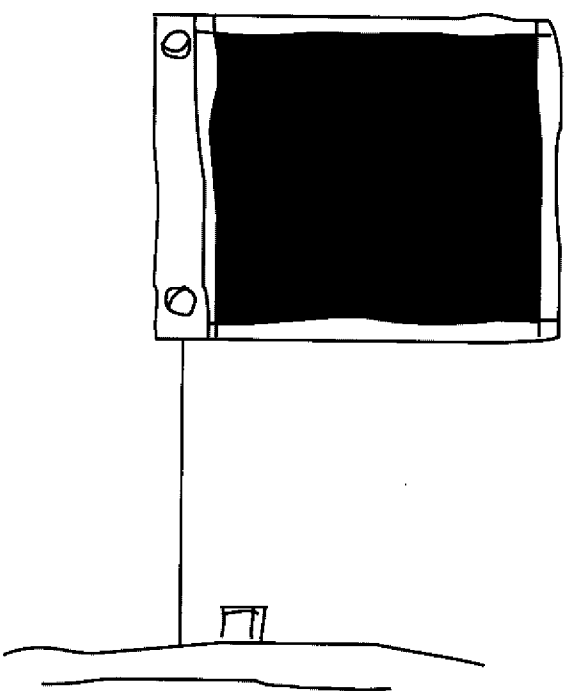
Training and Technology for Safety at Sea



an international symposium

September 20-21, 1990
Sitka, Alaska USA

SUMMARY PROCEEDINGS

Training + Equipment + Attitude = Survival

Alaska Sea Grant College Program Report No. 92-01

Training and Technology for Safety at Sea

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International Symposium
September 20-21, 1990
Sitka, Alaska, USA

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Training + Equipment + Attitude = Survival

Preface

Oil and fish are important energy components for the world's machines and for the world's human population. Both of these sources of energy are found and transported in the maritime environment, an environment which is inherently hostile to human life.

Unfortunately, occupations in maritime industries often have above average casualty and fatality rates. This is particularly true of commercial fishing which has one of the highest fatality rates of any industry worldwide.

It is recognized that the cause of these fatalities is complex and involves environmental, engineering, and most important, human factors. Because of the complex nature of safety and survival at sea, symposium organizers solicited papers from a variety of people with expertise in a wide range of areas. This interdisciplinary approach seemed to be the most effective way to address problems and potential solutions to safety at sea.

Presenters came from backgrounds in commercial fishing, regulatory and safety advisory agencies, training schools, equipment manufacturers, and emergency medical facilities in the United States and Western Europe. It was obvious at the conclusion of the symposium that all of the fields represented had valuable contributions to make. In fact, safety at sea can be addressed only by interdisciplinary methods. These methods include effective training, proper equipment, and safe attitudes.

The organizers of this symposium wish to extend their heartfelt gratitude to the presenters who gave their time and expertise to improve the opportunity for survival in the marine environment, and most important, to prevent casualties from occurring.

Jerry Dzugan
Executive Director
Alaska Marine Safety Education Association
(AMSEA)
Sitka, Alaska

Introduction

When the International Association for Sea Survival Training (IASST) scheduled its annual general meeting for September 1990 to be held in Sitka, Alaska, the Alaska Marine Safety Education Association (AMSEA) and the Alaska Sea Grant College Program took advantage of the international flavor of the event to hold a symposium on Training and Technology for Safety at Sea. The symposium drew on the expertise within IASST and others responding to a call for papers to fill the symposium program. This publication contains abbreviated versions of most of the papers presented at the symposium.

Members of the symposium program planning committee are:

Brenda Baxter, University of Alaska Fairbanks Sea Grant College Program
Ken Coffland, U.S. Coast Guard (retired)
Jerry Dzugan, Alaska Marine Safety Education Association
Dolly Garza, University of Alaska Fairbanks Marine Advisory Program
Richard Griffin, University of Alaska Southeast Islands Campus
Jim Herbert, Alaska Vocational Technical Center
John Manning, Alaska Marine Safety Education Association
Margaret McMillan, McMillan Offshore Survival Technology
Hank Pennington, University of Alaska Fairbanks Marine Advisory Program
Greg Switlik, U.S. Marine Safety Association
Madelyn Walker, Alaska Vocational Technical Center

Symposium attendees were feted at a reception hosted by the Sitka fishing community. Thanks to Marian Allen, Dana Pitts, Page Else, Melissa Thorsen-Broschat, Wendy Natkong, Tim Northrop, Harold Thompson, Dena Weathers, Carol Garcia, Mary Todd Anderson, Debbie Reeder, Anne Lowe, Dennis Hicks, Linda Boord, and Jeanette Chavez for their efforts.

Special thanks to Marian Allen and Dana Pitts for assistance throughout the symposium from initial planning to conclusion.

The theme running through the symposium, coined by Jerry Dzugan, was training plus equipment plus attitude equal survival. We used that slogan on the symposium materials and have organized these proceedings the same way: Training + Equipment + Attitude = Survival.

Overview of the Coast Guard Plan for Implementation of U.S. Commercial Fishing Safety Regulations

Capt. J.M. MacDonald and LCDR M.B. Karr
U.S. Coast Guard
Washington, D.C., USA

The purpose of the Commercial Fishing Industry Vessel Safety Act of 1988 is to save lives in the commercial fishing industry, an industry with one of the highest death rates of any in the United States. Our plan is a preventive approach to carry out the Coast Guard's goal to promote the safety of lives and property and protect the marine environment.

The Act affects 131,000 fishing industry vessels. Approximately 31,000 of these vessels are documented. No one has officially tried to figure out the number of fishing vessels that are not documented. The Coast Guard has used the figure 100,000 as an estimate. These vessels are numbered by state governments, except in Alaska where they are numbered by the Coast Guard. Documented vessels are the largest of the fishing vessel fleet. By law vessels that are "commercial" and measure over five net tons have to be documented.

The Act establishes basic safety standards, lists emergency equipment to be carried, and mandates several safety initiatives. Congress allowed fishing industry vessels to remain uninspected vessels. Areas of contention during passage of the legislation were whether a vessel inspection program, similar to our inspection program for freight, passenger, and tank vessels, and a licensing program, similar to that for mariners on inspected vessels, were warranted.

Implementation of the Act's provisions concentrates on public awareness of the Act through education of the industry, examinations of vessels in the normal course of business, and through creative use of other Coast Guard and industry personnel. The implementation plan consists of continued at-sea examinations in conjunction with search and rescue and law enforcement boarding, and dockside examinations conducted by full time personnel, reserves, and auxiliarists as well as recognized third party organizations such as the American Bureau of Shipping (ABS) and the National Association of Marine Surveyors (NAMS).

Fishing vessel safety coordinators coordinate vessel examinations and training of Coast Guard personnel on provisions of the Act, and determine how the Coast Guard can best improve safety within the fishing industry.

Field enforcement relies on shore stations and cutters continuing to conduct examinations at sea. There is no increase in boardings associated with the new rules. The change the industry will see is that the cutters and shore units check for the additional requirements over and above what they already examine.

More in-depth examinations are carried out dockside as time permits and are our preferred method of meeting the

safety needs of the industry. A dockside visit to a vessel comprises a more in-depth examination, such as removing exposure suits from storage bags and checking their condition. These examinations are done randomly. Ideally, we arrange these visits for the convenience of the owner through fishing vessel cooperatives, organizations, and individual owners.

Many of the vessels we intend to reach are already being surveyed by third parties. For example, NAMS surveyors presently conduct surveys of commercial fishing industry vessels for a myriad of reasons and frequently include checking for compliance with applicable Coast Guard regulations as a service to their clients.

NAMS surveyors annually examine approximately 20% of commercial fishing industry vessels. Owners of commercial fishing industry vessels benefit from these examinations by having experienced, professional surveyors verify compliance with the regulations. These complimentary efforts are a very important force multiplier.

When discrepancies are found that show an obvious disregard for the new rules, consideration must be given to penalty action in order to deter future violations. Reports of discrepancies aboard fishing industry vessels will eventually reach a Coast Guard hearing officer. The hearing officer reviews a case to decide if *prima facie* evidence exists. If it does, a preliminary assessment letter is sent to the owner or operator of the vessel. If the assessment is contested, the owner or operator can request a hearing with the hearing officer. At the hearing the case may be dismissed or an appropriate penalty may be assessed in light of any new evidence submitted by the party.

"On scene termination" to prevent an accident is also an option to deter future violations. The Coast Guard may direct a vessel to return to a mooring until the situation creating a hazard is corrected or ended. We strive to provide our field enforcement personnel with clear guidance that will lead to consistent application of the authority.

The Coast Guard district fishing vessel safety coordinators are charged with developing the necessary relationship with the fishing industry to insure smooth implementation of the fishing vessel safety regulations. We urge the fishing industry to make an effort to get to know the people in these positions and their staffs. The strength of the plan will be the fishing vessel safety coordinators overseeing all Coast Guard fishing vessel safety activity in each district.

The challenges are to ensure we train and qualify all personnel for the tasks assigned to them; to administer an efficient and fair program; and to listen, understand, and be responsive.

Some Lessons Learned from Accident Investigations

William Gossard
National Transportation Safety Board
Washington, D.C., USA

I am pleased to participate with other safety professionals in discussing the need for safety training for two of the most hazardous maritime industries, commercial fishing and offshore oil. My comments are limited to commercial fishing vessel operations, although they generally may be applicable to the offshore oil industry. The safety levels in the maritime industries are of great concern to the U.S. National Transportation Safety Board (NTSB). We have learned that the difference between life and death at sea is measured in only minutes and sometimes seconds. The NTSB is in a unique position to report on accidents because our independent investigations do not have to look at determining fault or violation of regulations.

Training and preparedness to handle an emergency at sea is one area that the NTSB focuses attention on during its investigations. The end products of the Board's investigations are the determination of probable cause and safety recommendations issued to improve safety. Recommendations can be issued to any organization, association, company, or governmental unit that can effectively improve safety conditions.

The NTSB has been in the forefront in pushing, cajoling, and recommending that a safety training regimen coupled with a licensing mechanism be required for commercial fishing vessel masters. The Board believes that safety training should be required not only for captains of commercial fishing vessels, but also for crewmembers. In its investigation of a number of accidents, the Board concluded that training could have improved the outcome of the casualties.

The Board's position on training and licensing is spelled out in its 1987 safety study. A number of major fishing vessel casualties, involving the U.S. uninspected fishing vessels *Sea Dancer*, *Santo Rosario*, *Amazing Grace*, *Americus*, *Altair*, *Bonaventure*, *Liberty*, and *Atlantic Mist*, addressed in the study led the Board to conclude that training of captains and crewmembers was needed. The Board considered a number of initiatives to address training, including voluntary approaches through fishing vessel organizations and associations and work done through Sea Grant programs. These efforts represent sincere and dedicated attempts by a number of highly motivated persons and organizations to improve fishing vessel safety. However, the Board also recognizes that the owners of only an estimated 13,000 or fewer fishing vessels are in organized associations. This means that of the 33,000 fishing vessels targeted for master and crew safety training requirements, most commercial fishermen/women are not introduced to a

voluntary safety program or requirements such as the North Pacific Fishing Vessel Owner's Association program in Seattle, the stringent safety requirements of the Point Judith Club in Rhode Island, or the training programs developed by Alaska Sea Grant and the Alaska Marine Safety Education Association, to name a few.

I will highlight the importance of safety training for captains and crewmembers by looking at the sudden capsizing and sinking of the U.S. fish processing ship *Aleutian Enterprise* in the Bering Sea on March 22, 1990.

On March 2, 1990, the 162-foot long U.S. fish processing ship *Aleutian Enterprise* departed from Dutch Harbor, Alaska, to trawl for cod, pollock, and rock sole in the Bering Sea. The vessel was configured to be a fish processing ship that would process its own catch. The vessel had accommodations for 30 persons and bunks for 31 persons. The *Aleutian Enterprise* was not inspected or certified by the U.S. Coast Guard, nor was it required to be. The Coast Guard regulations applicable to the *Aleutian Enterprise* required that the vessel have either a type I life jacket for each person on board or Coast Guard approved exposure suits. In addition, class B2 fire extinguishers, as specified in Coast Guard regulations, were required.

Thirty crewmembers and a National Marine Fisheries Service (NMFS) observer were on board. By 1330 on March 22, 1990, the vessel was almost fully loaded with fish and nearly ready to return to Dutch Harbor. As the crew was hauling aboard its last catch, the top of the net burst. About 14,000 pounds of fish spilled from the net onto the deck, causing the vessel to list about 5^{o} to port. When the ship heeled to port, sea water entered the port side of the processing deck through openings designed to discharge unwanted fish and fish parts from the vessel. The captain, who was on duty in the pilothouse at the time, transmitted a mayday radio message as the stern settled deeper into the water and the list increased.

As the vessel flooded and the list worsened, crewmembers working below deck came topside as quickly as they could. Some crewmembers hollered and beat on doors to awaken other crewmembers who were off duty and sleeping in their quarters.

Although exposure suits were stowed in three lockers on board the vessel, some crewmen did not know that this equipment was on board. Others knew that suits were on board but were prevented from obtaining a suit because other equipment was stowed in a locker with the suits. Most of the crewmembers had never donned an exposure suit. Of the crewmembers who were able to obtain suits, only a few were able to put them on before the vessel capsized.

Crewmembers crawled onto the side and then onto the upturned bottom of the vessel as it continued to roll over to port. Crewmembers jumped, fell, or were washed into the sea as the vessel capsized and sank within five minutes from the time the vessel started to list. The water temperature was reported to be 1 degree C. Survival time for crewmembers in such waters without an exposure suit would be minimal if rescue was not quick. It is estimated that in such waters the crewmembers would have had 15 to 30 minutes until exhaustion or unconsciousness, and 30 to 90 minutes survival time.

Crewmembers in the water clung to nets, net floats, floating fish, or debris to stay afloat until they could board a liferaft or be rescued by other vessels in the area. One of the vessel's four liferafts did not inflate and another had to be manually inflated in the water. The other two liferafts inflated automatically, as they were designed to, when the vessel sank. Two liferafts inflated bottom side up. Some crewmembers righted and

boarded one of the inverted liferafts, while others climbed onto the other liferaft without righting it. Twenty-two survivors were rescued within 15 minutes by the fish processing vessels *Northwest Enterprise* and *Pacific Enterprise* which were also fishing within two miles of the *Aleutian Enterprise*. Eight crewmembers and the NMFS observer are missing and presumed to have drowned. Six crewmembers were injured.

This accident provides a number of areas where safety training and properly functioning safety equipment might have made a difference as follows:

1. There was not a working general alarm or tilt alarm.
2. The crew consisted of mostly 19 to 23 year old fish processors and seamen. The captain was 26 years old and could find fish. He had no formal safety training.
3. The company did provide a video tape for review by prospective employees on the fish processing operation highlighting the long arduous hours; its intent was to discourage the faint of heart. However, management did not provide safety training or require the captain to hold emergency drills or safety training. The company had purchased a full set of safety videos but they were never shown to the crew on board the vessel.
4. Exposure suits were on board, but were inaccessible to most of the crew (berthing and fish processing areas). Most of the crew had never tried the suits on to see how they worked.
5. The emergency position indicating radio beacon (EPIRB) which was securely located in the pilothouse did not function as intended. Fortunately, rescue vessels were in the immediate area. However, if the vessel had capsized and emergency messages had not been received by other fishing vessels or by rescue personnel, a functioning EPIRB would have been critical in locating the crew.

The NTSB continues to press for the U.S. Coast Guard to require the licensing of captains of commercial fishing vessels, including a requirement that they demonstrate minimum qualifications in vessel safety including rules of the road, vessel stability, firefighting, watertight integrity, and the use of lifesaving equipment; establish minimum safety training standards for all commercial fishermen, commensurate with their responsibilities; and require uninspected fishing vessel captains/owners to provide safety training to all crewmembers.

It is hoped that the Commercial Fishing Vessel Safety Act of 1988 will limit the loss of life in the fishing vessel industry and that the industry will move voluntarily to improve its safety posture. The loss of the *Aleutian Enterprise* highlights that safety, if it is to be taken seriously, must be mandated. Certainly, licensing and training requirements must move forward with great haste.

Mr. Gossard is a Program Director with the National Transportation Safety Board in Washington, D.C. He has worked for 23 years in transportation safety such as pipelines, hazardous materials, recreational boating, and passenger and fishing vessel safety. He attended Harvard University as a Senior Executive Fellow and has a master's degree in Public Administration.

Survival Training—Simulation and Trainee Fitness

J.H. Cross, OBE
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Development of Life-Saving Appliances

Historical maritime records provide an insight into the appalling loss of life among seafarers and passengers who were forced to abandon ship. Many of these deaths were in what might be called "survivable" conditions.

The sinking of the SS *Titanic* in 1912 after colliding with an iceberg resulted in the loss of 1,489 lives, due in the main part to a lack of lifeboats. The resulting adverse publicity and public concern proved a watershed in the provision and improvement of adequate lifesaving appliances aboard ships throughout the world. The disaster also had the effect of generating the first International Conference on Safety of Life at Sea (SOLAS) in 1913, at which 16 countries were represented. Although the outbreak of World War I in 1914 prevented the signed convention from entering into force, the subsequent development of the Intergovernmental Maritime Consultative Organization (IMCO), now the International Maritime Organization (IMO), and its impact on safety at sea illustrates the importance of that first international conference.

A further important development in the improvement and provision of lifesaving appliances occurred as a result of an investigation into survival problems encountered during World War II by the British Royal Navy. The Admiralties Talbot Committee investigation revealed that some two-thirds of all Royal Navy fatalities, in the aftermath of abandonment, resulted from exposure to immersion or to the elements, which in turn often led to death by drowning. The findings of the enquiry led the Royal Navy to develop the naval inflatable liferaft based upon the successful multi-seat aviation liferaft used in larger Royal Navy and RAF aircraft. This successful and ongoing development has led to the current situation where inflatable liferafts are installed on a majority of the world's ships currently at sea.

Investigations into the circumstances surrounding emergency evacuation from offshore structures, ships, and fishing vessels show that lives have been lost, not just as a result of the catastrophic nature of the incident, but often due to the misuse of lifesaving appliances and the failure of personnel to adopt correct survival techniques during and after abandonment.

This has been particularly the case during the launch of totally enclosed lifeboats and in the use of inflatable liferafts. It was the public concern after the MV *Lovat* sank in the English Channel in January 1975, with the loss of 11 lives in, on, and about the liferaft, that generated moves within the British government and Department of Trade to develop basic personal sea survival training courses for

all new and re-entrants to the fishing and shipping industries of the United Kingdom.

The resulting compulsory courses are now available in nautical training establishments throughout the United Kingdom approved by the Department of Transport which maintains strict control over the syllabus content, facility support, and standard of instructors. Despite some inroads that have been made, regrettably, a number of British seafarers are still without benefit of this most important training.

The seafarer and the offshore oil worker at sea in the latter part of the twentieth century are provided with much improved lifesaving appliances when compared to the sad state of affairs in the nineteenth and early twentieth centuries. Totally enclosed lifeboats have replaced open lifeboats; inflatable liferafts are to be found on most ships and fishing vessels; and immersion suits and inflatable life jackets are firmly on the scene. The free fall lifeboats and other novel launching systems now being introduced illustrate the accelerating rate at which change is taking place.

Requirements and Developments in Survival Training

The provision of life saving appliances alone is not sufficient to overcome the problems faced by personnel during a maritime incident that leads to abandonment. Most accidents, it is generally agreed, are caused by people doing what they should not do or failing to do what they should do. This happens in normal work situations. During a maritime emergency, when adrenalin is running quite freely, the likelihood of this occurring will be much exacerbated unless people are well trained to react properly, particularly when there is a need to deploy and use equipment speedily and correctly during an abandonment. Training is even more important where crews have responsibility for passengers.

Currently there are no international agreements or guidelines on personal survival training standards. Persons attending courses at nautical training establishments often receive survival training. However, a large portion of the world's seafaring population, including fishermen, do not necessarily attend nautical training establishments at any time during their careers. It is in this situation that the IMO must take much more positive action over the provision of personal survival training for all who work at sea if satisfactory and acceptable standards are to be achieved.

The international offshore oil industry has no formal approach to survival training for men employed offshore. In practice there is much inter-company cooperation, which has led to an improvement in training standards, particularly in countries surrounding the North Sea, where courses are validated by the responsible national authority. Elsewhere in the world standards vary considerably, and in some areas training is virtually nonexistent. In setting and applying standards the emphasis is often placed on the minimum requirement in terms of expertise, quality, time, and training resources, when only the very highest possible standards should apply in training people to survive life threatening situations.

People involved in a maritime disaster face many inherent dangers in conditions of extreme stress. In many cases the response to danger, particularly should it arise suddenly, is psychomotive rather than intellectual. It has been concluded that 12.5% to 25% of untrained personnel involved in a catastrophe will remain cool, calm, and collected. They will command and act sensibly. From 50% to 75% will be bewildered and indecisive and will wait for somebody to tell them what to do. The remaining 12.5% to 25% will tend toward panic (Hielm 1983). The middle group will,

as far as their ability allows, react to orders. However, if panic is allowed to spread, they will join the last group.

In comparison, the performance of a soldier in combat and his ability to tolerate the stresses of extreme danger has been shown to depend upon his integration within a cohesive group and upon his level of training, competence, motivation, and upon the quality of his leadership. To complete the equation, the effective soldier requires only good equipment with which to perform his allotted task. When faced with abandonment problems, the offshore oil worker, seaman, or fisherman will greatly benefit from similar leadership, training, and equipment support.

Ideally, maritime emergency response training must be aimed at ensuring that *all persons* who work on board a ship or offshore structure have a working knowledge of safety procedures, fire prevention, first aid, firefighting, and containment procedures, including use of personal survival clothing, life jackets, and survival craft.

Industrial training is best provided away from the work place in a well equipped training establishment by qualified and competent instructors who provide realistic and practically oriented safety conscious training, supported by essential theory, and not burdened with unnecessary detail.

Initial basic training followed by regular refresher training every three years is gaining popularity in the offshore oil industry. This should be supported by regular, well organized drills and exercises aboard the ship or offshore structure. Everyone at sea must be made to take part in all drills and exercises. No one should be excused, particularly the senior personnel who are often the worst offenders in this respect. It is extremely important that all personnel are trained together, including rescue procedures, no matter how small a part they may be expected to play in a real incident.

Simulation in Training

Where it is inappropriate or dangerous to provide the actual equipment or conditions for training, realistic simulation can play a very useful part in ensuring practical training at a satisfactory but safe level. Bear in mind the need for skilled and experienced trainers to carefully balance on the line between safety and realism.

Two examples of the way in which simulators provide a safe step closer to realism are:

1. The resuscitation manikin (Resuscitation Annie) allows a level of realistic, safe training in essential life support techniques, which would otherwise not be possible.

2. The environmental drill tank has controlled water temperature, waves, and wind to provide realistic, repeatable standard conditions in which to practice water survival techniques. Should there be a health related incident or accident during training, the staff can respond instantly and backup medical support is available far quicker than if the training were conducted at sea.

The latest in a long line of extremely useful emergency response simulators is the Aircraft Evacuation Simulator. Based on the Super Puma helicopter, it was designed to complement the Helicopter Underwater Escape Trainer used in the Survival Center in Aberdeen. It is used to train passengers in in-flight emergency procedures, preparation for ditching and emergency landing procedures, and emergency evacuation procedures.

The flight simulation achieved by the simulator is extremely realistic providing for pitch, roll, and vibration.

Medical Fitness of Survival Trainees

Fatalities occurring during survival training have highlighted the need to apply the very highest safety standards during practical training activities with a minimum health and fitness standard for trainees undergoing training. Because of strenuous and often stressful activities during training, it is extremely important that the persons involved are "fit" to participate. Ideally, attendees have a recent medical certificate identifying their level of fitness. In Aberdeen we medically screen all individuals at the Survival Centre prior to training. This is achieved by an occupational nurse screening service backed up by a duty doctor.

Screening is achieved through a questionnaire completed by the trainee. The procedure is not designed to prevent trainees from completing the course, but does help significantly to prevent medically unfit personnel from participating in the more strenuous and stressful exercises that may otherwise cause them harm. A number of "human time bombs" with quite serious medical problems have been screened out of the practical training. Some of those persons were in possession of current medical certificates. It is possible that if they had been allowed to participate, serious complications or much worse may have resulted.

Conclusion

It should be the right of everyone who works on or in close proximity to the sea to be provided with good personal survival training conducted safely by a competent training establishment. When this situation is achieved internationally, it will have the effect of maximizing the chances of survival for everyone who is at risk during a survivable maritime incident. For people to die in these circumstances when good equipment is available, due to a lack of comparatively low cost but effective training, is completely indefensible.

Reference

Hielm, J. 1983. An Appreciation of the Requirements for Dealing with Emergencies Offshore, *Safety and Health in the Oil and Gas Extractive Industries* (Graham & Trotter, London).

Mr. Cross is the Managing Director of the Robert Gordon Institute of Technology—Offshore Survival Centre in Aberdeen, Scotland which trains 15,000 people a year. He spent 21 years in the Royal Navy in the survival training and safety equipment branch. He is a Fellow of the Institute of Training and Development, Honorary President of the International Association of Sea Survival Trainers, and was awarded the Order of the British Empire.

How Safety Training of Fishermen Has Influenced Accident Rates and Economy

Capt. Kurt Hanssen
Norwegian Underwater Technology Centre
Bergen, Norway

Over the past five years I have developed and initiated different types of safety training courses for the offshore and shipping industry. At present I am not involved in safety training for the fishing industry.

Norway has a long tradition as a seafaring nation. As much as 80% of the Norwegian population lives within 20 minutes of the sea. In 1948 we had some 85,000 fishermen, comprising a fairly large percentage of the work force. Norway is a comparatively small nation of approximately 4 million inhabitants, so fishing is one of the more important trades in the country.

Nevertheless, a high risk of loss of life or injury has been accepted as a part of the "fishing culture." To be a fisherman is accepted as "dangerous." This attitude has perhaps been one of the most underestimated obstacles to improving safety and the environment of fishing. On the other hand, safety has played a major role in sea operations in Norway. For a long time we have been toward the bottom of the international list of merchant shipwrecks.

Today fulltime fishermen in Norway number approximately 22,000. In addition to these, another 5,000 participate in the cod fishing season along the coast of northern Norway, mainly in small vessels manned with one or two men.

During the period from 1971 through 1984 a total of 655 fishermen perished. This translates into an average of 33 fatalities per annum, with a risk of death more or less at the same level during the whole period. It was alarming to us that the risk did not fall considerably during this period due to technological developments such as better navigational aids, surveillance equipment, and other safety equipment.

Something had to be done about the high number of accidents and fatalities.

Research on Fishing Industry Safety

With improved statistics and general knowledge about accidents in the fishing fleet, the research activity between 1975 and 1987 concentrated on stability and sea-keeping capabilities, survival at sea, and information and training.

Even though it is too early to draw definite conclusions, it is obvious that this concentrated research and development has had a positive influence on the overall accident statistics for that time period (Table 1).

There are several reasons for this positive trend, especially regarding loss of lives due to foundering. The most important are improved rescue services, improved safety equipment, improved safety training, improved safety control, and improved knowledge of accidents and preventive measures.

Among the surveys conducted between 1978 and 1987 was the Andoya

Table 1. Loss of life in the Norwegian fishing fleet

	1980-1984	1985-1987
Founderings	15-16 per annum	5 per annum
Working Accidents	14 per annum	11 per annum

Project, a comprehensive effort to improve the working environment of coastal fishermen. The hallmarks of this project were:

General health of fishermen—Improve overall conditions on board the vessels to improve rest and nutrition.

Rolling rates of fishing vessels—Reduced by 30% to 40% through the addition of stabilizing keels. This improved comfort and working conditions and reduced accidents.

Noise levels on fishing vessels—In most areas of vessels noise levels interfere with rest, while in some areas noise levels are high enough to interfere with communications and damage hearing.

Personal protective equipment—To provide protection against cuts, blows, crushing, impaling, falling overboard. Recommended hard hats, protective boots and non-skid soles, protective working gloves, working suits with life jackets, safety lines and safety belts. All should be functional and comfortable to assure use.

General working environment—Construction solutions for protection against blows, getting caught or falling overboard include increased rail height, improved handling of grapnels, securing of anchor lines and anchor baskets, emergency stops on winches, protective screens, securing of wire and rope, securing of nets and net baskets, skid protection from improved surfaces (interior and exterior), noise muffling and insulation, better use of hoisting gear to reduce strain injuries, safety hoops for protection while hauling the catch, and overboard and rescue ladders.

Shipwrecks and Accidents in the Norwegian Fishing Fleet

A major portion of the Norwegian fishing fleet operates in the arctic region, where water temperatures range between 0 and 10^0 C, and air temperatures range between $+10^0$ and -30^0 C. Heavy icing as a consequence of these climatic conditions is a major cause of accidents. In the period between 1955 and 1970 about 80 vessels were lost due to icing. The consequences of the icing included ice on the radar antenna, loss of navigational capability, groundings, and capsizing due to loss of stability from accumulated ice. In many of these accidents, the entire crew was lost.

In spite of this, accidents caused by a bad working environment accounted for the highest losses in recent years. Table 2 compares loss of life due to shipwrecks with work accidents for the period from 1961 through 1988.

In these statistics prepared by the Norwegian Maritime Directorate, deaths from shipwrecks are clearly reduced, while working accidents are at the same levels they were before the safety training became compulsory.

Table 3 compares fatalities per 10,000 man-years of fishing with those of other occupations in 1983.

Table 2. Loss of life caused by shipwrecks and accidents

YEARS	61-64	65-68	69-72	73-76	77-80	81-84	85-88
Wrecks	21.5	16.5	16.0	16.0	15.0	14.0	6.0
Accidents	18.0	17.0	16.5	14.0	14.0	13.0	12.0
Totals	39.5	33.5	32.5	30.0	29.0	27.0	18.0

Table 3. Comparison of fatalities per 10,000 man-years of fishing with those of other occupations in 1983

Fishing	13.7
Shipping (except social accidents)	10.0
Mining	10.0
Supply vessels	3.6
Construction/civil engineering	2.5
Onshore industry (except administration)	1.5

Safety Requirements for the Norwegian Fishing Fleet

According to Jan-Erik Sverre, Nordland Research Institute, there are three ways to improve safety in fishing: regulation by maritime authorities; government funding of safety and work environment investments; and motivation, information, and training.

The results of our research, as well as recommendations from *The Safety Commission for the Fishing Fleet Report* (1986), have been implemented through various regulations set by the Maritime Directorate. Table 4 shows some of the regulations.

Safety Training Program for Fishermen

A safety training course was made compulsory for fishermen in August, 1986. The first step was undertaken by Ian L. Hoest at the Norwegian Fisheries College as a voluntary safety training course on the sailing vessel *Hestoy*. This was a mobile school visiting fishing villages around the coast of northern Norway. It offered one-day and two-day courses free of charge. This led in 1982 to an extended course (40 hours) based upon the basic sea survival course for the shipping and oil industry. This course is still voluntary and free of charge.

In 1984 a Royal Commission was given the task of investigating the state of safety in the Norwegian fishing fleet. A preliminary report in 1985 confirmed the need for improved general safety training and personal accident prevention. The final report, published in 1986, recommended compulsory safety training for fishermen. Its conclusions included:

- The number of fatalities connected with founderings and other serious vessel casualties show a clear downward trend, with 48 fewer lives lost during the last four years than during the five that preceded.
- This improvement was undoubtedly associated with safety training.

Table 4. Regulations set by the Maritime Directorate of Norway (* Indicates emphasis)

Regulation	In Force From
Liferafts on vessels >36 feet	1 Mar 58
Light reflectors on all vessels < 36 feet	1 Dec 68
Safety harness, helmet, anti-skid surfaces	5 Oct 80
Protective boots and gloves, roll-damping and safety ladders (one on each side)	15 Oct 80
Accident Commission established	1 Jan 81
* Survival suits on all vessels >36 feet	1 Jan 82
Free-float EPIRB, vessels >50 T outside 12 miles	1 Jan 82
* Stability heeling tests, 36-45 foot vessels	1 Mar 83
Heeling test and complete stability calculations vessels >45 feet, Directorate Construction Rules for Fishing Vessels	30 Aug 85
* Compulsory safety training course	20 Aug 86
Survival suits on all vessels <36 feet	1 June 87
Liferafts on all vessels <36 feet	1 June 87
VHF on all vessels <36 feet	1 June 87

Regulations under preparation include freefloat EPIRB on all vessels <36 feet; new regulations from Andoya Project study; new regulation on ice-class and stability in icing conditions; and high water alarm, high temperature and smoke detectors.

- Unfortunately the number of personal accidents due to working routines or environment have not been reduced.

The compulsory course recommended by the Royal Commission includes first aid, sea survival, fire fighting, and safety on board (working environment, stability, and associated matters). The safety school, headquartered in Tromsø, has developed a wide range of videos, slide shows, and booklets. In addition to its own training site, the school runs two 110-foot vessels as mobile training schools that visit different villages and small towns along the coast. The country and state-owned schools are also capable of performing basic safety training for fishermen.

A special thank you to Dr. Ing. Halvard Aasjord, Marintec, and Jan-Erik Sverre, who supplied vital information during the preparation of this paper.

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Training for Deck Safety on North Pacific Trawlers

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A good friend of mine who has worked on trawlers for years describes it as "like logging at sea." Imagine for a moment the huge moving weight of timber, the cables under extreme tension, and the deftness required to avoid accidents when felling trees. Place all of that on an erratically moving platform at sea, and you have an idea of the environment we're dealing with. The crew is working with heavy pieces of hardware, wire rope, chain, synthetic lines, netting, and other materials which are all under a great deal of strain and shock loading. To complicate it further, it may be dark, cold, and icy, and visibility may be restricted by blowing snow or rain.

You can see why commercial fishing has been rated seven times more dangerous than the average occupation.

In this presentation I concentrate on deck safety, as opposed to vessel safety. It should go without saying that such training as donning survival suits and abandoning ship is necessary for any person working at sea. I will discuss more specific training for the people who are involved in purchasing, operating, or maintaining the fishing gear.

I'll begin with a brief introduction to the trawl fishing of the North Pacific. Trawlers are fishing vessels which tow a funnel-shaped net behind them, generally targeting on high-volume, low-unit-value species of fish such as yellowfin sole or pollock. The vessels range in size from under 50 to over 300 feet in length, and individual catches or hauls may range from a few tons to over 150 tons. The catch is either transferred to another vessel for processing, or hauled up a stern ramp and dumped into the holds for processing on board or delivery to a processing plant on shore.

Ten years ago most of these fish were harvested by foreign trawlers operating within the U.S. economic zone. The U.S. trawl industry has gone through dramatic changes since then.

In the 1980s foreign fishing was replaced by joint-venture operations, in which U.S. trawlers caught the fish and transferred them directly at sea to foreign processors. Most joint-venture size vessels use gear which is designed to have a safety factor of about five to one, meaning that it is used to about one-fifth of its breaking strength. This additional strength is a safety buffer for extreme conditions like snagging the bottom or fishing in very heavy seas.

Within the past 10 years, and most dramatically within the last five years, we have seen the advent of American factory trawlers. These are large vessels, typically 150 to 300 feet or more in length, which are able to process their catch on board, much as the foreign fleet did. They are able to land upward of 100 tons at a time, and to fish in worse conditions than joint venture vessels.

On factory trawlers the increased

size and horsepower, coupled with the fact that the catch is brought on board rather than transferred to another vessel, means that the gear is taking much more strain. Even with the use of stronger and more sophisticated materials, size and weight restrictions are such that the safety margin enjoyed by smaller vessels is no longer present. On many factory trawlers that safety margin is down to as little as two to one. This means that the gear is much less forgiving than it was, and the crew can't afford to make mistakes. Add to this the fact that the demand for deck hands has increased with the addition of new vessels, and the average pay has decreased from former levels experienced in joint ventures, and the result has been an increase in inexperienced people working on deck. The stage is set for injuries and gear loss.

The deck crew is responsible for the routine tasks of setting and hauling, and for maintaining and repairing the fishing gear. It is quite common for the net to snag on an obstacle on the bottom and come back badly damaged. The crew's job is to put it back together. This means mending torn netting, splicing ropes or wires, untangling snarled ropes, etc. Regular inspection for bad splices, over-stressed hardware, chafed ropes or other weak areas which might result in gear failures are also part of their job.

Anyone who understands the materials they are working with will be able to make better decisions. Many injuries occur because the crew simply did not recognize the characteristics of the material they were using. The classic example is using a nylon line to bring the gear on board. Nylon, because it stretches, has extremely high recoil if it breaks. A breaking nylon line will sweep the deck and could easily kill anyone in its path. In contrast, a polyester line has about half as much recoil. Some of the newer synthetics have much less recoil than that. Surprisingly few deck hands can tell the difference between these materials or consequences of their use.

Some ropes which look very similar are actually quite different in terms of strength and stretch. For example, two lines which are used in different parts of the net (under the trade names of Tenex and Duralex) may look nearly identical. However, one is almost twice as strong as the other. One is all polyester, and one is a combination of polyester and polypropylene. There is a simple way to tell them apart, if you know what you are looking for. If not, the deck hand looking to make a quick strap for overhead lifting may easily chose the wrong one.

The same situation can also happen with hardware. Both alloy and non-alloy shackles are available on deck, the difference in strength may be up to five times. How is an untrained, inexperienced deck hand to tell them apart? The best materials are only as good as the person using them. A piece of chain is much more likely to break if it is lifted sideways than if it is pulled in a straight line. When you are using chain bridles to lift 150 tons of fish onto the deck, that is a critical piece of information.

Let us suppose that we have trained all the deck hands so that they are really top notch. They know how to make a proper wire splice that won't pull out; they understand how to use the hardware; and they can select the appropriate materials for the job. Further, and this is important, we have trained them to maintain the gear in a safe condition. They know how to spot over-stressed hardware and how to replace it. The captain understands how to operate the vessel to minimize gear failure. All of this knowledge isn't doing any good if they don't have proper materials to begin with.

That's where training moves away from the vessels and into the offices. Vessel owners, managers, and purchasing agents, the people who are making the decisions about what supplies go to the boat, must understand both what the vessel needs and

what their options are as far as purchasing. It may be as basic as making sure that when a vessel orders a hammerlock, the purchasing agent sends a hammerlock and not channel locks. More likely it comes down to being able to rank the needs of the crew and being sure that they receive the best gear possible at a price that allows the vessel to operate.

Back to the examples of line that we looked at earlier. As you may have guessed, the line that is twice as strong is also about twice as expensive. What happens when the person ordering the stronger one finds a line that looks just the same and costs only half as much?

The person who purchases the gear for the vessel must have an appreciation of how that gear is going to be used to be able to make intelligent decisions about what is necessary and what is superfluous. Beyond that, they should be aware of all of the options available to them. As an example, try suggesting to any vessel that they replace the heavy wire rope on the winches with a light synthetic line. It will assure them that you don't know the first thing about trawling. However, in the last two years a super synthetic has been developed which promises to be as strong as wire rope, about one tenth the weight, easier to splice, and infinitely safer on deck. An organized training program will make this information available to the fishing industry.

You can see that there are at least three audiences to be targeted for training: the vessel owners and managers, the captains and fishing masters, and the deck hands themselves. I would also add to this list enforcement personnel, insurance agents, and anyone who influences what gear is used and how it is used aboard the vessel.

Operations at sea will never be entirely safe. Any time we venture away from shore we will be reminded that the elements are to a large extent beyond our control. But the more we know, the better we are prepared, and the greater the chance that our fishermen will return from the grounds intact and healthy.

Safety Training for Factory Trawlers

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Carrying out an effective program of safety enhancement and loss control is crucial to factory fishing vessel operators and their employees. In the interest of high productivity, reduced expenses, good employee morale, and maximized opportunity at both the corporate and personal levels, establishing and maintaining a thorough safety program is vital for each operating corporation.

The direct objectives of such a program are to control and eliminate crew injuries, fatalities, and illnesses, and protect vessels and equipment. Its indirect objectives are to maximize crew morale, crew productivity, and corporate profitability for the benefit of the operating corporation, its employees, and its stockholders.

It is essential that the program begin with an iron-clad commitment by management, extend through shore based and shipboard supervisory personnel by means of clear channels of authority and accountability, and provide each individual crewmember with appropriate guidelines and responsibilities. It must be implemented in such a fashion that every member of the operational team appreciates it for what it is: a set of tools designed to prevent catastrophic emergencies and industrial accidents that could jeopardize their lives, limbs, and livelihoods and the well being of their families.

Because of the inherent dangers of the at-sea environment, the safety program must impose rigorous procedures designed to guard against the threat of catastrophic emergencies. The size and complexity of factory fishing vessels, coupled with the large numbers of non-seamen carried aboard, makes this an especially serious concern for vessel management necessitating a more formal procedural approach to safety preparation than is traditional in commercial fishing. Better models for approaching the problem of catastrophic preparedness aboard large factory trawlers and motherships are provided by passenger vessels rather than traditional fish harvesting boats.

Industrial Safety Considerations

The threat of catastrophe must always be a consideration in the operation of factory vessels. A more immediate problem that constitutes the bulk of each safety program is reducing the frequency of routine industrial accidents that collectively represent enormous human and dollar costs for the factory fishing industry. The recent emergence of American factory fishing means that the necessary techniques lie outside of the experience of the U.S. fishing fleet. Because of the uniqueness of at-sea factory operations, the techniques cannot simply be imported from mature forms of shore-based industry, although there are standard methods of safety enhancement and loss control that can be perfected for high seas operation.

Thus such programs must

establish new standards of fishing vessel operation and management that exceed both regulatory requirements and industry traditions. Nonetheless, the costs associated with the fishing industry's historically high casualty rate make it imperative that vessel operators place safety enhancement and loss control among their very highest priorities. Each corporation's long-term success, and the rewards available to its employees and stockholders, depend upon how well it pioneers new dimensions of professionalism in fleet management and the preparation of a workforce that is capable of performing safely and productively in a very different industrial context.

Management Skill

It seems clear that non-traditional managerial skills will be the key determinants of which corporations and individuals succeed within the new realities established by the type of industrialized fishing that now occurs on the North Pacific and the Bering Sea. Stated differently, business-as-usual in commercial fishing is no longer adequate aboard the floating profit centers that place large numbers of non-seamen on some of the world's most challenging waters. Development of a safe and productive workforce is the central managerial challenge, and factory vessel operators have no choice but to temper production demands sufficiently to permit necessary levels of personnel preparation and training.

While each safety program must be comprehensive, it must also be practical in view of the rigorous operating constraints and competitive pressures faced by the factory fishing fleet. Thus, while the necessary commitment must begin with top management, the individuals who hold the greatest influence of the program's ultimate success or failure are the skippers, officers, and foremen who set the day-to-day examples and attitudes aboard each vessel. Only to the extent that the program incorporates their insights and earns their respect can it be successful. Thus, one key to safety aboard factory vessels is the establishment of mechanisms for information flow that permit the full weight of each corporation's collective talent and experience to be applied to the loss control challenge.

The Real Safety Experts

The best safety experts available to factory vessels are the industry's own supervisory personnel who understand the realities of living and working aboard such vessels, and who are capable of devising practical solutions to specific problems. Only by developing a supervisory team of professional fishermen-managers and applying their talents to the day-to-day business of loss control, can each corporation's safety program achieve its full potential.

That they are the real experts simultaneously extends to them the accountability for implementing safety procedures that are appropriate and effective. They must be encouraged to work in partnership with shoreside management in the development and implementation of the safety program, by mechanisms that respond to their insights and provide them with critical information and managerial tools.

Because industrial accidents can only be minimized and never eliminated, the safety program must also incorporate methods of gathering and analyzing information about casualties so that appropriate solutions are applied to real problems, so that crucial lessons are not overlooked, and so that vessels, departments, and individuals can be evaluated in terms of their safety

performance.

Finally, adequate systems must also be in place for responding to and managing casualties that occur, and for providing for the welfare of accident victims and their families.

I recommend a framework for safety enhancement and loss control aboard factory vessels. These suggestions are intended to stimulate review and comment from vessel operating personnel at all levels, and can only succeed to the extent that they initiate ongoing safety dialogue that results in constant refinement of the general methods of loss control proposed. While implementation of some or all of these procedures should produce tangible results almost immediately, each factory vessel safety program will always be an evolutionary enterprise that depends on the talent and commitment of company personnel who are in charge of vessel operations at a given time.

Mr. Sabella has been involved with marine safety for a number of years and is the author of the North Pacific Fishing Vessel Owners' Association Vessel Safety Manual.

Stability for Fishermen—Overview of a Correspondence Course for U.S. Fishermen

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My remarks relate to one of the two subjects of this symposium: training. I intend to focus on a single aspect of that subject, training with respect to vessel stability. I will review what, in my opinion, are the reasons that stability training for the commercial fishing industry constitutes a problem that must be addressed. Then, I will try to describe what my organization, the National Cargo Bureau, proposes as a solution, or at least a component of the solution.

The Commercial Fishing Industry and Stability

1. Fishermen are excellent seamen.
2. Fishermen work and stay at sea for protracted periods on small craft.
3. Fishermen help feed the nation as well as the world.
4. For centuries fishermen have suffered the "perils of the sea" and paid a high price in leaving widows and orphans.
5. New laws are on the books which are intended to reduce or eliminate the losses of fishing vessels at sea.
6. Studies of the problem, incident to passing the law, indicated that a high percentage of the casualties were stability related.
7. Stability must be addressed in the design of the fishing vessel, but also it must be addressed in the operation of the vessel.
8. Fishermen, in general, are not well versed in stability.
9. Fishermen are not uneducated, but in general their training has not focused on naval architecture, engineering, and mathematics.
10. The basic principles of stability are best described in mathematical terms. Fishermen are not mathematicians.

Possible Solutions to Losses Due to Stability Related Accidents

The preceding factors summarize the problem. It is necessary for fishermen to have a working knowledge of the basics of their boat's stability so that the important stability considerations are included in their operational practices and decisions. At present most of them do not have this knowledge. So, what means are available to impart this knowledge to them? This leads to the point of identifying possible solutions to the problem.

Require Licensing—Require a person to prove by examination that he has sufficient knowledge of stability before he is permitted to go to sea as a fisherman. How he obtains the knowledge is left to him.

This alternative is not viable, because at present there is no requirement in the law for licensing.

Provide Educational Facilities Ashore—Educational facilities such as schools or community colleges would

furnish classroom courses on stability.

This alternative is useful, and I am sure it will be tried in many locations. However, many fishermen will not be reached because they are not located near the school and/or because they cannot afford the time off from their work.

Provide a Self Study Course—A self study course structured for an adequate degree of student-teacher interaction, as well as testing, could solve many problems previously stated. Such a self study course can be administered in a time frame and location that best suits the student. Further, if approved as a USCG training facility, such a course could provide training in this area as a possible alternative to licensing.

Stability for Fishermen as a Possible Solution to the Problem

The National Cargo Bureau's solution to the problem was to develop a self study course entitled *Stability for Fishermen*. The National Cargo Bureau approached the Coast Guard with a proposal to develop a course specifically designed for the fishing industry. The Coast Guard encouraged the enterprise and cooperated by reviewing and making suggestions for each lesson as it was written. Eventually the Coast Guard approved the course and provided an incentive beyond self-improvement, to take on the task of acquiring new knowledge. Credit for two weeks of sea time was granted for successful completion of the course. This credit for sea time can be used toward any U.S. Coast Guard merchant mariners document or license.

Contents of *Stability for Fishermen*

The course is divided into eight lessons, taking the student at his own pace from the simpler principles of vessel stability to the complex practical problems likely to be encountered aboard fishing vessels. All course lessons are personally graded by me. Any questions the students have are also answered by me. If a student fails to attain at least 70% on a lesson, the student is asked to repeat the entire lesson. There is no additional charge for a repeated lesson. The eight course lessons are:

1. Why Study Stability?
2. What is Stability?
3. Understanding Stability Information
4. The Rolling Test
5. Determining Your Vessel's Center of Gravity
6. Icing and Your Vessel's Stability
7. Losses in Your Vessel's Stability Due to Free Surface Effects
8. Specific Fishing Vessel Problems Related to Stability

The National Cargo Bureau, Inc.

The National Cargo Bureau, Inc., is dedicated to the safe loading, stowage, securing, and unloading of cargo on all vessels, and the safety of shipboard cargo handling gear through the application of uniform standards designed to protect cargo, vessel, personnel, and the public interest.

The Bureau is a not-for-profit organization. Its members are prominent persons identified with steamship management or marine insurance underwriting organizations, persons in or officially connected with the United States government, and persons in civil life prominent in branches of science pertaining to or affecting the carriage of cargo in the maritime commerce of the United States. The board of directors is composed of individuals who are leaders of marine insurance and steamship companies, the Commandant of the United States Coast Guard, the Maritime Administrator, and the Commander of the Military Sealift Command.

Mr. George is a graduate of the United States Merchant Marine Academy. He has a Chief Mates License in any tonnage vessel, has worked on NOAA and NMFS fishing vessels, and is Assistant Professor of Nautical Science at the United States Merchant Marine Academy. He currently works for the National Cargo Bureau in Seattle as a senior surveyor. Mr. George also has several publications on vessel stability to his credit.

Use and Competency of Working Inflatables

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The U.S. Coast Guard does not presently approve inflatable life vests or personal flotation devices, or PFDs as they are officially known, for use as work vests or for use on recreational boats. We evaluate new equipment by considering its potential for increased use, better effectiveness, and high reliability. The problem we have with the approval of inflatable life vests is reliability.

The Coast Guard approves a number of different types of life vests or PFDs. They each have different characteristics, and fishermen should understand how they work and what they are intended for. The PFD pamphlet provided with each recreational PFD explains the basic differences in the five approved types.

Background

The Coast Guard's position on the use of inflatables is largely based upon a field study conducted in 1980. We evaluated the performance of inflatable PFDs in a recreational boating environment. The study included distribution of more than 500 inflatable life vests to U.S. Coast Guard auxiliarists for use for one year. Twenty-three models from 12 manufacturers were used in the study. To ensure that a good cross section of devices was included, about 70% of them were foreign designs, mostly European, which met the applicable foreign standards. Both manual and automatic inflators were included.

The auxiliarists filled out questionnaires on their experiences and compared them to their own inherently buoyant devices. At the end of the study, the devices were returned to us for examination and tests.

This study showed nearly a 20% chance that an inflatable would not have been in a serviceable condition at any given time. We found a slight increase in wear rate, compared to inherently buoyant types, but it would be more than offset by a decrease in reliability, resulting in greater overall risk to users.

Probability of Survival

To understand how we evaluate the trade-offs between reliability and use, consider the following. Since the vast majority of recreational boating fatalities are drownings, the probability of surviving an accident is primarily a function of three things: (1) whether or not a PFD is worn, and if not, whether or not flotation is available to cling to; (2) how effective the flotation was at the time of purchase; and, (3) whether the flotation is reliable, which means to provide "like new" performance at the time of an accident. We believe that these principles apply to most fishing vessel accidents that don't involve complete loss of the vessel.

Wearability

The vast majority of drownings in small boat work-related accidents and

recreational boating are incidents in which no life vest was used. The greatest risk for all types of mariners is not having buoyancy or flotation on their body when the need arises.

In general, the more flotation a PFD has, the more bulky it is. This discourages many from wearing them except when known danger is imminent. We refer to this as low wearability, with wearability being the likelihood that a PFD will actually be worn when needed. The Coast Guard estimates that over 75% of the lives lost each year in recreational boating (or 600 of 800 lives) could have been saved if boaters would make a habit of wearing their PFDs. A similar percentage of fishermen could probably also be saved.

This is particularly important on small boats which account for the vast majority of all fatalities. When an accident occurs on one of these boats, the occupants usually find themselves in the water before they have time to put on a PFD. Also, most of the drownings occur in noncritical situations (calm water, falls overboard in benign conditions, good visibility, etc.), so there is no good way to predict when a PFD should be worn. The only way to be sure is to wear one all the time.

For Coast Guard personnel, directives *require the wearing* of PFDs on Coast Guard small boats. The type required depends upon weather and sea conditions.

Effectiveness

Adequate performance from a PFD is mostly dependent upon water conditions. In rough water, using a type II or III Coast Guard approved PFD is physically taxing. The rougher the conditions or the heavier the wearer is in the water (high buoyancy requirement), the more effort is required. Wearing a high performance PFD requires less effort. Conserving energy is critical to survival.

If encountering rough water is a possibility, how much performance should a PFD have? Many say the more buoyancy the better, and we agree up to the point it starts to interfere with wearing or the ability to perform other critical survival functions, such as righting and boarding a liferaft or abandonment. Many believe the magic number is 35 pounds of buoyancy, which appears to have its origins in British standards.

We have conducted intensive tests in waves which do not support these standards. Our latest research, conducted by the David Taylor Naval Research Laboratory and published in 1988, points out a number of flaws in past wave tank and rough water studies. The many demands on the survivor make adjustable buoyancy, as provided in inflatables and hybrids, attractive.

The hybrid inflatable PFD combines the best features of conventional and inflatable PFDs. It has about half as much buoyancy material as a type III, plus it has an inflatable section. The buoyant material is enough to bring most users to the surface, and provides at least some measure of insurance against the failure of the inflatable section.

In terms of effectiveness, we believe that inflatable or hybrid PFDs should be seriously considered for applications which require people to work in exposed locations or which require active participation in the abandonment and survival process.

Reliability

A reliable life vest is one that performs its intended function throughout its useful life as if it were new. Some training organizations that use inflatables report a negligible failure rate for these devices, but regular use in a training or military environment can hardly be considered representative of the infrequent attention many boaters and fishermen give their safety equipment. Some inflatable

advocates acknowledge that, as our study showed, not all commercial or recreational users will accept added care and maintenance requirements associated with inflatables. To make inflatables reliable requires mandatory inspection and servicing, or a technology breakthrough to make them "self-inspecting." By self-inspecting we mean having features that make it obvious when the PFD is not in a serviceable condition, like an indicator on the inflation system.

Servicing Requirements

Coast Guard personnel have used inflatables in aircraft operations since at least the early 1930s. The Coast Guard *Rescue and Survival Systems Manual* describes inflatable life vests that are used on some Coast Guard vessels and aircraft. To avoid serious reliability problems with these vests, the Coast Guard has a rigorous maintenance program that requires inspections with leak tests by a trained technician before placing into service, then every three months thereafter.

When considering whether you will maintain an inflatable PFD, consider the 1980-85 National Fire Protection Association (NFPA) analysis of home smoke detectors. The NFPA study estimated that from 24% to 36% of the units were not working at any given time.

With an inflatable PFD the swimming skill of the wearer is also of concern. The swimming ability is of importance for hybrid/inflatable devices because the chance of survival is dependent upon the wearer's ability to inflate the device. It is suspected that non-swimmers will have a great deal more difficulty inflating any type of inflatable device. The difficulty with the hybrid should not be as great as with a purely inflatable device.

The importance of having immediate buoyancy is not well defined. However, the reports we see on accidents in working situations suggest that it would be a high priority. Also, the sudden drowning syndrome often cited in recreational boating supports the supposition that it is needed. Immediate buoyancy requires automatic inflation if there is no inherent buoyancy in the PFD.

There is substantial agreement on the potential advantages of inflatable PFDs. In its uninflated condition an inflatable device that might have type I performance characteristics, or even better, will be much less bulky than an inherently buoyant device. A less bulky device could be more comfortable and stylish than even the type III PFD, and therefore might be worn more often. At first glance the inflatable might seem to have more lifesaving potential than the types the Coast Guard now approves for uninspected and recreational boats. Unfortunately, maintenance and reliability remain problems with inflatable PFDs. In order to work, inflation chambers must be free of holes and inflation mechanisms must be charged and in proper working order. In a work or recreational boating environment of rough treatment and irregular maintenance, keeping the devices in serviceable condition is a serious problem.

These reliability questions are why we approved the type V hybrid that is now available to recreational boaters and fishermen, but only as auxiliary equipment. Commercial fishermen must still meet the carriage requirements for the standard type I, II, or III PFDs, depending upon vessel size, etc. If a commercial hybrid becomes available, that will be all that is needed to meet the carriage requirements.

Hybrids

The hybrid inflatable PFD can offer all the performance available in any conventional or inflatable life vest without significant sacrifices in wearability or

reliability. In addition, the foam used to provide a hybrid's inherent buoyancy may also provide a significant measure of hypothermia protection which a pure inflatable cannot. Since there is no regulatory maximum buoyancy for hybrids, manufacturers are free to develop whatever responds to the need or market. Hybrids could be made that perform as well or better than any fully inflatable device. In 1977 we approved a hybrid PFD with 15.5 pounds of inherent buoyancy and 35 pounds when inflated, but the manufacturer stopped making the device for lack of demand.

Hybrid inflatable PFDs are *required to be worn* to be counted as a regulation PFD. This provision is meant to be an educational tool as much as it is a caution about the limitations of the devices. By issuing this rule the federal government served notice that we do consider the need to wear devices important, and are willing to permit use of more comfortable devices if the user will make an important contribution to the system reliability by proper use and care of the device. Considerably more devices would need to be in use to draw any conclusion about this indirect link between use and care. To approve inflatables, we believe at least some similar condition would be required.

We are considering how to revise the standards regarding commercial hybrids to make the devices more interesting to users. A slight increase in the inherent buoyancy requirement might enable us to drop the dual chamber and automatic inflation requirements. These requirements are two of the most costly, and the existing, less expensive auto-inflators have a reputation for inflating prematurely.

Performance Recommendations

The worst kind of rough water in terms of life vest performance appears to be short, steep waves. Large waves with gradual slopes (long periods) do not cause rapid changes in direction of motion (up and down) of a person in the water, and therefore do not require much reserve buoyancy or extra lift to compensate for the motion. However, to rapidly lift a person over a steep wave, a great deal of extra buoyancy or lift is required, especially if the mouth is not to be submerged.

Three things have been identified that help most in keeping a person's mouth clear of the waves: freeboard, body and head angle, and waterplane area. Generally, the greater the buoyancy of the PFD, the better off you are. However, the location of the buoyancy makes a great deal of difference. If it is not low enough on your body, it doesn't provide enough freeboard in rough water; if it's too low, it doesn't provide face-up stability; and, if it holds you too near vertical, you are more likely to be dunked by waves.

For years people have made much ado about the ability of a life vest to turn a person face up in the water. While it is certainly not possible to breathe when face down in the water, it is equally certain that a person will drown face up in rough water if not conscious to exercise breath control. Proper freeboard, body angle, and water plane area will allow a person to conserve energy to remain conscious longer. Of course, hypothermia protection is vital to staying conscious as well.

Ideally you want a flotation device that keeps you warm, as near horizontal as possible, but head tipped up; mouth as high out of the water as possible and face up; and, one that you are willing to wear at all times. Unfortunately there is no device available that does all these things. Those that come closest are not wearable in warm weather. Therefore, compromises must be made. What is least important? We think today, for most open water fishermen and boaters, the factors should be ranked as follows (most important first): Wearability, freeboard, body and head

angle, hypothermia protection (ranks higher in cold regions), and face-up stability.

Reliability is also critical, but not listed because we believe that there is no need to sacrifice reliability to achieve higher wearability or any of the other characteristics above.

Fishermen operating in a variety of conditions can take a very good lead from the Coast Guard crews, which carry more than one type of PFD to adapt to prevailing conditions. Also, type III and type II devices can be worn together to get performance similar to type I for rough water survival. These should only be used together after a trial in calm water. The hybrid inflatable PFD also meets this need. The type II may not turn the wearer face-up as well, but the wearer should still have good face-up stability. However, don't use adult PFDs for children to provide more buoyancy, unless they have been previously tried in calm water for proper fit and stable upright flotation attitude.

Perspective on the Choice of Life Vest Type

There is no life vest that guarantees survival. The question is, how much will each of the various types increase the chance of survival? The answer depends upon the waters encountered and when. The best information available indicates that if used, all approved types can significantly increase the chances of survival. **From the perspective of overall lifesaving potential, the type III or hybrid is better than the type I, because it is likely to be worn more often.** In the cold waters around Alaska most fishing vessels carry immersion suits that meet their carriage requirements. To complement the immersion suit, a hybrid PFD would be a very practical choice because it could easily be worn. In an emergency the immersion suit could be donned over it, providing added protection.

If you know that you will properly maintain an inflatable and feel that you would wear it more consistently than a hybrid, we advise you to wait for an inflatable approved for use on inspected commercial vessels. Hopefully a number will be available soon.

Conclusion

We are very interested in the lifesaving potential of inflatable life vests, but their lack of reliability in a work or recreational environment is a serious problem. Those who wish to use them may, provided they accept responsibility for properly maintaining them and provided they also carry the required number of approved PFDs.

A New Dimension in Offshore Emergency Evacuation

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Selse, Norway

For the offshore oil and gas industry it is ironic, if not tragic, that after some 25 years the only means of escape from an offshore platform in a real emergency is to jump.

In the early 1980s this problem was addressed with the result that today there exists a viable, and we feel more effective, means of escape from a dangerous offshore accident. The basic concept of the system is to provide an integral part of an overall safety philosophy that is a first, rather than a "last ditch," means of escape.

The basic requirement was to provide a safe, rapid means of mass transfer away from the danger area. The system called for maximum capacity and availability with minimum risk to system users, while achieving the key design criteria of simplicity, functionality, and flexibility.

Product Overview

The first step of translating conceptual design requirements to usable equipment was finding the means to transfer personnel from the platform to sea level through the design criteria noted above. This evolved into development of a chute. From there it was only a matter of interfacing the chute with the platform and finding a means to transport personnel away from the platform once they reached sea level.

System Construction

The patented chute consists of a series of modular cells incorporating a speed retarding slide, all of which are made of Aramid Fibre netting. This enables the evacuee to control, to a highly accurate degree, his rate of descent. Each cell also incorporates an orifice in the wall to permit entry or exit at any level. The chute for offshore purposes incorporates a 500 kg stabilizing weight which, at full traverse, comes to rest some distance below sea level.

At the base of the chute is an inflatable collection point. When fully deployed there are up to four "satellite" liferafts floating around this collection point for use as needed.

When not in use, the whole system is stored in a specially designed container, which is normally cantilevered from the platform deck. The container, with an entrance either from the back or side, contains a 3-spooled wire winch, three pulleys to direct the winch wires from the horizontal to the vertical plane, and four lugs welded to the container roof to carry the four stress members which are the load bearing element of the system. These stress members are also made of fibre covered with a protective sheath for additional heat resistance.

To round off the system construction, the container is equipped with necessary electrical controls, limit

switches, lighting and backup systems, plus any specified components the customer might wish to incorporate. Indeed, because every operating company so far has had such additional components added, it has not been possible for us to standardize beyond the basic elements: chute, container, collection points, and liferafts. Each system, therefore, is custom built to the specific needs of the operator and location and structure of the platform.

Evacuation Philosophy and Considerations

While it is not within the scope of our work to recommend safety policy and procedures to be adopted by oil companies, there are certain features of the system that we believe to be highly innovative, if not unique.

We also leave it to the oil companies to decide whether it shall be used as a primary, secondary, or last means of escape. By combining this system with existent evacuation systems, synergy is achieved because we have a totally different approach to evacuation, i.e., passive deployment without personnel.

One of the prime recommendations we make when evaluating escape routes on platforms is to advise that the chute be deployed regardless of the level of the emergency. Of all the systems of evacuation currently in use on an offshore oil and gas facility, this is the only system where there is zero risk to personnel during the deployment phase. It is also the system which, requiring no mustering, is ready for use at the shortest notice (approximately 1.5 minutes).

A beneficial secondary effect of the system is the psychologically calming effect it has on evacuees who are fully aware that they are in control of their own escape, including rate of descent and point of exit from the system.

The thinking behind immediate deployment is that should there be time available to use other preferred means of escape such as helicopters or lifeboats, the International Maritime Organization (IMO) will decide upon appropriate procedures. It is our contention that, if there is time available to muster, decide upon order of preference, etc., then there is no danger to life.

Should the emergency worsen to the point there is no time at personnel's disposal, then the Skyscape will already have been deployed and will be ready to use immediately.

The Norwegian Petroleum Directorate has approved the system for use in offshore platforms as a replacement for davit launched liferafts. The British DOT has now approved the system for use in the UK offshore. It is not our intention, however, to promote the system as a replacement for any system except perhaps the redundant and obsolete, if not lethal, knotted ropes, rope ladders and scramble nets. This, therefore, is a long awaited answer to many problems associated with emergency evacuation of offshore structures which should dovetail neatly into overall rig or platform safety provisions.

Mr. Withers has a degree in electrical engineering from Southeast London Polytechnical. He has worked on radar and radio communications in Egypt, spent 30 years working in international industrial marketing and for engineering companies in the United States, and worked for the Canadian government in offshore gas and oil production. He has spent the last several years developing evacuation devices from oil rigs for the Norwegian government.

Human Factors Training and Accident Prevention

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Traditional training philosophy holds that the prevention of accidents may be approached from either the hardware side of the coin or the people side. The method of the hardware-oriented specialist (e.g., engineer) is to remove the hazardous equipment or its hazardous operation from the work place. The method of the people-oriented specialist (e.g., psychologist) is to correct for the human factors associated with accidents. In reality, these two approaches work best when brought together. But unfortunately, while the engineers do their best to design in safety considerations, the operator is often unable or unwilling to operate the equipment as originally designed. I will focus on the people-oriented approach of human factors training that can lead to accident prevention and the ability to handle emergencies when they occur, thereby potentially reducing injury rates.

Increasing awareness and understanding of human factors for improved flight safety is an objective being pressed hard on the aircraft industry. To achieve this objective we are taking a systematic human factors approach to our FACTS™ cockpit and cabin crewmember emergency training programs. This approach is to systematically explore, understand, and manage those factors uniquely human that could in any way be associated with aircraft safety.

Humans are humans, regardless of their interactive environmental situations—sea, land, air— so I'll refer this approach to marine safety.

These factors, uniquely human, encompass the biological, psychological, and social aspects of behavior. Biological factors as simple as what one eats for breakfast, or if one eats breakfast at all, as well as general physical strengths and weaknesses are evaluated. Psychological factors such as anxiety, depression, and ability to make critical decisions under pressure are reviewed. And social factors including family and occupational conflicts, communication style, and leadership skills are examined as they relate to marine safety. Then, these uniquely human factors are integrated into specific training subjects and topics leading to improved individual and team effort in the development of *attitude, procedures, standardization, and practice* necessary for a successful marine safety program. Using Federal Aviation Administration required training curricula as a model, training topics for a marine crewmember emergency training program could include:

- Rules and regulations
- Types of emergencies and accident review
- Human factors and crewmember development
- Emergency equipment type, location, and use
- Passenger safety briefing and crew duties

- Onboard fires, smoke control, and crew duties
- Onboard medical emergencies and crew duties
- Unusual situations and crew duties
- Emergency evacuation and crew duties
- Specific boat configuration training
- Survival aspects in differing environments

The content of each of these subjects and topics will have to be left to another situation. Here I want to focus on the human factors.

What I am going to present now is the basis for a systematic human factors approach to safety training. It is what we refer to as a biopsychosocial approach and it deals with how you (biologically) feel, how you (psychologically) think, how you (socially) interact with others, and how good of a stress manager you are.

Here is a way of looking at human factors and safety: If you feel rotten, you are going to think rotten, and if you're feeling and thinking rotten, you are going to act rotten. Then, suddenly something goes wrong in an emergency. Guess how you are going to handle the problem? On the other hand, how would you handle the emergency situation if you were physically top notch, thinking clearly, and socially in the right groove? You would be a lot more apt to handle the situation in an appropriate manner.

Therefore, what I am going to propose to you is that every industry's safety program should include basic human factors and stress management training. Every industry has its unique stressors. A librarian has stressors, a grocery clerk has stressors, an aircraft crew has stressors, and a boat crew has stressors. While the nature of stressors varies, the human reactions are basically the same. But if we are not trained how to deal with or how to manage those stressors *and* our reactions effectively, there can be potentially disastrous consequences, including high accident rates and associated injuries. Nowhere better is this seen than in Army combat troops, even after extensive training, when first put under actual enemy fire. It is estimated that as high as 25% of the involved soldiers will not be able to fire their weapons! The question is why aren't they trained in human factors and stress management? On the other hand, how many people are trained in applied human factors and stress management?

Starting with the factors as components of the human system, what does each represent? Here's a list of some (biopsychosocial) human factors:

- Biological factors: health, weight, fatigue
- Psychological factors: intelligence, will, ambition
- Sociological factors: married, children, job, communication

Do you know what *stress* is? Stress is your mind's and body's *reaction* to any change. Not the change itself, but the reaction to it.

There is also *distress*, which is the result of long term stress experience. For instance, if you worry about something until you get a headache, that is distress.

Here are some examples of distress based on the biopsychosocial approach.

- Biological distress: headache, ulcer, weight gain or loss
- Psychological distress: inability to sleep, lack of concentration, inability to perform duties
- Sociological distress: divorce, job loss, antisocial behavior, suicide

Now you know a bit more about the human factors *stress* and *distress*. But unless you can use this information, apply it in your personal and professional life, it's not worth much. Awareness is great, but understanding and acceptance are

required. Let's look at the relationship of stress to performance. As you can see in Figure 1, as stress becomes mismanaged, personal performance levels are negatively affected. Note that it doesn't matter whether stress levels are too low or too high, the negative effects on performance are the same: performance is best when stress levels are balanced, not too high and not too low.

Using the stress/performance graph as a model, we have devised a self-monitoring device called SASS, or Subjective Approximation of Stress Scale. This is the idea that, due to whatever human factor reason, if your stress level is too high or too low, you can modify the level to maximize your performance. However, you must first be able to monitor and quantify the beginning level, just like your blood pressure, heart rate, blood sugar level, etc.

Figure 2 shows how SASS works. It is based on a scale of 1 to 100, with 1 being too low a stress level, 100 being too high, and 50 being just right.

The way to use SASS is to remember a previous event, time, or episode you can quantify as to your experienced stress level. For example, a year ago I was in a car accident in which I allowed my SASS level to rise to at least 99.999. I was so rattled that I didn't know the brake pedal from the accelerator, lost control of the car, and ended up on the sidewalk halfway up a telephone pole. It only took seconds, but it seemed like hours. On another occasion, my wife left me and wanted a divorce. I allowed my SASS to drop to a low of about 15. I was miserable, or at least that is what I told myself.

So based upon your own past experience, what is your own SASS score right now? Referring back to the stress/performance graph, one can see the relationship between SASS level and performance. It is important to know that your SASS level goes up and down from moment to moment. That is normal. Sometimes, however, the level change is like a "spike." Related to this SASS spike level, one behavior that we can all relate to is that which we have termed "spontaneous incompetency." It's when a slug hits a line of salt. It is what I experienced when I saw the front end of a Buick coming through the right side window of my car.

Spontaneous incompetency is an immediate, temporary loss of motor function. Even highly trained behavior can be momentarily forgotten. It is like hitting your finger with a hammer. Most people find it very difficult at that time to remember much more than their name. Remember the trained soldiers encountering first combat. They became spontaneously incompetent. It will probably happen to you or to me in a future crisis situation. What is important is to be aware of this human factor and be able to quickly recover your effective SASS level and effectively deal with the stressor. The SASS can give you immediate feedback on your stress level, which can help you modify your stress reactions.

Where do we go from here? It is kind of like leading your horse to water. Human factors (stress management) training for accident prevention and dealing with emergencies when they occur is logical; it makes sense. It is certainly the correct step forward. However, in aviation the safety trainers have to put up with a lot of "leather helmet and silk scarf" anti-safety, anti-training attitudes. What name is there for these types of attitudes toward marine safety? Captain Ahab? I don't want to be insulting, but that is just the way it is. There has to be a positive level of acceptance for any training to work, especially human factors and safety training.

The first task is to find the "button" to push with both the individual and the interactive group of individuals to spur a motivated interest in being safety minded. I could go into a lot of psychological

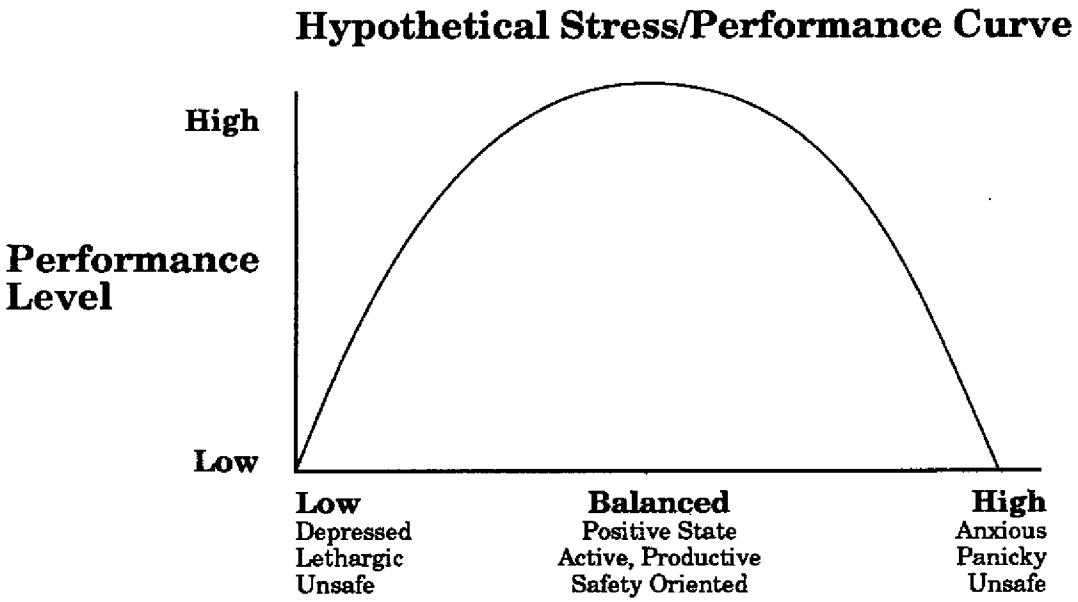

Figure 1. Hypothetical Stress/Performance Curve

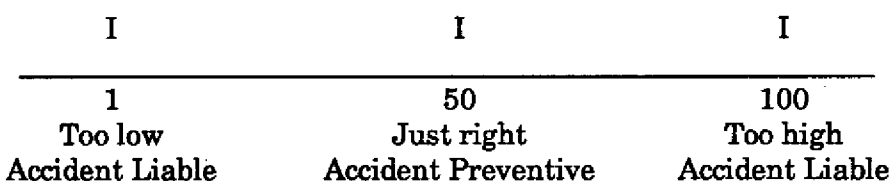

Figure 2. Subjective Approximation of Stress Scale (SASS)

studies, but to tell the truth, aside from equipment malfunction and horrendous acts of nature, there are only two reasons most people flagrantly disregard safety: attitude and ignorance. For example, most safety devices can be disengaged, but the pro-safety operator will not do so. To be really honest, there is not one of us who hasn't circumvented some sort of safety device. Angels only live in heaven . . . so do some people who disregarded safety oriented behavior and procedures. It's a problem.

Dr. Altman is a social/industrial psychologist specializing in human factors. He has done airline passenger safety research and evacuation training, co-designed and produced the first human factors tested aircraft passenger information card, developed a human factors oriented crewmember emergency procedures training program, and has written many professional training programs for the airline industry. For this presentation he adapted material used in his experience with aircraft to the marine situation. He is president of HBAcorp of Olympia, Washington.

Uniformity in Training

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Approximately 14 years ago I started a safety course for the offshore industries. It was set up at the request of the N.A.M., the Dutch Division and the subsidiary company of the Royal Shell Company, plus Penrod, Penzoil, Petroland, and Placid.

At that time our attention was still focused on the courses in Lowestoft. We had not yet heard about Aberdeen. A short time later Mr. Cross from Scotland visited, and later still Mrs. McMillan from the United States visited us.

Margaret McMillan already had, or was just about to start, a safety course which is now known as MOST. Joe Cross was already in business with the RGIT Offshore Survival Center. Margaret visited me for a general orientation, but Joe's visit had a different purpose. He wanted to develop an association of safety institutions. The International Association for Sea Survival Training (IASST) was subsequently founded during an inaugural meeting in Aberdeen.

The aims of IASST were:

- Mutual agreement on the curriculum, standards of admission, etc.
- Exchange of experiences
- Mutual acknowledgment of the courses at an international level and also acceptance of the certificates.

The first two conditions were easy to comply with. Recognition of the certificates by the various governments was quite a different story.

At first these goals seemed easy to reach, but they were soon limited by national interests. Precisely because of this many doors were soon closed. Even within the European Economic Community (EEC) we did not succeed in getting everything on line.

My own country has kept its own borders open for a long time. Now it is changing its point of view and certificates from other countries are no longer simply accepted.

Giving Safety Courses

Safety courses should be developed so that each participant in the course has learned the same information, not only on a national level, but also on an international level. However, this is not always the case. Let me illustrate this with an example.

As a fellow-founder and board member of the IASST, I attend two meetings a year which invariably take place on a different continent, or in a different country or city. When attending these meetings it is customary to attend a number of local courses. In this way I have been able to compare many safety institutes.

You may find that at one institute a fire-fighting exercise for 20 people uses 20 fire extinguishers, but in another institute 20 people are trained using only 10 fire extinguishers. This poses a problem in that in the first case each participant goes through all actions he

has to learn, but in the second case 10 participants have to stand by and watch. It is apparent that something is wrong with the educational set-up in the latter situation.

However, in many cases all receive the same certificate. The value of the certificate for the 10 people who did not actually use the fire extinguisher is doubtful. In any case, it is of less value than that of the participants who did all the exercises themselves. There is certainly a difference in the knowledge obtained in the practical training.

This does not need to be a problem as long as there are many people present in case of a fire. The chances are improved that among those present there is one who knows what to do and thus the problem solves itself. But the situation is completely different if only a few people are present and none of them has the required practical training.

Conclusion: Groups at both institutes received safety training, but for some it was insufficient, and therefore dangerous for others.

Uniformity in Safety Training Courses

Earlier I cited different approaches to a fire fighting course. Students all leave with similar certificates, so we may expect that they all are able to do the same things. The concern of uniform training is not limited to fire-fighting courses.

To solve such problems we need a system to assure that all courses have the same minimum requirements. This point has both theoretical and practical concerns. Personally, I think that it must be required that every person carries out the actions he has to rely on if an emergency occurs.

The requirements must be reasonable and not overdone. If an element of fear is incorporated, it will come to the surface at the most unexpected moment. All of a sudden a person is afraid to do something which would not be a problem in normal circumstances. Unexpected things can happen in situations of stress.

Why, for instance, should a free fall boat be dropped from a height of 25 meters, a height similar to that of some platforms? It is not the fall that is important, but the way of embarking, the speed with which it has to take place, the safety requirements which have to be met, and the realization that theoretically speaking you will not be as hesitant to carry through with the drop when evacuation is necessary.

I know that people are afraid to fall from a height of 25 meters. Keeping the height low will prevent these feelings of fear as they learn how to safely operate the equipment. If later an emergency situation arises, there will be no problem embarking because there are no bad memories from the training. After all, if the fall proves to be an unpleasant sensation, all that counts is the safe escape.

The aforesaid illustrates that it is easy to make demands in training without paying attention to their necessity or their consequences. Going through the various courses we will certainly come across more examples of unsound minimum requirements.

Stress

Another point is whether or not stress should be incorporated into a training course? Is it possible? Is it necessary?

In both cases, the answer is "Yes!" However, we have to take into account that by bringing stress into the training, small injuries can happen, which may be the responsibility of the training institute. Personally, I can see possibilities of incorporating tension in the training

within reasonable limits without inducing stress and taking chances with injuries.

Unity in Command Language

Another dangerous situation arises with lack of common language. On the continental shelf of Europe on the North Sea, and possibly in other places around the world, platforms are often manned by people from various countries who do not speak or understand each other's language.

Just try and imagine what would happen if a dangerous situation arises. Hopefully the alarm signals given will be the same the world over so the first warning will be understood.

Suppose that when going to the life boats or life rafts it becomes clear that a number of things are wrong, or things go differently from what is expected. The orders given are not understood or do not come across properly. This is possible. For instance:

1. A person who ought to be in charge is not there due to accident or death.
2. The person in charge panics.
3. The person taking over the command speaks a different language, or does not speak English properly, or has trouble with certain letters or intonations.
4. And finally, in a situation of panic anything can happen.

The solution is simple: We have to speak a "language" we all understand under all circumstances.

In this respect language is not only what we say or write, but everything that is necessary to make our meaning clear to each other, especially in an emergency. This can be done verbally, non-verbally, or through audible alarms, but most certainly in a manner uniformly acceptable the whole world over.

Conclusion: We need a "Command Language" where, in case of emergency, every command is known and understood, independent of language differences.

Uniformity in Word, Gesture, and Sound

You are probably aware that aviation uses a system of communication which is understood all over the world. This universal language has also been applied to navigation, where it is called "sea speak."

In my opinion the offshore industry needs a similar uniform language, especially for safety commands. This would help avoid casualties due to differences in understanding when giving or following orders. We need to develop "safety language" or "command language" that is accepted worldwide. Everyone should be able to understand and follow the same orders. This may imply that a person cannot be admitted onto a platform without having taken a short basic course in "command language," or at least receiving the training on the platform.

In this respect we have to be aware that the education of people on the platforms varies enormously. This also applies to their knowledge of languages. This may mean that the command language has to be simple and supplemented with gestures or a whistle.

Control

It must be possible to exert control over the teaching and instruction, as well as over the practical exercises. This seems to be complicated, but in fact it is not.

In The Netherlands we have founded an association to which all training institutes should belong. This association is recognized by the State Division of Mines, the relevant government institution. The association has established an absolutely

independent committee of inquiry. This committee investigates an institute prior to admission and afterwards at unexpected times. For this purpose the institute's working plan is required beforehand.

Cross Cultural Training

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My paper is divided into four parts. First I will cover "Micro-communications" problems. Then I will address the "Macro-communications" or bigger problems, followed by issues of politeness, and finally issues of ritual or etiquette.

Micro-Communications Problems

Any two human beings talking to each other are like two icebergs. The grammar of your native tongue, whatever it is, is what's up front; it's the part of the iceberg that you can see, but in fact, most of it is under water. We don't think about this very often, especially in language teaching. We teach people the grammar and vocabulary of a new language, but we don't teach them the *rhythm* of the new language. Some languages are spoken very quickly because everyone speaks it that way. They can even talk at the same time.

If you were born in rural Alaska and you speak Eskimo, you learned to speak very slowly. The rhythm is much slower.

What happens when someone who learned to speak very quickly, or whose culture operates at that tempo, meets some one who has a much slower rhythm? The person with the fast rhythm does all the talking, and the person whose language and culture functions much more slowly never gets a chance to talk. And the person who has a fast rhythm, by the way, thinks that the person with the slow rhythm doesn't have anything to say. Otherwise they would talk at the same time like "everyone else."

We need to tell people who are coming from overseas to learn English that they need to decide *whose* English they are going to learn. If they are going to learn "New York" English they have to learn to talk very fast. On the other hand, if they are going to Louisiana, rural Alaska, or the southwest among the Navajo Indians, the beat of the culture and the language are entirely different.

When do we learn those things? Very early. In fact, I believe that people pick up the rhythm of their language and culture in the womb. We get it from our mothers. The rhythm at which we talk, walk, and function comfortably is that of our own language, and moreso of our own mothers. The rhythm can make languages difficult. Rhythm differences are at the very bottom of the iceberg, something we never talk about.

When we deal with people who speak English as a second language (and this has probably never been pointed out to them), they are speaking English in the rhythm of their native tongue. Once they get fluency in the grammar and vocabulary (remember the things at the top of the iceberg), they will automatically revert to the rhythm of their culture as they speak English.

Now if that rhythm is slower, and their English is faulty in some way with an accent or errors of grammar or diction or vocabulary, we don't take what they have to say very seriously, if we give them

a chance to talk at all.

This happens in classrooms when teachers, whose rhythms are fast, ask a question. They wait a beat or two to get an answer, when in fact their "beat or two" is half a beat for their students from a different culture. The teachers think they have waited long enough, and thinking the students haven't grasped the question, they repeat it again before their students have had a chance to respond.

The teacher instinctively thinks there is too much silence. The students aren't "getting it," so they rephrase the question. This happens in job interviews. When we interview someone with a slower rhythm, we wait and wait for an answer, and finally we jump in again. Something is wrong, but it is the fact that we are operating at different rhythms. When the teacher is of one culture and all the people being trained are of another culture, the results can be devastating. When the students' answers are "out of sync," the teacher literally doesn't hear them. You don't hear what is not synchronized with your way of operating. You have to deliberately slow down or speed up once you become aware of this problem.

Tonal system is another problem. People can learn English or another language as a second language, but they will incorporate into it the tonal system they learned in the crib. This is imprinted in the first weeks of life. If you are Native American, Eskimo, or Hispanic, your mother spoke to you at crib-side in a smooth, evenly metered tone without a broad range of tones. If she was angry her voice rose and she spoke more quickly. Papa never used that note or tone. He spoke with the same rhythm, but when he got angry, he lowered his voice.

If you are an English speaking American, especially from the East Coast, your mother at crib-side spoke with a wide range of tones from the very high to as low as she could manage. When Mrs. Jones greats her kindergarten class "Good morning boys and girls," she uses those same tones. She is imitating what she knows every Anglo-Saxon boy and girl learned early on as a reassuring and affectionate tone.

But imagine what happens when Mrs. Jones uses those same tones in a classroom with young Hispanics, Native Alaskans, or American Indians. She has hit Papa's lowest notes. Mamas don't use that low, angry note. And she hits notes far above the highest used by their mothers, indicating "hysteria." The kid in the classroom cannot interpret Mrs. Jones' tonal system, saying: "Our teacher has a different socio-linguistic interpretation of pitch." All the kid knows is that he has never heard a human being, especially an adult, hit notes like that, speak in that kind of a tone. What Mrs. Jones is doing is trying to send notes of friendliness and warmth and affection to her students, but what she is doing is sending terror through the hearts of all her minority kids.

And Mrs. Jones doesn't know it. These terrified children, and they could also be adults, don't know how to relate to this "maniac" they have as their instructor. They can't articulate it, but that is the way they feel. In their intestines, that's what they know. And yet, the person at the front of the room isn't trying to intimidate them. But that is what is happening. And that happens plenty of times, more often than those of us in the majority culture would like to believe.

In addition to the tonal system, which can send different messages for the same words, there is also the "volume problem." At Alaska Pacific University ten years ago we invited students from nearly every continent to join us in Alaska. One world, one universe, many people, many cultures, many languages all studying in the same dormitory, going to the same classes, etc.

After nearly two months there were barbed wire and machine gun nests in the dormitory. That's an exaggeration, but it was almost like that.

And it was the West African men who were the most discriminated against. They had no trouble with rhythm, although they talked a little bit faster than other students. They didn't have so much trouble with pitch or tone as I have just described it.

But they were very loud and they stood very close to whomever they were talking. What was the message they were sending? They created the impression that they were angry at everybody there. So everyone avoided them. And they were the only blacks.

When everyone avoided them, they said: "Aha, American racism." No one told them to talk a little quieter. When they talked to each other, by the way, they were just as loud. They stood six inches from each other and from the way it sounded to us, from our point of view, it sounded as if they were screaming at each other. From our perspective you don't stand nose to nose with someone and talk that loud unless you are angry. In their culture apparently it is quite normal.

Everyone was backing off from them. No one wanted anything to do with them. The Japanese, Chinese, and Koreans couldn't stand the Africans. And it had nothing to do with racism. All it had to do with was how loud they talked. All we had to do was point it out. And the Nigerians, although it didn't seem very natural to them, learned to talk a little slower and quieter. And people found out that they were human beings, nice people trying to be friendly, trying to strike up friendly conversations with their roommates, who fled.

There is another important cross-cultural difference. How much silence are you used to? When I ask you a question, how much of a pause is necessary? (You already know in New York, none at all.) In most cultures of the world, especially the Orient, Middle East, and rural Alaska, you have to pause. You have to pause because you have to show that you are giving consideration to what the other person said. You have to allow some measure of silence within a conversation. It is important to know within a culture how much of a pause is appropriate, and how much is needed just to be polite.

All of these things are the micro-picture. They vary cross-culturally, and even from one region to another within a single culture.

Macro-Communication Problems: How We Organize Information

I deliberately told you the four main topics of this talk: I just finished the first. I start now with the second. You are used to that presentation, to that kind of organization of the information. Western civilization has done it that way since the time of Aristotle. I give you the topic, then I back it up with examples.

And then we will go on to the next main heading. We have just made that transition. I think you are all still with me because you expect information to be transmitted that way. *That's not true in most of the world.*

In most of the world people start out far into our organizational outlines. They start off with all the details and build a case, working up to the main points.

Now what happens when I am delivering the information organized as I have here today, but the students in the class are computing it the other way around? When I reach the end they are waiting for the grand finale, and I am into the minutest of details. To them my whole presentation, which I thought was perfect and clear and logical, made no sense at all because they expected the information to be presented in exactly the opposite way. And if I turned my whole outline inside

out that way, it wouldn't make any sense to Western culture.

That happens lots of times. Then students flunk their exams and we tell them that they are stupid, they weren't paying attention, they didn't study. And that wasn't what was happening. The whole structure of information was different.

Here in Sitka a number of years ago a Tlingit elder took me to lunch and told me three stories afterwards. I didn't know why he had taken me to lunch, and I had no idea why he was telling me these stories. Stories in Tlingit culture have a "copyright." Only certain people can tell them, and even though he told the stories to me, I still don't have the right to re-tell them.

Why was he telling me these stories? He has a vast repertoire of legends and myths, and he gave me these three stories in the course of most of one afternoon. Why me? Why now? Why these stories? He knew that I had lived here in Sitka a few years, then I had gone off and met my wife and lived with the Eskimos for ten more and that I had come back to Sitka for a visit.

When I lived here he didn't socially interact with me. We had never gone to lunch before. Why now? What was he driving at? In effect he structured his information so that each story was an arc, each story linked, and with the final story he closed the circle; he delivered his message. It took him three stories, and perhaps four hours. And the message was something he never said. I don't know how he did it. He took these three stories out of his repertoire, wove them together, and delivered his point, which was right in the middle of the circle, something he never stated, something he worked around. And by the way, his point was: "Since we Tlingits are so fascinating, why are you messing around with those Eskimos?"

So the structure of information is another major problem in dealing with people of other cultures, especially third world cultures, who would rather document their main point by telling you stories. They give you all the details first, then come to a conclusion based on those details, rather than tell you right up front what they are going to do and then backing it up with the details. You have to know how people expect information to be presented and how they are going to present it to you in order to communicate. And we often don't do a very good job across cultural barriers.

This is a good place to add that all of us are involved in cross-cultural communication, because there is such a thing as "women's culture" and "men's culture." There is a wonderful, entertaining book about this called *You Just Don't Understand*, by Deborah Tannen (William Morrow, Inc. 1990 New York), a linguist at Georgetown University. Every conversation between men and women is an inter-cultural or cross-cultural event. Conversations across genders are always cross-cultural, and there are lots of breakdowns, because we don't share even a basic notion of what talking is good for.

Men and women are acculturated differently. Women talk to establish rapport and build relationships and men talk mostly to share information.

Politeness

There are lots of ways to be polite and everybody usually tries to be polite most of the time. But there are two main ways of being polite, two opposite ends of the continuum of politeness, if you want to conceive of it that way.

One of them is the All American, which is "I am going to be polite to you because we are basically the same." American politeness confirms the basic truth that everyone is essentially alike. By the way, the extreme example of this

is, again, the New Yorker. You may not think of it this way, but when New Yorkers finish your sentence for you, they are demonstrating that they are so much like you that they know what you are going to say before you say it. They are filling in the blanks for you if you dared pause. It's their way of saying "I am with you. Keep coming."

In fact for most people of the world, when a New Yorker does that, you stop talking completely and say to yourself, "Okay, you talk wise guy." That's not the way New Yorkers interact. Two, three, four New Yorkers can all talk at the same time and have a great time at it. It seems rude to most of the rest of the world, but it is an extreme form of what we call "solidarity" etiquette. I'm with you, we're all one, we're alike.

The other form of politeness, the other extreme, is called "deference." We all know how to use deference style etiquette. Deference style politeness is based on the notion that we are different, that no two people are alike, and that I can't dare assume that I know how you feel or what you are thinking, because I am me and you are you. That's equally as true as the solidarity form of politeness.

Consequently, if you are from a culture that prefers and uses the deference form of politeness, you live in a culture that breeds lots of pauses in their conversations. I don't dare interrupt you. I don't dare assume that I can put words in your mouth. I am very careful not to transgress or interfere, and so are you.

We all know how to use deference style etiquette, even in America. The deference style of politeness always comes into play in a conversation when the two people are of unequal power. You all know how to say "Yes, sir" and "No, sir" to the arresting traffic cop. It is "Yes, your Honor" and "No, your Honor" in court, and you don't interrupt. When one party has power over the other, the person of lesser power almost universally reverts to deference styles of politeness. Even if you know the judge, you still don't call him "Bob" when you come to court.

Americans meeting people from almost any place else in the world will catch the first name, and not only immediately leap to the assumption that you can use the first name, but even abbreviate it. Americans are trying to be polite in doing that, but it doesn't always come across that way. It seems a bit intrusive or presumptuous to people in other cultures.

What do you do with this politeness problem when dealing with people from other cultures? I suggest that you use deference until invited to use any other form of politeness.

Native Alaskans always use deference, even among themselves. We all know how to do it. We just seldom do so. It is not the way our culture operates, in particular in the American West. We offend a lot of people by assuming that we can be on a first name basis, or even a nick name basis, the first time we meet. It is not necessarily wrong or evil; it just rubs people the wrong way.

Rituals

How do you say hello and goodbye? Lots of people can learn the words in 20 languages, and you can learn how to say please and thank you in 20 languages. That's not the problem. The problem is, when do you use it?

I know how to say thank you in Eskimo. But it isn't said as often at the table as in English. It's natural to say thank you when someone passes you something at the table. At an Eskimo table you don't say it till everything is finished, desert and all. In that culture one thank you at the end of the meal is sufficient. You don't talk unnecessarily during the meal—it's bad manners. You are supposed to be paying attention to the food, and as they would put it, showing

respect to the food. That's good manners.

What constitutes good manners and good etiquette? Our sense of manners at a meal, in the sense of rituals, is whatever you do, be neat about it. You can eat a sandwich with your hands in a snack shop, but in a nice restaurant they give you several types of forks and spoons, and maybe even more than one knife. It's kind of like surgery. You are supposed to go in there and know how to use the right kind of utensils on the right thing.

With Eskimos sometimes you are lucky if you get a spoon. Sometimes you eat soup and there are big chunks of meat in it, and with just a spoon you really can't manage. You go in after it with your hands. It's bad manners according to Emily Post, but for them good manners means finish everything, waste nothing. If the Eskimo goes to that same fancy restaurant where European-Americans are using all those fancy utensils he'd be horrified at the bad manners because there was so much food left over and thrown away.

What constitutes an American hello and an American goodbye? It takes two. Both persons say hello or goodbye. Two of each is the bare minimum of friendly, American English conversation.

In my wife's Eskimo culture no hello or goodbye is necessary. When it is obvious that the conversation is over, you get up and leave. There is no ritual for saying goodbye. You can say goodbye, but it is not required culturally speaking.

That's one extreme. I come from an Eastern European culture that is the other extreme. I discovered this much to my dismay when I took my new bride to meet the family. In my type of culture it takes a long time to work up to the actual goodbye, and the goodbye itself can take forever. We don't want to look too eager to leave. Parting is such sweet sorrow. The whole ritual takes at least two hours. And I took my Eskimo bride to visit these people!

When I made my first weak gesture to start the ritual, my wife stood up, put on her coat, and walked out the door. The message she sent was, "I can't wait to get out of here." This was exactly opposite of what the whole farewell ritual of the family is meant to produce.

What do you do cross-culturally? Well, you have to talk about these kinds of things. If you are the one who has power as the supervisor, instructor, or trainer, and this kind of cultural difficulty arises, don't label their performance "incompetent," their mind "slow," or their response "unenthusiastic," when that probably isn't an accurate interpretation.

We have to expect, and even learn to appreciate, the differences because there is really no way of undoing the lower end of everybody's iceberg. We got it from our Moms. It is indelibly part of the person that we are.

That's why being with and conversing with family seems so normal and relaxing, while being with people of other cultures, rhythms, paces, tonal systems, volume and pitch, as well as politeness style can be so frustrating and difficult.

But that is the kind of world we live in. "Sea speak" is a great idea, but I am sure that intonation and pausing and all the things we talked about earlier will invade even that. People are people, and we have to learn to deal with the differences and not penalize anyone for being different, for not being the same as us. It may mean people's lives. It will certainly mean their education and their jobs, which could mean pretty much the same thing.

Father Oleksa is a Russian Orthodox priest who has spent many years in Alaska. At the time of the symposium he was returning from California to a new assignment in Juneau with Sealaska Heritage Foundation. Father Oleksa has written many cross cultural curriculum materials and has taught cross cultural studies at Alaska Pacific University in Anchorage.

Treating Severely Hypothermic Patients

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Recently, hypothermia has been at the forefront of the news in the United States. Headlines have blared at us from the news presented at the supermarket checkout stand, "Man Frozen in 1936 Revived Alive! He Thinks We're in the Great Depression, Say Doctors." I have always wondered who bought such "newspapers" until I realized I had just done so! I read the article with more than routine interest. It was sparse on fact, said little about techniques, and further stated he was still in critical condition, however. I should have learned, for months before I bought a similar tabloid announcing, "Tot Frozen 3 Weeks Thawed out and Lives." I long to speak for just a moment or two with the physicians and scientists with such resuscitative skills. Lacking the names and locations I will just have to tell you about our own obviously minor experiences and patients, people who pale in comparison (references on request).

Recognition

Recognition of hypothermia is not as easy or as obvious as it may appear. A nurse supervisor in a university hospital emergency department did an intake evaluation of an aged man in a wheelchair. He was not communicative, he sat still for an oral temperature, and she dutifully recorded 31° C or 88° F on the record. When it was his turn to be seen, he was found deceased in the waiting area. In this case the synapse failed in the recognition of a severely hypothermic individual.

The History

Was this individual exposed to conditions likely to induce lowered body temperature? Some are not subtle; some are like cases of urban hypothermia.

What Does the Patient Look Like?

Clinical description, shivering, wet, shaking, wearing minimal clothing, clouded mental status, muscle stiffness.

Vital Signs

Respiratory rate, heart rate, body temperature. How and what do we measure, oral, axillary, rectal, esophageal?

Physical Exam

Body size, type, sex, age, alertness. We are reminded of the importance of such findings after a routine call for a missing 14 foot aluminum fishing boat. A male and female were seen leaving a boat launch and did not return for their car after 24 hours. They went fishing and did not come back. A Coast Guard helicopter was launched for a search in the Great Lakes, and they were found. The history revealed they overturned their vessel, remained clinging to the overturned vessel through the night, and withstood 9° C water (48° F) for much of a night and morning. During the lifting procedure both victims fought to get into the hoisting basket together. Each weighed in

excess of 300 pounds! Obviously body had much to do with their survival.

Working Definitions of Hypothermia

Mild hypothermia is probably in the experience of everyone in attendance here today. One experiences the sensation of coldness, piloerection (goose bumps), shivering, and distinct discomfort. The classic setting is often a wet or damp day with air temperatures in the 4^{o} C (or 40^{o} F) range. Body temperatures are normally maintained as adjustments occur. There is often a desire to urinate (a cold diuresis).

Moderate hypothermia is a progression of further dropping of the measured rectal temperature (near 32^{o} C or 90^{o} F) accompanied by a cool skin, initial hyperventilation, mild shivering progressing to vigorous shivering, and mental clouding in the presence of cardiac stability.

Severe hypothermia occurs when shivering stops, muscles become stiff, respirations diminish, unconsciousness or coma develop, and cardiac instability develops, usually with body temperatures below 32^{o} C or 90^{o} F.

These are working definitions we use to determine the extent of our rescue and recovery procedures, evaluating the expenditure of our resources, and the risk versus benefit of retrieving our victims.

Treatment

Rewarming strategy begins with *Primum Non Nocere*: First Do Not Harm. The patient is treated gently, and carefully moved out of the environment that caused the cold injury, if this can be done without vigorously exercising the patient. Wet clothes are removed with care, and non-painful procedures are done with as little invasive procedure as possible. For example, intubation is avoided if simple jaw repositioning can effect an airway. The first 20 or 30 minutes after the rescue are a very vulnerable period for cardiac irritability and unwanted cardiac dysrhythmias. The patient is placed in a thermal recovery capsule to stabilize initially, or major heat loss areas are covered (head, neck, axilla, and inguinal areas).

Basic Life Support (BLS) is administered if there is no detectable pulse or respiration. There is no modification in technique for hypothermic victims.

Advance Cardiac Life Support (ACLS) is modified to one electrical countershock in the field and if there is no effect, the patient is transported with BLS in progress. ACLS drugs are avoided in those with body temperature less than 32^{o} C or 90^{o} F.

Pulse Oximetry measuring oxygen saturation has been used recently with monitoring of pulse rate, pulse waveform, and oxygen saturation. Earlobe measurements have been enhanced by using Ben Gay.

In-Hospital Rewarming techniques have included passive rewarming, blankets, warming blankets, warming pads, inhalation of heated humidified oxygen (40-42^{o} C, or 105-108^{o} F), gastric, urinary bladder, or rectal lavage, peritoneal dialysis, pericardial lavage, and pleural fluid installation.

In moderate to severe hypothermia victims we avoid exercise, vigorous rubbing or kneading of the extremities, application of pneumatic antishock garments (formerly MAST pants), hot fluids by mouth, alcohol or cigarettes in the rewarming phase, all of which prolong the vulnerable phase, or enhance development of cardiac ectopy.

If these measures appear to be failing, total perfusion by cardiopulmonary bypass has been attempted with success.

Where Does Survival Come From?

First and foremost, from the intangible or "Will to Live." In my opinion one of the most important factors in the eventual treatment success or survival success is the will to live. Looking back at a career of resuscitative efforts, I conclude that suicide patients fare worse despite the same treatment or resuscitative efforts. Efforts to enhance this will to live are essential for eventual survival. What are behaviors which enhance this?

- Communication links, e.g. "You are a survivor."
- Setting up a communications schedule
- Air drop clothes and radios if there is to be a delay
- Air drop supplies, medications
- Company or companionship enhances survival
- The addition of a rescue swimmer, and para-rescue specialists are enhancing our survivals

New Directions in the Future

- Increased numbers of dive-rescue personnel, para-rescue specialists, and rescue swimmers.
- Improved technology and further refinement of search and rescue.
- Advances in clothing technology, raft technology, and deployment of these advanced techniques.
- Rewarming strategies advanced with more perfusionist input.
- Continued sharing of experiences and new ideas at conferences such as these.

Dr. Nemiroff is a physician who pioneered life-saving techniques on victims of cold water near drownings, while on the faculty at the University of Michigan. He left academia to join the U.S. Coast Guard and continue his work with survival in cold-water emergencies. At the time of the symposium he was stationed at the U.S. Coast Guard Training Center in Petaluma, California.

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