Journal of Human Performance in Extreme Environments

Volume 7 | Issue 2 Article 6

Published online: 10-1-2003

A Research Agenda for the United States Coast Guard

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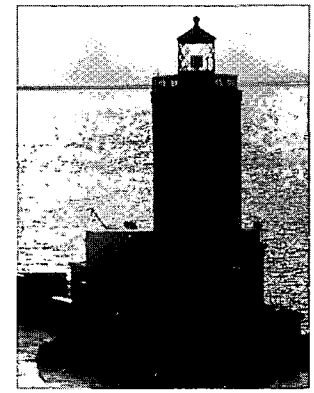

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Historically, the United States Coast Guard has not been widely recognized as an armed force relative to those branches housed under the Department of Defense. However, the country's implementation of the Department of Homeland Security (DHS) has resulted in an increased awareness of the Coast Guard as a critical agency in the country's line of defense. In large part, this change has occurred because the Coast Guard has been incorporated as a part of DHS while previously the agency was housed under the Department of Transportation. Consequently, many problems relating to the day to day operations of the Coast Guard have received relatively little of researchers' attention. Therefore, there is a need to identify critical issues faced by the members of the Coast Guard. Toward this end, the current paper identifies areas of needed research and provides suggestions for ways they might be addressed by research psychologists.

Introduction

Prior to September 11, 2001, the United States Coast Guard was housed under the Department of Transportation rather than under the Department of Defense, as are the other armed forces. As such, the Coast Guard has gone unrecognized by many as an armed force of the United States. Historically, the Coast Guard has suffered from lack of funding, aging equipment, and decreased manpower. However, with the implementation of the Department of Homeland Security (DHS) after September 11 and the subsequent incorporation of the Coast Guard into the DHS, the service's profile has been heightened and resources have been increased. Under this new appointment, though still suffering from reduced manpower, the Coast Guard has been tasked with additional national security duties to perform along with an increase in the maritime safety, maritime mobility, maritime security, and protection of natural resources missions they already perform. This increase in mission responsibility and national visibility necessitates identification of critical issues within the Coast Guard in need of research.

Thesis and Sources of Information

Search and rescue (SAR) takes precedence over all other United States Coast Guard (USCG) missions during peacetime. The duties of a SAR station are primarily SAR, law enforcement, and environmental protection (R.J. Radakovich, personal communication, September 20, 2003). SAR crews at these stations work in 24-hour plus shifts and must be ready to respond to cases around the clock on each day of the year. According to Radakovich, there are only three SAR crews at his previous station. They must be available to respond to all cases and he recalls an incident when he and his crew worked 11 regular daytime hours and then responded to a nighttime SAR case that continued for another 12 hours. As is typical, reinforcements were not an option and Radakovich speculates that this is common practice for many SAR stations in the USCG because many SAR cases occur at night after a full day of work.

Unfortunately, much of what is known about fatigue and shift work in these crews is anecdotal. In a mishap report filed March 26, 2002 by Station Key West, fatigue was listed as the primary causative factor of the grounding of a SAR boat at 2:00 a.m. The coxswain driving the boat was underway for 14.4 hours at the time of the incident. In another recent unclassified statement, D. A. Goward, Chief of Boat Forces for the USCG,

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http://dx.doi.org/10.7771/2327-2937.1031

noted the increasing number of major mishaps at the shore-based stations. Goward states that the recent mishaps have injured several crewmen, decreased unit readiness, and increased the already full workload of the unit crewman. Goward cited long-term fatigue and decreased vigilance as possible causal factors of the mishaps.

Captain W. Russell Webster (2001) of the USCG published an article in which he discusses the serious problem that occurs when SAR personnel working 24 hour shifts are required to make key decisions when fatigued. The USCG Research and Development Center, in collaboration with Group Woods Hole, determined from their study described in Webster's (2001) article, that SAR crews standing more than 12 hours of watch were "walking a tightrope of endurance." Any crew standing more than 24 hours of duty could be pushed well past their limitations in response to any increase in operational tempo (Webster, 2001).

While few studies have specifically focused on how shift work affects the USCG SAR crews working 24-hour plus shifts, much has been done to investigate and demonstrate the deleterious effects of shift work (Goh, Tong, Lim, Low, & Lee, 2000; Akerstedt, 1988; Torsvall & Akerstedt, 1988; Morgan and Coates, 1974) and how to design more effective shift schedules (Rosa, 2001; Knauth, 1996; Folkard, 1992). The USCG Research and Development Center collaborated with Group Woods Hole, a senior operations center, to investigate the effects of a 24-hour watch schedule on SAR personnel. The participants wore wrist activity monitors (WAMs) 24 hours a day for 30 days. The WAMs measured sleep quality and duration in addition to work/rest schedules and sleep/ activity schedules. From the data collected via the WAMs, the researchers assessed the time of sleep onset, sleep duration, wake up times, and the number of awakenings throughout the sleep period. Sleep wake profile analysis produced information on the daily changes in sleep onset and wake up times, percentage of sleep periods less than six hours, and the incidence of disrupted sleep patterns (Webster, 2001). During data collection, Group Woods Hole was called on to respond to the EgyptAir recovery operation. According to Webster, this turn of events allowed the researchers to collect data during both a slow operations tempo environment and during full-scale emergency operations.

The Center found that no watch standee should engage in more than 12 hours on watch. Those standing longer shifts were "walking a tightrope of endurance" and, after a 24-hour watch, these watch standers could be well into their "red zone" (the result of a pattern of sleep and work cycles that induce performance decrements and fatigue) for performance and decision making after any increase in operational tempo (Webster, 2001). The researchers also found that prevention of chronic declines in performance and alertness would not be avoided if the 24-hour watch standers did not receive a full 72 hours off duty after a shift. During the recovery operation of EgyptAir, personnel working 24-hour shifts exhibited acute periods of suboptimal performance (Webster). The study concluded with the following statement: "Prolonged performance in the Red Zone will lead to human error and can significantly reduce the safety of Group personnel and the entire maritime community."

In addition, research currently being conducted at the Coast Guard's Research and Development center is focused on addressing crew endurance issues on board commercial vessels or Coast Guard cutter vessels, both operating in very different circumstances from those under which search and rescue crews and now homeland security crews operate. Research is needed to address the effects of fatigue on SAR and homeland security crews.

Along with reducing fatigue, proper small boat handling is essential to the success of both search and rescue and homeland security missions. The U.S. Coast Guard Academy provides simulated facilities for cadets to train on the handling and navigation of Coast Guard vessels. Facilities such as the Ship Control and Navigation System (SCANTS) and Tow and Wave Tank are training facilities accessible only to those cadets preparing to become officers. Consequently, those enlisted Coast Guard men and women responsible for the operation of the Coast Guard's small boat fleet (e.g., 47' Motor Life Boat, 24" Rigid Hull Inflatable Boat) are not provided with the opportunity to receive a more cost-effective simulated training experience onboard their vessel. These coxswains are only able to train on active vessels, thus rendering training time limited and costly.

Many Coast Guard small boats operate out of search and rescue/law enforcement stations. As such, vessels are required to perform regular operations as well as emergency operations on a daily basis. This pattern of activity restricts available training time for potential coxswains. Fuel availability reductions also act to limit training time onboard small boats. The limitation of training time could leave the training coxswain, as well as the practicing coxswain to a lesser degree, without sufficient practical situations in which to acquire and apply skills and knowledge to real time situations. Furthermore, this unpredictable availability of training time results in an uneven skill distribution from one coxswain to another.

Recent interviews with Coast Guard subject matter experts who operate small boats indicate the desire to have access to an alternate method of training boat handling, navigation, search and rescue decision making,

and crew leadership skills. Each of these areas might be addressed through the use of simulation.

Simulation is currently utilized in several areas, including medicine and aviation and the Coast Guard uses simulators to train pilots and officers. Moreover, marine navigation and handling simulators as well as search and rescue simulators currently exist that might be adapted and made readily available to fit the needs of the Coast Guard. The merits of using simulation for aviation and medical training have been demonstrated in the past (Issenberg, McGaghie, Hart, Mayer, Felner, Petrusa, Waugh, Brown, Safford, Gessner, Gordon, & Ewy, 1999; Jentsch & Bowers, 1998). Research is needed to determine if indeed simulation provides a reasonable alternative to boat handling, crew leadership, search and rescue decision making, and navigation training and if so, will the use of a high fidelity simulation provide better transfer of training than a low fidelity simulation?

Discussion

The Coast Guard has achieved increased visibility and responsibility after the events of September 11. As such, critical issues in need of evaluation relating to the success of the Coast Guard in fulfilling their duties must be identified and addressed to optimize performance. The current paper identified such potential critical areas. There is a lack of research to identify and rectify situations of fatigue unique to search and rescue and homeland security crews. In addition, there is an unstandardized and unpredictable availability of training on board small boats that carry out search and rescue and homeland security missions. As such, the need for alternative methods of training boat handling techniques, navigation skills, search and rescue decision making, and crew leadership has been expressed by Coast Guard subject matter experts. Research is needed to confirm that these are indeed critical issues that face the Coast Guard and to identify additional unrecognized needs. Furthermore, research is needed to determine how to most effectively address the issues. In the case of using simulators, the validity of using simulation must be determined along with the validity of using a high versus low fidelity simulator and the methodology for evaluating the simulator's capability.

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