The Coast Guard Journal of Safety at Sea

U.S. Department
of Homeland Security

United States
Coast Guard

PROCEEDINGS

of the Marine Safety *&* Security Council

Search & Rescue

Always Ready for the Call

In partnership with the Winter 2004 issue of ON SCENE
the Journal of U.S. Coast Guard Search and Rescue

PROCEEDINGS

Fall 2004

Vol. 61, Number 3

On the Cover

A 47-foot motor lifeboat crashes through surf. This type of vessel is designed as a first response rescue resource in high seas, surf and heavy weather environments. They are built to withstand the most severe conditions at sea and are capable of effecting a rescue at sea even under the most difficult circumstances. They are self-bailing, self-righting, almost unsinkable, and have a long cruising radius for their size. The 47-footer is the replacement for the aging 44-foot fleet. Presently, 117 are operational, being added to monthly. The total (to be delivered over five years) will be about 200. Image is © Dan Nerney Photography. Cover is a USCG illustration.

The SAR System

What and How

Planning and Education

Technology

On Deck

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All are USCG illustrations.

What and How: Helicopter image by Public Affairs Officer Dave Hardesty, USCG.

Planning and Education: Coast Guard petty officers assist Kodiak, Alaska, paramedics as they secure a litter bearing a man onto a stretcher in August. Suffering gastrointestinal bleeding, he was medevaced from Air Station Kodiak. Public Affairs Officer Paul Roszkowski, USCG.

Technology: A Coast Guard 47-foot motor lifeboat in 25-foot waves. Boatswains Mate Christopher Enoksen, USCG.

Assistant Commandant's Perspective

by Rear Adm. R. Dennis Sirois
Assistant Commandant for Operations, U.S. Coast Guard

Prior to Sept. 11, 2001, there was a clear and unequivocal position in the U.S. Coast Guard regarding our #1 mission...it was search and rescue (SAR)! Now there are two #1 missions: SAR and homeland security–both of which relate to protecting the sanctity of human life. These separate but distinct missions complement each other in many ways and strengthen our total ability to save and protect our fellow citizens and to keep them from harm's way. As the Coast Guard transitions toward a greater homeland security posture, we need only look at and emulate the traditions, mission requirements and readiness of the Coast Guard's SAR program, which has always had a positive and cascading effect as the keystone that supports our multimission environment. In the past as it is today, SAR response standards have been used to dictate the placement of stations, air stations, patrol boats, high-level sites, Group Commands, Rescue Coordination Centers (and District boundaries) and Command Center watchstander requirements, among other capabilities. It's for this reason that the Coast Guard's transition in assuming a much higher profile role in homeland security has been easier than it would have been otherwise. Because of SAR, we were already there and prepared to meet the threat. The Coast Guard motto, "Semper Paratus–Always Ready!" has its origins in the SAR mission. If we consider the impact this mission has had over the rest of the Coast Guard, it is easy to make the analogy that our effectiveness in performing our homeland security mission is directly attributable to our traditional readiness to conduct SAR; of maintaining a tight watch, keeping a good lookout and being ready for the call.

Conversely, our expanded presence on our waterways, our use of sensors and expanded tracking abilities and other interventions to secure our homeland has and will continue to benefit SAR and to reduce its occurrence. The heightened maritime domain presence of the Coast Guard (active duty, reserves and auxiliarists) and our local, state, federal and industry partners can only serve to result in a safer maritime environment for the boating public, while concurrently keeping would-be terrorists at bay from potential waterborne and shoreside targets.

In echoing the Commandant's Direction of People, Readiness and Stewardship, it is easy to see how they each interact with SAR, and how SAR, as a mission, will always be a primary theme that holds our Service together. Our stewardship of the public trust has a lot to do with managing our resources to more effectively serve the public, but it also means taking care of the public's immediate needs where our SAR program provides a direct benefit to mariners—whether recreational boaters, commercial fishermen, or others—who find themselves in a distress situation. Our readiness is drawn from our traditions and heritage as rescuers…of being "Semper Paratus." And the adaptability and dedication of our people, whether they are full-time or part-time or civilian, are what makes the U.S. Coast Guard the most renowned multimission, military, maritime institution in the world. We've altered course significantly since September 11, yet, I am proud to say, our commitment to SAR and the protection of life has never been stronger!

Statement of Ownership, Management and Circulation

DIST (SDL No. 134)
A: ac(2): ebfghijklmnopqrsuv(1).
B: nr(50); cefgipw(10); bklqshj(5); xdmou(2); vyz(1).
C: n(4); adek(3); blo(2); cfgijmpqr tuvwyz(1).
E: ds(5); abcefghijklmnopqrtu vwyz(1).
E: kn(2).
F: abcdehjkloqst(1)
List TCG-06

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Proceedings (ISSN 1547-9676) is published quarterly by the Coast Guard's Marine Safety, Security & Environmental Protection Directorate, in the interest of safety at sea under the auspices of the Marine Safety & Security Council. Special permission for republication, either in whole or in part, except for copyrighted material, is not required, provided credit is given to *Proceedings*. The views expressed are those of the authors and do not represent official Coast Guard policy.

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Subscriptions, *Proceedings* Magazine
U.S. Coast Guard
National Maritime Center
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Champion's Point of View

by Capt. STEVE M. SAWYER
Chief, U.S. Coast Guard Office of Search and Rescue

Since the events of Sept. 11, 2001, the Coast Guard, understandably, has prudently focused on ramping up our efforts on homeland security issues and creating a deterrent and response capability to potential acts of terrorism in our maritime domain. So I'm very appreciative that *Proceedings* has given us a forum at this time to address and re-emphasize the Search and Rescue (SAR) mission, to discuss the latest issues that affect our program and to provide an avenue to tell our story.

The U.S. Marine Corps has an edict, "Every Marine A Rifleman." It's short and to the point, and reflects their respect for tradition and the knowledge that all Marines, regardless of occupational specialty, rank or gender, are able to support each other in times of combat. Deep down, every Coast Guardsman has a similar feeling for one of our own adages—we're the "Lifesavers"; we're always ready for the call. If we were honest about it, the one thing that intrigued most of us about the Coast Guard when enlisting or going on to get our commission was the immediate kinship we felt after seeing one of our recruiting posters for the first time. That poster of the motor lifeboat breaking through a bar on its way to a SAR case to save those in distress is what hooked me; I'm sure it's what hooked a lot of us. When I was looking at and considering Officer Candidate School options after college, the Coast Guard spoke to me in terms of our humanitarian missions. This was something I wanted to do for a career; and I've been fortunate to spend almost 11 years of it directly involved in SAR. The Coast Guard has provided many of us opportunities to get involved in different fields, including Aids to Navigation, ice-breaking, military readiness, environmental response issues, regulatory functions, law enforcement, homeland security and other specialties. But the common thread that holds us all together—the one thing that causes us to drop what we're doing and to refocus our attention—is our collective response to a distress search and rescue mission; to save the lives of those in peril.

As the Coast Guard continues to evolve to face and counter the issues that threaten the American public, our way of life, and the freedoms that we all enjoy, I am confident that we will be ready—because it's readiness that defines us as borne from our SAR heritage. It's that tradition of being "always ready" that we all share, knowing that we are there to support each other in preventing an incident or to respond to a crisis—to protect and hold close all that we stand for—of having the attitude, disposition and values that make a difference and that truly define who and what we are. "Every Coast Guardsman A Lifesaver."

Search and Rescue Response System Overview

By Lt. Cmdr. JEFF OVASKA
U.S. Coast Guard Office of Search and Rescue, Policy Division

In December 2003 the last communication between the *Sea Gypsy IV*, a 45-foot fishing vessel that had departed St. John's, Newfoundland, en route to Bermuda, and the vessel's owner indicated that the *Sea Gypsy IV* was 210 nautical miles northeast of Bermuda. When the vessel failed to arrive on time, the owner contacted the Rescue Coordination Center (RCC) in Bermuda, which commenced an aggressive communications search for the vessel.

Two days later, RCC Bermuda contacted the U.S. Coast Guard's Atlantic Area RCC in Norfolk, Va., regarding the overdue vessel and requested assistance. RCC Norfolk queried the U.S. Mission Control Center for any possible correlating Emergency Position Indicating Radio Beacon (EPIRB) hits during the period and used the Computer Assisted Search Planning (CASP) tool to develop an HC-130 aircraft search plan. With a possibility of multiple days adrift, the vessel could have been anywhere within 400 square miles of ocean.

An HC-130 aircraft from Air Station Elizabeth City was launched, and, on the third leg of the search pattern, it located the vessel, then sent up a flare. RCC Norfolk then diverted an Automated Mutual-Assistance Vessel Rescue System (Amver) participating vessel to recover the three persons from the disabled vessel.

As the preceding account illustrates, the Coast Guard's Search and Rescue (SAR) system is comprised of RCCs and Subcenters and other subordinate Operations/Communications Centers (Figure 1). These centers are tied into an extensive communications network consisting of the National Distress and Response System VHF-FM sites and MF/HF sites, SAR coordinators (watchstanders/planners), SAR assets (ships, boats and aircraft and their operators), SAR technology (satellite beacons, computer search planning tools), and other domestic and international participants (Departments of Defense and State, international agreements, Amver participants). In the case described earlier, international cooperation and persons properly trained in the many components of the SAR system, and having the ability to effectively manage both its technology and resources, effected this rescue. It provided a textbook example of what SAR personnel would like to have happen every time we go out looking for someone lost at sea—no lives lost.

Search and rescue is one of the Coast Guard's oldest

missions. Minimizing the loss of life, injury and property damage or loss by rendering aid to persons in distress and property in the maritime environment has always been a Coast Guard priority. Coast Guard SAR response involves multi-mission stations, cutters, aircraft and boats linked by communications networks. The National SAR Plan divides the U.S. area of SAR responsibility into internationally recognized inland and maritime SAR regions. The Coast Guard is the Maritime SAR Coordinator. To meet this responsibility, the Coast Guard maintains SAR facilities on the east, west and Gulf coasts; in Alaska, Hawaii, Guam and Puerto Rico,; as well as on the Great Lakes and inland U.S. waterways.

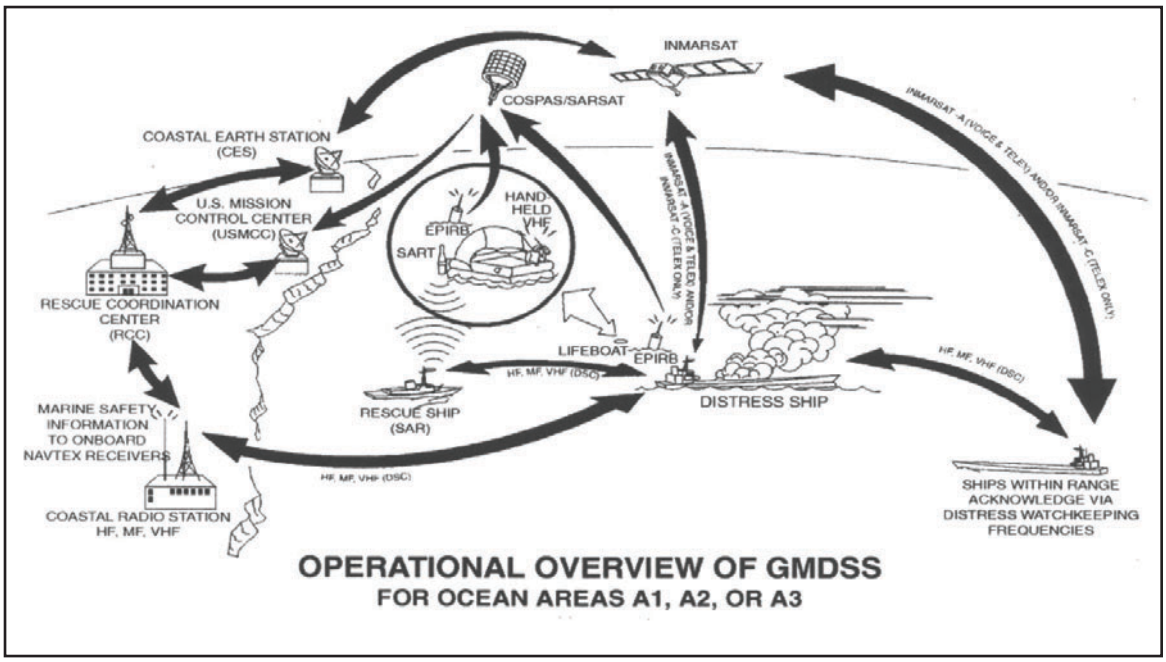


Figure 1. Diagram of a SAR system.

Today, as in the past, the Coast Guard's goal is to save 100 percent of all persons in distress; however, today, as in the past, we have recognized that this is an unattainable goal. We are not always capable of responding quickly; there are regional variances in water temperatures, or incidents take place in remote locations. In 1979, the Coast Guard's SAR Program indicated "program effectiveness is measured in terms of saving endangered lives and property *which were considered savable* at the time the Coast Guard was notified.[1]"

Today, we do not use this in our measurement but consider lives saved against lives lost. First, we are to save the lives of 85 percent of all persons in distress and, after being notified, to save at least 93 percent of those people at risk of death. In other words, we must be more effective once we know an incident has occurred. We have been meeting or exceeding these standards, and the Coast Guard is planning to increase the first target to 86 percent in 2005 and to 88 percent by 2009. The goal will be raised as we expect to increase our capability and improve performance and response through improvements in technology. Faster boats and planes and better technology will more accurately determine the distress position, reduce the area to be searched and result in less time searching.

The most important part of the SAR system is people. You can have all the ships, boats and aircraft at the ready, but they are not effective tools for conducting an extensive search unless you have someone to receive the distress call, plan a search, and manage the available assets for the search. SAR Mission Coordinators are to process and evaluate information about a SAR incident, determine appropriate initial action and initiate action within five minutes of notification of a distress incident. SAR units are to proceed within 30 minutes of notification of distress and be on-scene or in the search area within 90 minutes of getting underway. As the mean water temperature in the maritime region is 60 degrees Fahrenheit, which equates to survivability for an unprotected person of about two hours, the siting, basing or staging of search and rescue units is to provide for no greater than a two-hour total response time for a surface or air unit within that area of responsibility.

To coordinate these actions, the staffing of Coast Guard SAR Command Centers has undergone a significant transition throughout the past several years. Following the *Morning Dew*[2] tragedy in 1997, the Coast Guard conducted studies that recom-

Figure 2. Inside an RCC.

mended and led to an increased level of staffing for SAR watch positions. In addition, Congress mandated in the Maritime Transportation Security Act of 2002 that Coast Guard SAR watchstanders serve no more than a 12-hour watch to ensure a continuous and alert watch.

With an increase of watchstanders needed to staff Command Centers, the Coast Guard created new civilian SAR watchstander billets at most Command Centers. One benefit of adding the civilian staff is that many of the persons hired were former Coast Guard-trained watchstanders who had separated or retired from service and brought with them the skills needed to quickly assume the job. Another benefit is that some staffing problems were alleviated that were associated with transfer gaps resulting from the military personnel transfer process. With time, the civilian staff members are also expected to become the resident local area knowledge experts.

In a separate action, the Coast Guard stood up the Operations Specialists (OS) rate to fill the majority of watchstander positions, making OS the primary operator of the Coast Guard's command, control and communications function. In the past, SAR watchstanders were comprised of Boatswains Mates, Quartermasters and Telecommunications Specialists. Although these persons superbly performed the duties required, as many a rescued person would attest, efficiencies could be gained by creating one rate. Persons in that rate would perform all the tasks in the command center. Junior personnel would operate the radios, and, as they progressed in the rating, they would grow into the search planner position, serving in multiple Command Center tours during a career; a rare occurrence when multiple rates filled the Command Center positions.

Presently, the Coast Guard's 52 Command Centers are staffed with approximately 831 watchstanders, of which 680 are OS, 79 are civilian and 72 are officer. This equates to roughly 82 percent of watchstanders being OS-rated personnel. The correct number of watchstanders needed, and the level of expertise and training they need, continues to be studied as traditional SAR watchstanders are expected to respond to and process more information related to law enforcement and homeland security issues (Figure 2).

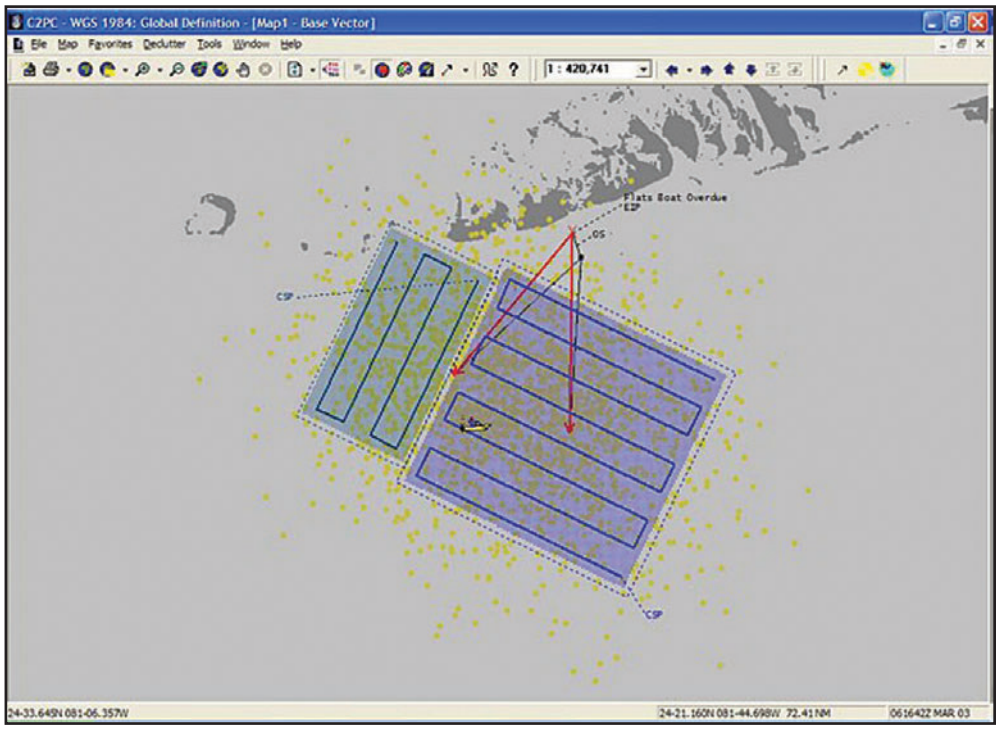


Figure 3. Search and rescue pattern.

The SAR system continues to evolve and improve (Figure 3). The Coast Guard's Deepwater program will provide new response assets with improved capabilities as well as enhanced command and control. RESCUE 21, a VHF-FM distress system communications upgrade project, is being installed at our communications centers to enhance communications and provide radio direction finding capability. A new SAR satellite system is planned that will provide more accurate position data for emergency distress beacon alerts received by satellite. New voice recording software is helping us better evaluate and identify false distress calls, which allows us to avoid deploying assets that may be needed for a genuine distress call. The Coast Guard has also recently begun deploying new Self Locating Datum Marker Buoys (SLDMB)—the most reliable source of total water current—to provide more up-to-date environmental data needed to better determine where to begin a search (Figure 4). Reports received from the field have already proven the value of these buoys and that their deployment has directly resulted in us successfully locating survivors we may not have otherwise found.

The Coast Guard has in development a new computer program, the SAR Optimal Planning System (SAROPS), to more efficiently and effectively conduct SAR planning. SAROPS will be a unified search planning system to replace the Joint Automated Worksheet (JAWS) and Computer Assisted Search Planning (CASP) as the primary search tools. (JAWS is used for coastal and short-term searches, and CASP is used for oceanic searches.) It will improve the search planning process and more accurately predict drift and locations of search objects, thereby improving the Coast Guard's ability to put search assets where the mariner is in distress.

> Excerpt from operational report, May 2004
>
> "This was the District's first operational use of SLDMBs since the authorization to deploy was promulgated. The SLDMBs provided crucial data on total water current that was substantially different than the historical environmental data on CASP. Without the SLDMB data, I doubt we would have found the overdue vessel and saved the six lives."

To ensure our personnel are ready to use new technology and systems while on watch, a training analysis is currently underway to evaluate the training needs for watchstanders who will be staffing future Command Center positions and who are expected to operate new Command Center sensors and information sharing and processing systems. All this, working in concert with our domestic and international maritime lifesaving partners, will better enable the Coast Guard to continue to move forward and save more lives.

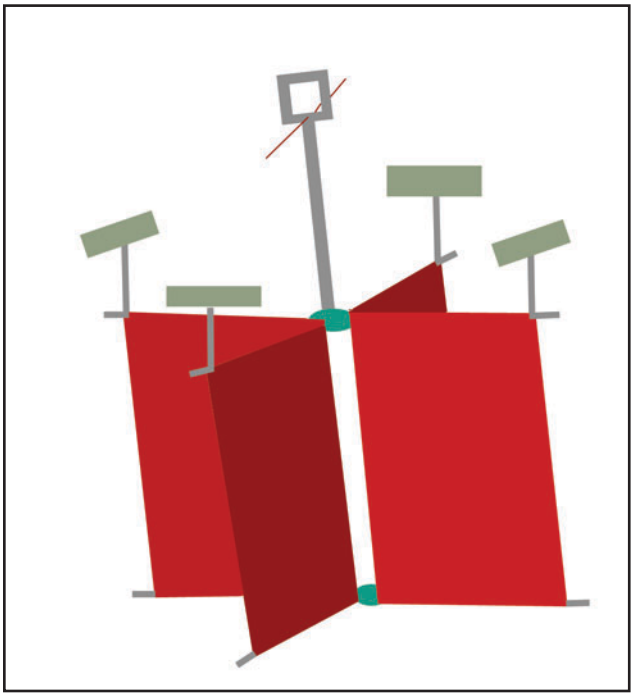


Figure 4. A self-locating datum marker buoy. USCG illustration.

[1] FY82-91 Operating Program Plan for the Search and Rescue Program.

[2] The *Morning Dew*, a 34-foot sailboat owned by a recreational sailor with 20 years of experience, sank in 1997 resulting in loss of life of the owner, his two sons and his nephew. Delayed search due to communications and other problems was found to contribute to this tragedy.

Bow Mariner

Coast Guard Air Stations Accepting the Tragic Challenge

By Lt. Mike Frawley
U.S. Coast Guard Air Station Elizabeth City, N.C.

U.S. Coast Guard Air Station (CGAS) Elizabeth City is located in the coastal plains of northeastern North Carolina, approximately 45 miles south of Norfolk, Va. Established in 1939, Air Station personnel and aircraft have stood watch over mariners transiting the coast of the mid-Atlantic for greater than 60 years. During this period, the unit has responded to more than 10,000 search and rescue (SAR) cases, in addition to operations supporting and executing each of the service's 14 other congressionally-mandated mission areas. The large majority of these SAR cases involved sinking vessels, disoriented or lost boaters, or at-sea medical evacuations; they are completed with clockwork precision and excellence that belies the difficulty of the missions. Every two or three years, the men and women of Elizabeth City are called on to provide a maximum effort to accomplish the highest undertaking the Coast Guard fulfills: rescuing individuals at sea. The motor tanker (M/T) *Bow Mariner* was one of those instances, and the efforts required by this maritime disaster established another milestone in the storied history of this proud unit.

As part of the Coast Guard's Fifth District and Atlantic Area, CGAS Elizabeth City provides a 24-hour aviation response for all Coast Guard-related emergencies and mission tasking for the mid-Atlantic states. Equipped with the Sikorsky HH-60J "Jayhawk" helicopter and the Lockheed HC-130H "Hercules" airplane, crews must be in the air within 30 minutes of tasking directed by the Atlantic Area/Fifth District command center in Portsmouth, Va. To fulfill this requirement, the station has one Jayhawk and one Hercules crew on alert 24 hours a day, seven days a week.

Feb. 28, 2004, was a fairly routine day; both aircraft crews had flown an afternoon training flight. The weather was clear and cool, typical for late winter in northeastern North Carolina, and it looked as though the rest of the day would pass uneventfully. The air station's most recent SAR case was seven days previously; the busy season for CGAS Elizabeth City, like most Coast Guard units, is during the summer when the population on the water is at its height. Most of the duty section members were just wrapping up their evening meal and looking forward to watching a movie on this Saturday night.

At about the same time the SAR crews in Elizabeth City were finishing their dinners, Coast Guard Group Eastern Shore, located on the south end of

Chincoteague Inlet, Va., received the first panicked call for help from the *Bow Mariner*. The vessel was a 570-foot chemical tanker ship owned by the Odfjell shipping company of Norway. It was transiting from New York, N.Y., to Houston, Texas, and carrying 11,000 metric tons of ethanol. Crewed by 27 personnel, mostly from the Philippines, it also carried about 200,000 gallons of fuel.

Bow Mariner's cargo is produced in less than 10 places in the United States; the majority of them are located near Houston, Texas, or the state of New Jersey. Ethanol is given the international risk phrases R11, R20, R21, R22, R36, R37, R38, R40, which, in layman's terms, denote it as highly flammable; irritating to the eyes, skin, and respiratory system; and harmful if swallowed. Luckily, there is limited evidence of carcinogenic effects. It has a boiling point of 78° C, a flash point of 13° C and an auto-ignition temperature of 362° C. Ethanol is in international standards Packing Group II, making it a "medium danger" packing item.

When Group Eastern Shore received the Mayday call from the *Bow Mariner*, the Coast Guard's emergency response system began moving. The basic concept behind the Fifth District SAR plan is to hit hard early with the maximum number of SAR assets to achieve a successful case result with no loss of life. Within 10 minutes of realizing the size of the crew onboard *Bow Mariner* and the magnitude of the emergency, the Atlantic Area/Fifth District (LANT/D5) Command Center had directed both Air Station Elizabeth City and Air Station Atlantic City in Atlantic City, N.J., to launch helicopters to respond to the disaster. Coast Guard Station Chincoteague and several Good Samaritans—civilian vessels in the vicinity of the stricken ship's position—were directed to the scene to provide assistance. Within 20 minutes of first notification of the explosion on *Bow Mariner*, Coast Guard units in three states were racing at their best speed to respond to the catastrophe 50 miles east of Chincoteague Island.

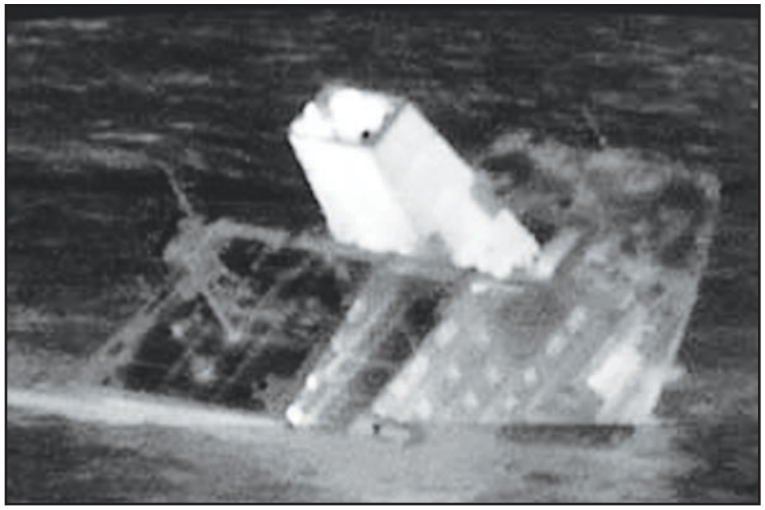
In Elizabeth City, Canadian Forces Exchange Officer Capt. Wayne Sippola, the Operations Duty Officer and veteran of more than 15 years of SAR operations in Canada, understood immediately that the environment around the vessel would be a confusing scene at best, one that demanded some sort of on-scene presence to organize and direct the rescue effort. His suggestion to the LANT/D5 Command Center to launch a C-130 was immediately adopted,

***Bow Mariner* underway.**

and the seven-man crew of CG 1501 was in the air in 20 minutes, making 300 knots toward the *Bow Mariner*'s position.

A surreal scene of burning diesel fuel, dozens of salt water-activated strobe lights and the sinking superstructure of the stricken ship greeted the Hercules crew. Shaking themselves free of the initial shock of the cataclysmic scene, the crew of the CG 1501 began concentrating on the task at hand. Lt. Steve McKechnie, son of a career Naval officer and older brother to another, started circling the Hercules around the scene at 3,500 feet, while his copilot, Lt. Josh Fulcher, radioman Petty Officer (PO) Chris Schultz and navigator PO Jim Swartwood began rendering order from the chaos by establishing radio communications with each of the Coast Guard and civilian assets assisting the search. A former Navy corpsman, Lt. Fulcher understood that the first few minutes would be most important in finding those souls lucky enough to survive the explosion. He, PO Schultz and PO Swartwood began to divide the search area into manageable sections that would provide the quickest, most effective results for the search assets. As 1501 continued orbiting, PO Jeremy McMullen began to look for signs of life among the flotsam of the *Bow Mariner* using the aircraft's infrared camera.

CG 6588, an H-65 Dolphin helicopter from CGAS Atlantic City, had arrived on-scene around the same time as the 1501 and was searching the area around the ship's stern for possible survivors. Slowly flying 200 feet above the water, Lt. Russ Torgerson realized his aircraft was in the center of the explosive mixture of alcohol and diesel fuel. His crew, copilot Lt. Jeff Graham, flight mechanic PO Ryan Bradley and rescue swimmer PO Zee Lee, were immediate-



Forward looking infared photo of *Bow Mariner* taken by CG 1501 before the vessel sank to the bottom of the Atlantic Ocean.

ly affected by the almost overwhelming smell of vaporized ethanol and diesel fuel. Lt. Torgerson knew this would not be the most conducive environment for saving people and passed specific information about the conditions to the overhead Hercules.

As this information was passed, the crew, with night vision goggles (NVGs), was able to see three or four individuals in the water; only one of them showed any life, weakly waving to the hovering helicopter. Lt. Torgerson, PO Lee and PO Bradley talked briefly about the overall risks involved, and PO Lee was sent down into the toxic water to pick up the survivor. The lone survivor and rescue swimmer, covered in thick, black oil, were hoisted into the small Dolphin helicopter's cabin, immediately fouling the entire working area and magnifying the effects of the noxious fumes on the whole crew. Torgerson and Graham turned the aircraft toward Ocean City, Md., both knowing that the 6588's night was probably done; PO Lee, almost blind and completely covered in oil, and PO Bradley, exhausted from the physical effort of hauling the two men into the helicopter during the hoist, worked feverishly to resuscitate the victim. The 6588 arrived at Ocean City two hours after the initial call to respond to the explosion; the patient was transferred to the local hospital where he expired. POs Bradley and Lee were treated for chemical burns.

CG 6026, the H-60 helicopter from CGAS Elizabeth City, arrived on-scene as the 6588 was completing its hoist. The CG 6026's four crewmembers were Lt. Eric Bader, a tall, athletic native of Lakewood, Ohio; Lt. j.g. Steve Bonn, a former Army helicopter pilot who seemed to be a lightning rod for big SAR cases in his three-year Coast Guard career, having already flown in the rescue of 34 sailors off the motor vessel (M/V) *Sea Breeze I* in December 2001; PO Sam Pulliam, a quiet, competitive Texan who was a hellion on the basketball court and would run the rescue hoist; and PO Dave Foreman, a rescue swimmer almost completed with his first aviation tour. The crew had heard the Atlantic City helicopter's report about the alcohol smell and difficulties with the hoist of its survivor. Like the rest of the rescuers who were off the coast of Virginia that evening, the entire flight crew of CG 6026 had to shake off the feelings of disbelief and shock at the size of the disaster. Directed by the C-130 and using their NVGs, the Jayhawk crew began a slow search of each of the liferafts around the southern area where the ship went down.

The cool, late winter air and colder ocean water made for an optimal infrared environment, and PO McMullen was able to almost immediately identify the warm outline of human bodies in a liferaft in the 45° F water. The Hercules directed the 6026 to the spot. Knowing that the Dolphin crew had almost been overcome by the wicked chemical mixture in the water, Lt. Bader was leery of trying a hoist to pick up these survivors. He also did not want the victims to expire as a result of the shock of being hoisted by a hovering 21,000 pound helicopter. The crew attempted to mitigate the dangerous situation by having a Good Samaritan vessel carry out the rescue of the individuals in the raft. Lt. Bader, Lt. j.g. Bonn and PO Pulliam made several attempts to signal members of the surface vessel by flashing their searchlight and making radio calls and hand signals to make their way over to the stricken liferaft. After five minutes of frustratingly unsuccessful communications, the crew realized the environment was so dangerous that the Good Samaritan was willing, but not able, to enter the waters near the survivors because of the accumulated ethanol/fuel oil mixture.

The 6026 would have to attempt a hoist of the men in the liferaft. With the strong odor of alcohol and diesel fuel in the cockpit and cabin of the Sikorsky helicopter, both Lt. Bader and Lt. j.g. Bonn did not want to risk losing PO Foreman while dispatching him into the oily, black waters. The least dangerous alternative was to try and hoist the survivors by lowering the basket down to the liferaft and signal-

ing the people inside to climb into the basket. Bader established a 70-foot hover over the raft.

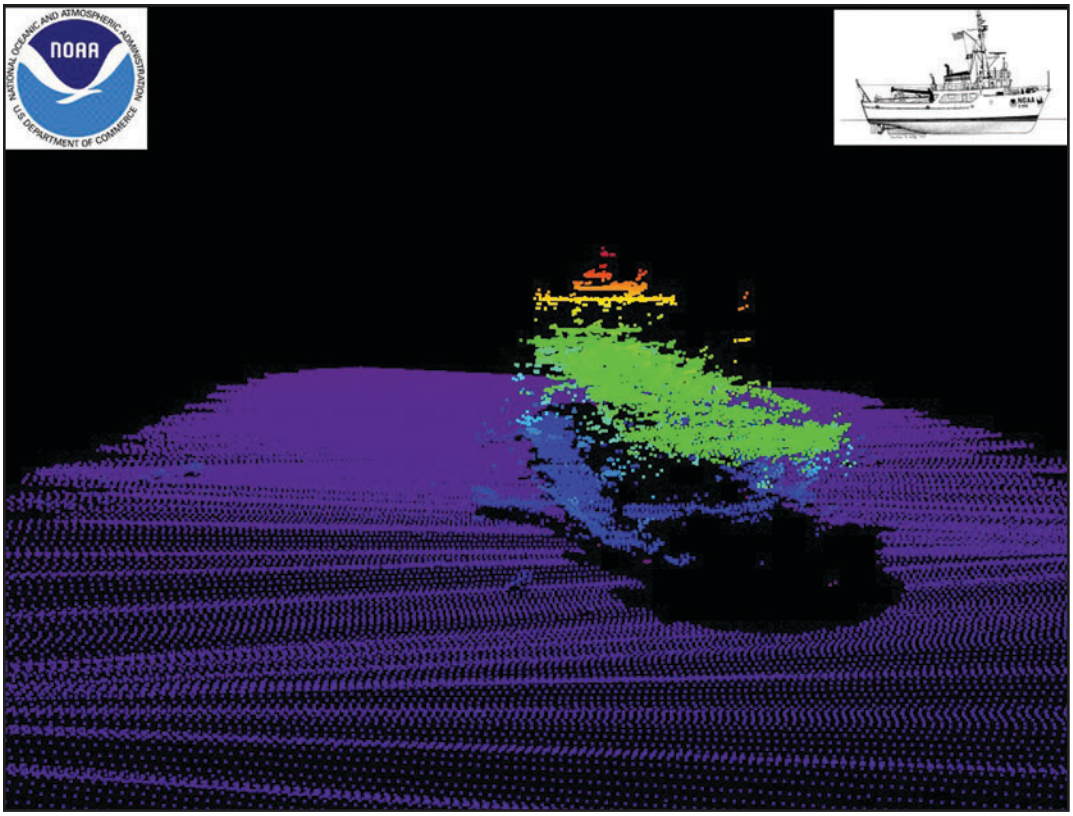
On the best training days, conducting helicopter rescue hoisting operations is an evolution that calls for a high level of crew cooperation and personal skill on the part of the pilot and flight mechanic running the rescue hoist. As the 6026 hovered almost seven stories above the dark waters that February night, Lt. Bader and PO Pulliam were operating in an environment that for helicopter aircrews could be analogous to playing in the National Collegiate Athletic Association (NCAA) basketball tournament's Final Four; only the best will succeed and continue. Flying the aircraft through voice commands to the pilot, PO Pulliam maneuvered the rescue basket to hang within arm's length of the raft's roof opening. For five minutes that seemed to stretch into an hour, Lt. Bader held the helicopter in a rock solid hover while PO Pulliam and PO Foreman attempted to signal the raft's occupants into the basket. Repeated attempts were unsuccessful, and the hanging basket remained empty as the survivors either did not understand or were not able to enter the basket on their own. Understanding that the people on that raft had run out of options, PO Foreman, a 24-year-old native of Norfolk, Va., volunteered to be sent into the water to pick up the survivors.

As Foreman was lowered to the water level, the air took an almost physical property that would endeavor to practically suffocate him as he tried to carry out his task. Once at the raft, PO Foreman found the inside of the raft was pitch black from both the night's darkness and the thick coating of combustible fluids. He was forced to conduct an initial survey of the situation by feeling his way around the raft. The fuel oil-ocean water-ethanol mix from the explosion had created an apocalyptic scene in which the survivors were not even identifiable as humans. Working to maintain a calm atmosphere through the constant noise of the helicopter, language barrier and lethal atmosphere, PO Foreman realized he would have to remain on the raft for the hoist of each of the survivors. Successfully signaling his intentions to remain in the raft for each of the hoists to make sure the survivors got into the basket, PO Foreman helped the hoisting evolution begin in earnest.

In the cockpit above, Lt. j.g. Bonn realized that PO Foreman was becoming affected by the toxic fumes to the point that the rescue swimmer was laboring to even speak on the radio. All of the crew in the Jayhawk realized that the race against time was not only one in which the survivors would lose if the hoists were not completed quickly, but one in which the very lives of the crew would be in danger if they did not leave the chemically spoiled environment. The final three hoisting evolutions would take a supreme effort from each of the 6026's crewmembers to ensure a successful conclusion to this rescue.

Lt. Bader and PO Pulliam skillfully maneuvered the helicopter and basket to hoist each of the oil-covered survivors. As each victim entered the helicopter cabin, the level of difficulty for the hoisting increased as excess oil, ocean water and ethanol/water mix began to coat the cabin, rescue devices and personnel. Maintaining a cool, calm demeanor and sense of mission, PO Pulliam rigged the rescue litter in minimum time and carried out the final two survivor hoists using, first, the rescue litter and, then, the rescue basket. The final survivor had to remain in the rescue basket as it was stored on top of the litter. PO Pulliam had to fight through the effects of the deadly atmosphere to complete the

> The Coast Guard's efforts to find and rescue the 27-man crew of the 570-foot ethanol tanker *Bow Mariner* would continue for several days and involve two Coast Guard cutters, a 47-foot motor lifeboat, four rescue helicopters and a C-130 fixed-wing aircraft. It would also employ the talents of more than 80 Coast Guard SAR professionals. The multi-day search included 30 separate search patterns covering more than 70 square nautical miles of ocean and involved more than 3,500 man-hours.
>
> **—Lt. Robert Bryan Hollis (page 64)**



Sonar scan of *Bow Mariner* sitting on the bottom of the Atlantic Ocean. Courtesy NOAA.

final hoist of PO Foreman and rig the helicopter cabin for safe forward flight. Finally successful in completing their formidable task, the crew of 6026 sped the helicopter toward Norfolk's Sentara Leigh Hospital, 50 miles to the south. Once on the hospital's helipad, the aircraft would be grounded until the inside of the helicopter was cleaned. POs Pulliam and Foreman would be hospitalized with chemical inhalation injuries. The six men they picked up out of the liferaft would live.

Back in Elizabeth City, Capt. Sippola realized that, even with helicopters from two different air stations and many surface vessels plying the waters around the wreckage of the *Bow Mariner*, the possibility of 27 live survivors would exceed the capacity of the six-passenger Dolphin and 12-passenger Jayhawk. Along with the H-60 maintenance control captain, PO Bill Bradley, Capt. Sippola began calling the air station's off-duty helicopter pilots, trying to organize a second helicopter crew to go out on the rescue on this Saturday night. Lt. j.g. Marty Simpson, Lt. j.g. Steve Cerveny, PO Jim Geramita and PO Joel Sayers were all just finishing up dinner and agreed to come in as soon as they could. Ninety minutes after the first call from LANT/D5 Command Center to Air Station Elizabeth City to respond to the disaster off the Eastern Shore of Virginia, CG 6031 became the third Elizabeth City aircraft to begin searching for the 27-member crew of the *Bow Mariner*.

As the 6031 approached the scene from the south, they received the latest information from CG 1501, now flying above the scene on two of its four engines to conserve fuel. Lt. McKechnie and crew determined to stay on-scene as long as possible to ensure the crew members of the *Bow Mariner* were given the best chance of survival. As the night grew older, those odds of survival were decreasing, and the toxic fumes and frigid water were taking their toll on the boat and helicopter rescue crews. The 6031 flew 5.5 hours through the chemical cloud searching for the remaining 20 unaccounted-for *Bow Mariner* sailors. In concert with Coast Guard Station Chincoteague's 47-foot motor lifeboat and the fishing vessel (F/V) *Capt. Buckley Smith*, they were able to hoist one remaining survivor, who passed away en route to the hospital. Like the flight mechanics and rescue swimmers of the 6588 and 6026, both POs Geramita and Sayers were treated for chemical exposure upon landing. By the time search and rescue and environmental response operations had concluded the following Wednesday, Air Station Elizabeth City had flown over nine separate aircraft sorties using eight different aircrews, totaling more than 30 flight hours responding to this major disaster.

The tragedy of the M/T *Bow Mariner* was not one without some success. As it has done countless times before, the Coast Guard accepted the challenge of an overwhelming situation. And, as it has done many times before, Air Station Elizabeth City went above and beyond the call to ensure those who get in trouble on the water are able to return to their families with a story to tell.

The Caribbean Volunteer Maritime Search and Rescue Initiative

By Wayne Spivak
Communication Division, International Affairs Directorate, U.S. Coast Guard Auxiliary

The Caribbean Basin consists of more than 30 nations, plus the bordering countries in Central and South America. This region has become the world's foremost aquatic playland, with its miles of pristine beaches, resorts and secluded bays and coves.

Thousands of seagoing vessels ply these waters, from small recreational boats to inter-island vessels, from the major cruise lines to supertankers. Add to this traffic the commercial airlines that fly over the vast maritime portions of the Caribbean, and we have the unwelcome possibility of an untimely "landing" in the water.

Several Caribbean nations, identifying what was obviously a great shortcoming, established either governmental or voluntary search and rescue (SAR) organizations. Most noteworthy were the volunteer SAR organizations in the Bahamas, British Virgin Islands, the Netherlands Antilles and the French West Indies, whose establishment and growth was fostered by the SAR organizations in the United Kingdom, France and the Netherlands.

The Vision
Former U.S. Coast Guard Commandant, Adm. James Loy, recognized the need for improving the safety of life at sea in this area, as well as the successful use of the Coast Guard Auxiliary as a force multiplier for the Coast Guard in SAR and other mission areas. In August 2001, he directed the Auxiliary to place primary emphasis on its international program by enhancing the safety of life at sea in the Caribbean region and by fostering the development and strengthening of volunteer SAR organizations within the Caribbean.

The Auxiliary is the civilian, uniformed, volunteer component of the Coast Guard as well as the lead volunteer force in the Department of Homeland Security. Founded in 1939 by Congress, the 38,000 men and women volunteers provide support to the Coast Guard in all its mission areas, except direct law enforcement and combat operations. Support of the SAR mission, both in the air and on the water, has been a hallmark of the Coast Guard Auxiliary.

Auxiliary International Affairs Time Line
Even before Adm. Loy's tasking, actions had been taken by the Auxiliary to foster the development and strengthening of volunteer SAR organizations in the Caribbean.

In 2000, the Dominican Republic approached the

A Coast Guard helicopter performs training exercises with the Virgin Islands Search and Rescue team.

U.S. Embassy requesting assistance in creation of a volunteer SAR organization or Coast Guard Auxiliary. In December of that year, the Coast Guard, Auxiliary and other established Caribbean search and rescue volunteer organizations held a conference aimed at educating and assisting in the creation of a volunteer SAR component. Following this conference, the Dominican Coast Guard Auxiliary unit was established.

The U.S. Coast Guard Auxiliary established ties through memorandums of understanding (MOUs) with both the Virgin Islands Search and Rescue (VISAR) organization and the Citizens Rescue Organization of Curacao (CITRO) in mid-2001. These MOUs emphasized the exchange of SAR training materials, vessel examinations, boating safety education and joint attendance at selected conferences.

At the Eastern Caribbean SAR Conference in Tortola, British Virgin Islands, in September 2002, which was attended by representatives of the Caribbean governments, the Auxiliary, in conjunction with the U.S. Coast Guard, promoted the concept of establishing volunteer Caribbean SAR organizations to meet the growing need for SAR assistance. Several attending countries expressed interest in investigating the formation of a volunteer SAR organization.

The Auxiliary organized the first Caribbean Volunteer Maritime Search and Rescue (CSAR) Conference, with support from U.S. Southern Command and the Coast Guard, in Miami in December 2002. Government and volunteer representatives from 24 countries were in attendance, along with the International Lifeboat Federation and other international SAR organizations. This conference was the first-ever large-scale meeting of almost the entire Caribbean SAR Community.

During this meeting, the nations of Jamaica, St. Kitts and Nevis, Cayman Islands, Dominica, Barbados, St. Lucia, Trinidad and Tobago, Turks and Caicos, St. Vincent and the Grenadines, Netherlands Antilles, Venezuela, and Grenada all expressed the desire either to establish or strengthen volunteer SAR organizations during the coming year(s).

Following this conference, the Search and Rescue Association of Grenada was formed in 2003, and the Turks and Caicos Rescue Association was reorganized to fulfill SAR operations. Also during this year, the Coast Guard International Programs Office disseminated information to the Caribbean countries on how to obtain excess Coast Guard vessels and equipment. In addition, the Auxiliary implemented an Internet initiative, including a Web site (**www.cgauxinternational.org**), mailing lists and a bulletin board to encourage discussion and discourse among Caribbean SAR community members.

In August 2003, an agreement between the Auxiliary and Bahamas Air Sea Rescue Association (BASRA) was signed, whereby BASRA was able to utilize the Auxiliary's "America's Boating Course" and provide boating safety instruction to the residents and visitors to the Bahamas. This was the first-ever public boating safety course adopted in the Caribbean and represented a major step forward in recognizing the valuable contribution that preventive measures can play in reducing the loss of life and the number of life-threatening SAR call-outs.

CSAR in Recent Events

The success of the first CSAR Conference in 2002, assisted by funding from the U.S. Southern Command (SOUTHCOM), enabled the Coast

Guard team to introduce members of the CSAR community to each other. Never before had so many members of this rather small community had the opportunity to sit and openly discuss issues that affected all participants.

This first meeting provided the framework and groundswell that enabled several SAR organizations to both establish themselves and create tighter working relations. At the Auxiliary National Conference in 2003, several of the international partners joined the Auxiliary for a roundtable discussion of current SAR events. This was the third collaborative effort, which gave both the Auxiliary and the Coast Guard International Programs the impetus to plan and execute the 2nd CSAR Conference.

A passerby looks at a sailboat aground after a particularly nasty storm. Notice the shredded jib, which must have unrolled.

The 2nd CSAR Conference was held in May 2004 in Miami, again sponsored by the Auxiliary, U.S. Southern Command and the Coast Guard, with almost 80 government and volunteer delegates from 26 different countries. In attendance were members from the International Lifeboat Federation (ILF), as well as the Australian Volunteer Coast Guard Association and Canadian Coast Guard, Auxiliary.

This conference enabled the members of the Caribbean SAR community to build upon the previous events in a manner that excited every participant who was in attendance. What was unique about this conference was the empowerment of the participants to share and build trust. Several members remarked, after participating in some of the workshops, that this was the first opportunity they had had to interact with various SAR organizations in their region, some even within their own countries. The sharing of organizational goals, plans and challenges was critical for the members to begin designing methods of reaching mutual goals, better organizing and integrating their plans, and addressing challenges using resources from all the available organizations.

During the conference, attendees indicated the loss of life annually at sea in the Caribbean was significant and included a number of American boaters.

During one workshop, a modified tabletop exercise of a Mass Rescue Operation (MRO) involving a ferry was conducted. From the reactions, comments and questions this workshop generated, it was evident conference attendees realized the importance of prior planning, integration of efforts, resources and joint operations, and exercises among Caribbean countries, whenever feasible. This realization was also reinforced during a comparative and contrasting demonstration of how the Coast Guard and VISAR would respond to similar types of SAR cases. Again, the Caribbean community was able to visualize that "no man is an island" and that SAR is a community issue.

A highlight of the conference was the announcement by the Grenada Coast Guard that the plans for a volunteer auxiliary component had been approved and that actions were underway for its establishment. These volunteers would be used to support SAR missions as well as other non-law enforcement missions of the Coast Guard. [*See* **www.cgauxinternational.org/presents/csar04/grenadacgaux.pdf**.]

Also announced at the conference was a joint effort of the Auxiliary and the Coast Guard International Programs to publish a how-to guide for the establishment of a volunteer Coast Guard auxiliary component that can be used by other interested nations.

To say that this conference was a total success

would not even begin to reflect its value to all participants. In a nutshell, the single statement that appropriately summed up the collective experiences of the attendees was made by Capt. John Chomeau, U.S. Navy (Ret.), the president of the Association for Rescue at Sea. He said, "With the vast diversity of cultures, languages, peoples and countries, they all share the same exact problems. While detailed particulars of these problems differ, the problems themselves—be it time, money, logistics or training—are exactly the same."

CSAR Tomorrow

While these conferences have assisted in broaching some of the barriers that have stifled cooperation between CSAR members, there is more work to be done. Cultural barriers need to be breached, and emphasis needs to be brought to bear on the art of communication. This is not an easy task—but it is one that is critical to the initiative. The old adage, *silence is golden*, does *not* apply here. Every community member needs to continue what was started at the conferences by sharing his/her experiences, offering SAR information to others and continuing the chatter on work and accomplishments.

What we, the CSAR community, have established is in line with many of the points made by Como Everette Tucker, Director of the Coast Guard Auxiliary International Affairs Directorate, during a briefing at U.S. Southern Command just prior to the May CSAR Conference. He outlined the current and future objectives of the Caribbean initiative:

- To enhance the security, stability and safety of life at sea in the Caribbean region. This will be done through the strengthening and establishment of local Coast Guard volunteer components and non-government volunteer SAR organizations that can provide their government SAR and other non-law enforcement support, thereby freeing their forces to better focus on law enforcement and security missions.
- To emphasize the importance of supporting Caribbean volunteer search and rescue and volunteer components of Caribbean Coast Guard organizations.
- To provide a greater capability within Caribbean countries to surge larger numbers of trained and properly equipped maritime assets to meet the requirements imposed by natural and/or man-made disasters.
- To foster regionalism within the Caribbean by encouraging the sharing of ideas and experiences among the countries and volunteer organizations and with the Coast Guard, Auxiliary and other conference attendees.
- To gain acceptance of the attending Caribbean government attendees of the value and benefits the volunteers can provide in assisting in accomplishing non-law enforcement missions.

To achieve these objectives, it was agreed by all attendees that it was important to hold a third CSAR conference in 2005. This would maintain the momentum toward the establishment of volunteer resources to support SAR and other government missions. Further, in support of interest shown by many countries for on-site instruction and assistance in establishing preventive SAR outreach programs, it was agreed that such assistance would be provided during the next year. Finally, assistance visits would be provided to countries in response to the Military Liaison Officer requests and funding support provided by U.S. SOUTHCOM.

How Best to Describe the Success of the Caribbean Initiative?

I'll let Cmdr. Osmond "Griff" Griffith, Assistant Superintendent, Commander Grenada Coast Guard, describe it. As one of the presenters at the 2nd CSAR Conference, Griff, as he prefers to be called, stated unequivocally:

"The Auxiliary Unit being established at this point will benefit the Coast Guard by giving it the flexibility of having additional support assistance to ensure operational readiness. The Auxiliarists will benefit from the training and experience from the Coast Guard. The major beneficiary will be the maritime community who will receive an enhanced service as a result of a combined effort."

This is the genesis of what we envision as a vital, life-saving network of concerned citizens and governments to protect those that brave the seas of the warm and beautiful Caribbean, as well as provide their government much needed non-law enforcement support to allow them to meet today's threats against society.

Emergency Medical Services in Coast Guard Search and Rescue

By Capt. ARTHUR J. FRENCH III, MD FACEP
U.S. Coast Guard Office of Health Services, Quality Assurance Division

In the United States, emergency medical services (EMS) systems are regional networks of out-of-hospital emergency care and transport provided by trained non-physician emergency medical technicians (EMTs). The U.S. Coast Guard maritime EMS system is part of its search and rescue (SAR) responsibilities.

Emergency medical care of survivors in maritime SAR operations is well founded in international SAR doctrine. Maritime SAR EMS includes medical evacuations (MEDEVACs) and medical advice consultations (MEDICOs) to vessels. MEDICO is an international term usually meaning the passing of medical advice at sea by electronic communications. The Coast Guard performs approximately 1,200 MEDEVACs per year—one-third by helicopter and the remainder by small boat or cutter. The *International Aeronautical and Maritime Search and Rescue Manual*, a joint publication of the International Maritime Organization (IMO) and International Civil Aviation Organization, requires countries to provide MEDEVACs and MEDICOs as part of their SAR systems.

Coast Guard EMS System

Every country provides EMS differently. In many countries, particularly in Europe, prehospital emergency care is provided by ambulances staffed by physicians. In the United States, EMS is provided by EMTs.

The U.S. Department of Transportation (DOT) is the lead federal agency that establishes the EMT standard curricula. There are several levels of EMTs defined by DOT. The EMT-Basic provides non-invasive prehospital care and preparation for transport. EMT-Basic is approximately 110 hours of training. Invasive and advanced life support is provided by EMT-Paramedics. Paramedic training is usually 1,200 hours long, not including hospital and clinical preceptorships. There is also an EMT-Intermediate level, which includes some advanced life support procedures taught in an additional 100- to 200-hour course.

Through the 1970s the Coast Guard traditionally used hospital corpsmen for MEDEVACs. In response to Congress passing the Emergency Medical Systems Act in 1973, the Coast Guard established an EMT-Basic program in 1978 to train enough EMTs with the intent of having one EMT-Basic on every SAR crew. At the same time the Coast Guard established a rescue swimmer aircrew specialty because the new HH-60 and HH-65 helicopters did not have water landing capabilities.

AST3 Aaron Brown, from Air Station Atlantic City, MEDEVACs a man suffering from severe chest pain off the tanker *Satra Spirit*. The helicopter launched in a 300-foot ceiling and two-mile visibility, and navigated through bad weather conditions and rain showers to arrive at the vessel. Lt. j.g. John Morgan, USCG.

Rescue swimmers are on all helicopter SAR missions to provide water rescue capabilities and basic emergency care. At some air stations, particularly in Alaska, rescue swimmers may be trained to the EMT-Intermediate level. Their primary training, however, is in water rescue and survival, not emergency medical skills.

In 1996 a study group was convened to review the Coast Guard's EMS system and to make recommendations to change the EMT-Basic requirement. SAR data showed that very few SAR cases performed by small boats or cutters required EMT-level care. Unlike helicopter MEDEVACs, surface transport times were relatively short and advanced care was infrequently required. Most EMTs at SAR units were not using their skills frequently enough to keep proficient, and recurrent training every two years was expensive and not cost-effective. The study group recommended keeping rescue swimmers at the EMT-Basic level but eliminating EMTs at SAR stations and on patrol boats. A 40-hour First Responder program was established that could be taught at the SAR unit level, enabling more SAR crewmembers to be trained while maintaining adequate EMS capabilities for SAR.

Helicopter MEDEVACs

Helicopter MEDEVACs usually involve further distances offshore, longer patient transport times and often more critically ill or injured patients. U.S. civilian air medical transport services provide advanced life support (ALS) care with physician, nurse and EMT-Paramedic medical crews. The EMT-Basic rescue swimmers provide en route care during MEDEVACs. On some occasions the air station flight surgeon, a physician trained in aviation medicine, may be available to respond. Not every air station has a flight surgeon onboard, and they are not always available immediately to respond to SAR. Also, the Coast Guard uses its helicopters for SAR, law enforcement, Homeland Security and other missions; they are not configured to be "air ambulances."

The limited cabin area and aircraft engine performance restrict how many people and how much medical equipment can be carried, particularly on the HH-65 helicopter. Usually, there is only capability to take the normal three-person aircrew and the rescue swimmer. These factors need to be considered during MEDEVAC mission planning. In some areas U.S. military helicopters with advanced-level medical crews and air-to-air refueling capabilities are available to respond if the patient's condition or distance requires. The U.S. Air Force also has combat pararescue units that can deploy offshore in fixed wing aircraft and parachute into the water to provide advanced EMS care until within range of helicopter evacuation.

MEDEVAC Risk Management

MEDEVACs can be extremely hazardous to both patients and SAR crews because of environmental conditions and dangers inherent in transferring a patient from a vessel to another vessel or helicopter. The benefits of a MEDEVAC must be weighed against the inherent dangers of such operations. During the 1970s and 1980s several fatal Coast Guard aircraft mishaps occurred during MEDEVACs that, in retrospect, were not actual medical emergencies. Since then, a policy requiring a flight surgeon's medical evaluation of a MEDEVAC request to estimate the medical time-sensitivity and urgency of each request was instituted. The flight surgeon provides medical recommendations to the SAR operational commander to balance the risk to the patient and potential benefits of rapid MEDEVAC against the operational risks to the rescuers, particularly from adverse weather and night-flying conditions.

The Coast Guard performs approximately 1,200 MEDEVACs per year: one-third by helicopter and the remainder by small boat or cutter.

Civilian air medical transport criteria, such as those developed by the National Association of EMS Physicians and the Air Medical Physicians Association, that are based only on clinical conditions are not always applicable in the Coast Guard SAR system. Many air medical transport systems respond to every request for air transport if they are safely able to respond and do not use the patient's medical condition as a go/no go factor. Usually, their flight risks are very low in a well-controlled environment. Weather, sea conditions and the risks associated with helicopter hoisting evolutions or small-boat transfers at sea make the maritime SAR environment a unique situation in which the customary medical indications for air transport requests do not always apply.

Flight surgeons must provide recommendations on not just the medical severity and risk of deterioration due to transport delays, but also on several other factors that are important to the success of the mission. The objective is to optimize care of the patient and to minimize risks. This sometimes requires a combination of SAR and medical resources.

Helicopter hoisting is a significant risk even under the best of conditions. Evaluation, stabilization and transport preparation is often much easier aboard the vessel if the rescue swimmer can safely be hoisted aboard. The medical benefits of the additional insertion hoist may not outweigh the risks of a single extraction hoist. A critical patient aboard a vessel offshore may benefit from the rapid extraction and transport by a Coast Guard helicopter capable of hoisting, even if the en route care is by an EMT-Basic provider.

Recommendations regarding direct MEDEVAC to specialized facilities while overflying closer hospitals, or to rendezvous with a civilian air medical aircraft at an intermediate location, also need to be considered. If specialized en route care is needed, the flight surgeon must recommend that and advise the SAR unit of the risks and benefits of delaying the MEDEVAC until the specialized team can be assembled. Often, aircraft performance limitations and lack of availability preclude this option. All of this occurs in a dynamic environment in which operational flight conditions, the patient's condition, responding on-site EMS providers capable of providing more accurate diagnostic skills—or all of these factors—may change during the mission.

The MEDEVAC Process

Federal law prohibits competition with civilian air medical transport. The SAR operations center receiving a request for a MEDEVAC must first determine that a civilian medical resource is not available or not capable to complete the mission. The next step is to determine the medical necessity and urgency of the MEDEVAC request. Coast Guard flight surgeons are the primary source for these recommendations. The Coast Guard has approximately 30 flight surgeons that rotate in regional duty rosters. Every SAR operations center has immediate telephone access to their regional or local duty flight surgeon.

Due to the adverse-weather capabilities of Coast Guard helicopters, we are often asked to provide interhospital transport of patients when civilian air medical transport services cannot, particularly in rural areas. These MEDEVACs present additional medical and operational risks. The patients are usually more critical, and the locations of the remote medical facilities are often inland, requiring flight through hazardous terrain in bad weather. These flights are usually higher risks than maritime MEDEVACs and absolutely require communications between the flight surgeon and the requesting physician to ensure an accurate medical risk assessment is provided to the operational commander.

The final decision to MEDEVAC a patient is made by the operational commander of the SAR unit. The Rescue Coordination Center responsible for the area usually is the SAR Mission Coordinator, which brokers communications and available response options among the operational SAR unit, the vessel requesting MEDEVAC and the duty flight surgeon. The aircraft commander or boat coxswain may abort the mission if conditions change during the mission. Sometimes, a physician or medical

The stokes litter is a versatile device designed to safely transport non-ambulatory personnel onboard ships and boats, or for applications such as helicopter hoisting (seen here). The basic stokes litter design can be reconfigured for hoisting or surface operations. Only stainless steel or titanium alloy litters are authorized.

provider who can assist in providing medical information to the flight surgeon is aboard the vessel. Information obtained through direct communications between the flight surgeon and someone actually at the patient's side tremendously improves the quality and accuracy of the recommendations to the operational commander.

A frequent situation that creates dilemmas for SAR units, EMS responders and vessel crews is the patient in cardiac arrest who requires cardiopulmonary resuscitation (CPR). CPR is a temporary solution, until advanced life support procedures, particularly defibrillation, can be performed. Numerous medical studies have shown that, unless stopped hearts can be defibrillated within 10 minutes, the person has only a rare chance of survival. The maritime environment and Coast Guard SAR response standards make this 10-minute response time usually impossible. This leaves rescuers and crews with the dilemma of continuing futile CPR or to stop and accept the patient's death onboard. Coast Guard policy is that a flight surgeon may direct rescuers to discontinue CPR if the patient has not responded after 30 minutes. The physical and emotional risks to SAR crews outweigh theoretical benefits of continuing prolonged CPR, especially for traumatic cardiac arrest due to injury.

Emerging Issues

Mass rescue operations involving high-capacity passenger vessels are becoming a focus of Coast Guard SAR. Any mass rescue operation is an EMS mass casualty event. The motor vessel (M/V) *Prinsindam*'s fire and subsequent sinking off the coast of Alaska in 1980, during which 524 passengers and crew were evacuated, is an example of potential maritime mass casualty scenarios. Today's increased capacity passenger vessels, carrying thousands of passengers, pose an increased challenge as potential mass rescue-casualty operations. The post-September 11 maritime terrorism concerns and threats of weapons of mass destruction have also created new challenges for Coast Guard SAR planners and the Coast Guard EMS system. Developing and maintaining new EMS capabilities required for Maritime Homeland Security missions, including weapons of mass destruction scenarios, and training of Coast Guard first responders require innovative solutions.

In keeping with the Commandant's Direction to embrace effective management practices, the Coast Guard's EMS program is aligning with quality improvement initiatives in DOT's "EMS Agenda for the Future." DOT specifies 10 components of a quality EMS system. The Coast Guard EMS system is striving to implement those components to improve emergency care during SAR operations. Areas being addressed include: standardized treatment protocols; standardization of risk assessments; additional training of flight surgeons; en route patient care equipment; EMT certification through nationally-recognized organizations; and improved data collection.

Documentation of patient care and outcomes is essential to review quality of care and to support program management decisions. The maritime SAR environment and challenging environmental conditions make patient en route care documentation challenging. The Coast Guard SAR program has instituted an improved on-line operations data collection system: Marine Information for Safety and Law Enforcement (MISLE). Integrating DOT's recommended uniform prehospital data set with MISLE would assist monitoring the quality of EMS care provided during SAR. Continuous improvement of the EMS component will contribute to the Coast Guard's SAR operational excellence.

Ice Rescue in the Great Lakes

By Petty Officer Cindy Marshal
Ninth U.S. Coast Guard District

Mike Ruddick and Ken Wagner began packing their fishing gear onto a small plastic sled in the early morning of Jan. 25, 2004. The light of the morning sun hadn't yet begun to peek over the horizon. Clothed in waterproof, windproof, insulated pants and jackets, the pair hiked three miles across an ice expanse of Lake Erie near Catawba Island, Ohio. The ice crunched beneath their feet, disturbing the morning stillness. The sled, dragging behind them, also carried a heater, food, and two items they didn't know they would have to use—a cell phone and a Global Positioning System (GPS). They walked out to the shanty they left standing the previous day, set up, and began fishing.

The forecast predicted 10–20 knot winds and developing snow but, around 3 p.m., the winds began to exceed the predicted 20 knots.

"We didn't pay much attention to what was going on outside," said Ruddick.

But the howling winds grew louder, and the shanty began to quiver. Around 4 p.m., Ruddick and Wagner began to worry. They decided to pack up and head back early. Two miles into their hike, they stopped. Approximately 20 feet of frigid waters separated them from the last mile to their car. The section of ice they were on had broken away from the mainland and was floating free.

The call for help came into U.S. Coast Guard Group Detroit shortly after 5 p.m., patched through the Ottawa County sheriff's office. Ruddick and Wagner weren't alone. There were others on the same ice floe, and yet more on another. With his GPS, Ruddick was able to give his position. In less than 20 minutes, a helicopter from Air Station Detroit was en route to the scene.

Just after 7 p.m., well after the sun had fallen beyond the western horizon, the rescue helicopter delivered the last four of 14 people who were rescued that night back to the Catawba Island State Park. The Coast Guard rescued 10 people by helicopter, while the local police department picked up the other four on an airboat. During one last fly-over, the Coast Guard crew reported that, at the closest points, the gap was about 100 yards and widened to 400 yards away from the mainland. In two hours, the separation had increased by more than 90 yards.

A hovering HH-65 helicopter lowers a rescue swimmer. HH-65 helicopters are the primary resource to answer most distress calls.

Twenty-seven similar cases took place during the 2003-2004 ice season, and 558 ice-related cases took place over the past five years. HH-65 helicopters are the primary resource to answer most distress calls, but crews from surrounding small boat stations are sometimes called upon to trek the dangerous ice as well. Proper training, the right equipment, and a solid relationship with other rescue agencies have become fundamental essentials in ensuring the best response while maintaining safety for Coast Guard members and the members of other rescue agencies.

Although ice rescues constitute about 10 percent of rescues year-round, the Ninth District has been eager to incorporate an ice rescue chapter into the Coast Guard Search and Rescue Addendum. The Ninth District has long maintained its own policies and procedures regarding ice rescue, but this year was a turning point. The change to the addendum was completed, and February 10 brought the first Coast Guard Ice Symposium to Coast Guard Station Saginaw River, which has been officially designated as the Ice Rescue Center of Excellence for the Ninth District.

At the symposium, medical experts covered emergency medical care, and personnel experienced in ice rescues trained other Coast Guard personnel in various rescue techniques. Petty Officer Joseph Marion, a boatswain's mate at Coast Guard Station Ludington, is one of two Coast Guard ice rescue instructors. He attended the Ice Symposium, working with Chief Petty Officer Jason Rule, the other instructor, to train other Coast Guard members in "reach, throws, and goes," said Marion. "Reach—you're reaching with a boat hook; throws—you're throwing a line; goes—you're going into the water," he explained, giving the very basics of the techniques.

Training involved classroom time, demonstration and application. In the classroom, they discussed a range of topics from the many different ice formations to the rescue techniques. For the application portion, participating members were given scenarios, then donned dry suits and other necessary gear and effected mock rescues. While this conference was the first of its kind for the district, training has always been a priority. When Air Station Detroit received the call January 25, months of training kicked in.

"From the start of the [ice] season, we have rescue training," said Lt. Josh Miller of Air Station Detroit, co-pilot on the Catawba Island case. "The first case is much more comfortable because we practice so much." This wasn't their first case of the season, but it was a case with several complications and caused the crew to elevate it to yellow on a green-yellow-red type risk assessment model. As the crew scurried about, gathering information on weather and performing preflight checks, they shouted their concerns to one another.

Winds blew at 30 knots, with gusts up to 35. Visibility was reduced due to the oncoming night and snowstorms passing through. There was a possibility for icing on the aircraft. The temperature that night was negative 18 degrees Fahrenheit.

"We were always concerned about the weather," Miller said.

The concerns weren't enough to halt the mission, though. During the previous months, the crew had practiced three different air rescue techniques: disembarking, direct deployment, and use of the rescue swimmer harness. Disembarking requires the helicopter to virtually land on ice, deemed safe and allows the rescue swimmer to climb out and retrieve the survivors. In a direct deployment, the helicopter hovers three to five feet above the ice, and the rescue swimmer harness is used when the helicopter has to hover further above. That night, they chose the disembarking method and retrieved the 10 people without any further complications.

Another essential element in carrying out a safe, quick rescue is that rescue personnel have the proper gear and equipment. Various vendors displayed their products during the symposium, promoting hovercrafts, survival suits, and miscellaneous products such as ice picks. The Coast Guard discussed the options.

One major change that is in the process of being implemented is the switch from an ice skiff to a rescue sled. In the past, if a rescue team from a station was called upon, the crew of three or four would drag a small aluminum hull boat (commonly referred to as an "ice skiff") which was outfitted with a small outboard engine. The idea was that if they came across open water, the crew would hop into the boat and keep going until the next patch of ice, where they would take the boat out of the water and drag it behind them until they reached those in distress. The survivors would then be transported back to land in the boat, with the crew repeating the same process.

Although the cases these teams are sent on are generally within a thousand yards from shore, the trip can be exhausting for the crew.

"The boat weighs about 400 to 450 pounds, and that's without the motor, fuel or gear," said Marion.

In comparison, the rescue sled weighs about 65 pounds and can be pulled by one person. There is no motor to aid in crossing the open waters, but the sled floats, and with the proper clothing, the crewmen can hop on and paddle their way across. Because the sled also acts as a backboard, the smaller amount of gear necessary to bring along reduces the stress placed on the crew. But crew fatigue is always a concern.

"Our crews are only so big, and ice rescue can wear you out," said Marion. "The more people that have the proper training, and can support and supplement our crews, the better. Our crews aren't as exhausted, so they can effect a better rescue and have less chance of error."

That and the fact that the Coast Guard isn't always the closest or best resource is why the Ninth District values its partnerships with other local rescue agencies.

According to Ninth District's ice rescue policy, "These operations, perhaps more than any other class of SAR, depend on an interactive network of local response agencies with specific capabilities."

Lt. Rebecca Heatherington (left) and Lt. Jessica Fant ride an ice rescue sled during training at Coast Guard Station Saginaw, Mich., in February. Public Affairs Officer Jeff Hall, USCG.

Further on, it encourages units to organize and participate in multi-agency drills and to maintain close working relationships so that the Coast Guard is able to notify the appropriate resources under any circumstance.

Marion and Rule understood this need, and in January 2003, while stationed at Coast Guard Station Saginaw River, the two instructors gave the same training to a class for the Michigan Department of Natural Resources (DNR) as given at the Ice Symposium.

"We work a lot with DNR," Marion said. "We couldn't do our job without the help of everybody else."

As new developments, better equipment, or more advanced techniques develop, the Ninth Coast Guard District will continually strive to reach the goal of optimal performance. Of course, there are battles along the way—a big one being funding, but visions of hovercrafts at each ice rescue station, top-of-the-line personal protection equipment on every rescue team member, and seamless collaboration with multiple rescue agencies motivate those fighting the battles. Next year, Coast Guard members will meet again in Saginaw River in an effort to stay on top of the ice rescue mission.

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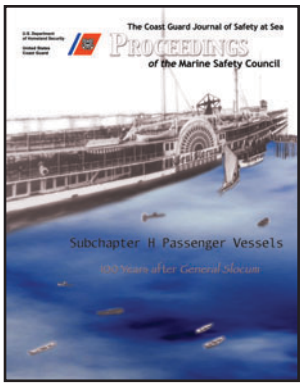

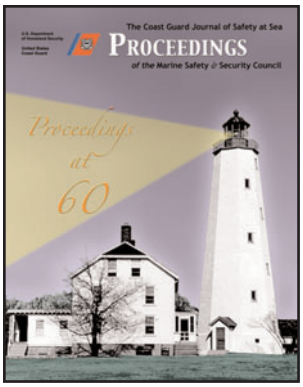

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We look forward to hearing from you soon, and we hope you have enjoyed this issue of **PROCEEDINGS**!

Search and Rescue in the Eastern Caribbean

By Lt. Cmdr. JOHNNY GONZALEZ
U.S. Coast Guard Greater Antilles Section San Juan

A recent dawn saw the U.S. Coast Guard airlifting the captain of a 43-foot sailboat 217 miles north of Puerto Rico to a medical facility in San Juan. This November 2003 effort involved the close coordination of a Coast Guard Falcon jet, a Jayhawk helicopter and a Coast Guard 110-foot Island Class Patrol boat. Medical evacuations (MEDEVACs) of heart attack victims 200 miles offshore, in extreme weather conditions, are not typical missions for the Rescue Subcenter San Juan. However, MEDEVACs 75–100 miles offshore at night are practically routine events for the intrepid airmen of Air Station Borinquen. The Coast Guard's Greater Antilles Section is one of the most operationally diverse and challenging areas of responsibility in the service. Although law enforcement and alien migration interdiction comprise nearly two-thirds of operations, search and rescue (SAR) (along with homeland security) remains one of the U.S. Coast Guard's foremost priorities.

The entire Caribbean area of responsibility (AOR) is managed by the Seventh Coast Guard District Commander in Miami, Fla. Owing to its vast distance from Miami and the enormity of its 1.3 million square-mile AOR, the command of the eastern Caribbean, which was once District 10, is specifically designated as a "section," one of only two in the Coast Guard. Greater Antilles Section, or GANTSEC, is located at Coast Guard Base San Juan, Puerto Rico. The moniker is somewhat a misnomer since most of the GANTSEC AOR, with the exception of the Dominican Republic and Puerto Rico itself, consists of 18 island nations known as the Lesser Antilles.

Not technically within the GANTSEC AOR, Venezuela is also a major search and rescue partner within the region. Commander of Greater Antilles Section, a captain, is the SAR coordinator for the San Juan SAR sector and director of Rescue Subcenter (RSC) San Juan. A "rescue subcenter" is an internationally recognized entity; RSC San Juan is the only RSC in the Coast Guard [operating under the oversight of Rescue Coordination Center (RCC) Miami] and one of only a few in the entire world. Within the eastern Caribbean, there are four other Maritime Rescue Coordination Centers: MRCC Fort De France, MRCC Trinidad and Tobago, MRCC Marquetia, Venezuela, and MRCC Curacao, Netherlands Antilles. Additionally, nine other nations in the eastern Caribbean (in order from north to south) have active coast guards, including Antigua and Barbuda, Netherlands Antilles and Aruba, St. Kitts and Nevis, Dominica, Grenada, St. Lucia, Barbados, St. Vincent and Trinidad and Tobago.

Aerial photo of Rescue Subcenter San Juan. The area's average year-round water temperature of higher than 80 degrees F provides a greater rate of survival for persons stranded at sea. Thus, long-term searches are common for the controllers of RSC San Juan.

RSC San Juan is a component of the Coast Guard integrated command center (ICC) at Coast Guard Base San Juan. Currently, the designation as an integrated command center refers to the command center's responsibility for coordinating all Coast Guard mission areas. A typical watch consists of a junior officer and a senior petty officer, who are designated in writing as controllers and assistant controllers, respectively. The training to qualify as a controller or assistant controller is identical; the only difference is the scope of leadership and responsibility. Controllers are in charge of supervising the watch team while assistant controllers are more focused on the details of case prosecution. Two communication watchstanders, subordinate to the controller, operate the communications center within the ICC. An intelligence analyst and a marine safety specialist further augment the watch during busy operational hours. Controllers and assistant controllers are required to attend a three-week training course at the National Search and Rescue School in Yorktown, Va. GANTSEC controllers are arguably some of the most experienced SAR specialists in the Coast Guard. The GANTSEC AOR includes more offshore open ocean cases comparable to a district RCC's, as well as coastal SAR from the extensive recreational boating population throughout Puerto Rico and the Virgin Islands. As a result, GANTSEC controllers get much more experience in coordinating all facets of SAR cases.

Having an average year-round water temperature throughout the AOR of greater than 80 degrees F provides a greater probability of survivability for persons stranded on boats. Occasionally, even persons without life jackets have been located alive after several days by hanging on to flotsam, aids to navigation or even treading water. Thus, long-term searches are common for RSC San Juan controllers. Advances in computer applications have made the search portion of search and rescue more effective than ever. The Joint Automated Work Sheets (JAWS) program uses vector mathematics to calculate various forces that affect the total surface drift of a person or object in the water and allows controllers to make more accurate estimations for search areas. JAWS is most effective when a recent last known position or datum is known. For more timely searches offshore, the Computer Aided Search Program (CASP), a simulation application, uses highly sophisticated supercomputer mathematics and extensive environmental databases to derive optimal search areas.

A number of relatively recent advances in technology have also assisted in the elimination of the search quotient of search and rescue. 406 Electronic Positioning Indicating Beacons (EPIRB), required on most commercial vessels and available to recreational mariners, can pinpoint the location of a person in distress to within a few meters. New self-locating datum marker buoys provide real-time current data. Digital selective calling radios (with GPS) automatically transmit calls for distress with known positions. Even low-tech survival equipment such as flares are enhanced by computer applications that analyze flare sightings to assist

controllers in developing the best search plans possible.

Nonetheless, technology has not eliminated the need for Coast Guard men and women to frequently risk their lives and go into harm's way to save mariners. As one major automaker has the motto: "Quality is Job One," for GANTSEC controllers, who direct boats, cutters and aircraft into these inherently dangerous environments, "Risk Management is Job One." Although never seemingly enough, the resources available to GANTSEC controllers are considerable. GANTSEC has six 110-foot patrol boats, four HH-65 helicopters at Air Station Borinquen and Station San Juan, which operates an all-weather 47-foot motor life boat and six state-of-the-art response boats. GANTSEC controllers work very closely with pilots, cuttermen and boat assets and manage risk so that, when tasked to launch or get underway, they ultimately return safely.

An Immigration and Customs enforcement aircraft spotted this overturned boat in the Mona Passage with a number of the passengers hanging on to the vessel. Originally, 33 passengers were onboard this small boat, which had been stolen from a Dominican Republic resort.

Greater Antilles section units rescue dozens of persons each year and provide assistance to hundreds more. Statistics, however, do not tell the whole story. For example, last year GANTSEC coordinated the search for a recreational diver who became separated from her dive group. Despite a search that lasted for several days and involved numerous air and surface unit sorties, the efforts were not successful in locating the woman. Several weeks later, the Section Commander received a heart wrenching letter from the victim's husband who, while lamenting the loss of his wife, had expressed the satisfaction of knowing that everything possible was done to locate her, providing some comfort and closure to his loss.

Some of the best "saves" do not always occur on the water. Recently, GANTSEC controllers received a request from the Puerto Rico Emergency Management Agency that submitted a request for the Coast Guard to transport a woman who had been stabbed seven times in a domestic violence incident. The woman was at a regional hospital that was unable to stabilize her, and medical personnel feared she would not survive the several-hour ambulance transit to the only trauma center on the island. GANTSEC controllers coordinated the patient's transport by ambulance to Air Station Borinquen, where an HH-65 helicopter transported her to the trauma center in San Juan. The patient received emergency surgery within an hour of arriving at the hospital, directly resulting in her survival. In a similar case recently, an Air Station Borinquen helicopter flew with no illumination through driving rain and thunderstorms to transport a cyclist who had been struck by a hit-and-run driver on the small island of Culebra. The patient was suffering from brain swelling, which most certainly would result in death unless he received immediate attention from a neurosurgeon. In a letter to the Section Commander, the attending physician at the Culebra medical clinic expressed his amazement when an aircrew from Borinquen was able to complete the transport despite the horrendous weather conditions.

GANTSEC personnel are often required to shift modes instantaneously as is often the case in Alien Migration Interdiction Operations (AMIO). The goal of the AMIO mission is to secure the borders from illegal migration, including the introduction of criminals, drugs and terrorists from abroad. The largest threat in the GANTSEC AOR comes from those fleeing the Dominican Republic, which regularly involves the use of extremely unseaworthy vessels, overloaded and captained by cruel smugglers with no regard for their human cargo.

While on routine patrol recently, an Immigration and Customs Enforcement (ICE) aircraft located an overturned boat in the Mona Passage with a number of people clinging for their life to the overturned vessel. A Coast Guard Island Class Patrol Boat arrived on-scene within minutes and rescued a dozen survivors, who reported that there had been up to 33 persons onboard when the vessel overturned. The boat had been stolen from a Dominican

An immigration interdiction operation (AMIO) often requires GANTSEC personnel to shift modes instantaneously. The goal of the AMIO mission is to secure the borders from illegal migration, including the introduction of criminals, drugs and terrorists from abroad.

Republic resort. A massive search was launched involving multiple aircraft and surface assets, as controllers struggled with developing search areas based on the receipt of questionable information. One survivor was located on the nearby uninhabited island of Desecheo, but the most amazing rescue was of a woman who was spotted holding onto a life jacket by an alert HH-65 aircrew in the middle of a search area developed by GANTSEC controllers. After surviving more than 24 hours in shark-infested waters, the woman was found to be in relatively good health. The controllers recalled the rescue of two men in critical condition under similar conditions several weeks earlier. Three additional men were later located deceased.

Perhaps the most satisfying aspect of being assigned to GANTSEC is that, despite the challenges of resource constraints, we always seem to be getting better at what we do. Partnerships are the key to success. For instance, GANTSEC recently hosted a search and rescue conference attended by all the RCCs and coast guards in the eastern Caribbean. The theme of the conference was interoperability. Since that time, early notification of cases originating "down island" has improved significantly, allowing GANTSEC controllers to monitor cases and provide assistance in a timely manner. A recent bilateral SAR agreement with the Dominican Republic is the first of its kind in the eastern Caribbean. Based on the internationally accepted principle of assistance entry, the agreement allows for Coast Guard assets to respond to bona-fide cases of distress within Dominican territorial seas without being hampered or delayed by international sovereignty concerns. As mentioned before, self-locating datum marker buoys (SLDMBs) recently made their debut providing drift information directly from the scene into Coast Guard SAR applications. Plans are in motion to eventually provide partner nations with SLDMBs, which can be deployed and tracked by GANTSEC controllers.

In 2003, the Coast Guard began to hire civilian controllers. Military controllers gain a great deal of experience and corporate knowledge that is lost when they transfer. Civilian controllers, who often remain in the job for many years, will help ensure that lessons learned do not have to be relearned every few years. A civilian search and rescue specialist and a civilian controller are already on the job; plans are to add at least one more civilian controller billet in 2005 or 2006. Additionally, the Coast Guard Auxiliary has always played a significant role in boater education within the GANTSEC AOR. A pilot program in St. Thomas is underway in which a Coast Guard-owned response boat is operated by Coast Guard Auxiliarists. The principal purpose of this program is to aid homeland security patrols, yet, it is worth noting that on their very first patrol, the Auxiliary response boat was diverted to assist a vessel taking on water in the vicinity of St. Thomas.

The Greater Antilles Section is often referred to as the "Tip of the Spear." From a SAR perspective, it is an apt name as GANTSEC is always on the cutting edge of progress, setting the standard in Coast Guard search and rescue excellence.

Technology has not eliminated the need for Coast Guard men and women to frequently risk their lives and enter harm's way to save mariners.

Search and Rescue Responsibilities

The BIG Picture

By Dan Lemon
U.S. Coast Guard Office of Search and Rescue, Coordination Division

Are you a naval architect or marine engineer? A regulator? A ship passenger or representative? A recreational boater or general aviation pilot? A hiker, skier or hunter? A commercial fisherman? Perhaps you're in the search and rescue (SAR) business at the federal, state, local or volunteer level? If you fit any such description, you know that bad days happen.

Last year in the United States and adjacent ocean areas, many persons in distress had to be found and rescued…in spite of prevention efforts and in spite of firm convictions of many that "it won't happen to me." In fiscal year 2003, the U.S. Coast Guard, using not only its own resources, but also the assistance of the Coast Guard Auxiliary, ships at sea and others, saved more than 5,100 lives in 31,562 SAR cases, mostly from incidents involving vessels or aircraft at sea. In addition, the Coast Guard SAR Program assisted nearly 38,000 persons in various ways and prevented loss of property with a total value of about $106 million.

In calendar year 2003, the Department of Defense, often with the support of the Civil Air Patrol, state and local authorities, and volunteers, handled 3,194 civil SAR cases and saved 237 lives, and the National Park Service handled 3,108 cases and saved 427 lives. These included land, aeronautical and water-related cases. Maybe the weather was bad or the cargo shifted. For whatever reason people need help every day all around the world. How are responsibilities for providing all of these SAR services established?

Responsibilities to assist persons, vessels or aircraft in distress are based on humanitarian considerations and established international practice. Specific obligations can be found in several international conventions, including the following: Annex 12 to the Convention on International Civil Aviation; International Convention on Maritime Search and Rescue; International Convention for the Safety of Life at Sea (SOLAS); and United Nations Convention on the Law of the Sea (UNCLOS).

Even if a national government is not party to conventions such as those above, it can still be obligated to provide SAR services, especially if it has accepted responsibility for a search and rescue

region (SRR). Such services include distress monitoring, communications, searching, and rescuing (which includes providing medical advice, initial medical assistance, or medical evacuation). Nations can provide SAR services individually or in cooperation with other nations.

The United States provides national SAR services as part of the global SAR system. National legislation authorizes the U.S. Coast Guard to conduct SAR. U.S. law requires the Coast Guard to develop, establish, maintain and operate SAR facilities, and provides for using these to assist other federal and state entities.

This legal provision is supplemented by a *National Search and Rescue Plan* (NSP), which is an interagency agreement signed at the cabinet level by six federal departments, including the department in which the Coast Guard operates. The NSP obligates the Coast Guard and other agencies to perform or support SAR services. The Coast Guard is responsible for aeronautical and maritime SAR services in oceanic SRRs.

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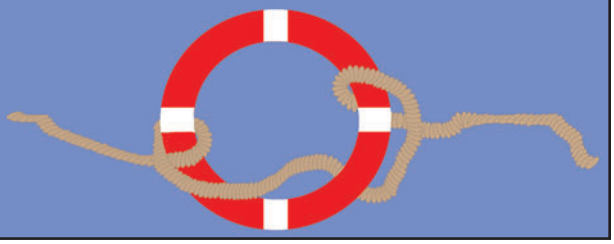

A guiding principle for the U.S. SAR system is to use all available resources. This is achieved by arrangements to augment capabilities of designated SAR units with use of non-dedicated government facilities, and use of commercial, private, and volunteer resources, including ships at sea. On the national level, this is provided through the National Search and Rescue Committee (NSARC). NSARC is composed of the federal agencies that are responsible for or have primary support roles for maritime, aeronautical and land SAR, the same ones that sign the NSP. These agencies (to which the Department of Homeland Security is being added) are as follows:

- Department of Transportation
- Department of Interior
- Department of Commerce
- Department of Defense
- Federal Communications Commission
- National Aeronautics and Space Administration (NASA)

SAR operations are normally coordinated by rescue coordination centers (RCCs). RCCs coordinate SAR within their own respective SRR and with other U.S. or international RCCs as appropriate. Every SRR has an RCC. Coast Guard multi-mission command centers at the Area and District levels operate as RCCs. Simple cases may be handled at lower levels.

The NSP describes how the United States will meet its international legal and humanitarian obligations to provide SAR services. Under overall provisions of the NSP, SAR doctrine, standards, policy and procedures are provided in the following primary documents: the *International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual* (applies worldwide); the *U.S. National Search and Rescue Supplement (NSS) to the IAMSAR Manual* (applies to all federal agencies involved in SAR); and the *Coast Guard Addendum (CGADD) to the NSS* (applies within the Coast Guard).

The *IAMSAR Manual* is jointly published in three volumes by the International Maritime Organization and the International Civil Aviation Organization, two specialized bodies of the United Nations as follows:

- *Volume I* discusses establishment and improvement of national and regional SAR systems and cooperation among neighboring countries.

- *Volume II* assists RCC staff who plan and coordinate SAR operations and exercises.
- *Volume III* is intended to be carried onboard rescue units, aircraft, and vessels to help with performance of a search or rescue function and with aspects of SAR that pertain to their own emergencies.

The NSS describes national SAR services, expands on topics covered by the IAMSAR Manual, and provides guidance that may be unique to the United States.

Plans of Operation are maintained at RCCs and units that have SAR response coordination responsibilities. A Plan of Operation discusses responding to a specific type of SAR incident that might occur within an SRR. Key Plan of Operation information is typically included in a Quick Response Card (QRC) for rapid use during an actual mission.

When SAR facilities are dispatched, the SAR case is generally referred to as a SAR "mission," which typically advances through five stages: Awareness; Initial Action; Planning; Operations; and Conclusion. These stages are associated with the nature of assistance provided at any particular time.

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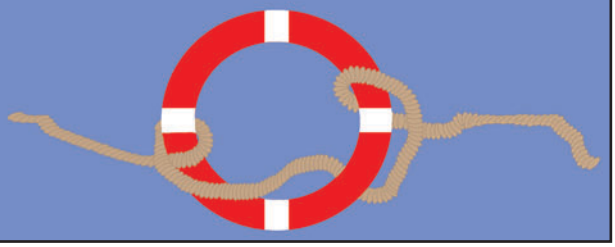


The United States is responsible for SRRs established over land and water in accordance with the International Convention on Maritime Search and Rescue and with *Annex 12, Search and Rescue, to the Convention on International Civil Aviation*. These Conventions provide for dividing the surface of the globe into maritime and aeronautical SRRs, which are described in a Global SAR Plan, and Regional Air Navigation Plans, respectively. Aeronautical and maritime SRRs and associated SAR services are typically harmonized to the extent practicable, which often requires cooperation between aeronautical and maritime authorities. Lines delineating SRRs must also be agreed among neighboring countries. The U.S. civil aviation authority, the Federal Aviation Administration, does not provide SAR services but maintains air route traffic control services, and cooperates with the Coast Guard to provide aeronautical SAR services at sea and with the U.S. Air Force to provide such services over land.

The U.S. SRR associated with RCC Miami includes and is adjacent to numerous countries in the Caribbean. To facilitate SAR coordination in this region, a rescue subcenter (RSC) has been established in San Juan, Puerto Rico, with an associated rescue sub-region. RSC San Juan supports RCC Miami by coordinating SAR for a portion of RCC Miami's SRR. Some countries establish RSCs with sub-function rather than sub-region responsibilities. SAR facilities are any mobile resource used to conduct SAR operations, including but not limited to designated SAR units that have specialized SAR training and equipment. SAR units may have SAR as primary duty, or be made available for a SAR mission by a parent agency not having primary SAR duty. Other SAR facilities may include aircraft, ships or other vessels at sea, or any other government, private or commercial facility that may undertake or support SAR operations.

Aeronautical SAR facilities, fixed-wing and rotary-wing aircraft, can quickly search large areas, intercept and escort aircraft in distress or other SAR facilities, and perform aerial delivery of supplies, equipment, and personnel. Maritime SAR facilities, typically boats and ships, are capable rescue facilities and useful for searching smaller areas than aircraft can handle. Merchant ships may be the only available craft in some areas. On-scene endurance and communications capabili-

ties often make vessels more suitable than aircraft to perform coordination functions on-scene. Vessels may also be used to escort or tow disabled surface craft, and for surface delivery of supplies, equipment, and rescue or medical personnel to the distress scene.

Besides SAR facilities, other available SAR resources include RCCs, training facilities, communications stations, computer centers, meteorological services, air traffic services, satellite services or any other capability that might provide or support SAR services.

Effective SAR response relies on effective communications among shore stations, vessels and aircraft for coordination as well as to receive distress alerts. Coast Guard ships (cutters) and aircraft normally have both maritime and aeronautical communications capabilities on international distress alerting and on-scene frequencies, in particular, VHF-FM maritime and VHF-AM aeronautical voice. Coast Guard boats communicate only on maritime frequencies. RCCs have indirect access to a full range of terrestrial and satellite capabilities needed for receiving and relaying distress alerts, coordinating SAR response, and working with other RCCs. Ships or aircraft already in the vicinity of a distress situation provide the most immediate help available to a distress ship or aircraft. Most ships can be contacted via the Inmarsat satellite system as well as by radio. En route aircraft can be informed of emergency situations by the responsible air traffic control center. Under some circumstances, en route aircraft might be alerted by aircraft towers or approach control facilities, usually when incidents occur in the vicinity of these facilities. Ships and commercial aircraft share, but do not guard, certain common frequencies that can be used for aircraft-ship communications if arrangements are made via RCCs. SAR agreements with other organizations, or with authorities of other nations, are of practical value for the following purposes:

- Fulfilling domestic or international obligations and needs;
- Enabling more effective use of all available resources;
- Integrating national or regional SAR services into the global SAR system;
- Building commitment to support civil SAR;
- Resolving SAR procedures and sensitive matters in advance of time-critical distress situations; and
- Identifying cooperative efforts that may enhance or support SAR operations, such as access to medical or fueling facilities; training and exercises; meetings; information exchanges; or use of communications capabilities.

A guiding principle for the U.S. SAR system is to use all available resources.

The international flavor and inclusive nature of the entities and resources that support civil SAR, as discussed in this article, may be surprising to some… even to many who actually provide SAR services at the operational level. Since the mid-1950s, our national SAR services have been part of a worldwide system, organized and implemented in accordance with international law and practices; this is increasingly true as the SAR community matures, and as aeronautical, maritime and land SAR becomes more harmonized. Improvements in civil SAR are coming rapidly due not only to Coast Guard and national initiatives, but due to an intense and welcomed interest in SAR that has exploded within the international community.

Search and Rescue Engagement

By Dave Edwards
U.S. Coast Guard Office of Search and Rescue, Coordination Division

As the U.S. Coast Guard goes about its search and rescue (SAR) missions, it is easy to lose sight of the fact that the United States is one part of the larger global SAR system. When gazing at the world chart of the SAR regions, many may be awed by the massive segments of the North Atlantic and Pacific Oceans within which the United States has agreed to coordinate SAR operations to be carried out by the U.S. Coast Guard. And, it is well known that we reach out beyond these regions to help our neighbors, as best demonstrated in the Caribbean and western Pacific.

However, it should be equally understood that the Coast Guard covers our own SAR regions in a manner that has become an international principle for providing SAR services: *Use all available resources*. These resources include U.S.-designated SAR units and non-dedicated government facilities; use of commercial, private and volunteer resources; and possibly the same types of resources from other countries. Best use of these resources is attained by having partnerships and arrangements, domestic and international, in place ahead of the distress.

So what happens when U.S. citizens travel abroad, as do many millions each year on business, pleasure and adventure? The United States should do as other nations have done for their citizens traveling toward the U.S.—rely upon the nation with the SAR region to provide SAR services. Thus is born two primary reasons for SAR engagement: (1) when coordinating SAR within our own SAR regions, there will be times when we, as an agency or as a country, do not have adequate and timely response resources; and (2) for countries beyond our own SAR regions, we have a vested interest and humanitarian concern to enable those countries to provide SAR services.

For the Coast Guard, SAR engagement occurs on many levels—internal, local, national and international. And it is conducted with a wide range of public, commercial and private organizations. The focus of this article will be more on the international and national level, with the understanding that there is daily engagement on the local level.

In recent years the global community has greatly expanded in both desire and capability to provide SAR services. In many countries that lag behind, there are international initiatives to develop solutions. The Coast Guard, with a well-established reputation for SAR, is one of the most sought after agencies by international organizations and individual countries trying to establish SAR systems or to improve existing ones. Initially, this engagement appeared overly focused on one-time training or

providing a facility, such as a boat and initial training. Follow-through was weak since the Coast Guard was not funded nor staffed to sustain such an effort. SAR engagement has evolved and now includes encouragement of regional cooperative efforts since a single country alone often does not have the full capability; advice and guidance on government processes to sustain a SAR system; recurring operational contact as able; and expectations that progress will be made over time.

The Federal Aviation Administration (FAA), the Department of Defense (DoD) and the State Department actively seek to have the Coast Guard engage in international forums for SAR. The FAA is primarily concerned with aeronautical SAR over water. DoD and the State Department see SAR as a means of friendly U.S. engagement with a wide range of countries, friendly and sometimes not-as friendly.

The Commandant of the Coast Guard has already signed several documents with the purpose being to provide guidance for Coast Guard strategic engagement with various regions of the world. These documents include the signed Caribbean and Central America plans and the European Union plan, which is in development. SAR is a prominent component of this strategic engagement.

An international SAR agreement is an area of engagement led by the Coast Guard Headquarters SAR Program staff, who have the authority to negotiate international agreements, but includes Coast Guard District involvement as well. These agreements may be signed at the agency (Coast Guard), department or government level. With U.S. SAR regions being adjacent to 28 other SAR regions or countries, a SAR agreement should be in place with each to allow for operational arrangements and procedures. It will also prescribe collaborative efforts such as exchange of visits, joint exercises and training. These collaborative efforts provide the opportunity for interaction other than just distress situations.

For the Coast Guard to have an active international engagement effort, it must sustain a solid foundation at home. While the local Coast Guard field unit and district naturally engage the local responders, industry and citizens, the Coast Guard Headquarters SAR Program has staff assigned to conduct engagement on the national and international level. And the staff does a lot of engagement with other Coast Guard Headquarters program offices, especially in the area of passenger vessel safety under the directorate of the Marine Safety, Security and Environmental Protection program (G-M). All of this is done to help field units in the performance of SAR operations.

The top level of U.S. national SAR engagement and cooperation is the National Search and Rescue Committee (NSARC), the federal-level committee chaired by the Coast Guard and established to coordinate civil search and rescue matters of interagency interest within the United States. It oversees the National SAR Plan and the interagency guidance for its implementation. This, and the National SAR Supplement, 1999, which implements the

The Asia Pacific Regional Forum in April in New Zealand. Clare Wilson, U.S. Coast Guard International Affairs.

National SAR Plan, provides the framework for Coast Guard coordination with federal and local SAR resources. Attaining the goals of NSARC requires active outreach and participation by all the key players.

National engagement with commercial and private resources is an ongoing effort in many forums. For example, the Coast Guard works with the passenger vessel industry through its Passenger Vessel Safety Program and also through its Partnership Action Team with the International Council of Cruise Lines. Another means, used by the National Association for Search and Rescue (NASAR), is to participate in the scheduled NSARC meetings as a non-federal observer. The Coast Guard has membership in NASAR and is quite active in its annual SAR conference along with other federal, state and local agencies and volunteers. Field unit participation in NASAR's annual conference is encouraged; the next one is May 2005 in Oakland, Calif., as posted at **www.nasar.org**.

To get a better picture of engagement on the international and national levels, some representative events are provided below. They represent a varied portrait and include both Headquarters and field level initiatives. By no means comprehensive, the examples nonetheless give a fair presentation that engagement is an active responsibility among many partners.

International Maritime Organization (IMO)
The key international body for maritime safety is the International Maritime Organization (IMO). IMO created the *International Convention on Maritime Search and Rescue*. This SAR convention, in conjunction with the *Annex 12—Search and Rescue of the Convention on International Civil Aviation*, provides the framework for all nations to work together to provide SAR services. The Coast Guard has one representative at IMO who serves as the U.S. SAR expert in the Communications and SAR (COMSAR) Subcommittee of the Marine Safety Committee of IMO, where international standards, practices and procedures are developed and U.S. standards, practices and standards are advocated for international adoption.

Department of Defense Initiatives
SAR is viewed as a positive topic for DoD's Combatant Commands to engage other nations within their overseas area of responsibility. The Coast Guard often serves as the civil SAR expert. Distinction is clearly made between *civil* SAR and *combat* SAR; nonetheless, civil SAR has consistently benefited from this joint effort. Regional effort has included the NATO SAR Panel as well as bilateral work with countries such as India and Vietnam.

Maritime Safety (MarSaf) Colloquium
Since 1993 the Coast Guard has been an active participant in the Middle East confidence building measure called the Maritime Safety (MarSaf) Colloquium. It is a Canadian-led initiative supported by the United States through the State Department with the Coast Guard providing subject matter experts. The colloquium is held in the region (Middle East/North Africa) with an agenda that always includes SAR. The overall objective of MarSaf is to facilitate the Middle East peace process through confidence-building dialogue at the working level outside the political parameters.

Asia-Pacific Heads of Maritime Safety Agencies Forum
The seventh session of this Forum met April 2004 in New Zealand. Representatives from 19 international maritime agencies attended. The purpose of the Forum is to promote safe, secure shipping and a clean maritime environment within the Asia Pacific region by bringing together senior maritime officials to exchange ideas and identify areas of cooperation. SAR is a standard part of the proceedings.

North Atlantic Maritime Rescue Coordination Center (RCC) Meeting
RCCs around the North Atlantic initiated this biennial meeting to further promote international SAR cooperation and liaison. The 2003 meeting was attended by 11 RCCs from nine countries. SAR staff from the Atlantic Area command center typically represent the United States. RCC Boston is hosting the next session scheduled for 2005.

Caribbean Search and Rescue Workshop
An annual event organized by Greater Antilles Section (GANTSEC) and hosted by various countries in the Caribbean, GANTSEC is serving as the catalyst to develop regional cooperation and initiatives to improve SAR services in the Caribbean.

Though quiet in nature, engagement is a vital part of the Coast Guard's Search and Rescue Program. Reaching out and planning ahead with our neighbors—including other countries, responders, commercial enterprises, national and private organizations—ensures that the best use is made of all available resources to competently assist all persons, vessels or aircraft in distress.

The Amver Program

Matching distress calls with the vessel(s) best suited to respond

By Beverly Howard
U.S. Coast Guard Amver Maritime Relations, New York

Amver—the Automated Mutual Assistance Vessel Rescue Program—is a computer-based vessel reporting system operated by the U.S. Coast Guard to promote safety of life and property at sea. The system's objective is to match distress calls with the vessel best suited to respond, giving other vessels that hear a call—and by international law are obligated to respond—the freedom to continue on their way if released by the search and rescue mission coordinator (SMC).

Today, Amver has ships participating from more than 140 nations and is the only worldwide safety network safeguarding people in every ocean of the world. Amver participation is free, voluntary and available to merchant ships of all nations. No costs or special equipment are required of shipowners, but participation requires the master or operations director to fill out a search and rescue questionnaire (SAR-Q) upon registration. The SAR-Q form may be accessed and submitted at Amver's Web site at **www.amver.com/sarqform.html**. The SAR-Q provides vital SAR information, which is entered into the Amver database. On any given day, Amver's computers in Martinsburg, W.Va., plot voyage information on 2,900 ships. Maximum participation is the key to Amver's effective support of SAR around the world. To date, more than 12,000 vessels participate in the Amver program. The more ships enrolled in the system, the better the chances of emergency assistance being quickly located and dispatched to those in distress.

Vessels at sea provide reports to Amver via:

- Coastal Radio Stations
- Inmarsat

- Internet
- Telex
- Facsimile (when other methods are not available).

Before being released into the active plot, Amver reports received from vessels are reviewed by the Amver Data Validation Staff at the Coast Guard Operations Systems Center located in Martinsburg, W.Va. The staff is on duty around the clock, seven days a week, every day of the year.

Sail plan, position and/or diversion data reported to the Amver computer is used to produce a surface picture (SURPIC) of an area of the ocean, which indicates the relative position of all Amver-participating ships around a specific geographic point (the location of the ship in distress). The SURPIC can show the position of ships as little as 50 miles around, or out to 500 miles around. After quickly reviewing and evaluating the information presented, the SMC, typically at a rescue coordination center (RCC), is able to select the best one or several ships to respond to the emergency. A number of considerations and variables go into this selection. The closest ship might be asked to divert, or one farther away may be selected if it can make better speed. In a medical emergency, the ship with a doctor or nurse may be asked to respond.

Sail plan, position and/or diversion data reported to the Amver computer is used to produce a surface picture of an area of the ocean.

This gives the relative position of all Amver-participating ships around the location of the ship in distress.

Weather and sea state conditions might mitigate against diverting a relatively smaller ship to respond. Conversely, a ship with a smaller freeboard (or height above water) might be better suited to recover survivors from a raft in heavy seas than a huge supertanker or containership. Considering the commercial nature of the ships involved, an SMC would prefer to divert a ship heading toward the distress, rather than turn one around, all other things being equal.

Amver provides all this invaluable information in seconds, at the touch of a button.

Another type of SURPIC (called a "Trackline" or "Snapshot" SURPIC) is used in aviation emergencies to look "downrange" of an aircraft in distress and identify an area where there is a cluster of ships that could mount an immediate rescue effort for passengers/survivors. Given the luxury of such time, the SMC can arrange with the aircraft for a "controlled ditch" into a specific area of the ocean, favorable to a successful rescue operation.

Requests for SURPICs from rescue coordination centers (RCCs) outside the United States are processed by a Coast Guard RCC and forwarded by the most expeditious means (telephone, fax, telex) to assist in that nation's response to an emergency within its area of responsibility under international agreements. Amver computer terminals reside only in Coast Guard RCCs or rescue subcenters (RSCs) to prevent any misuse of Amver data for purposes other than SAR. Internationally, a U.S. RCC is identified as an RCC since that function is performed there; but, internal to the Coast Guard it is often referred to as a "command center" (CC) in recognition of its coordination or relay of information for other missions in addition to SAR. However, the Coast Guard RCC has a staff dedicated to coordinating SAR planning and operations separate from the other possible missions within the command center.

Operational use of the Amver system by the Coast Guard and the international community is largely due to the behind-the-scenes work of three staff elements that work as the Amver Team—Coast Guard Headquarters SAR Program (G-OPR), Amver Maritime Relations (AMR) staff in New York City, and the Coast Guard Operations Systems Center (OSC).

G-OPR has one person assigned as the Amver Program Manager. This person works with others within the SAR Program and Coast Guard Headquarters to provide overall program management and oversight. Primary efforts include policy guidance, funding issues, and a broad range of national and international engagement as an advocate of Amver's use, availability and cost effectiveness. Awareness of Amver—within the United States, internationally, and the maritime industry—is viewed as critical to its continued success as a global lifesaver.

AMR is the marketing arm of the Amver program. This staff of three is tasked to retain and expand the number of participating ships. Crucial to these efforts are its outreach initiatives such as conducting Amver awards ceremonies in the United States and overseas, directing contact with mariners and shipowners, and participating in international forums that encompass major segments of the maritime industry. They also serve as the "voice" or "face" of Amver as they actively seek out the news media to promote Amver's accomplishments.

The OSC can be considered the "Amver Center" since that is the home of the Amver computer and its technical staff. A government manager is assigned as the Amver Project Officer and the technical work and support is performed by contracted personnel. The Amver staff at the OSC has a well-deserved reputation as highly dedicated professionals. These are the people who are constantly making improvements by staying current with technology and also keep the system operating 24 hours a day, every day, for the benefit of all.

Welcome to the world of Amver!

Amver team members at the Coast Guard Operations System Center.

2003 Association for Rescue at Sea Award Recipient

By Ensign Eric D. Leese
U.S. Coast Guard Office of Search and Rescue

The Association for Rescue at Sea (AFRAS) is an organization that, among other things, recognizes U.S. Coast Guard active duty enlisted personnel and Auxiliarists for outstanding rescues at sea. The AFRAS gold medal award was established by the association's first chairman, Vice Adm. Thomas Sargent III, a former Vice Commandant for the Coast Guard. The medal is presented to an enlisted man or woman who has demonstrated extraordinary bravery during a rescue at sea. The silver medal is used to recognize Auxiliarists under the same criteria.

Coast Guard Aviation Survival Technician Third Class Laurence D. Nettles, a member of Air Station New Orleans.

In 2004, AFRAS bestowed the gold medal upon Coast Guard Aviation Survival Technician Third Class (AST3) Laurence D. Nettles in a ceremony that occurred September 15 at the congressional Rayburn House Office Gold Room in Washington, D.C. AST3 Nettles is stationed at Coast Guard Air Station New Orleans, where he and the crew of the Coast Guard Helicopter 6514 saved the lives of four fishermen from the clutches of Tropical Storm Bill in June 2003.

So others may live is a motto heard at many search and rescue (SAR) units. Undoubtedly, those words came to mind to AST3 Nettles on June 30, 2003, when he leapt from the HH-65B Dolphin helicopter into the raging ocean to assist in saving the lives of four fishermen. Their boat was going down in 20-foot seas 40 miles south of Houma, La.

On that stormy day in June, the Eighth Coast Guard District received an emergency locating transmitter (ELT) signal and launched the crew of the 6514 from Air Station New Orleans in search of the distress beacon. The crew of the 6514 consisted of Lt. Russell S. Burnside, Lt. j.g. David P. Merriman, Aviation Maintenance Technician Third Class (AMT3) Kevin G. Lajeunesse, and AST3 Nettles.

The weather was bad and getting worse as Tropical Storm Bill was only 10 miles southeast of Timbalier

The crew of helicopter 6514. Clockwise, from top left: Lt. Russell S. Burnside; AST3 Laurence Nettles; Lt. j.g. David P. Merriman; and AMT3 Kevin G. Lajeunesse. In September 2004 the Association for Rescue at Sea awarded AST3 Nettles its gold medal, which is reserved for an enlisted man or woman who has demonstrated extraordinary bravery during a rescue at sea. AST3 Nettles leapt from a helicopter into the ocean during Tropical Storm Bill to save four fishermen in June 2003.

Island. The National Oceanic and Atmospheric Administration (NOAA) reported tropical storm warnings from east of Highland Island, Texas, to Pascagoula, Miss. The winds were at 45 mph with maximum sustained gusts up to 60 mph—close to Category 1 hurricane force. The oncoming storm was forecasted to deliver five to 10 inches of rain over portions of Louisiana, Mississippi, Alabama and all the way to the western Florida panhandle. Seas from Tropical Storm Bill were already at the 20-foot mark, causing many vessels to require Coast Guard assistance.

With no distress found from the errant ELT signal, the 6514 was setting up to search in another location when the fishing vessel (F/V) *St. Joseph* broadcast a distress call. The crew's dewatering efforts had failed, the vessel's decks were awash, and the boat was going down with four people onboard. The Coast Guard crewmembers of the 6514 were ready, however, because of their training.

The *St. Joseph* was 15 nautical miles from Timbalier Island, La. The 6514's copilot, Lt. j.g. Merriman, entered the coordinates into the computer, and the aircraft commander, Lt. Burnside, turned the helicopter and headed west toward the brunt of Tropical Storm Bill. The flight mechanic, AMT3 Lajeunesse, began his rescue checklist to ready the cabin for what they might find.

The 6514 arrived on-scene to find the crew of the *St. Joseph* still onboard the floundering vessel. The aft deck was already awash and severely listing, which prevented using a rescue basket to directly pick up the survivors. After conferring with the aircraft commander, AST3 Nettles chose to be deployed close to the stricken vessel to effect a rescue of the fishermen, one at a time, as they abandoned ship. He would then tow each one clear of the sinking vessel to be hoisted.

The pilots, Lt. Burnside and Lt. j.g. Merriman, worked with precision to stabilize the aircraft in the severe winds. Once ready for deployment, the seas were estimated at 20 feet with winds at 60 knots, rough water for even the most accomplished swimmers. AMT3 Lajeunesse readied AST3 Nettles in the door and called "swimmer is ready." After having been given the command to deploy the swimmer, AMT3 Lajeunesse tapped Nettles on the shoulder three times and away he went into the stormy seas.

Nettles plunged into the water and gave the "I'm OK" hand signal when at the surface and swam to the boat where he told the first survivor to "jump!" The first survivor leapt into the sea, and AST3 Nettles grabbed him and towed him away from the boat. He placed the survivor into the rescue basket that AMT3 Lajeunesse had ready and waiting. AMT3 Lajeunesse hoisted the first survivor into the cabin of the helicopter, and the process was repeated again with the second survivor.

The seas fought back at this point, and AST3 Nettles was swept downswell twice and was reconnected to the hoist hook to be repositioned back toward the floundering *St. Joseph*. When Nettles had the third survivor in his grasp, a 25-foot breaking wave engulfed them, almost capsizing the *St. Joseph* and nearly slamming them into the hull of the vessel. For an agonizing 15 seconds, the helicopter crew lost visual contact with the two men in the water until they reappeared 50 feet downswell. AST3 Nettles held on to the survivor and towed him through the turbulent seas to the basket to be hoisted to safety.

After rescuing the fourth and final crewmember, AST3 Nettles was hoisted back up to the 6514 and immediately attended to the medical needs of the four survivors. The crew of the 6514 departed scene, flying low to pick up landmarks to navigate by and delivered the survivors to Coast Guard Air Station New Orleans for further medical attention.

For their outstanding courage, judgment and devotion to duty, the crew of the 6514 was awarded the Coast Guard Air Medal—one of the most prestigious awards an aircrew can receive.

Making Preparations for a Mass Rescue Operation

By Capt. Steve M. Sawyer
Chief, U.S. Coast Guard Office of Search and Rescue

Because of the 1997 blockbuster movie of the same name, the *Titanic* and its tragic story have become well known. In 1912 the "unsinkable" cruise liner with an insufficient number of lifeboats departed on its maiden voyage from the United Kingdom to New York City, hit an iceberg en route, breached its too few watertight compartments in the cold north Atlantic Ocean and sank with the loss of 1,490 souls. Even the name itself, *Titanic*, has become analogous to enormous tragedy, evoking a sense of God's wrath in response to the hubris of mankind.

As in many instances, humankind's failures often serve as the primary catalyst to prompt action in remedying problems—and, in this case, the global community's call for action in the development and creation of the International Convention for the Safety of Life at Sea (SOLAS). Standards and technologies developed since that time, involving communications, carriage requirements, structural integrity, qualification standards and more, have substantially reduced the probability of other *Titanic*-like tragedies. Despite these and other prevention efforts, the unforgiving sea is still able to lay claim to a host of maladies and misfortunes that continue to stretch the response capabilities of our search and rescue (SAR) brethren worldwide. This was evidenced in more recent tragic events such as the roll-on/roll-off passenger ferry *Estonia*, which capsized and sank in the Baltic Sea in 1994 with 851 losing their lives.

Even though built-in and tested safety redundancies make a major passenger vessel mishap a very low probability, it is still incumbent upon us to prepare in advance for an incident like the *Estonia* that has the potential of high consequence—literally affecting thousands of passengers and crew. Such events may be caused by human error, weather, structural failure or a combination of all three. They may also be caused by a maritime equivalent to September 11, where purposeful terrorist actions target large numbers of innocent people embarked on a vessel or an area ashore where survivor evacuation to a place of safety may best be remedied via waterways. Perhaps terrorist attacks in the Middle East on the *USS Cole* and the French tanker motor vessel (M/V) *Limburg* were meant as initial probes into the possible damage terrorists could do to an even more vulnerable maritime target, closer to the United States.

No matter the cause, we have the benefit of time—right now—to make preparations for conducting a mass rescue operation (MRO), defined by the International Maritime Organization (IMO) as "an

operation that involves the need for immediate assistance to large numbers of persons in distress such that capabilities normally available to search and rescue authorities are inadequate." SAR happens when everything else fails. For most potential MRO responses within the United States, a series of prevention efforts—to also include law enforcement deterrents, intelligence and port security interventions—must fail in a catastrophic manner to exceed our immediate response capabilities using dedicated and traditional response resources. But, if that unfortunate situation occurs, we need to have a plan.

Why, though, spend time and effort on a plan for something that may never happen? We can look at past efforts for notable examples of successful MROs being conducted without the benefit of advance preparations. One example is the passenger vessel *Prinsendam* where all 524 passengers and crew were rescued from the burning cruise liner in 1980. We can also look at the successful shoreside retreat from Dunkirk in 1940 during the early days of World War II, prior to the entry of the United States into the war. During a nine-day period, more than 325,000 British Expeditionary Force and French troops were evacuated in every type of vessel imaginable under hostile wartime conditions across the English Channel to Great Britain.

However, why take the chance that purely heroic deeds, as evidenced in these two examples, will be the only difference between a major loss of life and a successful outcome? Given the unknown circumstances and unplanned events of a potential incident, coordinators and responders to an MRO will fair much better with exercising a plan that anticipates and takes into account the need for non-traditional response resources, various disembarkation points, survivor accountability issues, points of contact, communication issues and shoreside infrastructure requirements.

The passenger ferry *Estonia* before its capsize and sinking in 1994. The vessel went down in the Baltic Sea with 851 passengers who lost their lives. Copyright © Martin's Marine Engineering Page, www.dieselduck.net.

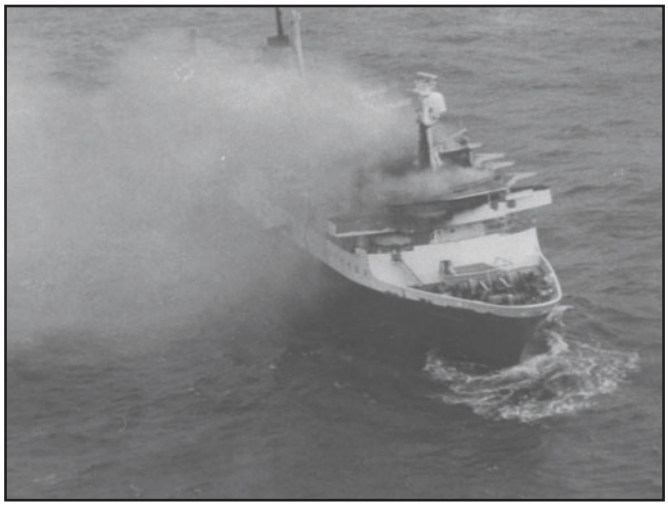
One of my first priorities upon becoming the Chief of the Office of Search and Rescue two years ago was to develop guidance for our SAR Mission Coordinators (normally our group and sector command centers) and SAR Coordinators [our Rescue Coordination Centers (RCCS)] on responding to an MRO. To do so, we brought SAR Controllers, readiness planners, SAR school instructors, Strike Team members and others together at Coast Guard Training Center Yorktown to collectively discuss the type of initial guidance required to effectively conduct an MRO.

We assumed an incident occurred "after hours," when a unit's surge capacity is most diminished, and that a single SAR controller was the only one on duty to handle our immediate response. When debating our immediate response options, we studied IMO guidance on MROs from its Subcommittee on Radiocommunications and Search and Rescue (COMSAR) Circular #31 (Guidance for Mass Rescue Operations, dated 06FEB03). We also visited lessons learned as documented by Capt. W. Russell Webster (USCG, retired), a former Group Commander at Group Wood's Hole whose units and command center coordinated the Coast Guard's immediate response to the 1999 Egypt Air 990 tragedy. Capt. Webster's team also coordinated the response to the 1999 plane crash involving John F. Kennedy, Jr., which was a non-MRO event that generated its own set of special circumstances and lessons learned due to public interest in the case. Finally, we heard firsthand the recounted efforts of Coast Guard personnel who helped coordinate the massive waterborne evacuation of lower Manhattan Island in the wake of the World Trade Center's destruction by terrorists on September 11.

From these efforts, a template was created for an MRO Quick Response Card (QRC), addressing guidance for those supplemental actions that needed to be considered above and beyond what would

normally be handled during a "routine" SAR incident. (Those who work SAR know there is no such thing as "routine.") A QRC is a job aid used by the SAR controller to address actions that need to be taken during an evolving SAR incident. Of particular note, the supplemental actions to take for an MRO, with some items specific to each port of consequence, included (among others):

- Identifying nontraditional air (fixed and rotary wing) and surface resources (off shore and inshore) from hundreds of miles away to augment high readiness and traditionally used resources;
- Maintaining a list of points of contact for units and facilities at potential risk within the area of responsibility;
- Identifying potential debarkation points for survivors—given type of response craft—to better enable a quick return to the distress site for more survivors;
- Accessing the SAR data provider system for passenger vessel SAR Plans of Cooperation;
- Communications with the Coast Guard's National Command Center to quickly ramp up the notification process, bringing more possible assets to bear;
- Invoking the Incident Command System, as needed, to better coordinate the total local response;
- Addressing hazardous materials, especially given acts of terror, and protective clothing requirements; and
- Addressing mass maladies/illnesses, requiring U.S. Public Health Service/Center for Disease Control input and/or intervention.



The cruise ship *Prinsendam* burning in 1980. This incident is an example of a successful mass rescue operation—all 524 passengers and crew were rescued.

After creating the QRC template, our next task was to validate the contents, which was accomplished by sending a draft to each Coast Guard RCC, the International Council of Cruise Lines and several of our international colleagues. After their collective review, and with feedback in hand and tweaks made, it was time to test the document during a mock scenario. The opportunity soon presented itself at the Ninth Coast Guard District Office in Cleveland, Ohio.

Under the guidance of that district's Chief of Search and Rescue, Capt. Paul Preusse, the RCC was preparing to conduct an extensive multi-mission exercise involving a foreign passenger vessel and a tanker that "collided" on Lake Erie. Suffice to say, part of the exercise required removal and evacuation of the "passengers," which allowed Jerome Popiel, the RCC's Senior Controller, to test the use of the QRC under "real life" conditions. Based upon Popiel's thorough feedback, our MRO QRC was finalized and is now included within both the Coast Guard's Search and Rescue Addendum and the National Search and Rescue Supplement, with various changes in the latter to remove Coast Guard-specific wording and policies.

In closing, we must all work together to ensure that our collective prevention efforts will be sufficiently effective so that the MRO QRC will never have to be used by our operational commanders during an actual incident. However, just like the fire axe behind the glass casing, it needs to be there—just in case.

Rescue of *Miss Judith*

By Lt. Cmdr. Daniel Pickles
Commanding Officer, U.S. Coast Guard Cutter Bainbridge Island

The Stage
It was Dec. 5, 2003, the winds were picking up and the temperature was dropping. The first winter storm of the season was coming in, and, like most other boats at the time, we were starting to head in. We finished one last fisheries boarding in Nantucket Sound and then set a course and speed for Woods Hole, Mass.—one of our favorite ports. It was a little after noon when our operations petty officer, First Class Boatswain's Mate Jay Vazquez, discovered a problem. The pier at U.S. Coast Guard Station Woods Hole was full. The duty watchstander suggested we could moor alongside another cutter, but with the forecasted winds, we could not risk damage by pounding against another boat. Additionally, we were the on-call search and rescue (SAR) cutter. Should anything happen, we would need to be able to get underway quickly and mooring at Woods Hole would not put us in a good position to do so. We needed to find an alternate berth.

The weather continued to deteriorate. After a quick council with the executive officer and department heads, we decided our best option was to moor at the Coast Guard Academy in New London, Conn. Although it was an additional four-hour transit, it offered the best protection from the storm. We headed west. It was getting late, and as night fell, we got our first taste of the storm crossing Buzzard's Bay. The storm was a Nor'easter, so luckily the 20-knot winds and five-foot seas were primarily off our starboard quarter. By the time we turned up the Thames River, though, the snow was falling, and the visibility was dropping steadily.

We piped the Special Sea Detail early to allow for everyone to dress in their foul weather gear. The Executive Officer and I suited up in our heavy jackets and goggles and went up to the flying bridge for the mooring evolution. As we approached the Thames River Railroad Bridge, the visibility was less than 100 yards and the snow was blowing horizontally. Deck force had to shovel off two inches of snow and ice before they could set out the mooring lines. Despite the 25-knot off-the-dock winds, the mooring was uneventful. We were able to double up the mooring lines and secure the ship before the brunt of the storm hit. We planned to spend the next 48 hours inport and let the storm pass.

The Call
The following day the storm hit in full force. More than a foot of snow fell where we were on the edge of the storm. At 5:30 a.m. on December 7, we received a call from the District Command Center. They had a case developing—a disabled fishing vessel, (F/V) *Miss Judith*, 50 nautical miles south of Montauk, Long Island, N.Y. The Duty Officer fired

off the standard questions: "what's your status?" "how long would it take you to get underway?" "how long would it take you to get on-scene?" I looked at the weather, 45-knot winds and 25-foot seas offshore. The questions were all academic. As a 110-foot patrol boat, we couldn't go out in that weather. Fortunately, *Miss Judith*'s sister ship was on-scene and was attempting to tow her in. We would sit and wait for now. In the meantime, we recalled the crew and assumed immediate standby.

The thickening layer of clouds quickly doused the sunlight, and the winds grew stronger and seas larger.

Approximately five hours later, another call came from the District. The good news was that the height of the storm passed and the winds and seas were starting to subside. The bad news was the sister ship's attempt to tow *Miss Judith* failed and it was adrift again. The only other available Coast Guard asset was a 210-foot Medium Endurance Cutter anchored off of Cape Cod. We were the closest and most capable asset available. Although the weather was still marginal for us to operate, it was time for us to go.

Riding into the Storm

After making last-minute preparations and securing for sea, we were underway. With *Miss Judith* drifting south and sunset only four hours away, every moment counted. Ironically, the sky had cleared over New London and the sun was shining promisingly. Racing against time, we took advantage of the lee near shore and ran as fast as possible. As we headed offshore, the sky grew darker and more ominous. The thickening layer of clouds quickly doused the sunlight, and the winds grew stronger and seas larger. We were forced to bring back our speed as the boat began to pound against the sea and roll in the breaking waves.

By the time we arrived on-scene four hours later, the conditions had built to 32-knot winds and 15-foot seas. It was dark and snowing again. The gravity of the situation was punctuated the first time we came about. Everything that was not lashed down went flying across the boat. Even some things that were secured broke loose. People and objects went flying everywhere. On the bridge, boatswains mates worked feverishly to keep hold of the plotting gear in the 30-degree rolls. If there was any doubt about the weather conditions before, it vanished in an instant.

After reviewing the procedure with the master of *Miss Judith*, it was time to set up the towing gear. The deck force needed to secure 600 feet of towline on the fantail. The deck was slick with ice, making it extremely dangerous to maneuver. Not only was there the fear of losing someone overboard, but should any part of the towline be washed overboard, it could easily be tangled in the propeller and render the boat inoperable. After a nail-biting hour and several close calls, they were ready on deck.

Everything that was not lashed down went flying across the boat. Even some things that were secured broke loose. People and objects went flying everywhere.

Hooking up the Tow

Finally, we were ready for our first approach. With the poor visibility and both vessels bouncing around uncontrollably, it was extremely difficult to gauge the relative motion of the vessels. As we neared the *Miss Judith*, the gunnersmate fired the line-throwing gun. Despite the normal loud explosion of the gun, no

one heard the gunfire in the howling wind. It didn't look good; our first approach was too far away. As much as I wanted to try to salvage it, we were forced to abort and make another approach. All hands braced themselves as we piped over the intercom, "Stand by for heavy rolls while *Bainbridge Island* comes about!"

To reach Miss Judith *with a heaving line in 25-knot winds, we would have to get uncomfortably close ... We adjusted the chafing gear and hoped for the best. Hoping was not enough, for less than an hour later the towing bridle parted.*

The second approach was better. About 30 feet away from the vessel, the gunnersmate fired his second shot from the line-throwing gun. Again, we looked for the messenger line. Our crew on deck looked as did the crew of *Miss Judith*. We all looked for the messenger line, but it could not be found. It would take five minutes to reload the gun, five minutes we did not have. We would have to use heaving lines.

Both vessels were now virtually dead in the water and beam to the seas. The boatswain's mate and I were on the flying bridge, bracing ourselves as much as possible, but still sliding across the deck. Another approach might not be possible. To reach *Miss Judith* with a heaving line in 25-knot winds, we would have to get uncomfortably close. Trying to time the waves, we waited until the right moment and backed down hard. As the next swell lifted the boats, we were close enough to virtually hand the heaving line over to the *Miss Judith*. The instant the heaving line made it over, the boatswain's mate jammed the throttles forward and we pulled away not a moment too soon.

On deck our crew feverishly fed out the towline. With the tow established, chafing gear in place, we turned north to begin our homeward trek. The crews of both boats were mentally and physically exhausted. Even though we were turning for 7 knots, against the headwind and with the tow we were only making 1 knot over ground. Still 50 nautical miles from Montauk, we were looking at a two-day transit home at that rate. Thankfully, there was only one task at hand now, and that was to watch over the towline. Both vessels set up a tow watch, and we had *Miss Judith* check its chafing gear and contact us on the radio every 30 minutes.

A Turn for the Worst

We continued to plod north. At 4:00 a.m. the watches changed on both boats. The new report from *Miss Judith* was that the chafing gear slipped off and the towline was chafed a third of the way through. We adjusted the chafing gear and hoped for the best. Hoping was not enough, for less than an hour later the towing bridle parted. Still frigid cold out, it took several minutes for our crew to get dressed out in their proper safety equipment. Crewmen soon arrived on deck and start retrieving the 600 feet of towline. They worked fervently as again the towline risked getting fouled in our propellers. Solely by sheer determination was the cold, wet and heavy towline recovered without incident.

The fishing vessel *Miss Judith* in tow.

Tired and frustrated, and still 25 nautical miles from land, we wondered if we would be able to establish the tow again without a bridle. The first lieutenant came up with an innovative idea, but, first, he proposed we wait until sunrise and get some rest. Looking around at the crew, I knew we had no choice but to wait.

Quickly shifting gears from SAR to law enforcement, we devised a plan to send over a boarding team without raising the suspicion of the crew.

No one could sleep, but the extra hour of rest and daylight paid great dividends. The weather had subsided, and after minimal setup we made our approach to set up the tow. Compared to the conditions the night before, the 15-knot winds and eight-foot seas seemed calm. Using a makeshift single-leg bridle, we quickly resumed the tow and our course north. In that short hour we drifted, we were set south 1 nautical mile. It seemed like our journey continued to be uphill.

Another Development

The next several hours were quiet. The storm had passed completely now, and we could slowly pick up speed as the seas subsided. With the exception of checking the chafing gear extensively, things were looking up. It was at this time we realized there was another complication. One of the crewmembers onboard *Miss Judith* was suspected of fishing illegally. Before releasing the tow, we would have to investigate this information.

Quickly shifting gears from SAR to law enforcement, we devised a plan to send over a boarding team without raising the suspicion of the crew. As we approached the calm waters off of Block Island, we dropped the tow and immediately sent over a boarding team to conduct a post-SAR boarding. The boarding team consisted of our law enforcement and fisheries experts. While reviewing the catch and fishing gear, our boarding team identified several violations. They also identified a crewmember wanted by local authorities. The boarding team remained onboard when *Miss Judith* was towed into Newport, R.I., by another fishing vessel, and turned over their information to Rhode Island police and the Department of Environmental Protection waiting on the pier.

Conclusion

While the boarding team briefed local authorities about the case, the remaining crew anchored the boat in Newport Harbor. Finally, around 1:30 a.m. on December 9, we recovered the boarding team and after almost a 48-hour ordeal were able to rest for the night. Although some of us had seen rough seas and tough rescues before, this was the first major SAR case for most of the crew. Through teamwork and training they were not only true sailors, they earned the right to be called heroes.

The crew of the U.S. Coast Guard Cutter *Bainbridge Island*, the on-call search and rescue vessel the night that the *Miss Judith* became disabled during the onset of a heavy snow storm. The Coast Guardsmen of the *Bainbridge Island* spent 48 hours pulling the fishing boat into port, while at the same time, they discovered several violations and a wanted fisherman aboard the *Miss Judith*.

Two Countries, Two Boat Forces, One Common Cause

Who leads the pack?

By Capt. Dean Lee
Chief, U.S. Coast Guard Office of Boat Forces

With Contributions by
Andy Whyte, Royal National Lifeboat Institution,
and
BMC Joseph Mains, U.S. Coast Guard Exchange Liaison to RNLI

The U.S. Coast Guard has long touted itself as being the world's premier search and rescue organization, and I have myself frequently declared that seemingly indisputable fact throughout my career. But do we truly lead the pack?

While most hard-core Coasties would insist that this truth is self-evident, I would argue that we should be more circumspect in our self-assessment. In short, we stand to learn a lot from taking a hard look outside of our proverbial "American" box at how our international counterparts are doing business. As difficult as it is to accept, we are not necessarily always as good as we think we are. In fact, our own pride could be our worst enemy.

As the business manager for the Coast Guard boat fleet, which now constitutes more than 1,800 boats of 35 different varieties, it is my job to question these matters—to look beyond our borders to see what we can learn from others with similar forces and comparable missions—and to influence change if need be. We are indisputably the world's largest public safety and security boat force, but that fact, in and of itself, does not make us anything other than the biggest. The "best" is measured by a different yardstick. To get a better perspective on who does what more efficiently, and/or more effectively, I've examined how our British brethren tackle the business of maritime search and rescue (SAR).

The purpose of this article is to compare and contrast certain aspects of two boat fleets, both dedicated to the saving of lives at sea, both deeply rooted in maritime history, and both hell-bent on being the best in the world. To that end, I'll highlight several of the best practices in the United Kingdom and Republic of Ireland—practices that I believe would serve the U.S. Coast Guard well to adopt.

First, who are these people?
The Royal National Lifeboat Institution (RNLI) has provided search and rescue services for the United Kingdom and Republic of Ireland since 1824 and is

There is no maritime endeavor that is more noble, nor more satisfying, than saving those in peril.

recognized as one of the most efficient maritime emergency response services in the world. RNLI is the functional equivalent of a huge Coast Guard district comprised of 233 lifeboat stations and 57 beach lifeguard units situated at strategic locations all along the British and Irish coastline, enabling them to respond immediately to distressed mariners up to 100 miles from shore. RNLI's strategic performance standard is to reach at least 90 percent of all casualties within 10 nautical miles of lifeboat stations within 30 minutes in all weathers, in seas often exceeding those handled by our own 47-foot motor lifeboats. However, unlike our multimission stations, they focus entirely on search and rescue. SAR is their only mission, and they are passionate about it.

Contrasting the U.S. Coast Guard, RNLI stations are manned by volunteer crews, and every penny required to maintain and operate the lifeboat service is raised from voluntary contributions. The RNLI is proud of its independent status as a charity but works closely with the Maritime and Coast Guard Agency, with responsibilities analogous to our SAR coordinator and SAR mission coordinator duties, and other organizations to provide a coordinated sea rescue response.

The RNLI operates a litany of sophisticated vessels ranging from 16- to 55-feet long. The larger all-weather lifeboats are self-righting and are all fully equipped with modern navigation, location, and communications equipment. On average, these boats, and the more than 4,600 volunteers who operate them, launch more than 6,700 times (8,109 times in 2003), and save approximately 6,000 lives every year (7,987 in 2003: 21 a day). Since it was founded in 1824, the RNLI has saved more than 136,600 people. Remarkable.

How do we compare?
No other SAR organizations in the world are closer matched in size, complexity, and purpose than the U.S. Coast Guard and the RNLI. We are sister organizations who have much to offer one another in terms of best practices, shared lessons, and technology. Although our mission portfolio is radically different, let us compare and contrast the similarities of our two organizations from a surface capabilities and SAR response perspective.

- Each operates and maintains a large fleet of small boats ranging in size from 16 to 55 feet.

- The Coast Guard has 188 small boat stations. RNLI has 233 lifeboat stations. Our typical station has a crew of 21; theirs has a crew of 30.

- Our stations are manned seven days a week, 24 hours a day (24 x 7) with a (B-0) ready crew, and are required to be underway within 30 minutes of notification. By contrast, RNLI lifeboat stations are <u>not</u> manned 24 x 7. However, they always have a ready crew on call, and their underway response time averages 14 minutes from notification.

- While we are funded by the taxpayer, the RNLI is a volunteer-based, self-funded charity organization run entirely through donations, legacies, fundraising and sales.

- Each goes out in extraordinarily dangerous conditions, including breaking surf.

How do we interact?
To capitalize on our similarities and learn from one another, the Coast Guard Office of Boat Forces and RNLI initiated an exchange program in 2002. We send hand-picked operators, one each, from our respective organizations to do a two-year exchange tour at our individual training centers, i.e., Yorktown, Va., and Poole, United Kingdom. We just concluded the first successful exchange whereby two experienced operators from both organizations swapped billets. Here is what they reported back:

Regarding the Coxswain and Crew Qualification Process
The Coast Guard Personnel Qualifications System

The 38-foot Mersey class RNLI carriage-launched lifeboat. This vessel is one of five current classes of all weather lifeboats, ranging from 38- to 55-feet.

(PQS) is surprisingly similar to the more recently introduced RNLI Competence Based Training (CoBT) system. Both organizations have their crew working toward assessed levels of competency. Unlike the full-time professional stance of the Coast Guard, the RNLI crewmember will conduct training once or twice a month at their station and also attend residential courses or utilize distance-learning methods.

Regarding the Experience Level of Coxswains

An RNLI crewmember volunteers for his local home station and can expect to operate in the same area of operation, on the same lifeboat/s, and with the same crew for his/her entire RNLI career. Many crews can follow their family history through the local station. The local knowledge of coxswains is extremely high, and in many cases it can take more than 10 years for a crewmember to attain the RNLI 'Coxswain' qualification standard. The Coast Guard is a full-time professional service and can train personnel to reach high levels of competence and boat qualification in considerably less time. Moving personnel every few years has a negative impact on local knowledge of the area of responsibility.

The 53-foot RNLI 'fast' lifeboat. RNLI's all weather lifeboat fleet currently is comprised of five classes of boats, with this vessel to be introduced shortly as the sixth.

Regarding Response Boats

The RNLI operates eight different classes of "lifeboat." Three of these boat classes are called inshore lifeboats (ILBs) and range in size from an inflatable 16-foot, 20-knot craft to a 29-foot, 40-knot water jet lifeboat. The all weather lifeboat's (ALB's) fleet is made up of five classes ranging from 38 to 55 feet, with a sixth class of boat shortly being introduced at 53-feet long. Recent RNLI initiatives have introduced light hovercraft for shoreline and estuary rescue and small versatile surf rescue boats and rescue water craft (RWC) for operation by the RNLI beach lifeguards. Rapid Response Units, made up from crewmembers, can be called at short notice to provide domestic and international flood relief work using dedicated inflatables and equipment. All RNLI boats are "standard" and maintain a common equipment outfit relevant to their class. This eases operations, training and maintenance issues across the organization.

With the introduction of standard small boats (RBS and RBHS) to replace the nearly 300 different types of nonstandard craft within the Coast Guard, the commonality of this large fleet of resources will begin to match the well-established standard of the 47-foot motor lifeboat (MLB) and the 41-foot utility boat (UTB) fleet. With a moving force of personnel, the need to standardize boats makes operations, training and inspection an easier task to manage.

Regarding Research and Development

Similar concepts of managing research and development are adopted within both the Coast Guard and RNLI. Each organization has dedicated staff to research and build programs and manage the development of equipment. Within the RNLI, all lifeboats are designed "in house" based on need of operation and purpose. ILBs are built at the RNLI Inshore Lifeboat Centre in Cowes, Isle of Wight. The larger ALBs are tendered to commercial boat building yards around the UK and Ireland, with rigid

RNLI inspection regimes to ensure high standards are maintained.

Regarding Personal Safety Equipment (PPE)
The Coast Guard has some of the best PPE in the world. The range and scope of this material ensure personnel have the best levels of protective clothing and equipment available in the event of immersion or exposure. RNLI crews have two dedicated sets of protective equipment for use on either the ALB or ILB. ILB crews are required to wear a dry suit and helmet at all times, while ALB crews are provided with a water resistant jacket and trouser combination with helmet required for certain operations. All crews are required to wear reflective lifejackets(LJs). ILB wear a personal flotation device (PFD) with a manual LJ built in; ALB crews wear an automatic and manual inflation combination lifejacket.

Regarding Risk Assessment
There are no formal risk assessment procedures for underway operations in the RNLI. Standard Operating Procedures (SOPs) are provided to ensure common drills and functions are conducted in a safe manner. Both the U.S. and the Canadian Coast Guards have processes in place to calculate risk both prior to launch and during a rescue mission, and some of these tools are currently being examined by the RNLI.

Regarding Kill Switches
Kill switches are not fitted to RNLI lifeboats due to the operational need for the helm to move as required by the nature of the service. A "man overboard" cord is used on the upper steering position of ALBs in rough weather, to activate an alarm to the crew in the event that a man overboard occurs.

Maintenance Philosophies
Similar maintenance procedures are adopted by both organizations. RNLI-planned maintenance is fully recorded using documentation and computerized record systems. All lifeboats are refitted at regular intervals (ALBs at five years/ILBs at one to four years depending on class). While Coast Guard platforms are maintained to a high operational standard, additional cosmetic considerations are required on RNLI boats due to the high level of public interest and ownership associated with these platforms.

Regarding Training and Professional Development
In recent years the RNLI has introduced a Competence Based Training (CoBT) system, which is surprisingly similar to the Coast Guard PQS.

The U.S. Coast Guard 47-foot motor lifeboat. Standardizing crafts within the Coast Guard will begin to match the well-established standard of the this vessel.

Each crew is issued and maintains a crew task book, which indicates the skills and training required to maintain competency. To maintain a strict standard of assessment, staff from outside the station are employed to conduct skill evaluations. Crew training is provided by a series of residential one-week courses, mobile training personnel, interactive CD programs and traditional reference and on-site station training.

Regarding Operations
Unlike the Coast Guard, the RNLI all-weather lifeboats (ALBs) are, as their name suggests, not given sea height or wind limitations for operation. It remains the call of the coxswain to determine the risk levels for each call. All ALBs are designed to

The E Class RLNI inshore lifeboat. All RLNI lifeboats are built in-house, at the RNLI Inshore Lifeboat Centre in Cowes, Isle of Wight.

self right after capsizing. However, ILBs do have limitations. The 16-foot D class lifeboat is restricted to Beaufort Force 5 conditions and the 21–24-foot B class lifeboats have an upper limitation associated with Beaufort Force 7 conditions. Both boats are capable of operating beyond these conditions if justifiable at Helmsman's (Coxswain name on ILB's) discretion. Shore-based Lifeboat Operations Managers (LOM), who manage the lifeboat station locally and receive the "request launch" call from the Coast Guard, have the authority to decline a call, based on the weather conditions, boat limitation or nature of the call.

Who does what better?

Training

When it comes to training, the Brits win. They painstakingly prepare their volunteers for the selfless and often dangerous service they provide. This fact rang loud and clear on July 28, 2004, when I had the distinct privilege of witnessing Her Majesty Queen Elizabeth II officially open The Lifeboat College in Poole, the latest of the RNLI's proud accomplishments. The Lifeboat College is a state-of-the-art training facility that brings together the complete range of RNLI training under one roof for the very first time. It is replete with wave generators, survival tanks, bridge simulators, and every kind of navigation and propulsion training aid imaginable. The primary goal is to prepare their operators to successfully complete their mission, to do it with as much realism as practicable, and to render them capable of surviving when things go wrong.

RNLI knows that it is inevitable that a boat will capsize from time to time. On average, they have experienced at least one capsizing per year on the ILB. When boats capsize, RNLI also realizes it is generally in severe conditions. To prepare their crews to properly egress the overturned vessel following such an event, they practice it. This is where we differ markedly in our training approaches. In short, we talk about it … they do it. How? They actually tether a boat in the center of a survival tank, fire up the engines, turn on one of four wave patterns, and intentionally capsize it with a full crew in it. The entire evolution is filmed and later critiqued by instructors who rate them on their adherence to egress procedures, and their subsequent ability to re-right the boat thereafter.

What do we stand to learn from this? Everything. Sooner or later we will capsize an RB-S or RB-HS. When it happens, I fear that a crewmember or an entire crew may drown in the ensuing panic as they attempt an unpracticed, uncoordinated escape from inside the enclosed cabin. The open cockpit of the old non-standard Coast Guard boat fleet is, slowly but assuredly, being replaced by the faster, more capable Defender Class boats. These are boats that are proving to be outstanding platforms offering substantially better crew comfort and protection from the elements. However, the very same cabin that offers protection from the elements could also become a death trap when inverted. I believe, as the Brits do, that we owe it to our crews to prepare them for this eventuality.

Surf training

The Coast Guard clearly takes the lead in large boat surf training at the National Motor Lifeboat School (NMLBS)–hands down. RNLI leads the way in small boat surf training based on the well-established ILB courses and the recently introduced Beach Lifeguard boat training. The Coast Guard prohibits small boats other than self-righting motor lifeboats from operating in the surf; hence there are no plans to mimic the ILB courses run by RNLI. The Coast Guard plans to place the next RNLI exchange member at the National Motor Lifeboat School.

Conclusion

The relationship between the Coast Guard and the RNLI is an old one. In the early years of the U.S. Life Saving Service, the RNLI graciously sent the *Original*: a wooden oar-powered boat to the United States. From this, many others were modeled. More recently, in the 1960s, the Coast Guard gave the RNLI a 44-foot MLB, from which the RNLI built more than 20 "Waveney" class lifeboats, which are now hard at work in other lifesaving services around the world.

Though SAR, the traditional lead mission of the Coast Guard, is now shared with homeland security, the link between these two world-standard lifesaving organizations has never been stronger. There are considerable opportunities to further exchange ideas, equipment and training between the RNLI and Coast Guard. With the recent opening of the new Lifeboat College and the establishment of a dedicated Boat Forces Center at Yorktown, information exchange and best practice training can be passed between these two centers of excellence.

So, who is the best? It doesn't matter. What matters is that we are working together, exchanging ideas, and trying to improve how we operate. After all, there is no competition in saving lives at sea.

More information about the RNLI can be found at ***www.rnli.org.uk.***

Storm Warriors in the 21st Century

By Chief Warrant Officer KENNETH D. STUBER
Commanding Officer, U.S. Coast Guard National Motor Lifeboat School

"The Blue Book says we've got to go out, but it doesn't say a damn thing about having to come back!"

-Keeper Richard Etheridge, a surfman of the USLSS

During the last quarter of the 19th century, Sumner Kimball, Superintendent of the U.S. Life-Saving Service (USLSS), went to great lengths to standardize the operations of lifesaving stations. In Article VI *Action at Wrecks*, of Regulations of the Life-Saving Service of 1899, he wrote:

> "In attempting a rescue the keeper will select either the boat, breeches buoy, or life car, as in his judgment is best suited to effectively cope with the existing conditions. If the device first selected fails after such trial as satisfies him that no further attempt with it is feasible, he will resort to one of the others, and if that fails, then to the remaining one, and he will not desist from his efforts until by actual trial the impossibility of effecting a rescue is demonstrated. The statement of the keeper that he did not try to use the boat because the sea or surf was too heavy will not be accepted unless attempts to launch it were actually made and failed, or unless the conformation of the coast—as bluffs, precipitous banks, etc.—is such as to unquestionably preclude the use of a boat."

The surfmen of the USLSS such as Joshua James, Rasmus Midgett and Richard Etheridge were renown for their self-less dedication to duty. Great eulogies accompanied accounts of their heroics. Praised as "Storm Warriors" and "Soldiers of the Surf," their rescues were recounted in newspapers and national periodicals. As an ethos of heroism grew, the following story circulated—a lifesaving crewman reported that a ship had stranded on Diamond Shoals off Cape Hatteras during a heavy

Sumner Kimball, Superintendent of the U.S. Life-Saving Service (USLSS), went to great lengths to standardize the operations of lifesaving stations.

storm. When Keeper Etheridge gave the order to launch the lifeboat, one of the men shouted out "we might make it out to the wreck but we would never make it back." Etheridge looked around and exclaimed, "The Blue Book says we've got to go out, but it doesn't say a damn thing about having to come back!" Such was the genesis of the Surfman's Motto.

The USLSS merged with the Revenue Cutter Service by executive order in 1915 creating the U.S. Coast Guard, whose members continued this legacy of self-less devotion to duty using much the same equipment as they had in the Life-Saving Service. They witnessed the advance of technology from oar-driven surfboats, to sail, gasoline and finally diesel engine lifeboats. Throughout the years, the 36-foot motor lifeboat (MLB) became the trusted mainstay of coastal search and rescue. Surfmen often spent their entire career at stations in one district, and amassed thousands of hours on the 36-footer. The local knowledge and boat lore they shared with their crews was passed down much as it had been during the glory days of the USLSS. Advances in boat building technology following World War II finally made the aging 36-footer obsolete. Need for a bigger, faster and more capable lifeboat resulted in the twin-engine, self-righting, self-bailing 44-foot MLB, designed and built at the Coast Guard Yard at Curtis Bay, Md. One hundred and five 44-footers were delivered to stations during the 1960s.

A 44-foot motor lifeboat in moderate surf.

During this time period, enlisted personnel transfer policy changes created a drain on sub-specialties, as ratings management was moved from the individual districts to centralized assignments in Washington, D.C. Conflicting programs diverted attention away from the small, elite surfman community–and boatswain's mates (including surfmen) were counseled to become well-rounded in all missions by serving on white hull cutters, buoy tenders and at other diverse Coast Guard units.

These seemingly unrelated events–the replacement of the 36-footer after more than a half-century of service and the routine transfer of crewmembers away from lifeboat—duty had a significant detrimental impact. Surfmen in the Pacific Northwest felt the brunt of this impact, while continuing to stand watch over some of the most hazardous waterways in the world. Knowledge of their entrance bars slowly evaporated as experienced personnel were transferred, and specific knowledge of boat performance was limited with the new 44-footer.

To stanch this loss of knowledge and experience, surfmen began meeting at Station Cape Disappointment in 1968 to share their hard-earned knowledge of operating the 44-footer in the surf. Clatsop Spit provided an ideal training ground. Well formed wave-trains march across the bar at routine intervals as swells generated far across the Pacific Ocean meet the fast ebb current of the mighty Columbia River. It wasn't long before the Thirteenth Coast Guard District recognized the value of these meetings and sowed the seeds for formal heavy weather boat training. Personnel from Quillayute River on Washington State's Olympic Peninsula to as far south as Fort Point at the Golden Gate of San Francisco Bay received hands-on instruction at the Thirteenth Coast Guard District Small Boat Training School Cape Disappointment in Washington, learning basic boat crew, engineer, coxswain and surfman duties. In 1980 the school became a service-wide training site and was renamed the National Motor Lifeboat School (NMLBS). Coxswains from lifeboat stations across the nation came to hone their skills in heavy weath-

Wreckage of MLB 44363 in James Island Cove near the mouth of Quillayute River in February 1997.

er and surf. But even with the formal training delivered at Cape Disappointment, the lion's share of surfman training, like the training for all other boat crew positions, was shouldered by the individual stations.

Early on a stormy morning in February 1997, four crewmembers set out from Station Quillayute River on a rescue mission. Three made the ultimate sacrifice when the coxswain became disoriented in the surf on the entrance bar and their lifeboat capsized several times before coming to rest on the rocky shore. Following a formal investigation of the disaster, the Coast Guard sought solutions to its chronic shortage of surfmen. An extraordinarily long qualification process, rapid advancements and short tours of duty often left up to 40 percent of a unit's surfman billets vacant. Transitioning to the new 47-foot MLB, compounded by the post-September 11 personnel growth rate, served only to exacerbate the shortage. Surfman incentives created with changes to assignment policy and special duty assignment pay resulted in a net gain of only one surfman per year from 1999 to 2002. Although the incentives were successful in attracting coxswains to the program, the problem remained that they were often unable to complete the training syllabus before advancing out of billet. Obviously, a change was in order. Up to this point, the curriculum at the NMLBS had focused on providing only exposure to operating lifeboats in extreme conditions as opposed to training to the qualification standard. At two weeks in length, the class was too short to take the students through all the tasks required for upgrading their certification to surfman.

To better meet service needs for surfmen, the NMLBS prototyped a new curriculum in November 2003 to prepare coxswains for certification as surfmen. Of the nine students that participated in the four-week class, six completed all tasks required for surfman qualification. During nearly 140 hours in the surf, they perfected boat handling and rescue techniques including a water survival exercise, risk

A 47-foot motor lifeboat in heavy surf.

assessment and management, transiting surf zones, station keeping, towing, and recovering a lifelike dummy in eight-10-foot surf. Incorporating the use of advanced technology, pocket video cameras were installed on the mast platform above and aft of the starboard steering station on each boat. The cameras provided an outstanding visual training aid—recording throttle management, helm control and the boat's interaction with the surf. Instructors employed the footage to effectively critique student performance. An unanticipated additional value of the video was its use to advertise and promote surfman training on the Internet. Showcasing the class sparked great interest in the surfman program.

Beginning in fiscal year 2005, the NMLBS will conduct two surfman classes per year to standardize training for the service's elite boat operators. This will relieve the 20 designated surf stations (the coastal stations from Quillayute River, Wash. to Morro Bay, Calif.; Merrimac River and Chatham, Mass.; Barnegat Light, N.J.; and Oregon Inlet and Hatteras Inlet, N.C.) of initial qualifications responsibility. Those stations can then focus their energy on operational missions rather than training, in effect a return to the original intent of the USLSS.

I believe that Sumner Kimball would approve.

Benchmarking the Coast Guard's Search and Rescue System Against the World's Best

By Capt. Dee Norton
Chief, U.S. Coast Guard Enlisted Personnel Management Division

On Jan. 25, 1999, the former Commandant of the U.S. Coast Guard, Adm. James M. Loy, made strong statements in the Final Action on the sailing vessel (S/V) *Morning Dew* Search and Rescue (SAR) Case Study[1]. These statements served as a guiding precept to the Foreign Rescue Coordination Center (RCC) Benchmarking Study undertaken later by the U.S. Coast Guard. Adm. Loy said:

> Among the most critical, yet extremely challenging, missions of the Coast Guard is the saving of life and property at sea. Search and Rescue is a hallowed tradition and a cornerstone mission of the Coast Guard's service to the American public and mariners everywhere. Every Coast Guard man and woman takes great pride in our reputation as 'The Lifesavers.' We must continue in our pursuit of excellence.

As stated above, search and rescue is one of the Coast Guard's core missions. The Coast Guard is renowned throughout the world as "America's Lifesavers," with a reputation for personal courage and selflessness that goes back to the earliest days of the Revenue Cutter Service. Minimizing injury, loss of life and property damage, by rendering aid to persons in distress in the maritime environment, has always been the Coast Guard's top priority.

These reports and others led the Office of Search and Rescue at Coast Guard Headquarters to head a coordinated effort to improve the Coast Guard SAR system. A benchmarking study of foreign RCCs was conducted with the goal of improving U.S. SAR controllers' SAR planning, watchstanding and competence by learning how other worldwide leaders accomplish the same in their SAR programs.

Benchmarking is a continuous, systematic process for measuring and comparing the processes of one organization to another, for the purpose of identifying best practices[2]. This study used what is known as a *cooperative approach*, targeting specific practices and comparing how they are done in other countries.

Benchmarking is a qualitative methodology, meaning the study team went to the locations of the workers (foreign RCCs) and gathered descriptive

information and statistical data. The descriptions and metrics given by the foreign RCCs were then compared with our own descriptions of similar policies and practices. Areas of best practice were noted, and the single best method in a given area was determined to be the benchmark.

Before the benchmarking study could begin, a team comprised of members with various backgrounds and skill sets was assembled. Representatives from the Coat Guard Office of Search and Rescue, the National Search and Rescue School, the Atlantic Area/Fifth District Command Center and a performance technology professional from the Office of Workforce Performance, Training and Development conducted the study.

The study team visited five foreign RCCs, as well as their training centers. The five countries visited were: Canada, China (Hong Kong), the Netherlands, Sweden and the United Kingdom. Study team members also interviewed a member from the Australian Maritime Safety Authority while he was visiting the United States.

Before the actual benchmarking study began, the team developed key components for assessment and comparison. The following areas of concentration among foreign RCCs that have well-developed SAR training programs were examined by the study team:

- watchstanding selection and retention;
- SAR training and training tools used;
- qualification and recertification programs;
- assigned tasks; and
- workload expectations.

Before embarking on the benchmarking study, the team identified gaps in the U.S. Coast Guard SAR Operations Centers. These included:

- personnel shortfalls;
- degradation of SAR controllers' perishable skills;
- excessive workload; and
- lack of a robust, recurrent SAR training program.

The study team adapted R. Camp's[3] benchmarking technique for the study. The study team used surveys, in-person observations and in-person interviews. Prior to visiting each of the targeted RCCs, pre-visit surveys were sent out to each country seeking preliminary data for the study team, which allowed for maximum personal contact time during the site visits and helped focus on follow-on questions.

A standard set of 67 questions was posed to the experts, both operators and managers, in each country. During the visits, observations, interviews and additional handout materials contributed to fully answering the questions.

The Foreign RCC Study Team determined three areas of best practice common to the foreign RCCs studied: RCC staffing, SAR training and remaining SAR-focused.

RCC Staffing

All studies previously undertaken on SAR for the Coast Guard emphatically state that more staff members are needed to reduce controller fatigue and increase performance of the Coast Guard SAR mission. All Coast Guard Operations Centers/RCCs are staffed 24 hours a day/seven days a week.

The recommendation was made to increase staffing standards. As a matter of priority for the Coast Guard, the recommendation was to staff all RCCs at the "7 + 1" level[4]. This is seven watchstanders with one supervisor for each position.

The Rescue Coordination Center (RCC) in Falmouth, United Kingdom. All of the foreign RCCs that assisted with the Foreign RCC Study have an appropriate amount of staff (at least five watchstanders and one supervisor) assigned to perform the job of search and rescue.

Country	*Staffing Standard (No. of Watchstanders + No. of Supervisors)*
USA	**5 + 1**
Australia	**7 + 1**
Canada	**5 + 1**
Hong Kong	**5 + 1**
Netherlands	**7 + 1**
Sweden	**7 + 1**
United Kingdom	**7 + 1**

Table 1. The six foreign RCC countries studied, and the United States, with their corresponding staffing standards.

The Coast Guard had routinely staffed RCCs at "4 + 1"—or four watchstanders with one supervisor—which did not allow for the 12-hour watches recommended by Congress[5]. A level of "5 + 1"—or five watchstanders with one supervisor—is the minimum required to stand 12-hour watches. The Coast Guard's 2002 budget request was approved to fund all RCCs to the 5 + 1 staffing standard by 2004. SAR School billets and training funding were also added.

By contrast, all of the foreign RCCs that assisted with this Foreign RCC Study have an appropriate amount of staff (at least 5 + 1) assigned to do the job, which allows for vacations, sick days, resident training, on-the-job (OTJ) training and SAR-related administrative duties.

The foreign staffs are mostly civilian, and most are compensated with overtime pay for extra hours worked, including surge operations. Once trained, these people typically remain in their RCC for 10 or more years.

By contrast, all SAR personnel at the time of the study were active duty military and assigned to the RCC for three to four years. Some downsides to this paradigm include that the United States has less continuity in Coast Guard SAR expertise, which has proven to be a difficulty with the constantly changing and complicated SAR planning software. Three-year assignments allow for only a short cycle of initial training to a newly qualified controller from a seasoned controller preparing to depart the assignment. Also, military personnel are not paid overtime for surge operations and can be put on more arduous schedules that may lead to costly mishaps. Based upon a recommendation made by the study team, all Coast Guard RCCs now have one civilian SAR professional on staff.

SAR Training

The Coast Guard SAR training, both formal and on-the-job, has a shorter duration than any of the countries studied. In addition, our learning on-the-job time is shorter than five out of the six countries studied.

To become a SAR controller, the candidate must be a graduate of the three-week Maritime SAR Planner Course at Training Center Yorktown. Once at the RCC, candidates have about six weeks of on-the-job-training, culminating in a written test and oral board to assess their knowledge and ability to successfully plan and coordinate SAR cases.

By contrast, most of the countries studied spend much more time training their SAR controllers, both with resident and on-the-job training.

Of the countries studied, only the United Kingdom's formal SAR school has a shorter duration than that of the U.S. Coast Guard. However, nearly all of their controllers have 10 to 12 years prior experience in the merchant marine. What is much more important than length of the course, however, is the course content and training methodology. The curricula of the various SAR schools visited and studied are remarkably similar to each other and to what is taught in the United States. However, the advent of new communications systems and revised SAR planning software, with the attendant skills/knowledge requirements these systems place on controllers, will probably be cause for increased formal training needs for Coast Guard SAR controllers. (The curriculum is currently under review.)

With the exception of Hong Kong, all of the countries studied have much more extensive on-the-job training programs than the United States. Sweden's is the longest at 18 months, and Canada's runs six to seven months. The United States transfers one-quarter to one-half of its qualified controllers each year, nearly all departing during the busy summer SAR season. Controllers-in-training get ample experience during the fast pace of the peak SAR season; however, transfer season puts the most strain on qualified controllers now in tighter watch rotations to proficiently handle cases, while spending extra time to supervise controllers in training.

The Coast Guard must also contend with higher training throughput needs than any country studied. Our steady-state requirements have been approximately 170 students per year with 10 to 11 courses convening per year. That number does not include the 58 international students and 25 U.S. Department of Defense students trained at the National SAR School annually. After the United States, the United Kingdom's and Canada's throughput requirements are the next most strenuous of the countries we studied, with approximately three courses convening per year with six to 16 students in each class.

Remaining SAR-Focused

While some RCCs have increased the number of controllers available on watch at any given time, most have not. As a result, those RCCs that traditionally performed mainly SAR functions also have the added responsibilities of coordinating law enforcement, maritime safety, homeland security and intelligence-derived missions. This added emphasis on other mission expertise is causing the SAR proficiency of many Coast Guard controllers to atrophy and may cause the watch to grow complacent about their SAR responsibilities.

The study team recommended a renewed emphasis on SAR missions Coast Guard-wide and stressed that SAR controllers should not be over-burdened with non-SAR and administrative tasks that reduce their vigilance to the SAR mission.

Country	*Length of SAR School*	*Length of On-the-Job Period*
USA	**3 weeks**	**6 weeks**
Australia	**2 months**	**2–3 months**
Canada	**1 month**	**6–7 months**
Hong Kong	**N/A[6]**	**2–3 weeks**
Netherlands	**3.5 months theory[7]**	**3.5 months**
Sweden	**3.5 months theory[8]**	**18 months**
United Kingdom	**10 days**	**Varies: 3 months–1 year[9]**

Table 2. The six foreign RCC countries studied, and the United States, with their corresponding lengths of SAR school and on-the-job training periods.

In contrast to the United States, the foreign RCCs visited during this Foreign RCC Study focus on one mission: SAR. This concentrated focus enables them to master the application and theory of SAR planning and operations.

Coast Guard SAR cannot be allowed to remain in a state of adequacy when excellence is needed. If SAR staffing, training and support are permitted to languish, the Coast Guard can expect to see a continuing decline in performance of SAR controllers. The U.S. Coast Guard cannot be the world's premier maritime service without proficient SAR professionals.

[1] Appendices 1A and 1B contain the Final Action on the Sailing Vessel *Morning Dew* SAR Case Study and a summary of actions completed to address U.S. Coast Guard shortcomings identified therein.
[2] Shafer & Coate, 1992.
[3] Camp, R. 1989, *Benchmarking, The Search for Industry Best Practices that Lead to Superior Performance*.
[4] The study team asked each country studied about its staffing standards in terms of the number of personnel assigned to rotate through each watch position. The term "7+1" indicates a supervisor available to assist the watch during surge operations.
[5] 14 USC 405, Section 676 *Search and Rescue Center Standards*.
[6] Hong Kong does not have its own SAR school, but personnel attend schools in other nations.
[7] The Netherlands does not have its own SAR school, but the Netherlands controllers who are graduates of the United States' and Canada's SAR schools train others during their 3.5 months of "SAR Theory."
[8] Sweden has a SAR school for search and rescue units only. The situation for their controllers is the same as for the Netherlands (see previos endnote).
[9] Most of the UK SAR Coordinators have 10 to 20 years of merchant mariner experience.

Civilian Search and Rescue Controllers

Who Needs Them? We Do!

By Cmdr. Steven Stilleke
U.S. Coast Guard Office of Search and Rescue, Policy Division

We have civilian controllers working in U.S. Coast Guard Search and Rescue (SAR) Command Centers? We've never done it that way before! Why now?

First, we *have* done it this way before. Currently, there are 72 GS-11 and GS-13 billets in District and Group Command Centers that are filled by dedicated, professional and hard-working civilian controllers. As for why we have civilians in Command Centers, they provide professionalism, experience and continuity. Civilian controllers, many being retired from active duty, bring not only a wealth of experience to the job, but they also provide continuity and a corporate memory.

Look at it this way: Traditional active duty watchstanders report to their new assignments in, say, July. They have to check in to the unit, find housing and move in. Then, it is off to search and rescue (SAR) school for three weeks after they get a quota to attend. After finishing school, they can start their local training syllabus and stand break-in watches. Then, perhaps around September to October, they are ready to stand watch on their own.

Of course, the reality is that, although they are qualified to stand the watch, they still need many more months of experience before they acquire the in-depth local knowledge of their geographic area of responsibility. Over a number of months, they will learn all the local community points of contact, regional hospitals and their capabilities, and a myriad of local details required to become truly effective. Then, of course, a few years later the active duty member is transferred, someone new arrives and the cycle repeats itself.

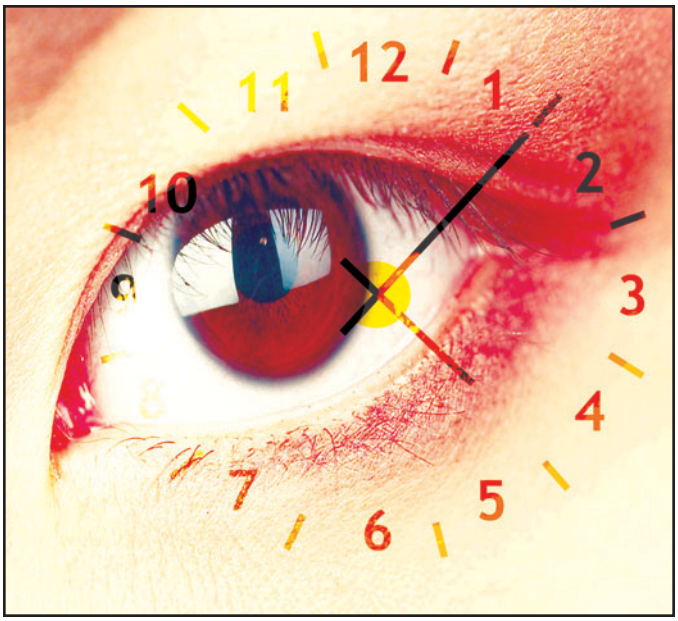
In contrast, civilian watchstanders typically remain in their jobs for many years. They become mentors, they provide an unparalleled depth and breadth of local knowledge and they provide the critical element of continuity required to maximize effectiveness in the Command Center.

Now, take those reasons and add another twist. The Maritime Transportation Security Act (MTSA) of 2002 set a new standard for Coast Guard Search and Rescue Command Center watchstanders. The Act requires that an individual watchstander "not work more than 12 hours in a 24-hour period, except in an emergency or during unforeseen circumstances."

To determine how to meet this new requirement, the Coast Guard chartered a study that examined the best practices of other country's Rescue Coordination Centers (RCCs). In July 2003 the study team issued its final report that included proposed RCC staffing standards. Historically, the Coast Guard had staffed RCCs at 4 + 1 (four watchstanders with one supervisor for each watch position). The study team's report recommended a new Coast Guard Command Center staffing standard for all positions requiring a continuous and alert watch, which was verified by a study conducted by the Coast Guard's Research and Development Center.

Still not convinced? The Coast Guard is in the process of shifting its organization to a new Sector Command model. Sector Command Centers (SCCs) will replace Group Operations Centers. SCC responsibilities will include prevention, response, communications, and sensor watch positions, with oversight for SAR, maritime domain awareness, environmental response, law enforcement and more. All Coast Guard mission areas will be coordinated and monitored from the Sector Command Center. So, to meet the mandate of the MTSA 12-hour watch and successfully shift to Sector Command Centers, we are going to need more people and positions—and civilian watchstanders are a critical part of the mix.

Of course, not all of these people will arrive at once. This implementation will be phased and dependent on many things, not the least of which is money. The first phase will be to increase staffing for controllers at existing District and Group/Sector Command Centers. You may hear this group of positions referred to as *legacy* SAR controllers because that has been their traditional function, though controllers have been multi-mission watchstanders for a generation. In subsequent years as sectors are implemented, the roles and responsibilities of Sector Command Centers will increase. This will necessitate growth in the number of watchstander positions and a further redefinition of their scope of work.



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The first of the new civilian watchstander billets will appear in 2005. The federal budget, as submitted to the President, contains a $9 million appropriation designated specifically to increase SAR watchstander positions as mandated in the MTSA legislation. Plans call for new civilian positions at various District and Group/Sector Command Centers throughout the country. Positions will range from GS-11s at current Coast Guard Groups/Sectors to GS-13s at District Command Centers. Civilian controllers should expect to work 12 hours on-watch, with some additional amount of time both before and after the watch to provide a proper watch relief. Hours will be capped at 80 hours per pay period (bi-weekly), with the exact work schedule left to the individual operational commander's discretion.

An old adage says, "If it ain't broke, don't fix it!" Civilian watchstanders have worked very well for the Coast Guard for a long time, and it is a credit to their professionalism and dedication that the Coast Guard has decided to expand that role. Working together, we can efficiently and effectively execute all Coast Guard missions and work to secure our homeland. Civilian watchstanders have been, and will continue to be, an integral key to our success.

If you are interested in learning more about civilian controller positions at U.S. Coast Guard Search and Rescue (SAR) Command Centers, please note that all Federal jobs will be posted on ***www.usajobs.opm.gov*** *as they become available.*

So That Others May Live

By Lt. Robert Bryan Hollis
U.S. Coast Guard Training Center, Yorktown

Shortly after 6:00 p.m. on Saturday, Feb. 28, 2004, U.S. Coast Guard radios crackled to life echoing a desperate message, "*Bow Mariner*…*Bow Mariner*…we are on fire…MAYDAY, MAYDAY, MAYDAY!!!" Before the rest of the frantic cry for help was transmitted, the Coast Guard search and rescue (SAR) system was already springing into action to effect a rescue that would take place approximately 50 miles offshore of Chincoteague, Va.

The Coast Guard's efforts to find and rescue the 27-man crew of the 570-foot ethanol tanker *Bow Mariner* would continue for several days and involve two Coast Guard cutters, a 47-foot motor lifeboat (MLB), four rescue helicopters and a C-130 fixed-wing aircraft. It would also employ the talents of more than 80 Coast Guard SAR professionals. The multi-day search included 30 separate search patterns covering more than 70 square nautical miles of ocean and involved more than 3,500 man-hours.

In any successful SAR operation, much of the credit goes, and rightly so, to the brave men and women commanding and crewing the Coast Guard aircraft, cutters and small boats. However, in every SAR case there are many other personnel just as important working behind the scenes. These are the people who take the initial distress call, gather the pertinent information, launch the rescue assets, direct them to the scene of the incident and coordinate their actions once they get there. This is the job of the SAR controller.

All qualified SAR controllers have one thing in common: They are graduates of the three-week long Maritime Search Planning course held at the National Search and Rescue School located at the Coast Guard Training Center (TRACEN) in Yorktown, Va. This is where they learn the skills to carry out their duties as a SAR controller. They need to be thorough, competent and knowledgeable; they need to embody the essence of attention to detail and possess excellent situational awareness.

This they must learn to do, so that others may live. This is the motto of the National SAR School and of SAR controllers everywhere: "This we do, so that others may live."

The National SAR School was established in 1966 as a joint Coast Guard/Air Force Command. This was a logical pairing as the Coast Guard is responsible for all maritime SAR in the United States and its territories, and the Air Force is responsible for all inland SAR in those same regions. The school was founded on Governor's Island in the middle of New York Harbor. Almost immediately upon opening its doors, it became recognized as a world leader in the field of search and rescue. Graduates included members of the Coast Guard, Air Force, Navy, Coast Guard Auxiliary, Civil Air Patrol, state and local government agencies with SAR responsibilities and officers from numerous foreign countries. The SAR school graduated its last class from Governor's Island in May 1989. Due to expansion and service/support requirements, it was necessary to relocate to Yorktown, Va.

Since that first class graduated in 1966, the core mission has remained the same: to train potential SAR controllers to carry out their jobs with confidence and to educate them about the different factors that will affect their search object on land or on the high seas. SAR school also stresses the point that the search object will be a person or persons in distress. The course emphasizes the fact that those people are real, that they have families and that the student's actions, decisions and judgments as a SAR controller will mean the difference between life and death for those persons in distress. The primary goal of any search and rescue mission is to save lives; this has not changed since SAR School opened and it will not change in the future.

However, there are several things that have changed in the way we train the students to carry out the mission. The courses we instruct are continually updated to keep pace with the changes in technology, improved drift models and the diverse background of the students. All of these changes have been driven by the desire of the Coast Guard, the Air Force and the National SAR School to retain our position as the premier SAR training facility in the nation and in the world. By maintaining this high standard, we ensure that the essential services of highly skilled SAR professionals will be available to the private citizens of the United States, commercial maritime and aviation industries, and all of our other Coast Guard and Air Force partners.

SAR school currently offers five courses to cover the needs of our customers. The primary course the Coast Guard teaches is the Maritime Search Planning (MSP) Course. This intense three-week course is tailored to those students who will become SAR controllers in one of the 50 Coast Guard command centers. The course familiarizes students with the capabilities of Coast Guard assets, teaches the students about drift theory, how to determine datum (the most likely location of the search object corrected for movement over time) and how to direct actions to affect the rescue. Graduating this course is the required first step a prospective SAR controller must take to complete his or her qualification process.

The primary course the Air Force teaches is the Inland Search Planning Course. This is a one-week course for personnel and representatives of state and local SAR agencies. This is a fast-paced course in how to effectively plan and conduct SAR in the inland environment. Topics include how to deal with different terrain and what to do in a myriad of scenarios ranging from lost children to downed aircraft.

The Coast Guard is also responsible for three other courses. One of these courses is the Search Coordination and Execution Course (SC&E), a one-week "exportable" course. Instructors travel to field units 20 times a year to teach this course throughout the country. This course is one of the ways Coast Guard personnel can fulfill their SAR training

requirement for qualification as a small boat coxswain or an aircraft commander. Additionally, there is a correspondence course that SAR school manages called SAR Fundamentals, which also satisfies this requirement.

Next, there is the SAR supervisor's course. This three-day refresher course is offered three times a year to senior Coast Guard members who are either assuming command of a unit or are an integral part of a unit's command cadre and will be involved in search and rescue decision making. SAR School also teaches a week-long block of instruction during the 10-week International Maritime Officers Course (IMOC), which is also located at the TRACEN.

> [1]search ob-ject \sərch ˈäb-jikt\ *n* : a person or persons in distress

One of the more beneficial changes has been the advancement in the tools available to the search planner. When SAR school first began instructing members in the art and science of search and rescue, it was quite literally a hands-on experience. Every different drift force and every mathematical equation had to be calculated and plotted by hand. When the SAR controller finally determined data (a process that could take three hours even in the hands of a skilled controller), he or she still had to plot the search pattern and pass the information to the asset(s) via radio. This was pretty much standard operation until the mid-1990s, when the Coast Guard began using computer-based search and rescue programs. The first versions of these programs were not the most user-friendly but were a vast improvement over the pen and paper method in the area of getting assets on-scene quickly and effectively.

Today, the Coast Guard teaches the JAWS (Joint Automated Worksheets) computer program to all SAR controllers and the Computer Assisted Search Planning (CASP) program to those members bound for Rescue Coordination Centers (RCCs). In the hands of a competent user, the JAWS program takes only about 15 minutes to come up with the finished search plan, which previously took hours to generate by hand. These computer-based search-planning tools continue to evolve into easier-to-use, more accurate tools with every upgrade.

Since the National Search and Rescue School was first founded in 1966, the core mission has remained the same: to train potential SAR controllers to carry out their jobs with confidence and to educate them about the different factors that will affect their search object on land or on the high seas.

Another advantageous change was in the area of search methodology. Over the years, oceanographers, marine scientists and the Coast Guard Research and Development Center have conducted numerous studies on how objects act/react in a maritime environment. This data has changed the way we conduct our searches and has refined our methods. For example, due to the effects of leeway forcing an object to fall off the wind in one direction or the other, we no longer focus on a single point datum, or a "datum mini-max" as it used to be called. We now focus our efforts around the right and left data. Generally, both data are encompassed in one searchable area. In the rare instance they are not, we have the option to maximize our effectiveness by searching each area separately.

Likewise, there is always a certain degree of error associated with the

drift vectors (such as tidal current, sea current, wind current, other water currents, even Datum Marker Buoy Data) that make up total water current (TWC). In the past, search planners gave a certain degree of error to the entire TWC block as a whole. Using the current method, the error is applied to each drift vector, individually resulting in a more accurate calculation of errors affecting the drift of the object. The culmination of these changes, and of other changes to the methodology, is a more precise search area allowing for a more precise search. In layman's terms, that means if you are lost at sea, the Coast Guard now has the best chance in its history of finding and saving you.

Another significant change occurring at the National SAR School is in the background and type of students we are receiving. The Air Force courses still cater to students from the local, state, federal and international SAR agencies. They have always had a variety of students with a myriad of backgrounds. The Coast Guard contingent primarily trained boatswain's mates (BMs) and quartermasters (QMs) to be SAR controllers. In the past year, this has changed.

THIS WE DO, SO THAT OTHERS MAY LIVE.

When the Coast Guard began looking at its command and control personnel several years ago, changes were made to the skills sets of the individuals that were to staff the command centers. A new rating or occupation was formed called operations specialist (OS). This rating now comprises the majority of our command center personnel.

As with any major change, there have been initial bumps in the road. A disadvantage to the system is that some of the seasoned professionals who earned their operational SAR experience at small boat stations or onboard Coast Guard cutters will no longer make up the staff at our command centers. Some critics feel that this will contribute to a loss of knowledge with regard to conducting SAR operations. It is important to point out, however, that just because a person may have previously been assigned to a small boat station or to a cutter does not necessarily mean they have the skill set to be a SAR controller. Additionally, when we were drawing from the BM/QM pool, that person might have spent one or two tours during their whole career as a professional SAR controller.

As this article illustrates, the field of search and rescue is dynamic in nature. With the new OS rate, their entire career will be centered on conducting Coast Guard operations. They will be kept abreast of the changes in methodology and technology in their chosen field. Once the initial wrinkles get ironed out of the system, we will have a rate dedicated to planning, coordinating and conducting search and rescue operations for the first time in Coast Guard history. This translates into a greater ability to serve our maritime partners and customers.

What is on the horizon for the National Search and Rescue School? Quite a lot, actually. We have increased our physical infrastructure and are now running simultaneous classes. We will conduct 21 MSP classes, bringing student throughput to an unparalleled 357 trained SAR controllers in Fiscal Year 2005. Add to that 20 SC&E classes, 12 Air Force Inland SAR classes, three SAR supervisor classes and three IMOC courses, and it is shaping up to be the National SAR School's busiest year yet.

Also coming soon are more technological advances such as RESCUE 21 into our curriculum. RESCUE 21 is new technology for short-range coastal communications and will be integrated into the SAR school curriculum. Hand in hand with that technology, we will soon be training students on the new SAR-OPS program. This will be a single program that will eventually replace the need for JAWS and CASP. The schedule is very ambitious, and the operations tempo is high at the National SAR School. This we do, so that others may live.

Command Center Team's New Quarterback

By Cmdr. Brad Clark
U.S. Coast Guard Office of Search and Rescue

When a National Football League (NFL) team takes on a new quarterback, it represents a significant change to the team's lineup. Although such a change is typically accompanied by press conferences, photo shoots and multimillion dollar contracts in the NFL, a quarterback change in the Coast Guard does not receive the same fanfare.

In September 2003, the Office of Search and Rescue (SAR) took over the responsibility of program manager for Coast Guard Command Centers—in effect, becoming the new quarterback for the Command Center program. The event was not marked by news coverage or multimillion dollar contracts, but it did nonetheless represent a significant change to the longstanding lineup for the Coast Guard's Command Center team.

The decision to transition the responsibility for the Command Center program from the Headquarters Command Center to the Office of Search and Rescue made simple sense. The Headquarters Command Center was set to undergo a significant transformation, geared to filling a seven-day-a week/24-hours-a-day need as the top rung of the Coast Guard's Command Center echelon within the new Department of Homeland Security. The change involved transforming from simply an information collection point designed to keep senior Coast Guard officials informed of operations to a focal point for command and control.

Eager to take on the challenge, the Office of Search and Rescue has a long history with Coast Guard Command Centers that stems from their original establishment as Rescue Coordination Centers within each of the districts. The Office of Search and Rescue has a strong liaison as the program manager for the National Search and Rescue School, which provides the formal training for Command Center SAR controllers. Furthermore, the staff members assigned to the office typically have significant Command Center experience at the group, district and/or area level. Combined, these reasons make the Office of Search and Rescue particularly well suited to take on program manager responsibility. As stated in the functional statements for this added responsibility, the Office of Search and Rescue

will…"in conjunction with the combined efforts of G-OCC (Headquarters Planning Coordinator and Facility Manager for Command Centers), G-OCS (responsible for developing and reviewing staffing standards for managed facilities) and mission-specific Program Managers, serve as Program Manager and focal point of Coast Guard Command Centers (at the Area, District, Group, Integrated and Joint levels) to coordinate and remedy the inherent multi-missions aspects of SAR and non-SAR policy, training, staffing levels/standards and other factors that have an impact on and complement overall Maritime Domain Awareness for the operational commander." This is a pretty tall order.

Regardless of qualifications, the task of expanding the Coast Guard's command and control capability to meet new mission demands is significant. Furthermore, the task is complicated by the complexity of issues facing the Coast Guard's Command Center. First, Command Centers are no longer SAR-centric. More and more each day, Command Centers are functioning as the primary command and control node for all Coast Guard operations. Secondly, the shape of the Coast Guard organization that Command Centers have supported for so long is changing. The traditionally separate professional fields of Operations and Marine Safety are combining and morphing into Sector Commands. The legacy in which Command Centers worked primarily "for" Operational Commands and "with" Marine Safety Commands is no longer valid. The customer base has changed and so must all the elements of the Command Center operation to align with evolving command objectives.

WITHOUT TRAINED AND QUALIFIED WATCHSTANDERS TO MAKE DECISIONS AND TAKE APPROPRIATE ACTION, INFORMATION REMAINS JUST INFORMATION.

To establish a strong vantage point in which to compete with the vast scope of issues regarding the future of Command Centers, the Office of Search and Rescue will concentrate primarily on three Command Center program elements that are part of their functional statement: namely, policy, staffing and training. Concentrating our efforts on these foundational elements will provide the opportunity to address some of the most difficult questions upfront and to work with the ever-increasing number of stakeholders in developing new solutions. A project team coordinated by the Office of Operation Capability and Maritime Domain Awareness is leading other facets of developing Command Center capabilities.

Policy

One of the top priorities must be to establish, organize and publish standards for Coast Guard Command Centers. Largely absent in Coast Guard doctrine, these standards will serve to dictate and/or guide Coast Guard management policies regarding staffing, facilities, systems, organization and specific protocols. The Office of Search and Rescue is leading a project team to develop a Command Center manual intended to consolidate these standards in one location to improve understanding, management and coordination of the Command Center program.

The Command Center manual project team has been designed to make use of both core and affiliated groups. The core group is a relatively small number of individuals (seven members), all with experience in Command Centers. This group has been identified and is intended to act as the primary driver behind collecting information and drafting the manual. The larger and more diverse affiliated groups are designed to provide feedback to the core group and assist in developing alignment between their office and the project. For the purpose of this project, one affiliated group will represent Headquarters programs managers while the other represents various field commands. So far, the support for the Command Center project has been outstanding as all participants realize that these standards must be in place to build and support a capable and healthy program.

Staffing

During the past several years, the Coast Guard has expended significant resources studying Command Center staffing and endurance management. Those studies have led the Coast Guard to reevaluate organizational practices regarding staffing and watch length.

The Coast Guard recently established policy limiting the watch duration of a Command Center watchstander to a maximum of 12 hours in any 24-hour period. Coast Guard field units have worked hard to maintain this standard; however, routine military personnel transfers leaving transfer gaps, the hiring of new civilian watchstanders, revised training requirements, and an increase in training needs have all had an adverse impact on the Coast Guard's ability to have all Command Centers come into and maintain compliance with the 12-hour standard. As program manager, our goal is to ensure that the adequate staffing is in place to provide Command Centers the capability to sustain a year-round, 12-hour watch capability.

Equally important is the imperative to evaluate the need for additional watch positions in Coast Guard Command Centers. The demand to increase the Coast Guard's maritime domain awareness brings with it the need for new sensors and integrated information systems. These systems will undoubtedly increase the amount of information in our Command Centers; however, without trained and qualified watchstanders to make decisions and take appropriate action, information remains just information. As the program manager for Command Centers, the Office of Search and Rescue has proposed a new watch organization for field-level Command Centers (Sector Command Centers), which is currently under review. Additionally, the Office of Search and Rescue will be working in cooperation with the Coast Guard's Deepwater program to evaluate and establish new personnel requirements for the upper echelon (District and Area level) Command Centers.

Training

The Maritime Search Planning course taught at the Coast Guard's Training Center in Yorktown, Va., has and will continue to be at the heart and soul of Command Center training. However, demand for new capabilities and a need for improved multi-mission command and control requires a fresh look into training concepts and new skill sets for Command Center controllers. This fresh look will begin with three specific initiatives.

First, the Office of Search and Rescue, with the aid of the Office of Training and Performance, is securing a contract to conduct a training analysis to develop the new skill sets required of those who fill Command Center billets. Once complete, the Coast Guard will use the conclusions of the analysis to establish new strategies and training interventions to support those skill sets.

Second, the Coast Guard, through a relatively recent rate merger within the enlisted force, created the Operations Specialist designation to serve as the Coast Guard's command and control rate. Whereas Command Center controller positions have traditionally been filled with people from a variety of Coast Guard operational rates, today's single rate (OS) approach to billeting Command Center positions provides the Coast Guard with the opportunity to establish and foster a dedicated career path for personnel filling Command Center billets. What proved to be too complicated in the past is now possible. The Office of Search and Rescue, working in conjunction with other stakeholder offices within Coast Guard Headquarters organization, will develop a career path allowing personnel to qualify at entry level (apprentice level) billets within a Command Center and, ideally, return to a Command Center in subsequent tours to fill positions of increased responsibility. Establishing such a career path, especially in light of increasing job task demands, has the potential to significantly improve the qualifications and performance of individuals fulfilling the job of Command Center controllers.

Third, we will seek to expand the capability of the Command Center Standardization Team (CSST). Originally established in 2000, the primary role of the CCST is to: *support policy and resource decisions by the Command Center program manager, through evaluating and reporting on service-wide Command Center effectiveness*. In light of the increasing multi-mission demands on Command Centers, it will be imperative for the CCST to extend the scope of its evaluation and reporting process from a primarily SAR-centric focus to one that is truly multi-mission.

Conclusion

Considering the scope, work associated with the Command Center program can be daunting, but the objective to create a new and expanded command and control capability is clear (See Transforming USCG Command and Control). As the newly assigned quarterback for Coast Guard Command Centers, the Office of Search and Rescue remains committed to creating a robust Command Center program without losing the integrity of our performance in Coast Guard's traditional search and rescue mission. With the support of Coast Guard senior leadership and the cooperation of members of the headquarters line-up who now have a stake in Command Center performance, we cannot, and will not, lose.

RESCUE 21

Improving Communications to Save Lives in the 21st Century

By Kathryn Manzi
U.S. Coast Guard Office of Search and Rescue

Can You Hear Me Now?

Many Americans expect the U.S. Coast Guard to respond to their calls for help at sea, like calling 911. Unlike 911, the Coast Guard cannot determine the position of a radio transmission. The lack of radio direction finding hinders the successful execution of search and rescue (SAR) cases in which distressed callers either do not know where they are or do not have the chance to report their positions. The Coast Guard is utilizing antiquated communications equipment that was installed in the early 1970s and is dependent on people in distress to clearly state their emergency, identity and location. That is difficult, at best, in many distress situations.

Little to no direction finding capability is just one of the many deficiencies of the current National Distress and Response System (NDRS). Other shortcomings include interoperability, Digital Selective Calling (DSC), single channel operation, VHF-FM radio communication gaps and failing equipment, to name a few. The Coast Guard has numerous coastal zone communication gaps or dead spots in today's system, areas in which the clear reception of transmissions is severely impaired or totally precluded due to terrain. Furthermore, if a transmission is received and recorded, the analog subsystems have limited audio storage and no ability to enhance the sound quality of the recorded signals. This deficiency continues to be highlighted by SAR cases during which the Coast Guard is able to play back the garbled distress call from the boat, but still cannot understand what the caller is saying.

The lack of communications interoperability with the Coast Guard's various partners and customers is another problem, especially for post-September 11 missions. In most cases, only one transmission frequency can be active at a time, and communications centers are frequently limited to single channel operations. Therefore, simultaneous communication with the distressed mariners and coordinat-

ing SAR efforts with the Coast Guard, federal, state and local agencies is difficult.

Finally, the present distress communication system's over-30-year-old technology works against economy and efficiency. It relies on dedicated data circuits between the communication centers and the radio high-level sites, which, in turn, require dedicated landlines. This is an expensive arrangement and limits access only to those Coast Guard units that are connected to that high-level site. Recorded or relayed messages must be repeated by voice or transcribed, which is a time-consuming process that is susceptible to errors. The system also lacks a common equipment standard that impedes the introduction of new or improved subsystems. It is not that the current short-range VHF-FM communications system does not work; it does. However, it is comprised of obsolete, aging and nonstandard equipment, and it is deteriorating quickly.

VHF-FM Channel 16 is your best chance of being heard when in distress.

The modernization of America's existing distress communications system has been in the works since the early 1990s. The Coast Guard is aggressively pursuing modernizing the NDRS into a fully capable, integrated distress response communications system. The new system, RESCUE 21, will feature enhanced VHF-FM coverage, position localization on a VHF-FM transmission beyond just simple direction finding, increased number of voice and data channels, protected communications, asset tracking and digital voice recording with immediate enhanced playback capability. In addition, it will have interoperability with various local, state and federal agencies and customers facilitating enhanced coordination of operations. With RESCUE 21, the Coast Guard has the opportunity to bring a critical part of the U.S. maritime communications system into the 21st century.

As former Coast Guard Commandant Adm. James Loy noted in a 1999 speech: "…there is a vast disparity between the communications capability that the public thinks we have and the communications system that we do have." The Coast Guard is relying upon RESCUE 21 to close this gap between perception and reality.

A World of Improved Capabilities

When RESCUE 21 is in place, mariners can expect a more effective response to emergencies at sea. The new system will allow Coast Guard operators to continuously monitor the distress and hailing frequencies, Channel-16 and the new DSC distress frequency, Channel 70. RESCUE 21 will have a dedicated "guard" capability for these frequencies, even when other "working" channels are in use.

To further define DSC, at the push of a button DSC automatically sends out a digital distress signal over Channel-70, which can be automatically relayed through nearby vessels to shoreside rescue authorities. If properly registered and interfaced with the global positioning system (GPS), the signal transmits the vessel's position, Mobile Maritime Service Identity (MMSI) number and nature of distress (if entered). The receiver enters the MMSI number into the database to reveal vital information such as the name, size, type and owner of the vessel. Presently, DSC is required equipment on only large commercial vessels and is optional for all others. The 1988 Global Maritime Distress Safety System Amendment to the International Safety of Life at Sea Convention (SOLAS) laid down an international requirement for DSC in Sea Area A-1—essentially the area along a nation's coast that is serviced by a VHF radio station. The introduction of RESCUE 21 will fulfill U.S. commitments to the convention in this area. Sea Area A-1 will be officially declared when the RESCUE 21 system is fully deployed in 2007. Until this time boaters are cautioned that the majority of Coast Guard units cannot receive DSC distress calls. The use of VHF-FM Channel 16 is your best chance of being heard when in distress.

With RESCUE 21, even normal voice distress calls over Channel 16 will not require the Coast Guard to launch SAR efforts based on a best estimate of

where the distress is occurring. The system will automatically provide a command center with a geographic display and a time-stamped line of bearing on each Channel 16 transmission from each high-level site. Using two or more correlated line of bearings, a position can be localized to an area less than 25 square nautical miles.

Digital voice recording with immediate enhanced playback capability will allow SAR controllers to replay and clean up recorded VHF-FM distress calls to improve audio quality immediately. Transmissions received in the last five minutes will be instantly available, transmissions up to 24 hours old will be retrievable within one minute, and older signals will be retrievable in 30 minutes.

Asset tracking automatically reports a Coast Guard vessel's position and status. This automatic reporting aids SAR controllers in determining how to best utilize each asset and maintains situational awareness of Coast Guard assets as they proceed on rescues or other missions under dangerous weather, surf or operational conditions, thus, increasing the safety of their crews.

RESCUE 21 will provide interoperability among command centers, Coast Guard assets, various federal, state and local government agencies and the recreational boater. In addition to the distress channels, RESCUE 21 will feature six data or voice channels operating in analog voice, digital voice or digital data, and users will have access to the VHF-FM, VHF-AM and UHF bands. These features give the Coast Guard much more surge capacity for response to major incidents in the maritime environment.

RESCUE 21 radios also have built-in secure communication capability, a critical requirement for Coast Guard units cooperating with other federal and state agencies during counter-drug, illegal migrant interdiction or homeland security missions.

Combined, these improvements spell vastly improved Coast Guard communications, response and operational effectiveness. That, in turn, has profound implications for those who find themselves in distress at sea or in U.S. inland waters and turn to the Coast Guard for help.

Saving Lives in the 21st Century

The Initial Operational Capability installation and testing of RESCUE 21 will occur at two adjacent Coast Guard groups: Atlantic City and Eastern Shore. Follow-on installations at other Coast Guard units will begin once the system is tested and verified.

The complete installation of the RESCUE 21 communications system is scheduled for 2007 at a total cost of $611 million. When RESCUE 21 is finally operational, the United States will have a maritime distress and communications system comparable to the land-based systems that many local and state emergency services already have. As more and more Americans take to the water for reasons of recreation, commerce and tourism, it is essential that America's lifesavers in the Coast Guard have the same distress and communications system capability.

RESCUE 21 Improvements Over the Current System

- Enhanced VHF-FM communications coverage
- Increased number of voice/data channels, multiple channel operation
- Digital Selective Calling
- Position localization beyond simple direction-finding
- Digital voice recording with immediate enhanced playback capability
- Coast Guard asset tracking
- Interoperability with federal, state and local agencies
- Secure communications capability

The Search and Rescue Optimal Planning System

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By Robert Netsch
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Many people equate search and rescue (SAR) with daring actions taken by helicopters and rescue swimmers. However, a critical component of the SAR process takes place well before a helicopter can get on-scene. This is the activity of search planning.

In 2003 the Coast Guard received more than 30,000 calls for assistance. Many of these calls were "rescue" rather than "search." However, five to 10 percent of the calls became significant SAR events, resulting in search actions by multiple land, air and sea units. Every day, on average in 2003, the Coast Guard assisted 136 persons in distress and saved 11 lives. An open ocean case with a long drift interval [the time between a search object's Last Known Position (LKP) and the searcher's on-scene time] can easily require the expenditure of hundreds of search hours and hundreds of thousands, even millions, of dollars. Determining how and where to place the available search assets to maximize their overall search effectiveness is the objective of search planning.

Figure 1. A Coast Guard "Dolphin" helicopter prepares to conduct a search and rescue demonstration with a 30-foot boat. Public Affairs Officer Harry C. Craft III, USCG.

The most effective search plan is the one that continuously maximizes the probability of finding the search object (also known as probability of success or POS) as each hour passes. Simply stated, search planning consists of (1) situational awareness (ascertaining what happened where and when), (2) search object drift modeling (how has wind and water current affected the search object over the drift interval) and (3) effort allocation (how best to spread finite aircraft and vessel hours over a search area).

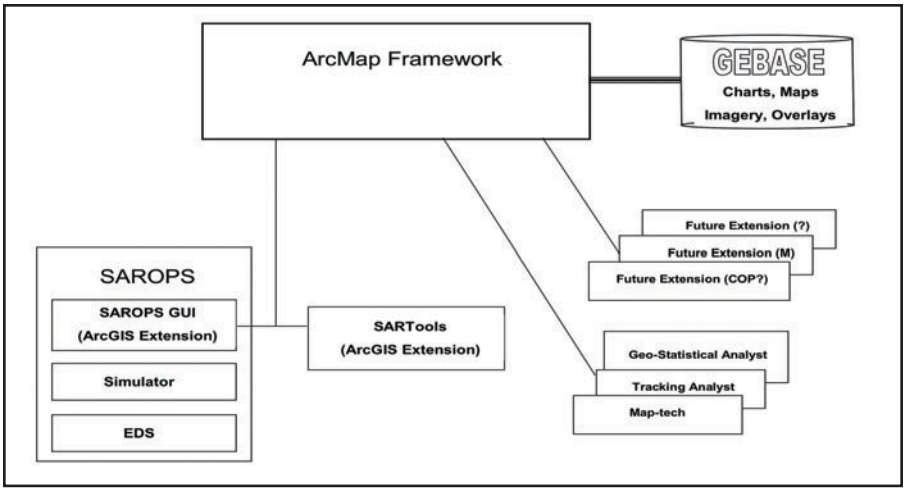

Figure 2. Search and Rescue Optimal Planning System (SAROPS) block diagram.

The Search and Rescue Optimal Planning System (SAROPS) is an information system designed to support situational awareness, drift modeling and optimal allocation of resources. When deployed, SAROPS will allow the Coast Guard to be even more successful in the timely rescue of lives and property in coastal waters and on the high seas.

SAROPS will provide several capabilities not currently available from other commonly available search planning tools. Some of these are:

- Simulate pre-distress motion and encounters with potential hazards to estimate where and when an overdue or unreported craft experienced a distress incident;
- Simulate the range of possible drift trajectories given the uncertainty and variability of environmental conditions and search object leeway parameters;
- Produce optimal search plans that maximize the probability of finding the search object with limited resources and minimize the average time required to do so;
- Simulate the simultaneous motion of search craft and search objects when evaluating completed searches; and
- Properly account for the statistical effects of prior searching when planning the next search.

In the following example to illustrate SAROPS usage, the fishing vessel (F/V) *Marine* has reported receiving a distress call from the sailing vessel (S/V) *Americana* with a partial position (latitude only).

No Coast Guard "High-Sites" ashore picked up the *Americana*'s distress call. Figure 3, below, shows how SAROPS could be used to analyze this information. The black range rings represent the nominal coverage of the three nearest Coast Guard "High-Sites." The red range ring, centered on the *Marine*, represents the *Marine*'s maximum reception range from another vessel. The short red line segment represents the portion of the reported parallel

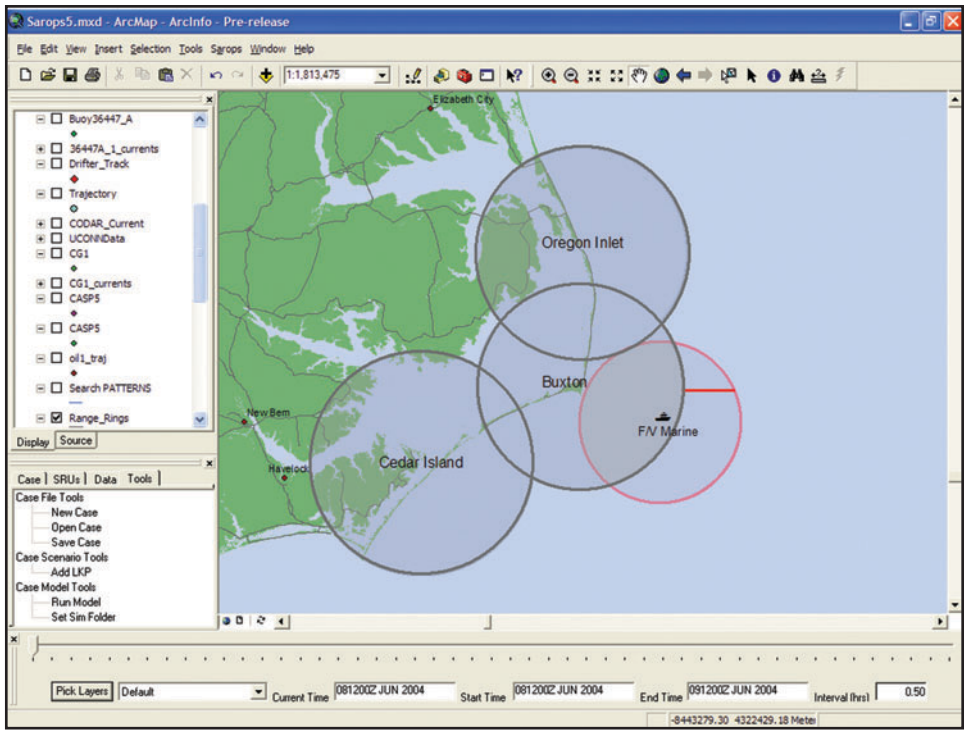

Figure 3. SAROPS Venn diagram.

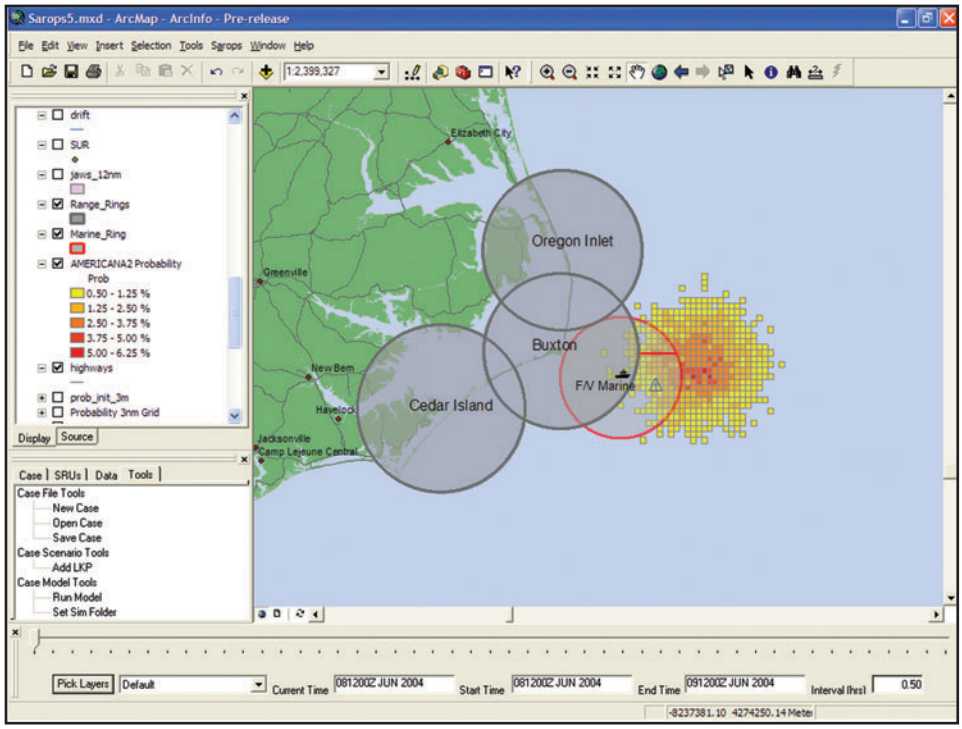

Figure 4. SAROPS probability distribution map.

of latitude that falls in the area where the distress apparently occurred.

The SAROPS system will receive emergency personal indicating radio beacon (EPIRB) alerts and plot their positions. Continuing with the example, an EPIRB position was received and plotted as a triangular icon in Figure 4. Contained in the EPIRB's SARSAT message was registration information that identified the vessel as S/V *Americana* owned by W. L. Herndon of Virginia. A registration database query and subsequent phone calls to the contact number confirmed that the vessel was a 42-foot deep keel sailboat en route from Panama to New York, with five persons aboard. The *Americana*'s equipment list included a life raft stored on the weather deck. The EPIRB signal correlated with the earlier Mayday, except that the SARSAT position provided was almost 10 miles southwest from where the earlier analysis predicted. Another unfortunate development was the apparent failure of the EPIRB as no further signals were received.

This produced two possible scenarios: Either the latitude of the distress position copied by the *Marine* was correct, or the EPIRB position was correct. SAROPS will allow the user to consider both scenarios and weight them as to which is more likely in the user's judgment. In addition, there were three possible search objects to consider: The *Americana* disabled and adrift, a life raft, and persons in the water. SAROPS will allow the user to consider these three possibilities for each scenario. Like scenarios, search object types may be weighted to correspond with the user's judgment on their relative likelihoods of occurrence.

Significant uncertainties and conflicting information are not that unusual. Computer simulation is one of the most powerful tools for dealing with uncertainty. In this case, the area containing the distress incident was reasonably small despite the conflicting positional data. This is not always the case, especially when vessels or aircraft become overdue.

Deployment of resources had to wait until first light. In the meantime, it was necessary to monitor the situation (i.e., weather, communications, and available resources), issue an Urgent Marine Information Broadcast (UMIB), brief the chain of command (CoC) and plan the first light search.

Air Station Elizabeth City had fixed- and rotary-wing aircraft ready for morning operations. Also available were a 123-foot Patrol Boat from Portsmouth and a 47-foot motor lifeboat from Station Oregon Inlet. The time between the LKP and the Mid-Search Time (MST) was roughly 17 hours. This was not huge as far as drift intervals go, but 60+ knot winds backing from the northeast toward north, heavy seas, and the Gulf Stream's strong currents, meanders and eddies meant there would be quite a range in possible drift trajectories. SAROPS would be used to review and visualize the situation and begin formulating a plan for the morning.

The SAROPS graphical user interface (GUI) "wizard" would be used to enter LKP, incident time, search object types, drift interval, on-scene weather observations and available resources. Additional environmental data to cover the area would be obtained automatically from the EDS. The user could choose to consider each scenario separately or both together. The user could also choose to consider each type of possible search object separately or

all of them together. In fact, SAROPS is designed to allow the user to consider any combination of the entered scenarios and search objects during the planning process.

An optimal search plan depends on several factors. These include:

- The amount of searching effort that will be available from the resources on-scene.
- The effective sweep widths.
- The geographic probability density distributions of possible search object locations (shown as a "probability map" with colored cells in Figure 4).

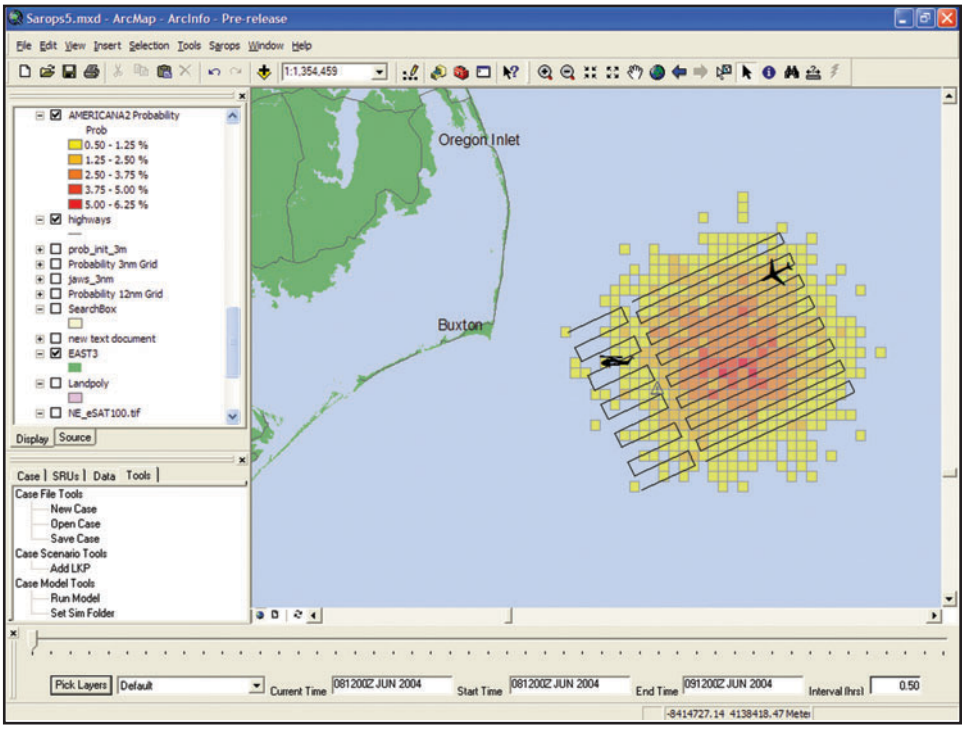

Figure 5. SAROPS search patterns.

A fundamental issue faced by all search planners is finding the best balance between search area size and coverage, given the ever-present limitations on resources. For a given level of effort, the larger the area, the higher the probability of containing (POC) the survivors, but the lower the coverage (C) and probability of detection (POD). The smaller the search area, the higher the coverage and POD, but the lower the POC. Since probability of success (POS) is the product of POD and POC (POS = POD x POC), the search area size that results in the highest POS value is optimal. Uniformly optimal search plans also minimize the average time required to find the search object. This has many benefits, including:

- More lives saved as a result of earlier finds;
- Fewer extended searches; and
- Less risk and less cost associated with searching.

However, optimal search plans are not always operationally feasible. SAROPS will provide tools to aid the user with transforming a theoretically optimal search plan into one that is both operationally feasible and very nearly optimal, as depicted in Figure 5. The search action plan (SAP), with pattern summary reports, can then be sent out and entered into each search craft's navigation system.

In our example, the helicopter and C-130 both ran parallel searches and a 123-foot cutter moved on-scene to lend assistance. On its third leg the helicopter spotted the vessel with all aboard. There was no engine activity, but a storm jib was up and sea anchor deployed. *These (unexpected) factors combined with a persistent landward tack pushed the* Americana *toward the western edge of the probability map.* The engine had been flooded and electrical system fouled early in the storm. The EPIRB was washed overboard during a roll and had self activated; the cause of its intermittent and short-lived signal was not known. The helicopter crew determined the *Americana* was no longer in immediate danger; therefore, no rescue swimmer was deployed and no persons evacuated. Instead, a pump was dropped; the helicopter was relieved by the C-130, which circled overhead until the WPB-123 arrived 90 minutes later. With the hull pumped, Capt. Herndon was able to raise partial sail and return to port under escort of the WPB-123 without further event.

Had subsequent searches been required, SAROPS would have properly accounted for the effects of prior searching on the probability density distribution when developing the next day's optimal plan.

Self-Locating Datum Marker Buoys

Technology Overdue, but Right on Time!

By Richard Schaefer
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The infusion of technology into an organization can often be a long and difficult task. The self-locating datum marker buoy (SLDMB) project for the U.S. Coast Guard was just that. The water current and other data provided by SLDMBs have always been needed by search planners, but, today and into the future, this information will be even more important.

So What is an SLDMB?

The SLDMBs currently in use by the Coast Guard are produced by METOCEAN Data Systems Ltd. Oceanographers would recognize them as 7/10th Coastal Ocean Dynamics Experiment (CODE)/Davis-style oceanographic surface drifters. Simply, they are submerged cylindrical buoys with vanes extending at 90-degree angles, reaching 100 cm deep (Figure 1). When deployed, only the antenna and four floats attached to the ends of the vanes show above the water's surface.

Figure 1. A deployed METOCEAN self-locating datum marker buoy (SLDMB).

The onboard electronics provide global positioning system (GPS) positioning and sensor data. Service Argos, Inc. receives and forwards the data using National Oceanic and Atmospheric Administration (NOAA) polar-orbiting n-series satellites. GPS positions are acquired at 30-minute intervals.

SLDMBs are ship- or air-deployable, and they operate for up to 30 days after deployment. Data consisting of position, sea tempera-

ture and battery voltage are usually available to the user within four hours. These data, when passed to the Coast Guard, are processed to provide direction and speed of drift, the total water current.

Environmental Data Needed and Provided

First and foremost, the Coast Guard, and other maritime search and rescue (SAR) agencies worldwide, needs environmental data, primarily winds and current, to accurately determine the location of search objects. In addition, visibility, water and air temperature, wave heights and other environmental factors are used to formulate how and how long to search.

All mariners, from the largest commercial cargo vessel's captain to families on weekend outings in their runabouts, have a need for weather and sea surface conditions information. For the professional mariner it is first a matter of safety—the ability to operate without loss or damage to their vessel or cargo—and then a matter of economics.

Visibility, winds, seas, temperature and general weather conditions greatly affect the ability to operate safely. Knowing of adverse conditions in an area, such as reduced visibility due to fog or rain or heavy seas, provides the mariner the opportunity to prepare for those conditions or route around the affected area. These same conditions with the addition of water current can affect the economic operation of the vessel. Given a choice to route a vessel in an area of strong current such as the Gulf Stream can add several knots to speed over the ground when traveling with that current, whereas bucking the current can have the opposite effect. To ensure an enjoyable and safe outing, the recreational boater relies on accurate information regarding the weather in their chosen destination.

To meet these needs, NOAA, the National Weather Service (NWS) and numerous other sources in the United States and around the globe work diligently to provide current and predicted weather and sea conditions. This information is provided to the mariner via a variety of means, from broadcasts and facsimiles to online computer presentations (Figure 2).

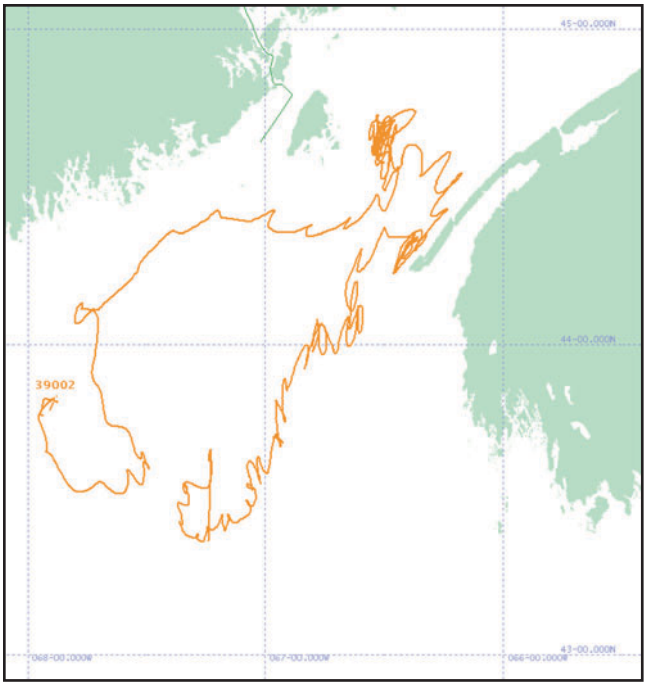


Figure 2. Typical SLDMB drift track; Gulf of Maine/Bay of Fundy drift for 37 days.

SLDMBs Fill a Gap

With the numerous environmental data sources in place, specialized tools like the SLDMB seem, on casual inspection, to be hardly needed. The truth is that, with all the sources available, none provide water current data over the expanse of area needed and with the granularity needed for effective search planning. Without SLDMBs a search planner must often rely on seasonal climatology (static historical database), which may provide only a single data point for water current covering areas as large as 60 NM by 60 NM (Figure 3, next page).

There is little improvement closer to shore where tidal effects are in play. Tide and current

SLDMBs operate for up to 30 days after deployment. They provide data for position, battery voltage, and sea temperature, which is usually available to the user within four hours. Once given these data, the Coast Guard is able to provide direction and speed of drift—the total water current.

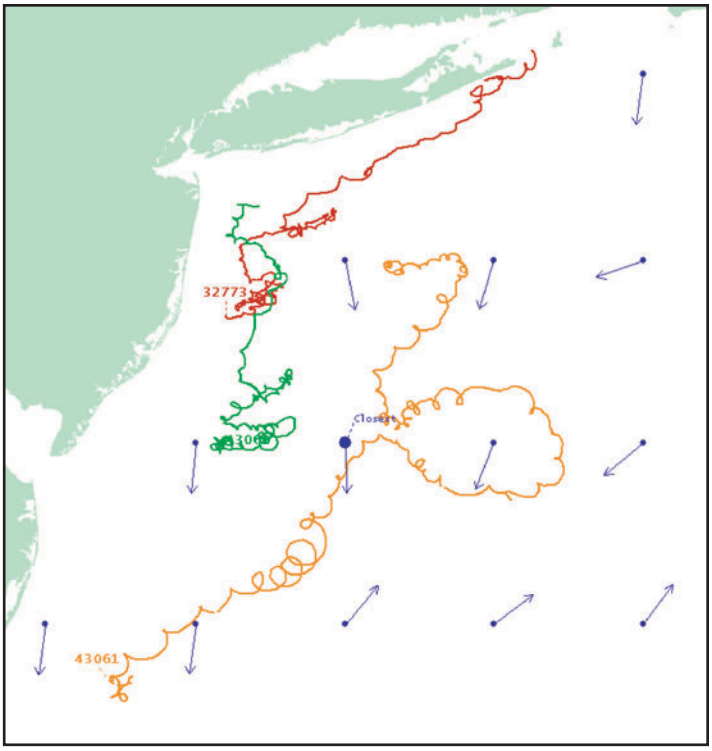


Figure 3. Comparison of climatology product (Mariano's seasonal currents) and SLDMB tracks. This is a clear indication of how the current for a period of several days will vary greatly from climatology, with significant effect on a search object's drift and the outcome of search planning efforts.

tables are fairly accurate only within a very limited area close to the tide and current stations, a limited number of positions on a vast coastline. SLDMBs can provide data directly in the area of interest. These data, because they are from direct observations, are also available to feed NOAA and other agency prediction models used in providing data over larger areas. A single SLDMB's data are also limited, applying to only a limited area surrounding its position. The size of this area naturally varies with location. Proximity to strong water current influences such as Gulf Stream or river outflows may reduce the area over which the data are reliable.

Planning Tools, Old and New

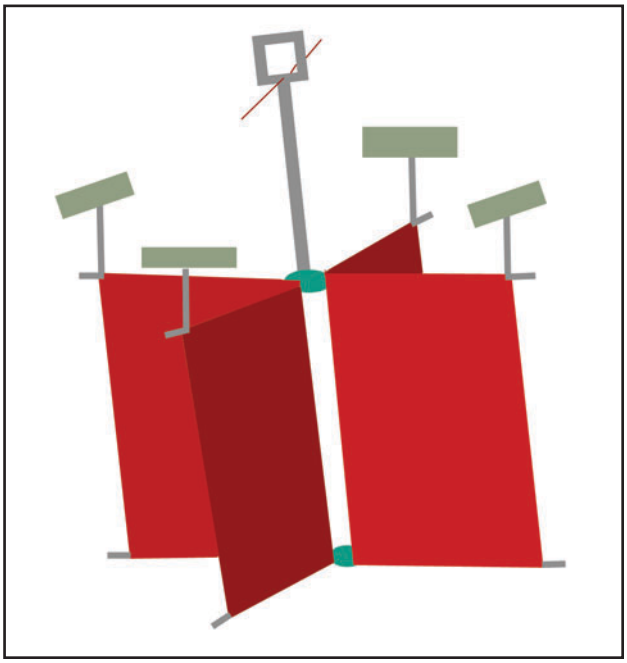
The search planning tools are used in part to determine what environmental data can effectively be applied. The manual search planning method and its computerized versions are able to use only single data points for computations. The Coast Guard's Joint Automated Worksheet System (JAWS) for each search plan operates this way. Multiple wind vectors can be entered, but in the end they are averaged to provide a single vector to apply in the drift computations. Likewise, only a single total water current vector is applied.

In the early 1970s the Coast Guard recognized the shortcomings of the manual method in its ability to accurately determine the drift of a search object and commissioned the development of the Computer Assisted Search Planning (CASP) tool. Still in use today, CASP, with its Monte Carlo drift engine, is able to use multiple wind and water current data points to drift search objects. CASP, however, is no better than the environmental data inputs it receives, and good sources that provide the coverage required in a grid format are next to nonexistent—so much so that CASP today uses climatology for water currents.

Do SLDMBs alone resolve this problem? No, SLDMBs can provide some help, but all data from this source must be entered manually and then will apply to only a limited area. As a manual entry it is again limited in its application and time consuming. CASP itself is hindered by its language and design being grounded in the technology of the 1970s. SLDMBs with CASP are not the final solution.

Companion Technologies Drive Need!

In the latter part of 2003, the Coast Guard embarked on a project to replace both JAWS and CASP with a single search planning tool. This new tool, currently in development and dubbed the Search And



An SLDMB. USCG illustration.

Rescue Optimal Planning System (SAROPS), will propel the Coast Guard's search planning capability into this more advanced technological age. A critical piece of SAROPS is the environmental data server (EDS), which, just as its name implies, will be the focal point and processor of the environmental information needed for drift calculations in SAROPS. And just in time, SLDMBs are being employed in the field, and the data provided will be effectively used along with a variety of other sources queried by the EDS.

Another potentially important technology being aided by the employment of SLDMBs is the Coastal Ocean Dynamics Application Radar (CODAR). SLDMBs are deployed within the coverage area of the CODAR system, and the current measures of the CODAR system and predictions of the Short Term Predictive System (STPS) model are tested against the actual drift of the SLDMBs. In this way the CODAR system and companion STPS model can be adjusted and improved to provide accurate water current data. CODAR and SLDMBs are complementary systems and may in the future provide all the water current data necessary in the coastal zone for search planning.

The Future

The SLDMB program has many opportunities for advances in the future—in physical design, electronics and employment for Coast Guard missions. An obvious first place to start with regard for Coast Guard units charged with deploying SLDMBs is the size of our current SLDMB. The current deployment package cylinder size of 8 in. x 43 in., weighing in at 25 pounds, SLDMBs are somewhat large for continuous storage onboard Coast Guard helicopters and boats (Figure 4, next page). Smaller SLDMBs would permit carriage onboard Coast Guard units and ease their deploying by crews. The challenge is to retain the functionality and drift characteristics in a smaller package while keeping the SLDMB cost effective. Size is driven by the requirement to provide the proper underwater cross section for drift, sufficient internal space for electronics and a power source, and antenna space for both receiving a GPS signal and transmitting buoy data to a satellite.

SLDMBs provide a convenient platform for additional environmental sensors to provide data required for effective search planning. In addition to the direction and speed of currents and the water temperature, which are now provided by SLDMBs, search planners have a need for on-scene air temperature, seas (waves/swell height), visibility, barometric pressure and more to develop search plans and properly employ search assets. In the future, the SAROPS program will directly employ the environmental data in the search planning and evaluation processes.

Figure 4. Left: A METOCEAN SLDMB deployment packaging tube. Right: An SLDMB removed from the tube.

As important as added sensors are for SAR, different sensors may be critical for effective employment of SLDMBs in other mission areas. Sensors to detect pollutants, such as oils and chemicals, or other hazardous agents, such as nuclear and biological threats, in the water column, on the surface or in the air would be of particular value to monitoring and responding to marine environmental protection missions. These same capabilities could play a key role in homeland defense and our response to intentional release of hazardous agents in, on and over our nation's waters.

Conclusion

SLDMBs have been on a long journey to aid the Coast Guard to plan searches; earlier arrival would have been nice, but the ability to fully use the information they provide was limited. Now, as the Coast Guard prepares to employ SAROPS, timing could not be better to have SLDMB data flowing.

Search and Rescue Plans of Cooperation

By Benjamin Strong
U.S. Coast Guard Office of Search and Rescue

How would pertinent information regarding a ship's size, number of passengers, and other important information be relayed among the master, shipping company, and search and rescue (SAR) authorities during an emergency? There are many plans and procedures in place to effect rescues if necessary, but how is information quickly shared among these parties? Plans of Cooperation are one way of sharing this information.

The International Convention for the Safety of Life at Sea (SOLAS) V/7.3 states "passenger ships, to which chapter one applies, shall have onboard a plan for co-operation with appropriate search and rescue services in event of an emergency…the plan shall include provisions for periodic exercises to be undertaken to test its effectiveness." Plans of Cooperation are intended to link required emergency plans of the ship, its company, and rescue coordination centers (RCCs), so that they will collectively ensure an effective and rapid rescue effort for the ship. The International Maritime Organization (IMO) outlined, in MSC/Circ.1079[1], the need for such Plans of Cooperation and provided guidelines for preparing them. By maintaining such plans, relevant contact information is quickly on hand for personnel who need it.

Plans of Cooperation, however, do not take the place of detailed plans pertaining to emergency response. Because the Plans of Cooperation are intended to be a component of, rather than replace other ship plans, other ship emergency plans should be discussed during the development of the Plan of Cooperation. By linking all relevant plans, the Plan of Cooperation should not be viewed as useful solely for a ship in distress; rather, it is useful for ships providing aid, ships coordinating rescue actions on-scene, or for RCCs.

The conduit of information, and generally the holder of Plans of Cooperation, is the SAR Data Provider (SDP). An SDP is the source for an RCC to contact and obtain the Plans of Cooperation. The SDP System was created to eliminate the need for ships subject to provisions of the SOLAS Convention (that carry more than 12 passengers on an international voyage) to file a Plan of Cooperation with each RCC within their operating area. Creating Plans of Cooperation is normally the responsibility of the ship or its company, although the Coast Guard may also initiate the process. IMO MSC/Circ. 1079 provides a template and guidance on how to create such plans. The U.S. Coast Guard also provides a model plan for ships subject to SOLAS Convention, Chapter V, regulation 7.3.

In an emergency, little time can be wasted in locating a particular Plan of Cooperation. RCC Falmouth, UK, maintains a database that identifies and provides contact information for SDPs worldwide that hold SAR Plans of Cooperation for particular ships. RCC Falmouth can be reached 24 hours a day by telephone at + 44 1326 317575, or via the

World Wide Web at **www.mcga.gov.uk/c4mca/mcga-hm_coastguard/dops_-_all-sar_co-operation_plans_020804.htm**.

So who is the SDP? As stated earlier, the SDP is normally the source that holds, maintains and distributes the information in a Plan of Cooperation applicable to ships that transit multiple search and rescue regions (SRRs). Normally the shipping company designates the SDP, which can be the company, an RCC, or other qualified entity that can perform the function 24 hours a day. If the SDP system is not used, all RCCs with responsibilities where the ships operate should hold a copy of the Plan of Cooperation.

Simply creating, holding, and accessing the Plans of Cooperation is not enough. SOLAS Convention, Chapter V, regulation 7.3 requires that the plans be exercised. Because the need to rescue many persons from passenger ships is a low probability, high consequence requirement, exercises are necessary to ensure adequacy of the plans and resources. Passenger ship exercises are typically coordinated as part of the Coast Guard-wide planning program, but, since exercising the Plans of Cooperation usually only involves establishing contact, accessing the plan, and verifying information, they may be exercised separately or as part of a coordinated planning effort. These plans should not be over-exercised or always exercised with the same SAR services. Exercises should not be limited just to RCCs but should test all parts of the emergency response network. Several different types of exercises are acceptable, as long as the principles of cooperation between the ship, the company, and SAR services are exercised. Tabletop exercises and seminars involving ship's personnel, shore-based emergency response personnel, and SAR service personnel are also helpful. In the event a ship has actually been involved in a SAR incident, it can count that as an exercise for the purposes of IMO MSC/Circ 1079.

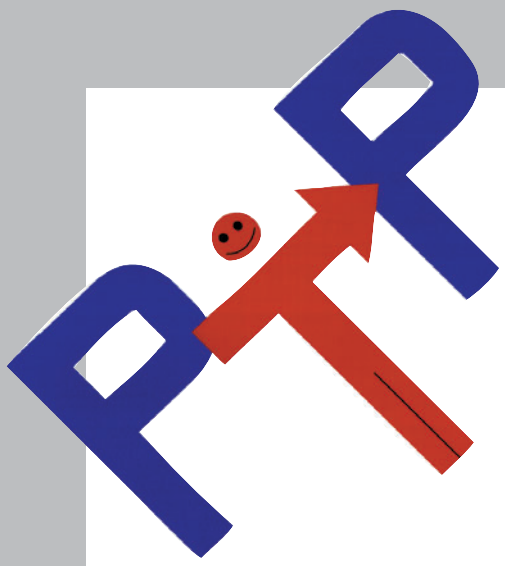
In addition to exercising safety plans and Plans of Cooperation, it is important to remember that large passenger vessel incidents may evolve into mass rescue operations. Mass rescue operations, regardless of their likelihood, involve the immediate assistance to large numbers of persons in distress such that SAR capabilities normally available are inadequate. Understanding and exercising all plans, including Plans of Cooperation, by relevant parties is crucial to prepare for a mass rescue operation.

Keeping the Plan of Cooperation updated is second only to creating the plan. Updating and auditing plans should be conducted as part of any safety management system. Additionally, the development of Plans of Cooperation can be used as an opportunity to review the adequacy of other emergency plans, ensuring that they, too, are updated and improved as necessary. Only after other required plans are in place should Plans of Cooperation be developed.

Plans of Cooperation should not be limited only to ships subject to the SOLAS Convention. Many ships, ferries, or other vessels that travel on fixed routes may also have a Plan of Cooperation developed, but do not normally use the SDP system. If a Plan of Cooperation is developed, the company typically provides controlled copies to all RCCs and rescue subcenters (RSCs) with responsibilities along the ship's route.

A Plan of Cooperation, besides being required, is an important component of a ship's safety plan. Ensuring they are complete will help the ship and rescuers in the event of an incident at sea. The Plan of Cooperation templates provided in IMO MSC/Circ. 1079 make their development relatively simple. It is important, however, that they be developed, exercised, updated, and stored appropriately. The difference between a successful SAR mission and one that ends in tragic loss of many lives rests on these plans.

[1] Maritime Safety Committee Circular 1079, July 2003, *Guidelines for Preparing Plans for Cooperation Between Search and Rescue Services and Passenger Ships.*



Search and Rescue

The last safeguard

By Joseph Myers
U.S. Coast Guard Human Element and Ship Design Division

and By Katie Clegg[1]

A ship in port is safe, but that's not what ships are built for.
—Rear Adm. Grace Murray Hopper, U.S. Navy

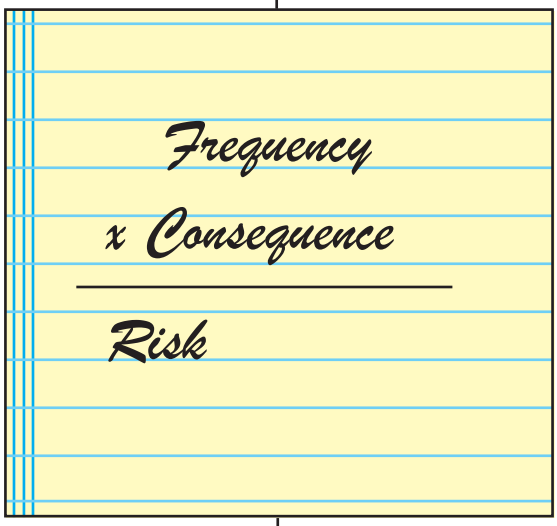
The goal of the Marine Safety Program, in a nutshell, is to put the Search and Rescue (SAR) Program out of business. As the U.S. Coast Guard Human Element and Ship Design Division, we develop and implement programs designed to help those within the marine industry minimize risk and facilitate safe and productive operations. Our initiatives address the human and organizational influences on maritime safety and system performances.

Accidents are sometimes unavoidable. As Rear Adm. Hopper's quote above points out, ships are designed to sail, and there is inherent risk involved with any marine operation. The Coast Guard works hard to promote marine safety, and there are numerous regulations, initiatives, and programs initiated and run by the Coast Guard to address potential risks in all aspects of marine operations. When a SAR operation takes place due to a marine incident, it is likely that one or more of the safeguards promoted by the Coast Guard have not succeeded. Although the Coast Guard is recognized as one of the worldwide leaders in SAR programs, it is advantageous to eliminate these missions from ever being necessary. Ultimately, SAR is the last line of defense toward protecting people at sea.

In 1994, the Coast Guard recognized the need to more actively address the role of human and organizational factors (HOF) in marine safety and environmental protection. It has been estimated that as many as 80 percent of marine incidents are a result of human error. Understanding HOF can provide insight into the cause of these incidents as well as ways to prevent them. Human factors engineering, a key aspect of HOF, draws from physiology, psychology and engineering. These disciplines analyze the interaction between human and machine and aim to improve the system in which they operate and can likely reduce the risk of an incident. HOF has been the catalyst for several important initiatives developed under the Prevention Through People (PTP) program.

PTP is a people-focused approach to marine safety and environmental protection that systematically addresses the root cause of most accidents: the human element. PTP involves several approaches to ensuring a safe marine

environment, including, but not limited to, Risk-Based Decision Making (RBDM) and the Crew Endurance Management System (CEMS). The specific goals and practices of these initiatives provide further insight into how the understanding of HOF plays a role in marine safety. A safe marine environment is a product of balance within and among management, work environment, the behavior of people, sound decision-making and the appropriate technology.



The Coast Guard's PTP Principle of Managed Risk states: "A thorough evaluation of the risks involved in an operation, and the exercise of good judgment in executing that operation, is of paramount importance for success[2]." RBDM is designed to help mariners identify when conditions make a marine incident more likely. Risk is the combination of frequency (F) and consequence (C), often expressed as F x C=Risk. There are two categories of risk: that which can be reduced or eliminated, and remaining risk. Risk is always present; however, the tools within RBDM allow mariners to determine exactly what threatens their safety and what precautions to take to determine if the risk is too great to continue safe operations.

In 1997 the Passenger Vessel Association (PVA) partnered with the Coast Guard under PTP to create the PVA Risk Guide, which allows operators an opportunity to perform risk assessments based on their operations. This assessment "details anticipated hazards and looks at the likelihood and consequences of those hazards, and a risk management plan that specifies additional safety measures to address those risks[3]." With RBDM, mariners can identify and evaluate foreseeable risks and, as a result, remove themselves from harm's way.

CEM, one of the Coast Guard Research and Development Center's recent initiatives, identifies the risks posed to vessel crews deployed for extended periods of time and provides a system for vessel operators to identify and minimize those risks. CEM explores the environmental, physiological, psychological and organizational factors that can reduce crew alertness and productivity and, therefore, increase the risk of fatigue. The objective of CEM is to maintain performance within safety limits while enduring job-related challenges. Companies are encouraged to adopt the CEMS onboard their vessels and tailor the specific needs of each vessel's crew to the applicable practices in CEMS. The system provides several tools for improving vessel operations by establishing healthier watchkeeping shifts, implementing light management, adjusting diet and reducing noise pollution, all of which can reduce potential crew fatigue and, therefore, reduce the likelihood of an accident. CEMS is just another example of a safeguard designed by the Coast Guard to protect mariners and prevent a scenario where search and rescue would be necessary.

So why is it so important for the Coast Guard to do everything possible to prevent a search and rescue operation from being necessary? While the Coast Guard SAR Program is excellent, there are significant risks and costs involved with rescue missions.

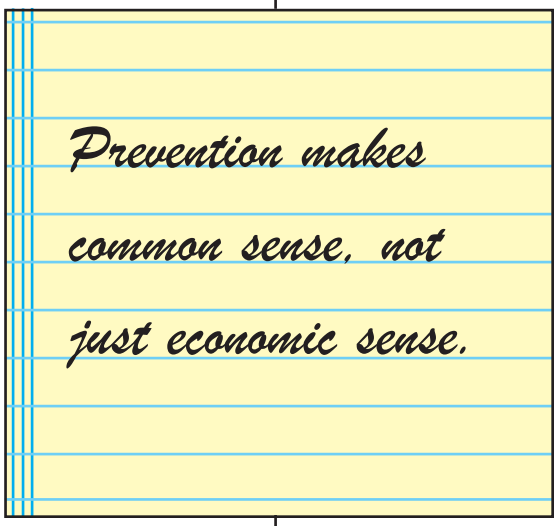
Vessels and mariners in distress can be extremely difficult to locate, especially within narrow time constraints. Severe weather, a common precipitator of SAR missions, can make rescue missions dangerous for even those conducting the search and rescue. Rescues can be hampered for many reasons: failure of communications devices, poor visibility due to inclement weather, lack of safety equipment/flotation devices and nightfall.

In fact, even when conditions are favorable for a SAR operation, there may simply not be enough time. A recent Coast Guard analysis of noncommercial boating fatalities indicated that many boaters die within only a few minutes of exposure to cold weather, due to the shock of dunking. This phenomenon can incapacitate boaters long before hypothermia has even had a chance to set in. The report states boaters may have perished when the "victims inhaled two quarts of icy water in a reflexive gasp or lost the ability to swim after arms and legs chilled within minutes[4]."

SAR missions also create significant costs to U.S. taxpayers. According to the Coast Guard's handout, *Search and Rescue is No Joke!*, "Each hour a U.S. Coast Guard aircraft is aloft costs about $3,700—and several may be used in a single search…medium size ships, referred to as cutters, cost roughly $1,550 an hour to run. Even a U.S. Coast Guard small boat costs between $300 and $400 per hour to

operate[5]." On average, the Coast Guard conducts 109 search and rescue cases each day[6]. Reliance on SAR as the only safeguard, however, may be even more costly.

From an individual standpoint, search and rescue missions are generally necessary when a vessel has sunk or has been significantly damaged. In 2003 marine incidents resulted in more than $120 million worth of property damage to vessels[7]. From an economic standpoint, any preventive measure that can eliminate these costs is beneficial to the marine industry as well as the general public. Prevention makes common sense, not just economic sense. Sole reliance on SAR as your safeguard is as foolhardy as driving a car without brakes, headlights or seatbelts at night and relying on the local rescue squad to save you when you crash.



There is a saying that hindsight is 20/20. Promoting marine safety means transforming that hindsight into foresight. Imagine that two vessels collide at night. The Coast Guard station is radioed, and, within minutes, both vessels sink and several passengers are left stranded in the water. The Coast Guard performs a search and rescue operation. Although all of the passengers are recovered, this incident still results in significant risk to the lives of several individuals, major property loss and a hefty cost to the U.S. government. The Coast Guard investigation reveals that the incident occurred because someone standing watch on one of the vessels fell asleep after working several irregular shifts over a period of several days. Once the Coast Guard has this information and can see the potential threat that irregular sleep cycles pose, they can encourage mariners to use more regular watchkeeping schedules and, therefore, help to prevent such accidents from occurring in the future.

It is important to remember at the end of the day, however, that safe operations are dependent upon vessel owners and operators. Regardless of how many initiatives the Coast Guard promotes, they will be completely ineffective if they are not adopted and incorporated into a vessel's operations. While the Coast Guard will do all it can to research and inform the public of potential safety risks and promote the use of effective technology and safety equipment, the Coast Guard's efforts will not be successful if they are not adopted. As former Commandant Adm. James M. Loy explained in a speech to the U.S. Naval Institute, mariners "have the ultimate responsibility for their own safety,…boaters must plan to minimize the likelihood of finding themselves in distress situations. And then,…boaters must plan to maximize the likelihood of being rescued if they do encounter distress[8]."

PTP's mission is to help foster a safe and productive environment for the marine industry and for recreational boaters by identifying the potential threats they face and reducing the need for our last line of defense: search and rescue. One day, we would like to ensure that Coast Guard search and rescue responders, like Maytag repairmen, have a lot of free time on their hands. With the cooperation of vessel owners and operators, our safety initiatives and programs can establish several layers of defense for mariners and boaters to protect themselves from the inherent risks involved in simply leaving port.

[1] Contractor with Sage Systems Technologies.
[2] "The Principle of Managed Risk," *Coast Guard Publication 1, U.S. Coast Guard: America's Maritime Guardian*, U.S. Coast Guard, Jan. 1, 2002.
[3] "PVA Risk Guide: A Guide to Improving the Safety of Passenger Vessel Operations by Addressing Risk," U.S. Coast Guard and Passenger Vessel Association, 1997.
[4] Doug O'Harra, "Shock of dunking, not hypothermia, kills boaters," *Anchorage Daily News*, July 5, 2004, p. B1.
[5] U.S. Coast Guard, "Search and Rescue is No Joke," **www.uscg.mil/hq/g-o/g-opr/nojoke.htm**.
[6] U.S. Coast Guard, "Coast Guard Fact File," **www.uscg.mil/hq/g-cp/comrel/factfile/index.htm**.
[7] U.S. Coast Guard, "CGInfo," **http://cginfo.osc.uscg.mil/**.
[8] Adm. James M Loy, "Lessons Learned From *Morning Dew*," U.S. Naval Institute, Annapolis, Md., April 22,1999.

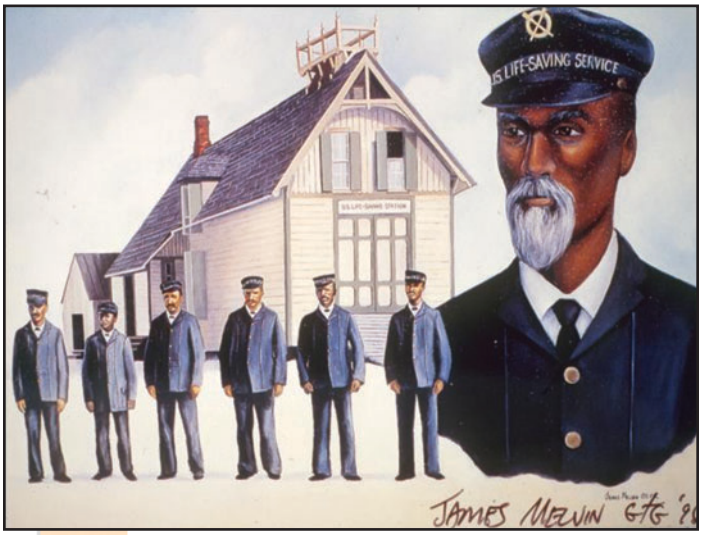
Bravery Against All Odds

The Pea Island Rescue Retold Over a Century Later

By Rear Adm. STEPHEN W. ROCHON
Deputy Assistant Commandant for Intelligence, U.S. Coast Guard Headquarters

The Pea Island surfmen outside the station house, circa 1896, left to right: Richard Etheridge, Benjamin Bowser, Dorman Pugh, Theodore Meekins, Lewis Wescott, Stanley Wise and William Irving. Courtesy U.S. Coast Guard Historian.

The Pea Island station house.



Capt. Richard Etheridge and the Pea Island crew. Painting by James Melvin.

On a white sandy beach once known as Pea Island on the Outer Banks of North Carolina, the nation gave birth in 1880 to its first and only lifesaving station manned exclusively by African-Americans. Later, the U.S. Lifesaving Service merged with the U.S. Revenue Cutter Service and the U.S. Lighthouse Service to form our modern day U.S. Coast Guard. Station Pea Island remained primarily all black until it was decommissioned in 1947.

Similar to other such lifesaving crews at stations along America's coastline, these heroic men often fought unbelievable odds to rescue passengers and crews of ships in distress. Nested on the northern half of Hatteras Island, the unforgiving waters around Pea Island and the entire Outer Banks were known as what David Stick referred to in his book as "The Graveyard of the Atlantic." This was largely because of its storm-prone geography with landmass protruding into the ocean as it met the Atlantic's treacherous seas. Even the best of seafarers could not win their many battles against the ocean's fury and rough tides along the coast.

During one of the Pea Island surfmen's most notable rescues, on Oct. 11, 1896, the three-masted, 396-ton schooner *E.S. Newman* was en route from Providence, R.I., to Norfolk, Va. Before reaching its destination, the vessel encountered a severe storm with hurricane-force winds, which were, according to the newspaper, *The Wilmington Messenger*, "the heaviest since 1847." With wind torn-sails the vessel was unable to maneuver against the raging seas off Cape Hatteras Island. The *Newman* then drifted almost 100 miles southward onto a shoal near the beach off Cape Fear on the North Carolina coast. The pounding waves and churning seas threatened to smash the ship to oblivion. The tide rose to the point where much of the Pea Island beach was completely submerged. With visibility almost reduced to nothing, the master, Capt. Sylvester A. Gardiner, ran the *Newman* aground a few yards off the beach in hopes of saving his wife, three-year-old son and six other crewmen from certain death. Realizing his desperate situation, Capt. Gardiner sent up a lighted distress signal and waited for assistance.

Capt. Richard Etheridge, the first African-American keeper of the Pea Island Lifesaving Station, had discontinued routine patrols that night because of the high water that had inundated the island. Fortunately for the crew of the *Newman*, however, Capt. Etheridge assigned Surfman Theodore Meekins to stand watch in the lookout tower. It

Pea Island Keeper, Capt. Richard Etheridge. Painting by James Melvin.

was difficult for Meekins to see beyond the station's buildings because his vision was obscured by rough seas and blowing sand. In the dark, with his keen vision, Surfman Meekins spotted what appeared to be a red flare, but he wondered if his tired, bloodshot eyes were playing tricks. He lit a Coston flare to notify Capt. Etheridge and the other lifesavers to watch for additional flares to verify the distress signal. After a few minutes, they saw a red torchlight burning near the beach, about two miles to the south.

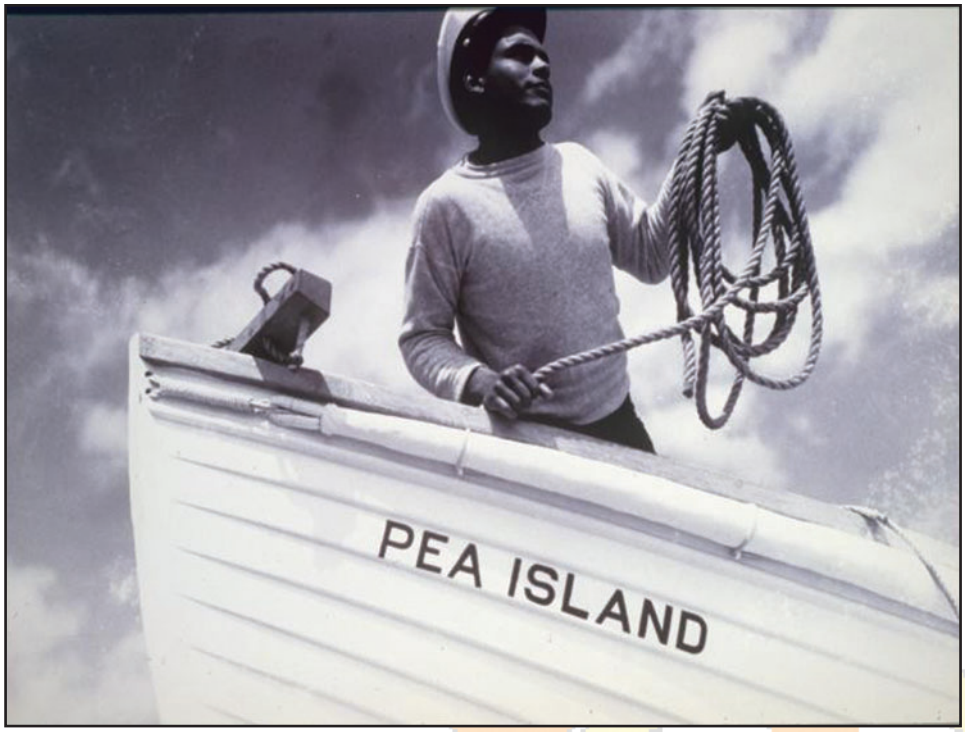
The dramatic rescue of the *E.S. Newman*'s Capt. Gardiner's young child by the Pea Island crew. Painting by Roy LaGrove.

"It seemed impossible under the circumstances to render any assistance," Capt. Etheridge later wrote, but he mustered his crew, including Benjamin Bowser, Dorman Pugh, Stanley Wise, Lewis Wescott, William Irving and Meekins as his lead swimmer. They hitched a pair of mules to the beach apparatus cart and fought their way down the beach. "The storm was raging fearfully, the tide was sweeping across the beach and the team was often brought to a standstill by the sweeping current," Capt. Etheridge reported in his log. The seven lifesavers and two mules waged a gallant struggle against the elements, crossing the two miles of wet and stinging sand, bone-chilling water and sweeping currents. Capt. Etheridge, a former slave, Civil War soldier and Lifesaving Service veteran of nearly 20 years, was considered one of the most daring lifesavers in the service. Never before had they come so close to a wrecked vessel only to be thwarted in every attempt.

Once on-scene, the lifesavers could not fire a line to reach the *Newman* because their 150-pound Lyle gun (a solid brass cannon) was rendered useless. The sand was so saturated that any anchor or platform for the gun would sink. Their only chance was to abandon their lifesaving gear and see what human strength, perseverance and luck could do. Thinking quickly, Capt. Etheridge directed two of his surfmen to lash each other together with a heavy line and move out toward the breakers. Surfman Meekins, known for his superior swimming abilities, was the first to brave the violent surf that night. He and a fellow surfman grasped another line in their hands while the other surfmen held the other end on the beach. They moved slowly into the breakers, past the high water mark and into deeper waters beyond. Bent low against the wind, the men were forced to rise up high to brace themselves against the pounding waves, then to swim the remaining distance to the ship. It was tortuous work, slow and dangerous, with slim chance of success.

Capt. Gardiner and his eight other crew and passengers of the *Newman* clung to what remained on the ship's deck structure, as they intently watched the progress of the lifesavers. Eventually, the two surfmen reached the *Newman* and began to extract the battered passengers from the ship. The rescuers tied the spare line around Gardiner's young child and headed for the shore, with their fellow lifesavers on the beach pulling and dragging them through the hungry Atlantic waters. Capt. Etheridge repeated this procedure for Gardiner's wife and each of the *Newman* crewmembers, with the surfmen rotating to replace the two who had gone out before them. Again and again, the surfmen ventured out through the raging sea, back to the side of the wrecked vessel.

For six hours, the seemingly inexhaustible Pea Island lifesavers braved the perilous waters nine times, literally carrying all nine souls to safety. All of the *Newman*'s passengers and crew escaped without injury, but the ship was a total loss. Capt. Etheridge and his men, under tremendous risk and imminent peril, had accomplished the seemingly impossible. The only recognition they would receive for this daring rescue, until now, was the ship's name board, given to Surfman Meekins by Capt. Gardiner to show his appreciation. Nearly 100 years later, Keeper Richard



Lt. Herbert Collins at Pea Island in the late 1940s.

The Gold Lifesaving Medal presented posthumously to the Pea Island crew in 1996.

Etheridge and his crew at the Pea Island Lifesaving Station received the nation's Gold Lifesaving Medal, posthumously, from former Coast Guard Commandant, Adm. Robert E. Kramek, for their daring rescue of the *Newman* by risking their lives so that others might live.

After the 1996 ceremony at the Navy Memorial in Washington, D.C., William C. Bowser, 89, a former Pea Island surfman and descendant of one of the rescuers, approached me and said, "Commander, I have to tell you something. You know, I have never experienced anything like this before," as the tears began to fill his eyes.

He continued, "I was really reluctant to come to the ceremony today from Norfolk, Va., because I thought I would hear the National Anthem being sung. You know why? I was treated so badly as a black man back in those days, that, whenever I heard that song, I would cry because I didn't believe the words included me. Now, after what you…and the Coast Guard have done to honor the brave men from Pea Island, I will continue to cry when I hear that song, but I will cry out of joy because you all have erased 50 years of bitterness from my heart."

Quoting parts of an e-mail I received just a couple of weeks before the ceremony from retired Fire Chief Daniel Gardiner, grandson of Capt. Sylvester Gardiner, the *Newman*'s master, says it all. He wrote, "To learn of this

William Bowser, Surfman (far left) and Lt. Herbert Collins, Surfman (second from left) at the 1996 Gold Lifesaving Medal Ceremony at the Navy Memorial in Washington, D.C.

story was like being born as an adult. I saw things for the first time, but with the ability to understand its remarkableness and far-reaching implications."

He continued, "It's almost too much to comprehend in one single lifetime, to suddenly discover that I owe my own being, indeed my life, to seven courageous black men

Pea Island Surfman William C. Bowser.

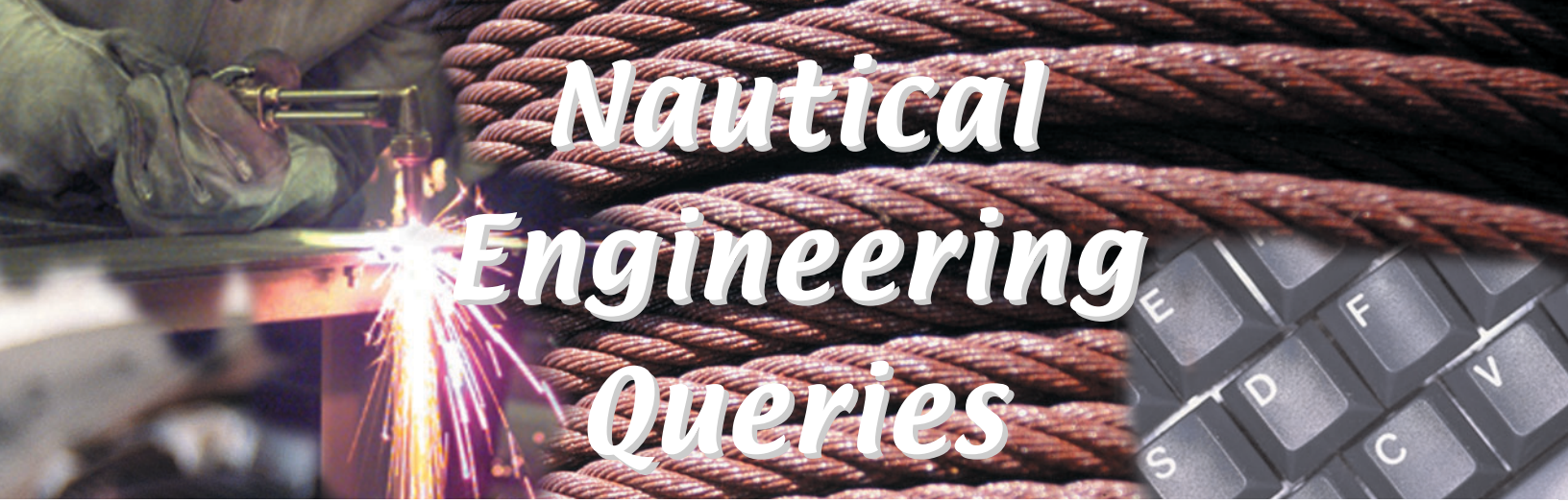
On Oct. 11, 1996, the 100th anniversary of the *E.S. Newman* rescue, Fire Chief Daniel Gardiner (left), grandson of the *E.S. Newman*'s Capt. Sylvester Gardiner, greets U.S. Coast Guard Capt. Dwight Meekins (right), grandson of Pea Island Surfman Thomas Meekins.

who were stationed at the Pea Island Life Saving Station over a 100 years ago. Wow, it's extremely humbling." The Gardiner family could not be located before the initial ceremony in Washington, but they were on hand to witness their history being retold at another ceremony held on the Outer Banks on the 100th anniversary of the now famous rescue. Before this, the phone call in 1996 to the Gardiner family was the first time they had ever heard of the rescue of their grandfather, grandmother and young uncle. The adult grandchildren from Connecticut suddenly realized that none of them would be alive today had the rescue not occurred.

Honoring the memory of the Pea Island crew, the Coast Guard commissioned a 110-foot patrol boat, naming it Coast Guard Cutter *Pea Island*. Capt. Etheridge and his family now lay in rest at the North Carolina Aquarium in Manteo, N.C., with the story displayed on the museum walls. William Bowser and Lt. Herbert Collins, USCG (retired), both descendants of rescuers and now in their 80s, and the only two surviving Pea Island surfmen, travel with me around the country to speak about their experiences and the legacy of their ancestors. Lt. Cmdr. Bill Travis, a Coast Guard reservist and television producer and director in his civilian life, recently completed filming the reenactment of the rescue on location using Coast Guard actors. The video will include heart-wrenching interviews of the Pea Island descendants, soon to be available for Coast Guard-wide use. In addition, a few books have been written on the subject.

Acknowledgments

The author, Rear Adm. Stephen Rochon, has researched the Pea Island story during off-duty hours since 1987 and was aided by the research of David Wright and David Zoby, now university professors, and Visha "Kate" Burkhart, a creative writing college student in North Carolina. Other contributors were Cmdr. Larry Barrow, USCGR (retired), Shirley Rochon, Norma Bullock, Chief Warrant Officer Edward Kruska, editor of the Coast Guard *Reservist* magazine, and the descendants of Pea Island and the *E.S. Newman*. Together, their efforts and the efforts of many others culminated with the Pea Island Lifesaving Station crew being awarded the nation's coveted Gold Lifesaving Medal. Chief Petty Officer Alex P. Haley, USCG (retired), renowned author of the famous book, *Roots*, greatly inspired this effort before his untimely death in 1992.



Nautical Engineering Queries

1. What is the value of the controlled variable that the automatic controller operates to maintain?

A. Set point

Incorrect: The set point represents a relative position to which the control-point-setting mechanism is set, and is only obtainable when the value of the controlled variable coincides with the physical setting of the controller and is achievable without the condition of "offset."

B. Control point

Correct Answer: The control point is the value of the controlled variable, which under any fixed set of conditions, the automatic controller operates to maintain the value of the controlled variable.

C. Deviation

Incorrect: Deviation is the instantaneous difference between the actual value of the controlled variable and the value of the controlled variable corresponding with the set point.

D. Offset

Incorrect: Offset is the steady-state difference between the desired control point and the value of the controlled variable that corresponds to the set point.

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2. Where would a metal-edge disk type strainer normally be found on a diesel engine lubrication system?

A. Pump discharge line

Correct Answer: This type of strainer is designed for positive pressure applications. It uses a simplified cleaning system and sludge removal feature that can be performed while the system is operating.

B. Gravity tank inlet line

Incorrect: The restricted size of this type of strainer is not practical for large volume/flow applications such as is common in a gravity type lubrication system.

C. Oil sump return line

Incorrect: Oil return lines are not usually fitted with filters, but drain directly and unimpeded to the engine's sump.

D. Pump suction line

Incorrect: The restricted flow through this type of strainer would create an excessive pressure drop and easily cavitate the oil pump.

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3. Which of the operating principles listed would apply to a single-element, thermo-hydraulic feedwater regulator?

Note: There are three main sections associated with a single-element feed water regulator. The feed water regulating valve and actuating bellows, which opens in response to applied vapor pressure; an inner tube affixed to the steam drum to reflect the virtual level of water in the drum; and an outer, enclosed tube, pressure generating system or generator. The generator is partially charged with water, and will increase in its percent of vapor in response to and proportional to the drum water level. Hence, the percent of vapor and corresponding vapor pressure will be inversely proportional to the level of water in the steam drum.

A. A failure of the regulator pressure actuating system closes the valve.
Correct Answer: A low water level in the steam drum would result in a large column surface area to be exposed to steam in the inner tube. This relationship results in the transfer of a greater amount of the heat to the fluids in the outer tube resulting in an increase in the percent of vapor and an increase in the vapor pressure. The increase in pressure develops a higher force to act upon the feed water valve actuating bellows atop the feedwater valve stem and in opposition to the countering spring force which attempts to close the feed water valve. A leak of fluid from the outer tube would prevent the pressure buildup required to open the valve against the spring force.

B. The regulator maintains a constant water level throughout the boiler load range.
Incorrect: The single-element or proportional control system is intrinsically subject to the condition of offset as loads vary. The amount of offset increases significantly as the rate of load (steam demand) changes, rendering a steady state or constant water level virtually impossible to maintain unless the control point is continually changed or the addition of process controls, such as reset or rate are added, as associated with the "two" and "three" element regulators.

C. The cooling fins on the generator prevent the formation of steam in the closed system.
Incorrect: The cooling fins applied to the "generator" are simply provided to maintain a continuous transfer of heat to allow and reflect changes in the steam/water relationship within the generator.

D. The pressure in the inner tube acts upon the bellows of the regulator.
Incorrect: The water and steam volumes existing in the inner tube are directly proportional and related to the steam drum contents of water level and steam. The relative volume of water and steam in the inner tube affects the quantity of heat transferred to the water contained in the outer, enclosed tube, pressure generating system or generator, whose vapor pressure changes accordingly and acts directly on the feed water valve actuating bellows.

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4. In a vapor compression type refrigeration cycle, the refrigerant temperature decreases the most in the _____.
A. evaporator
Incorrect: By design, as the cool, mostly liquid refrigerant passes through the evaporator, it absorbs latent heat from the refrigerated space to become fully vaporized. Even though the vaporized refrigerant absorbs additional heat to become superheated, it may only be 10 degrees warmer than it was when it initially entered the coil.

B. condenser
Incorrect: As the refrigerant transfers its latent heat, superheat, and heat of compression as it flows between the inlet and outlet of the condenser, there is a minimal change in temperature and is only due to some minor sub cooling as the high pressure of the condensing gas and liquid remains relatively constant.

C. compressor
Incorrect: The refrigerant vapor will increase in temperature as it is pumped through the compressor.

D. expansion valve
Correct Answer: Significant temperature differences occur in relation to changes in saturation pressure as the refrigerant passes through the restriction within the expansion valve and represent the greatest change at this point. As the high pressure/high temperature liquid refrigerant passes through the restriction into the lower pressure region, a small percentage of the liquid flashes to vapor as the latent heat is absorbed from the remaining liquid reducing its temperature.

1. The flammable limits of gasoline are 1.3 to 7.6 percent volume of the air. You are testing a tank that contained gasoline by using a combustible gas indicator. Under testing, the tank sample registered "55" on the instrument's dial. What is the concentration of flammable gases?
Note: A combustible gas indicator is used for detecting and measuring the percentage of vapors given off by a flammable liquid relative to the lower explosive limit (LEL). The actual concentration of a specific gas in the space measured by a combustible gas indicator is determined by the meter reading multiplied by the LEL. The meter reads a percentage, which is 55% in this case. Fifty-five percent is expressed as 0.55.

A. 0.7%
Correct Answer: The indicated value was calculated by multiplying 55% by the lower explosive limit stated as 1.3.
0.55 X 1.3% = 0.72%

B. 4.1%
Incorrect: The indicated value was calculated by multiplying 55% by the upper explosive limit stated as 7.6.
0.55 X 7.6% = 4.18%

C. 5.5%
Incorrect: The indicated value was calculated by multiplying 55% by 10, which is a non-factor.
0.55 X 10 = 5.50%

D. 55%
Incorrect: The indicated value is only the meter reading and must be factored by the multiplier to produce a value of percent volume of air as the answer.

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2. The free surface correction depends upon the dimensions of the surface of the free liquid and the _____.
Note: The height of a vessel's center of gravity is initially determined without considering the effect of free liquid. This correction is the distance by which the vessel's center of gravity is raised by the effect of the free liquid surface in the tank. This vertical distance is directly proportional to the surface dimensions (length and breadth) of the tank and inversely proportional to the vessel's displacement.

A. volume of liquid in the tank
Incorrect: The correction factor is unaffected by the volume and the depth of free liquid in the tank. Any volume, less than that which completely fills the tank, creates a free surface effect.

B. displacement of the vessel
Correct Answer: As noted above, the correction depends upon the dimensions of the free surface and is inversely proportional to the vessel's displacement.

C. location of the tank in the vessel
Incorrect: The correction factor is unrelated to the location of the tank.

Answer choices continued on p. 95

D. height of the center of gravity of the vessel
Incorrect: The center of gravity will be raised from wherever it would be, if there were no free surface effect.

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3. When bunkering at anchorage, which of the following signals must be displayed?
Note: The required warning signals for vessels transferring combustible and flammable bulk liquids are cited in 46 CFR 35.30-1(a).

A. A red flag by day, red light by night
Incorrect: These are the required warning signals if the vessel is "Fast to a Dock."

B. A red flag by day, ONLY
Correct Answer: This flag may be left up at night. There is no requirement to take it down.

C. A red light by night, ONLY
Incorrect: A red light is not displayed at anchorage because it could be confused with a vessel's port sidelight.

D. No signal is required at anchorage
Incorrect: Vessels transferring oil are required to display a red flag during daylight while at anchorage.

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4. You are upbound approaching a lock and dam, and see two green lights in a vertical line. This indicates _____.
Note: Locks and Dams – The required lighting is specified in 33 CFR, part 207.

A. the downstream end of an intermediate wall
Correct Answer: Two green lights mark the downstream end of either the river wall or the intermediate wall, whichever extends farther. The upstream end is required to have three green lights. These green lights signify that the lock is in use.

B. that a double lockage is in progress
Incorrect: Double lockage is indicated by an interrupted flashing light on each end of the intermediate wall.

C. the downstream end of the land wall
Incorrect: Each end of the land wall is required to be marked by one red light.

D. the navigable pass of a fixed weir dam
Incorrect: The assembly that–when removed–allows for a navigable pass through a dam is a "wicket." If the wicket assembly were removed, there would not be a need to operate the lock because the water upstream of the dam would be at the same level as the water downstream. In this case, the lights in choice "A" would be red instead of green to signify that the lock is not in use. An open weir would not establish a navigable pass, and a fixed weir can't be opened.

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