Operations and Human Resources to follow through with the direction provided in ALCOAST 440/06, in which, a one-day safety stand down was ordered for all dive units. In addition, the dive program safety surveys were accelerated and by 12 January 2007, all dive units will have had a safety survey within the last year.
- The Assistant Commandant for Operations to schedule a dive safety visit and diver operations refresher training to all Polar Icebreakers approximately sixty days prior to planned deployments.
- The Assistant Commandants for Operations and Human Resources to revisit and evaluate the existing Memorandum of Understanding with the Navy to maximize use of Navy dive trainers for scheduled dive visits.

F. I find that the overall management of the dive program aboard CGC HEALY was inadequate and did not comply with established Coast Guard and Navy dive policies.

I base this finding upon the following facts:

- Dive equipment was not maintained and checked in accordance with Preventive Maintenance System requirements. No discernable dive equipment PMS records that would serve to confirm dive equipment PMS was performed were located. The last discernible PMS records were dated 2002.
- The dive locker storage and equipment was generally unorganized and not well maintained.
- Some of the equipment in the dive locker was not serviceable. The unserviceable equipment was not clearly distinguishable or separated from the serviceable equipment.
- No centralized files or dive logs for either LT Hill or BM2 Duque could be located, nor did CGC HEALY utilize the Dive Reporting System as required by Coast Guard dive regulations.
- The tending lines were not marked at 10-foot intervals as recommended by the Navy Diving Manual.

- The only printed Navy Diving Manuals located aboard CGC HEALY were out of date. CGC HEALY had access to the updated Navy Diving Manual, Rev. 5 on CD-ROM; however, it was not readily available at the dive side as mandated by the Navy Diving Manual.
- No semi-annual or predeployment training on the assembly and use of Emergency Evacuation Hyperbaric Stretcher (EEHS) had been conducted. The EEHS is a transport-only chamber with very limited capacity to conduct treatment. It can only recompress to a maximum of 60 feet, despite this, first responders were attempting to assemble and employ the EEHS event though diver depth was at or exceeded 187 feet.
- No one aboard CGC HEALY pre-coordinated the availability of the nearest accessible Hyperbaric Treatment Facility to discuss notification procedures or any special instructions in the planning phase for diving operations, as required by regulation.
- The dive training program onboard CGC HEALY was not functional.
- The Diving Officer was not a member of CGC HEALY's training board as recommended by the Coast Guard Diving Manual.

Action: As a result of this finding, I direct:

- The Assistant Commandants for Operations and Human Resources to develop a dive training and inspection program similar to other objective evaluation programs such as Aviation STAN visits. Such a program should provide published visit dates, clear inspection criteria and have the necessary visibility of unit commanders and operational commanders.
- The Assistant Commandants for Operations and Human Resources develop a unit self-assessment process for diving operations that can be utilized by unit commanders and operational commanders to gauge need for support outside of normally scheduled dive visits.
- The Assistant Commandant for Operations to reaffirm and emphasize that dive unit commanders are to provide the opportunity for and require regularly scheduled training dives to allow divers to maintain proficiency as required by the Coast Guard Diving Manual.
- The Area and District Commanders who have oversight of dive units to designate dive program oversight billets within their commands responsible for tracking the readiness, qualification and training status of their units.
- The Area and District Commanders to reaffirm to their unit commanders the requirement to conduct an Operational Risk Management review prior to every dive evolution with Command Cadre, personnel involved in the dive, and supporting personnel. The review must include the qualification and proficiency level of all personnel involved in the dive evolution, including the Diver Tenders.

G. I find evidence that CGC HEALY's Commanding Officer, Executive Officer, and Operations Officer, (the "command cadre") failed to exercise leadership and supervision expected in command afloat. I further find that their actions demonstrated a lack of knowledge of the Coast Guard's dive program and a lack of knowledge and disregard for the high level of risk of cold-water diving.

I base this finding upon the following facts:

- The command cadre had a duty to ensure dive operations were conducted in accordance with Coast Guard policy. They also had a duty to ensure that operations were conducted in a safe manner and that proper dive training was conducted.
- The cold water dive conducted on 17 August 2006 was executed in violation of standard Coast Guard and Navy dive policies contained in the Coast Guard and Navy Diving Manuals.
- The command cadre was distracted by ice liberty activities during the dive operation and did not continuously observe the dive operation or actively supervise it in any meaningful way.
- Each member of the command cadre consumed alcohol during ice liberty.
- No command-level operational dive pre-brief or Operational Risk Management (ORM) assessment was conducted to ensure overall situational awareness and assess the benefit derived from attempting this dive.
- The command cadre left the administration of the dive program to the Diving Officer without regular oversight inspections even though the Diving Officer was on her first tour afloat.
- Dive requalification was improperly given and the Diving Officer was not properly qualified to dive.
- The submitted dive plan was routed through the command cadre in approximately 30 minutes with only one minor change: that the divers would deploy from the brow. While the employment of all three divers was questioned, no one verified the accuracy of the Diving Officer's statement that all three divers could dive concurrently. No one questioned the fact that there was not a separate and impartial safety observer at the dive side.
- The unit's own dive policy and procedures were not followed. The ship's own manning requirements were not followed and proper equipment tag outs did not occur. The following gear was running in violation of Coast Guard and Navy dive procedures: three sonar transducers, aft suction, the rudder was energized and both propeller shafts were turning. While the shafts were engaged to keep the ship against the ice, by failing to conduct Operational Risk Management, no risk analysis was done to consider risk factors and determine whether the risk outweighed the need to conduct a training dive.

- Ice liberty was granted to the crew and scientists in conjunction with the Coast Guard cold water familiarization dive. Ice liberty activities, including an unplanned polar bear swim that was unauthorized by the Executive Officer, were conducted in close proximity (approximately 30 feet) to the Coast Guard dive.
- Alcohol was served during ice liberty and consumed at the dive side. Crew members who were consuming alcohol were allowed to visit the dive side. The amount of alcohol provided to the crew and scientists was not strictly regulated.
- Two of the unqualified Diver Tenders had consumed alcohol.
- No medical evacuation plan was drafted or routed as required by Coast Guard and Navy dive regulations.
- No pre-established medical contacts were made and briefed to all potential responders prior to conducting diving operations.
- CGC HEALY was not in a geographical location to evacuate divers for emergency care, nor did the ship have the required emergency evacuation plan. The distance from land exceeded the range of the embarked helicopters. These risk factors were not considered despite increasing the risk exposure to the divers.
- The dive training program onboard CGC HEALY was not functional.
- The Diving Officer was not a member of CGC HEALY's training board as recommended by the Coast Guard Diving Manual.
- Although specifics regarding diving operations are not taught at Command and Operations School or at any other progression point for personnel in the command afloat career track, the command cadre had a responsibility to familiarize themselves with appropriate reference material to ensure compliance with Coast Guard policy.

Action: As a result of this finding, I direct:

- The Assistant Commandants for Operations and Human Resources to develop a dive training module for inclusion in appropriate training syllabi for Command Cadre, utilizing dive experts to deliver the training to the maximum extent possible. This training module is particularly important for units with divers assigned, but will broaden the understanding of safe diving practices of all units that utilize divers from other government agencies or from commercial sources.
- The Assistant Commandant for Operations to review and update as necessary Coast Guard Diving Manual guidance for command level dive program inspection responsibilities.
- The Pacific Area Commander to assess the culpability of members of CGC HEALY's command cadre under the Uniform Code of Military Justice and take any action he deems appropriate.

- Commanders and Commanding Officers with operational and oversight responsibility for dive teams to reinforce the use of Operational Risk Management (ORM) and Team Coordination Training (TCT) on a consistent basis. Actions should include regular examination of unit operations, discussion of case studies and inclusion in mission planning sessions; as well as, ensuring required ORM/TCT training requirements are met with quality, effective events.

H. I find that the overall management, structure and policies of the current Coast Guard dive program are inadequate to properly guide and manage the dive program.

I base this finding upon the following facts:

- CGC HEALY's dive locker had never been inspected by an outside entity. No Dive Safety Survey had been conducted onboard CGC HEALY since commissioning on 10 November 1999. The Coast Guard Diving Manual requires dive units to undergo a Safety Survey and dive operations refresher training annually.
- Per the Coast Guard Diving Manual, the Coast Guard dive program and personnel assigned to the NDSTC are required to conduct annual safety inspections on Coast Guard units. The Navy previously handled all Coast Guard dive safety inspections, but that was changed at some point in the late 1990s when the Coast Guard brought this responsibility in house.
- The Diving Program Safety Survey Form, as drafted, can lead to inconsistent results based on variances in inspector experience and judgment. Two separate Diving Safety Surveys were conducted after the HEALY mishap. Using the same inspection form, one team identified 20 discrepancies from the survey, while another found 28 discrepancies.
- The Coast Guard dive program has significantly expanded with the creation of Maritime Safety and Security Teams, from five dive units to seventeen over the last five years, without a commensurate increase in program management staff.
- The Coast Guard dive program manager is a lieutenant (O-3) assigned to CG-3RPC. The entire dive program management consists of the Coast Guard Headquarters dive program manager, plus one officer (O-3) and two enlisted personnel (HSC, MK1) assigned as liaisons to the NDSTC.
- Both the dive program manager and dive school liaison have previously served in only one dive billet. They were both commissioned in 2002 and have just started their third tour of duty in the Coast Guard.
- The vast majority of Coast Guard divers are trained at the minimum level for military diving (SCUBA). The Coast Guard has just one First Class Diver. There is one Dive Medical Technician in the Coast Guard (the Health Services Technician Chief currently assigned to NDSTC).

- One Diving Officer is assigned to each dive unit which is appropriate. Diving Officers are trained to the level of a First Class Diver; however, the training focuses primarily on leadership, medical response, supervision and administration, not on day-to-day diving. In the Navy, Diving Officers are not the primary dive experts in the locker, are not the most experienced diver and are expected to receive assistance from the seasoned senior enlisted dive crew, particularly First Class and Master Divers.
- The Coast Guard does not currently have any Master Divers in service. The most recent Master Diver retired in 2002.
- The week following completion of the five-week SCUBA course at NDSTC, Coast Guard dive instructors or the Dive Program Manager provide a two to three day course of instruction. The course lacks formalized training objectives, a written syllabus, specific funding, and sponsorship or recognition by NDSTC.
- The Coast Guard Diving Manual does mention cold water and/or ice diving as a Coast Guard diving specialty. The manual references the Navy Diving Manual for nearly all guidance related to actual diving operations.
- Coast Guard and Navy Diving Manual guidance is unclear about the requirements for a Coast Guard diver to regain qualification when the diver's last dive was completed within one year, but not within the last six months.

Action: As a result of this finding, I direct:

- The Assistant Commandant for Operations to charter a cross-directorate study team, including dive expertise from the Navy and other recognized sources of dive expertise, to evaluate the requirements, management and policy guidance of the Coast Guard's dive program with a report out to the Chief of Staff by 1 June 2007. At a minimum, the following aspects will be covered:
 - Validation of the operational requirement for dive capability aboard Polar Icebreakers, seagoing buoy tenders, MSSTs and any other types of units currently having such capability. If such a capability is found to be warranted, identify options for fulfilling that capability aside from organic Coast Guard staff (contracted divers, divers from other agencies, etc).
 - Determination of proper mix of dive experience and training levels required at Coast Guard dive units.
 - Determination of proper staffing levels of Coast Guard dive program management at Headquarters, Area and District levels.
 - Develop a section in the Coast Guard Diving Manual that addresses command cadre oversight and management guidelines.
 - Evaluation and determination of optimal method of conducting onboard preventive maintenance of Coast Guard dive equipment. Specifically evaluate the practice of equipment exchanges versus onboard maintenance.

- Review and revise, if necessary, the Safety Survey Form to ensure a more objective process that accounts for differences in experience levels of inspectors. Include the Safety Form as an enclosure to the Coast Guard Diving Manual.
- Until such time that the dive study team reports out and final actions are determined, the following actions should commence immediately:
 - The Assistant Commandant for Operations will amend and correct the existing Coast Guard Diving Manual to address the following items:
 - Provide comprehensive policy on cold water diving.
 - Establish standard relief process for Diving Officers.
 - Develop standard checklists for dive operations which accommodate different dive scenarios such as diving on the ship, in close proximity to the ship, and away from the ship.
 - Mandate diving pre-briefs using standardized checklists.
 - Establish clear guidance for units conducting dive operations outside of external emergency response capabilities.
 - Correct discrepancy in guidance regarding diving recertification after qualifications lapse beyond six months, but less than 12 months.
 - Emphasize that ORM shall be used prior to conducting dive operations.
 - The Assistant Commandants for C4IT and Operations to investigate compatibility issues between the Coast Guard Standard Workstation III and the Navy Dive Reporting System.

I. In addition to the above findings I also direct:

- The Assistant Commandant for Human Resources to review and update policies and procedures for the Casualty and Decedent Affairs, including a review and update of Chapter 11.A to the Coast Guard Personnel Manual, a review of procedures for handling personal effects, and action as necessary to resolve potential issues regarding disposition of remains.
- The Assistant Commandant for Operations to promulgate policy regarding ice liberty and alcohol consumption.
- The Pacific Area Commander to schedule and conduct a special Ready for Operations assessment of CGC HEALY's unit wide training program prior to the ship's next deployment.

4. **Summary:**

In summary, this tragedy resulted from failures in:

- Leadership – This mishap revealed numerous departures from standard Coast Guard policy at various levels despite the availability of policy that would have prevented the loss of life. Had CGC HEALY's divers and Command Cadre followed the policies in the Coast Guard and Navy Diving Manuals they would have been in a position to identify the shortfalls in their staffing, equipment and procedures and would likely have terminated the dive or not approved it in the first place. A lack of oversight of the onboard dive program contributed to this leadership shortfall. Active utilization of Operational Risk Management would have provided a sound check on the timing, necessity, value and risk of this dive.
- Training, Experience, and Judgment – It is clear that the divers who lost their lives lacked an adequate combination of training, experience, and judgment to recognize and properly manage the high risk of cold water diving and failed to follow known procedures and regulations. My direction to determine the right staffing of dive units and increased training and inspection visits will focus on providing sufficient dive expertise in unit dive lockers to address this shortfall.
- Program Management – The dive program in the Coast Guard has not kept pace with the growth of Coast Guard missions following the terrorist attack of 11 September 2001. The number of Coast Guard dive units has expanded from 5 to 17 over the past five years. There has been no growth in dive program management or training billets, or in their seniority to accompany that expansion. The dive program needs to be elevated on par with other high risk, training intensive operations such as aviation.

We will honor our lost shipmates and keep faith with our Core Values of Honor, Respect, and Devotion to Duty by diligently directing our energies toward improving our performance through the elimination of the shortfalls that led to this tragedy.

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Encl: Glossary of Terms

Dist: CG-09, CG-01
CG-092, CG-094
CG-1, CG-2, CG-3, CG-4, CG-5, CG-6, CG-8, G-A, G-D
All Area and District Commanders
All Diving Units
Naval Diving and Salvage Training Center (NDSTC)
Naval Experimental Dive Unit (NEDU)

GLOSSARY OF TERMS

Automatic External Defibrillator (AED)	Automatic External Defibrillator – A portable automatic device used to restore normal heart rhythm to patients in cardiac arrest. An AED will recommend an electric shock when the heart rhythm is abnormal but correctable. No shock is advised when the heart rhythm is normal or there is total absence of electrical activity in the heart, i.e. when a person is already dead.
AGA™ Full-Face Mask (FFM)	Also known as the MK 20 and Divator MK-II, is compatible with surface supplied and SCUBA equipment and is authorized for use in either mode. With surface supplied equipment, it has a working limit of 60 ft. With SCUBA equipment, it has a working limit of 190 ft.
Aids to Navigation (ATON)	Aids to Navigation – Divers provide buoy tenders in the Fourteenth District the ability to conduct extensive, independent ATON operations requiring minimal support. Divers can inspect moorings, salvage sunken buoys, and lift buoy sinkers. Most ATON diving is conducted from small boats, allowing the dive team to work ATON in shallow water where the cutter would be at risk.
Asphyxia	A condition in which an extreme decrease in the concentration of oxygen in the body accompanied by an increase in the concentration of carbon dioxide leads to loss of consciousness or death.
Aviation STAN or Boat Forces STAN, or STAN Team	A standardization team. In the Coast Guard, aviation forces and boat forces have special teams of trained individuals who visit Coast Guard units to evaluate that unit's ability to operate in compliance with Coast Guard directives and doctrine, and to conduct training.
Bight (of line)	The center of a <u>slack line</u> . (i.e: where it sags). The section of line between the point where the tender holds it, and the spool or reel on the ice behind the tender.
Brow	The railed platform the ship carries onboard to use between ships, from the ship to a pier, or from the ship to the ice to walk on and off (as in "Take in the brow.").
Buoyancy Compensator Device (BCD)	Typically worn by SCUBA divers to control positive and negative buoyancy. A BC generally has numerous pockets to store tools and other equipment. Most have integrated SCUBA tank harnesses and weight pockets. The weight pockets are designed to allow the diver the ability to quickly release the weight in an emergency. Weight pockets are different from other pockets usually found on the BC.

COMDTINST	Commandant Instruction: a policy document used to pass internal Coast Guard policy from senior leadership to the entire service.
COMPACAREA	Commander Coast Guard Pacific Area. The official title of the Coast Guard Vice Admiral in charge of Coast Guard operations in the Pacific Region. The direct superior of the Commanding Officer of USCGC HEALY.
Commanding Officer	The captain of a ship. The responsibility of the commanding officer for that command is absolute, except when, and to the extent, relieved therefrom by competent authority, or as provided by otherwise in Coast Guard Regulations. At the commanding officer's discretion, portions of that authority may be delegated to subordinates for the execution of details, but such delegation of authority shall in no way relieve the commanding officer of continued responsibility for the safety, efficiency, and well-being of the command.
Cutter or USCGC	A Coast Guard ship. Typically any Coast Guard ship greater than 65 feet in length. USCGC is an acronym for United States Coast Guard Cutter, not to be confused with USS, the acronym used by the Navy for United States Ship.
Direct Access	A personnel data system used by the Coast Guard to track service member employment data.
Diver Tender, also Line Tender	The diver tender is a surface member of the diving team who works closely with the diver underwater. At the start of a dive, the tender checks the diver's equipment and topside air supply (for surface-supplied diving) for proper operation and helps dress the diver. Once the diver tender is in the water, the tender constantly adjusts the tending line to eliminate excess slack or tension. The diver tender exchanges line-pull signals with the diver, keeps the Diving Supervisor informed of the line-pull signals, the amount of diving hose/tending line over the side, and remains alert for any signs of an emergency. Completion of Dive Tender Job Qualification Requirement is required for all non-divers to become a qualified diver tender.

Dive Officer (DO) or Basic Dive Officer (BDO)	Trained to perform SCUBA and surface-supplied diving to a maximum depth of 190 ft. Training includes diving physics and medicine, underwater tools, diving system certification, SCUBA, and surface-supplied air diving operations. Duties and responsibilities of the Diving Officer include ensuring the safe conduct of all diving operations by providing overall supervision of diving operations and ensuring strict adherence to procedures and precautions. The Diving Officer is further responsible for all diving related administrative duties and record keeping, conducting the diver training and qualification program, overseeing the command diving equipment maintenance program and ensuring that he or she becomes familiar with all command diving techniques and have a detailed knowledge of all applicable regulations. Additionally, the Diving Officer, is responsible for the safety of all diving operations and has the authority to abort diving operations when deemed necessary by risk analysis.
Dive Side	The location where a military or commercial dive is performed.
Diving Supervisor (DS)	In charge of the actual diving operation for a particular dive or series of dives. Diving operations shall not be conducted without the presence of the diving supervisor. The diving supervisor has the authority and responsibility to discontinue diving operations in the event of unsafe diving conditions.
Dry Suit, or Variable Volume Dry Suit	Variable volume dry suits provide superior thermal protection to the surface-supplied or scuba diver in the water and on the surface. They are constructed so the entry zipper or seal and all wrist and neck seals are waterproof, keeping the interior dry. They can be inflated orally or from a low pressure air source via an inlet valve. Air can be exhausted from the suit via a second valve, allowing buoyancy control. The level of thermal protection can be varied through careful selection of the type and thickness of long underwear.
Emergency Evacuation Hyperbaric Stretcher (EEHS)	Emergency Evacuation Hyperbaric Stretcher – This is a portable hyperbaric chamber. It is designed for the transportation of conscious, stable divers suffering from diving related illnesses. It can be pressurized to maximum equivalent depth of 60 ft.

Executive Officer	Second in command of a ship. The executive officer is directly responsible to the commanding officer. All orders issued by the executive officer shall have the same force and effect as though issued by the commanding officer and shall be obeyed by all persons onboard. The executive officer shall generally supervise the administration and business of the ship, supervise and coordinate the work, exercises and training of the personnel of the command, function as the safety officer of the command and administer the safety program by coordinating the safety indoctrination and planning of the various departments, and perform other duties as described in Coast Guard Regulations.
Expendable Bathythermograph	The Expendable Bathythermograph (XBT) has been used by oceanographers for many years to obtain information on the temperature structure of the ocean to depths of up to 2,000 meters.
Ice Checks	The practice of inspecting ice prior to beginning a science station or ice liberty to ensure the area is safe to conduct operations or support personnel.
Ice Liberty	Command authorized free time wherein the crew and embarked scientists may depart the ship onto the arctic ice – a break from regularly scheduled operations.
JQR or Job Qualification Requirements	Generally, JQR is similar to Personal Qualification Standards (PQS) in that they provide a step by step task list that must be completed for a crewmember to become qualified in a new skill, or watch station. JQR is usually a local version of PQS, which is typically a service wide qualification standard.- Dive Tender JQR is contained in the Coast Guard Diving Manual and is the Coast Guard standard.
Message or Message Traffic	A manner of formal written communication between Coast Guard or other government and military units sent electronically; similar to a telegram or teletype.
Morale Locker	Secure/locked area of ship used to store ship's equipment, such as sports equipment, games, rental movies, food and beverages which may be checked out to the crew, as authorized by appropriate authority.
Naval Diving & Salvage Training Center (NDSTC)	Naval Diving and Salvage Training Center – Located in Panama City, FL. With the exception of Navy SEALs, every military service conducts diving training here.

Navy Experimental Diving Unit (NEDU)	Navy Experimental Diving Unit – Located in Panama City, FL. Investigates equipment involved in all military diving accidents and may investigate equipment from civilian diving accidents when requested. Tests and evaluates all equipment to be considered for use by the USN. Develops the diving equipment Authorized for Navy Use (ANU) List.
Nitrogen Narcosis	State of euphoria and exhilaration that occurs when a diver breathes a gas mixture containing nitrogen. For a dive using standard compressed air (not a man-made mixture of breathing gas), narcosis usually appears at a depth of approximately 130 ft., is very prominent at a depth of 200 ft., and becomes disabling at deeper depth. There is a wide range of individual susceptibility to narcosis. The symptoms of nitrogen narcosis include loss of judgment, false feeling of well-being, lack of concern for safety, impaired problem solving ability, inappropriate laughter, and tingling and vague numbness of the lips, gums, and legs. Disregard for personal safety is the greatest hazard. The effects of nitrogen narcosis become more pronounced and develop more rapidly the quicker the descent.
Octo+™	A component made by <i>Zeagle Systems</i> used to inflate or vent a buoyancy compensator device while also functioning as a back-up (or octopus) regulator.
Officer of the Deck	The officer directly responsible to the commanding officer for overseeing the safe navigation, and operation of the ship. The “OOD” typically stands a four-hour watch on the ship’s bridge.
Operations Officer	The head of the Operations Department of the ship. The operations officer is responsible for the collection, evaluation, and dissemination of operational and combat information required for the assigned missions and tasks of the vessel. The operations officer has responsibility for all matters related to the operations of the vessel.
Polar Bear Plunge, or Polar Bear Swim	A morale activity. The practice of jumping into cold water with minimal dress, e.g., a bathing suit.
Polar Bear Watch	Crew member(s) designated and appropriately armed to watch for and, if necessary, ward off a polar bear.

Pulmonary barotrauma	<p>Pulmonary barotrauma is a condition that usually happens as a diver is ascending. The term refers to the rupture of lung air sacs, which generally occurs during ascent. Gas that leaks from a ruptured lung can enter one of three places:</p> <p>(1) the area around the heart (causing pneumomediastinum or mediastinal emphysema);</p> <p>(2) the pleural space between the lung and chest wall (causing pneumothorax);</p> <p>(3) the bloodstream (causing arterial gas embolism).</p> <p>Pulmonary barotrauma can be caused by breath-holding during ascent, by a rapid ascent or by certain lung diseases. (source Diver Alert Network)</p>
Sea Suction or Sea Chest	<p>Small underwater compartment within the <u>shell plating</u> through which sea water is drawn in or discharged; the sea water may be used for cooling the machinery systems</p>
Self-Contained Underwater Breathing Apparatus (SCUBA)	<p>Self-Contained Underwater Breathing Apparatus – An apparatus utilizing a portable supply of compressed gas (such as air) supplied at a regulated pressure and used for breathing while swimming underwater.</p>
Standby Diver	<p>A standby diver with a diver tender is required for all diving operations. The standby diver need not be equipped with the same equipment as the primary diver (except as otherwise specified), but shall have equivalent depth and operational capabilities.</p>
Surface-Supplied Diving	<p>Surface-supplied air diving includes those forms of diving where air is supplied from the surface to the diver by a flexible hose. The Navy Surface Supplied Diving Systems (SSDS) are used primarily for operations to 190 feet of seawater (fsw). In Surface-supplied diving a diver's air supply, movements and communications are heavily controlled from the surface. From the standpoint of the diver, Surface-supplied diving is heavily surface controlled, as opposed to SCUBA which is typically diver controlled.</p>
Tag-outs	<p>The procedure employed to prevent improper operation of systems or equipment.</p>
WAGB	<p>Coast Guard Cutter Icebreaker – This is the hull designation for Coast Guard icebreaking vessels.</p>