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Navy Dentistry Turns

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COVER: LTJG Alexander G. Lyle, DC, poses in a French village a month after saving the life of a Marine corporal on the Western Front during World War I. For this action he was later awarded the Medal of Honor. Dr. Lyle is one of two Navy dental officers to receive the nation's highest military honor. Story on page 10. Photo courtesy of the National Naval Dental Center.

You Can't Lie to DAVID About Your Measurements

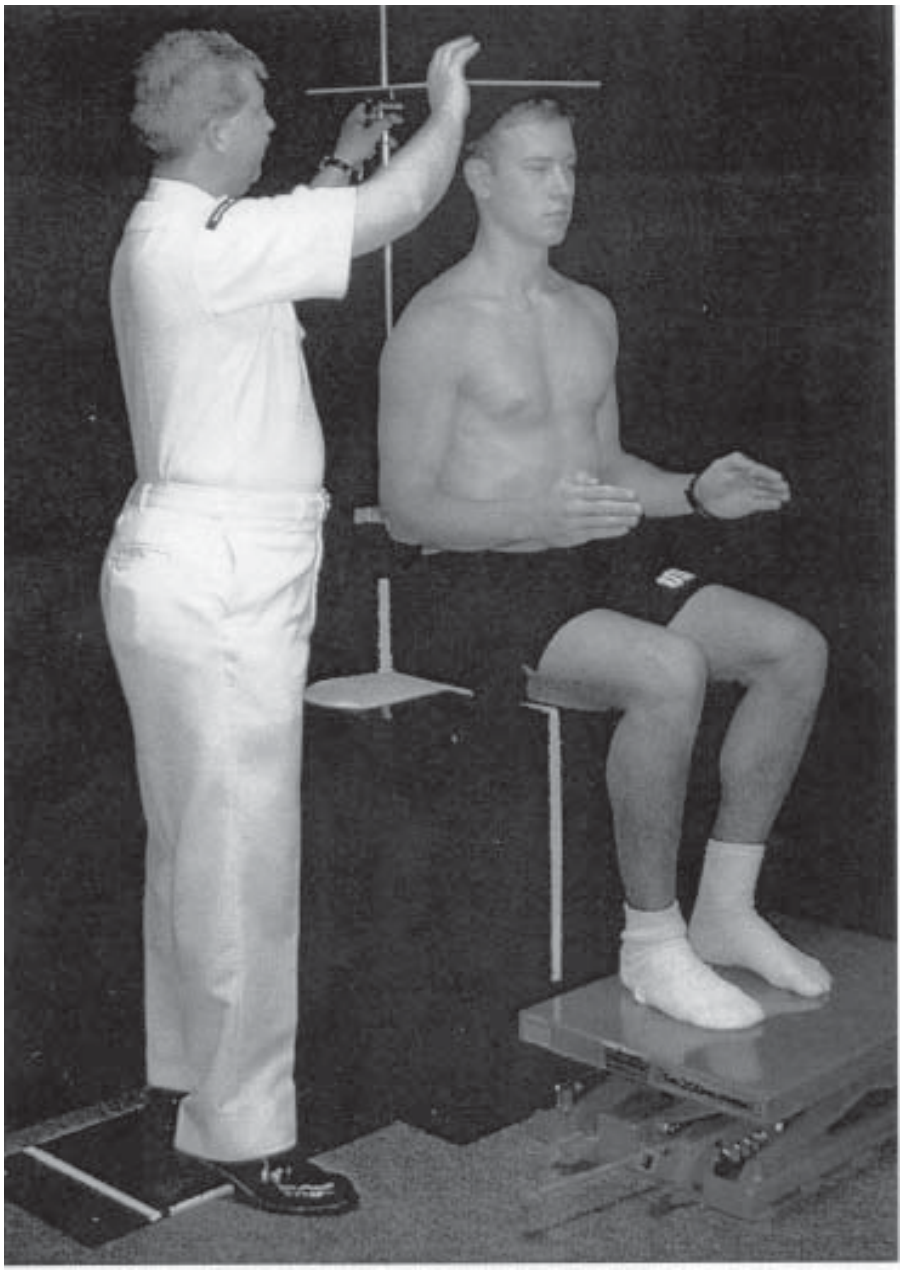

Photo by Naval Aerospace Medical Research Laboratory

An aviation candidate is being posed for DAVID, a computer-based digital anthropometric video-imaging device.

Your car fits the way you drive. The steering wheel adjusted for height and reach. The seat comfortable. Plenty of leg room. All the buttons and knobs—cruise control, radio volume, temperature—at your fingertips. The speedometer easy to see. As a car fits a driver, a plane needs to fit a pilot. Navy and Marine Corps aviators fly the most modern, innovative, high-tech aircraft in the world. But, before they get their wings they have to measure up.

Each aviation candidate is measured to the inch to ensure sufficient reach to operate controls and perform emergency ejection procedures. In the military, one of the primary selection criteria for aviation candidates is anthropometric screening, which reflects aircraft design specifications.

Since the 1960s these measurements have been taken by a corpsman with a slide, scale, and measuring tape. The corpsman requires special training that includes instruction in positioning the candidate, identifying specific anatomical areas to be measured, aligning the measuring devices properly, and applying the correct amount of pressure while making the measurements. Today, this pencil-and-paper technology is being re-

placed with a camera and computer. Scientists at the Naval Aerospace Medical Research Laboratory (NAMRL) Pensacola, FL, developed DAVID (Digital Anthropometric Video-Imaging Device), a computer-based digital anthropometric video-imaging system.

Jack L. Saxton, the research physiologist who heads the DAVID program said, "We are responding to the needs of the fleet. With the old system, errors occasionally happened, and candidates would continue on with training and be assigned to a specific airframe only to get out to the Wing and find out they didn't fit in the aircraft—either too big or too small. Then the candidates would have to be retrained for a specific airframe for which they fit. DAVID measures specific body dimensions to make sure the pilot can safely fit in and operate an aircraft. The Naval Air Systems Command, Chief of Naval Education and Training, and other commands are very enthusiastic about DAVID. DAVID is already operational at the Naval Academy and the Naval Aviation Medical Institute, and we will soon be putting a unit at Quantico for the Marines."

DAVID's camera is accurate and the software programming for the image acquisition, analysis, electronic transfer, and storage is user-friendly. The DAVID screening process begins with the candidate sitting in a chair (side-view) in a standard pose. DAVID's camera takes the photo. The software digitizes the image. The operator identifies the area to be measured and the required measurements are automatically calculated. In less than 2 minutes the data are available to evaluate and determine the right "size" aircraft for the potential pilot.

Three measurements are calculated from the image. The first is the sitting height measurement to determine if the pilot can see over the noise of the aircraft when landing. The second is the thumb tip reach. The thumb is extended as far out as possible, and the distance from the tip of the thumb to the shoulder blade is measured. This measurement will determine if the pilot can operate the switches and knobs. The third is the buttock-knee length, which measures the distance from the candidate's back to the knee. This is a critical measurement to determine if the pilot can eject from the aircraft without injury. A fourth measurement, independent of the image for eye height, is calculated by the software using the individual's sitting height measurement.

DAVID uses off-the-shelf software and hardware controlled by an in-house program. According to Saxton, "Compared with manual techniques, DAVID's advantages center on the computer and include the permanent electronic storage of images and measurements, electronic transfer of the data into other software packages, and file retrieval for quality control review." With DAVID, the file contains not only the measurements, but also exactly how the person was positioned and how each measurement was made.

For more information on DAVID and other research efforts at the Naval Aerospace Medical Research Laboratory, visit the web site at www.namrl.navy.mil/. ❑

—Story by Doris M. Ryan, Medical Research and Development Division (M2), Bureau of Medicine and Surgery, Washington, DC.

Naval Medical Center San Diego Joint Replacement Innovation

What do knees and hips jointly have in common? They wear out and sometimes need to be realigned or be replaced, and the Naval Medical Center in San Diego (NMCSD) is leading the way.

According to CDR Michael P. Muldoon, MC, Director of Adult Reconstructive Service, Department of Orthopedics NMCSD, "We provide a continuum of care for arthritis that includes knee and hip replacement."

Whether a patient is having a knee or hip replacement, or similar joint replacement procedure, the center at NMCSD provides an opportunity for Navy military personnel to get state-of-the-art treatment for these types of problems.

"Arthritis is part of life in our aging society. The sophisticated surgical treatments for it including arthroscopy, osteotomy, cartilage regeneration, and replacement are part of the ongoing care for our patients," said Muldoon.

"If patients have mechanical problems such as fragments of bone or cartilage or soft tissue tears, the hip can be inspected and treated with an arthroscope much like a knee can," said Muldoon. "We have treated about 50 people over the past 3 years with hip arthroscopy."

Treatment for repairing and correcting knee problems has also led to some innovative technology.

According to Muldoon, "If a knee has focal loss of cartilage, which are the bearing surfaces of the joints, we can use cadaver grafts, grafts from other sites on the patient or harvest cartilage to grow outside the patient that can be replanted at a later date."

Medical technology has also improved for hip and knee alignment problems.

"If a hip or knee has an alignment problem that is causing pain and the joint has not completely worn out, we like to realign the joint by angular bony corrections, which means the bone is cut with a saw and the bones realigned in a more favorable position for the adjacent joint, called osteotomies," said Muldoon. "We prefer this approach when possible especially in younger patients less than 50 years of age."

Although many new ways have come about to correct joint problems for knees and hips, it is not always the answer for everyone. Sometimes mother nature may pave the way for you.

"If patients have severe loss of cartilage and symptoms that cannot be controlled by conservative measures, joint replacement may be required," said Muldoon. "With knee replacements, we are using bearings that provide more degrees of freedom and hopefully decreased wear with increased function. In hip replacements, we have been involved for 2 years now with FDA trials of ceramic bearing surfaces that will hopefully increase longevity of the prosthesis."

NMCSD has seen many patients that have chosen to have partial hip and knee replacements based on their particular circumstances.

Although both knee and hip replacements are quite popular these days, NMCSD performs more hip replacements on younger persons.

"I have enrolled about 40 patients in the hip study," said Muldoon. "More hip replacements than knee replacements are done on younger patients because the causes for hip arthritis are frequently childhood disorders such as dysplasia, which is a malformed hip socket, or Legg-Calve-Perthes disease, a disruption of the

blood supply to the head of the thighbone, and slipped capital femoral epiphysis, an injury to the growth plate of the femoral head, more commonly known as the ball at the top of the thighbone.

Why did NMCSD undertake such a venture as ceramic hip replacement? "I have been here for 5-1/2 years and have embraced the opportunity to hopefully provide better surgical treatments for our patients," said Muldoon. "The success rate initially for these procedures is very good, and the future prognosis is favorable. Long term success is the goal, but early results have been excellent," said Muldoon.

Although this continues to be a great opportunity for NMCSD, where did funding come from to make this effort become reality? "Funding for the implants is provided by the department operating budget for patients over 65 and for active duty members," said Muldoon. "TRICARE patient implant costs are picked up by Foundation Health, the current TRICARE contractor."

This program is open to all eligible Navy active duty personnel, dependents, retirees, and reservists, although some studies have age/weight restrictions. This successful program sees a bright and prosperous future for the military.

"My insight is that we do a nice job of not lumping patients into one group and giving everyone the same surgical treatment or by treating with benign neglect until their joints have to be replaced," said Muldoon. "We also benefit from collaborations and communications with consultants in San Diego who are world renowned for their expertise in osteotomies and cartilage transplantation. This allows us to successfully treat patients without replacing their hips and knees more frequently than other centers."❑

—Story by Aveline Allen, Public Affairs Specialist (M00P), Bureau of Medicine and Surgery, Washington, DC.

Astronaut Visits Navy Medicine

Navy medicine professionals in the Washington DC area were treated to the ultimate sea story on 29 May 2002 as told by NASA astronaut CAPT Lee Morin, MC.

Morin participated in shuttle mission STS-110 in mid-April, which focused on the continued construction of the International Space Station (ISS). He is currently on a 4-week tour sharing some of his experiences in space.

As an astronaut, Morin said he has many opportunities to speak to groups. He felt strongly about spending a day talking to the Navy medicine family.

"I was scheduled to be in the DC area and wanted to show my Navy colleagues what the mission was all about," Morin said.

Audiences at the Bureau of Medicine and Surgery (BUMED), National Naval Medical Center (NNMC), and the Uniformed Services University of the Health Sciences (USUHS) saw photos and actual video footage of Morin working as part of the seven-member shuttle crew.

The crew installed a segment of a truss that will hold power-generating solar panels in the future.

For his part, Morin made two space walks totaling over 14 hours, installing bolts and maneuvering components that became part of the ISS.

"It's a strange thing to look down when you're strapped to the end of the robotic arm and know it's 240 miles straight down," he told the audience.

Attendees were delighted to hear his tales of life in space, which offered an escape from our busy world, if only for a short time.

Walking down the hall at USUHS after the presentation, a comment from a man returning to his office could be heard in the distance. "I just spent the last hour in space," he said to his co-workers. ❑

—Story by Brian Badura, Public Affairs Specialist (M00P), Bureau of Medicine and Surgery, Washington, DC.

Industrial Hygienists Clear the Air After Pentagon Terrorist Attack

Martin J. Dubin

Navy Photo

Industrial hygiene is the science dedicated to the prevention of occupational illnesses and injuries. Industrial hygienists evaluate the risks of exposure to chemical and physical hazards in the workplace. They also develop methods for eliminating or controlling those hazards. In a way, industrial hygienists are detectives, workplace Sherlock Holmes clones, who search out and identify health hazards potentially harmful to workers. They also track down sources of work-related illnesses.

One of their most important responsibilities is ensuring that everyone in a work area is protected from exposure to chemicals and other known or suspected contaminants. Following decontamination, industrial hygienists carry out *clearance sampling*, a method of ruling out the presence of health-hazardous levels of specific toxins before allowing employees and others to re-enter previously contaminated areas.

The 11 September terrorist attack on the Pentagon put a new spin on industrial hygiene clearance sampling. After the plane crash and fire that destroyed part of the Pentagon's structure, health-hazardous residues and dusts were released into the crash zone and adjacent areas. These contaminants included by-products of combustion, lead, asbestos, and other toxins. The resulting hazard meant that clean-up crews had to wear full-body protective suits and respiratory protection both while decontaminating and preparing to rebuild the Pentagon's damaged sections.

During clean-up, it was necessary to assess periodically whether a previously contaminated area had been decontaminated sufficiently to allow construction crews, Pentagon workers, and others to enter the area without wearing full-body personal protective equipment and respiratory protection.

Industrial hygienists based at the National Naval Medical Center (NNMC) were assigned to provide technical expertise to the Pentagon clean-up project and were integrated into a DOD team spearheaded by the Army's Special Medical Augmentation Response Team (SMART). Five additional industrial hygienists from NNMC's northern group also participated.

From 15 through 22 September 2001, Navy industrial hygienists worked long hours to expedite the recovery portion of the Pentagon restoration project. The team brought their sampling equipment and prepared for any contingency that might require industrial hygiene assistance. Team members also brought along full-body protective clothing and respiratory protection to safeguard them from any air and surface contaminants encountered at the crash site.

The industrial hygiene team's primary duties were to collect indoor

FEMA Photo

Exterior view of Pentagon shows significant damage.

environmental samples and continually assess the site for health hazards. The Navy industrial hygienists collected and analyzed *air samples* and *wipe samples* in the crash zone and adjacent areas of the Pentagon to identify or rule out the presence of hazardous substances. They used calibrated air-sampling pumps to collect air samples and took wipe samples by wiping down surfaces on which potentially health-hazardous dusts or chemical residues had accumulated. After clean-up of the crash zone and adjacent sections, additional wipe and air samples were analyzed to ensure that these areas were sufficiently restored to protect persons entering those areas from health risks due to contaminants. After *clearance sampling* confirmed that surfaces and the air in those areas were free of contamination, site clean-up workers and others were allowed to enter those areas without full-body and respiratory protection.

Because the site was a crime scene and not a typical work environment, the industrial hygienists faced several logistical challenges. Getting to the Pentagon itself was a lengthy and complicated process. Parking lots that surround the building had been closed, and security was extremely tight. Each team member and all equipment were inspected top to bottom every time the industrial hygienists entered and left the grounds.

The lack of electrical power and lighting were also obstacles that were overcome by snaking extra long power cords long distances to run the air sampling pumps. Team members used flashlights in the mostly dark and disordered areas to take wipe and air samples. Frequently, they had to climb over and around rubble, lopsided flooring, and collapsed sections of the damaged building.

In addition to measuring levels of surface and airborne contaminants in the crash area and determining when each area was safe for reentry without special protection, the industrial hygiene team investigated the trail of contamination from the fire to establish how far adjacent areas may have been affected. Team members collected numerous air and wipe samples to determine whether contaminants had migrated into areas of the building where employees were scheduled to return to work. Where they found contamination, they provided recommendations for decontamination. After that was accomplished, they scheduled follow up clearance sampling to verify the success of decontamination. After a clearance survey found no contaminants, the workforce safely entered that location.

By Saturday, 22 September, the industrial hygiene assistance team had completed its mission. Supervisor Nancy Davis stated, "The commitment and professionalism of these industrial hygienists was exemplary. We had more volunteers than we needed. All were more than eager to serve, unselfishly providing their expertise to get the Pentagon up and running again. Because of these selfless individuals, Navy industrial hygiene met the Pentagon's emergency needs while still servicing our regular customers."

Gil Clouser, a member of the industrial hygiene team, added, "We did a lot of walking, climbing, and crawling in dark and dirty places. The days were long and physically demanding. But we made a difference; we played an important role in restoring the Pentagon and calming fears of lingering health hazards."

The NNMC Industrial Hygiene Service did not end their work on 22 September. Jeff McClaflin, an industrial hygiene team member, developed a composite report using input from the industrial hygienists who participated in the Pentagon clean-up project. The report consolidated information that will help industrial hygienists in evaluating occupational health risks after other major disasters. ❑

Mr. Dubin is Industrial Hygiene Supervisor, National Naval Medical Center, Philadelphia Division.

Smallpox: Implications and Impact as a Bioweapon

LT Youssef H. Aboul-Enein, MSC, USN

Smallpox is a highly contagious viral disease unique to humans. It is spread person to person via the inhalation of micro-particles contained in water droplets exhaled by infected individuals. Touching an object contaminated with smallpox and then subsequently touching one's nose, mouth, or eyes with the contaminated hand also spreads the disease. The virus does not enter the body directly through the skin and there are no known animal or insect reservoirs.(*1*) Viruses exist on the threshold of life, remaining inert until they fasten onto the cell of another organism. Unlike bacteria, a virus consists of a protein shell, a sequence of DNA or RNA, and sometimes a liquid membrane, but is capable of annihilating the most sophisticated biological system.(*2*) Two principal forms of the virus exist. *Variola major* results in fatality rates of 30 percent or more among unvaccinated persons and the milder *variola minor* whose fatality rates are less than 1 percent.

The first symptoms occur 10 to 14 days after exposure with severe aching, malaise, headache, backache, and fever. Two or three days later macropapular rashes appear on the mouth, pharynx, face, and forearms. This rash spreads to the trunk and legs. Lesions quickly progress into pustular vesicles. Fever, aches, and pains remain throughout the course of the disease. About 14 days after the onset of the lesions, scabs are formed leaving the person's complexion pitted. Death occurs during the second week of the onset of the disease.(*3*)

Eradication

In 1967, the World Health Organization (WHO) embarked on a program of world eradication of the virus. Prior to the initiation of this program, smallpox claimed the lives of between 10 and 15 million people a year. The disease would be a scourge upon humankind for millennia and was even mentioned in ancient Egyptian texts. The eradication program had its roots in the 1796 discovery of British physician Edward Jenner. While conducting clinical observations he noted that milkmaids were immune from smallpox due to their exposure to cowpox, a milder virus. When intentionally injected with cowpox, a person developed a mild fever and recovered with a complete immunity to smallpox. His discovery revolutionized medicine.(*4*) Smallpox is a good candidate for eradication because the smallpox virus has a single, stable serotype. In addition, there are no animal reservoirs, and humans are the only hosts. Smallpox responds promptly to antibodies, so that exposed persons can be protected.

American physician Donald A. Henderson inherited the eradication program. It was a daunting task, as smallpox was entrenched in several parts of the world: Brazil, Africa, India, and Indonesia. Henderson fought the WHO bureaucracy and the politicization of the campaign into a Cold War race to accomplish the task in two decades. He did it by relying on carefully selected local staff members in each country, preferring a solid work ethic to actual experience in biology or disease.

Another aspect of eradication involved the development of two key technologies. One was a heat stable vaccine. The second was the introduction of the bifurcated needle that introduced the vaccine to the superficial layers of the skin where it was most effective. Finally, key diagnostic techniques were formulated by

which smallpox could be separated from monkey pox or severe chicken pox. The process involved injecting the clinical specimen into a fertilized egg, which reacted differently to each type of pox.(*5*)

The strategy for mass immunizations adopted by Dr. Henderson and his team was quite simple. In countries with a low rate of smallpox, 80 percent of the population would be immunized and the program would be augmented by surveillance and containment techniques. In countries with a high rate of infection, surveillance and containment activities would be limited to major outbreak areas and places where mass vaccinations took place. The logic of this approach was that mass vaccinations would lower the density of susceptible individuals in the population, reducing to a manageable level the number of smallpox outbreaks that surveillance teams could trace and contain.(*6*) It is important to realize this strategy had to be slightly amended when epidemiological studies showed that about 50 percent of the population was already immune through exposure to the virus or some form of vaccination or variolization. This negated the need to vaccinate 80 percent of the population.(*7*)

Traveling the globe and incorporating these techniques, smallpox was finally declared eradicated on 8 May 1980. According to the former head of the Soviet Bio-weapons program Dr. Ken Alibek, the Kremlin perceived a military opportunity from the eradication of the disease and sought to increase its production as a weapon.(*8*)

Smallpox as a Bioweapon

Russian experimentation with smallpox as a biological weapon dates back to 1947. By the 1970s smallpox was considered so important to the Soviet biological arsenal that an annual stockpile of 20 tons had to be maintained at all times.(*9*) The Soviets also scoured the country for infected sources of new biological agents and even foreign nations. One of the most aggressive strains of smallpox came from an Indian traveler who in 1959 caused a serious smallpox outbreak in Moscow. A special medical team was sent to India to help purge the virus and among those in the group were specialists from the KGB.

What these agents collected was to become the principal battle strain of smallpox for the Soviet military known simply as India-1.(*10*) The Russians successfully adapted the virus to be loaded on intercontinental ballistic missiles (ICBMs) and bombs. In 1997 American experts visited a well-guarded smallpox laboratory in Siberia; they unearthed long-frozen bodies of turn of the century smallpox victims and extracted samples from them.(*11*)

Smallpox is highly stable in aerosol form and an infectious dose is very small. To illustrate the amount needed to infect a person it takes five viral particles to infect 50 percent of lab animals. The same infection rate requires 10,000 spores of anthrax and 1,500 cells of plague.(*12*)

In 1952 French experts released a few rabbits infected with myxomatosis. This was an effort to reduce their population, which was overrunning pasture reserved for cattle and sheep grazing. Released not far from Versailles, the disease had swept not only through France, but also as far as Belgium, Holland, Switzerland, and Germany, killing 90 percent of the rabbits. This case was of special interest to Cold War germ warriors because myxomatosis is part of the pox family whose cousin is the infamous smallpox virus.(*13*) Looking at humans, 20 years after the French rabbit program, the Soviets tested smallpox on Vorozhdeniye Island, a major open air-testing site. The testing most likely caused an outbreak in the neighboring town of Arak in Kazakistan, where doctors filed detailed reports of smallpox outbreaks and reported three deaths as they struggled to contain the disease.(*14*)

Terrorists and rogue states engaged in asymmetric warfare can obtain the technology for a limited smallpox weapon through American and Russian medical research archives, hostile regimes that have preserved samples, and wild samples as illustrated in the India-1967 example.

Russian experimentation with bioweapons has not ceased and the quest for virulent and contagious recombinant strains continues. There is also the issue that existing Russian expertise and equipment might fall into non-Russian hands due to the financial crisis facing the nation.

Impact of Smallpox Release On a Population

The deliberate reintroduction of smallpox would pose unprecedented challenges to a nation's healthcare system and have repercussions on the economy and public policy. During the 1970s in Europe, smallpox was detected during the December and April months, and as many as 10 to 20 cases were infected from a single case. Outbreaks of fewer than 100 cases resulted in widespread panic and concern.(*15*)

A clandestine release of smallpox infecting 50 persons would rapidly spread in a highly susceptible population, expanding by a factor of 10 to 20 times with each generation of cases. The virus would spread until

checked by vaccination, or patients and their close contacts are placed in isolation. Between the release of the virus and the diagnosis of the first cases, an interval of 2 weeks is likely to occur, as the average incubation period is 12 to 14 days. Emergency response personnel such as police, medical staff, and paramedics will also require vaccination.

The United States is considered a vulnerable population as few persons under the age of 27 have been vaccinated. This represents a little under 100 million Americans.(*16*) These numbers illustrate how quickly overwhelmed the U.S. healthcare system could become by a deliberate release of smallpox. In addition, the U.S. has a limited reserve supply of vaccine sufficient for 7 million persons and there are no manufacturers now equipped to produce smallpox vaccine in large quantities.

Then there is the issue of complications arising from mass vaccinations. This includes Postvaccinal Encephalitis, which occurs in 1 per 300,000 vaccinations and results in neurological paralysis and death. Less serious complications include *Vaccinia Gangernosa*, a mild form of gangrene that if left untreated could result in serious tissue damage. Finally, aspects of the psychological nature of the disease can be viewed from the impact of witnessing the skin lesions and physical disfiguring of persons suffering from the virus. It has a 30 percent fatality rate and there is no treatment.

Future Developments in Smallpox Weapons

In March 1998, forty senior members of the Clinton Administration gathered to rehearse how they might handle a biological attack by terrorists. The scenario involved the spread of a genetically engineered virus in California. After doctors rushed to diagnose the epidemic as smallpox and immunized the population, they retired with a sense of a job well done. But what was initially diagnosed as smallpox turned out to be a sort of hybrid, a combination of smallpox and the Marburg virus. Though not as contagious as smallpox, Marburg causes hemorrhagic fever for which there is no cure.(*17*)

The scenario is scientifically plausible and the threat of designer recombinant viruses are real, with the former Soviets paving the way in research for these types of bioweapons.

In 2001, Australian scientists developed a genetically altered cousin of smallpox known as mouse pox that was modified to carry the interluekin-4 genes. This gene suppresses the immune system in order to increase the effectiveness of the virus. Interleukin-4 is also found in humans. The scientists published their findings detailing that this genetically altered weapon can also be spliced into smallpox.(*18*)

Conclusion

Smallpox represented a triumph for humans as they conquered a terrible killer, but mankind's need to dominate has created a series of terrifying weapons. While the actual level of the threat is debatable, the consequences of a deliberate release of the virus would be overwhelming. Today, terror groups like Al-Qaeda, have solicited the assistance of states in the region. Already, rudimentary interest in bio-warfare was found in Afghanistan.

We must not think that stopping a biological attack from happening is enough; we must also disrupt and deny to terrorists and the rogue states that support them bio-warfare experimentation. In addition, should the U.S. go to war with Iraq for the sole purpose of ridding the region of Saddam Hussein, judging from his previous history of survival, it is highly plausible that he would deploy biological agents should he feel that his grip on power is threatened. Smallpox is a regular and basic feature of nation's pursuing a biological weapons option and an unfortunate threat that military medical professionals must contend with in the current millenium.

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Navy Dental Corps: 90 Years Marching Forward

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Out of the proud traditions of Navy medicine's five corps, stands the Navy Dental Corps. Though junior to the Medical, Hospital, and Nurse Corps in years, Navy dentists can celebrate a 90-year heritage and history 22 August 2002. But how did it come to fruition?

Navy dentistry's birthright is equally as old as the Navy itself. However, the dawn of Navy dentistry can only be traced back to 1873 when dental needs of Sailors were assigned either to civilian dentists ashore or Medical Corps officers on board ships. Shortly thereafter, hospital corpsmen with little experience in dentistry were given the responsibility.

The treatment that could be given was meager. To rectify the situation, the Bureau of Medicine and Surgery drafted a Navy Dental Bill to authorize the employment of civilian dentists at large Navy facilities in the United States and abroad. Even as the text of this Bill evolved to the appointment of dental surgeons to military rank, the Dental Bill was rejected year after year by Congress. Not until August 1912, while William Howard Taft, a man with a passion for sweets, was President of the United States, did Congress pass the act that established the Navy Dental Corps.

The Secretary of the Navy was now authorized to appoint no more than 30 acting assistant dental surgeons to be a part of the Medical Department. In Oc-

LTJG Weeden Osborne.

Photos from BUMED Archives

tober 1912, Emory Bryant and William Cogan became the first two dental officers to enter active duty with the Navy. Just over 1 year later, the Surgeon General reported to the Secretary of the Navy that the Medical Department now had the ability to provide dental care that would allow the Navy to accept recruits who would otherwise be rejected for defective teeth.

When the U.S. entered World War I on 6 April 1917 there were 35 dental officers on active duty, but the number grew to 500 by the war's end. Most of the regular officers commissioned during the war were assigned to ships or overseas activities. Thirty dental officers served with the Marines in France. Two achieved the exceptional distinction of being awarded the Medal of Honor. LTJG Alexander G. Lyle received the Medal of Honor while serving with the 5th Regiment, U.S. Marines. LTJG Weeden E. Osborne, the first Navy officer to meet death fighting overseas in the war, was awarded the Medal of Honor for heroism while serving with the 6th Regiment, U.S. Marines. The torpedo boat destroyer USS *Osborne* (DD-295) was launched in his honor in December 1919.

RADM Alexander G. Lyle.

The war established the general recognition of the value of dentistry in the Navy. The post-war years saw the Dental Corps develop into a distinct organization. Early in 1922, two significant milestones occurred: the establishment of the U.S. Naval Dental School and the creation of a Dental Division in the Bureau of Medicine and Surgery. There were 150 dental officers on duty at the time. In 1927, Navy Regulations authorized dental treatment to officers and men on the retired list; before that only enlisted were treated. During this era, Navy dentistry began focusing heavily on prevention of disease, unique at the time and a quality that distinguishes their corps today. Navy dentists demonstrated their skills throughout the 1920s and 1930s in Navy and Marine operations in places like Haiti, Nicaragua, and China. By 1939, 255 dental officers served at 22 major dental facilities ashore and afloat. By 1941, 759 dental officers were on active duty at 347 dental facilities. Two Dental Corps officers were killed in the attack on Pearl Harbor, LCDR Hugh R. Alexander, aboard USS *Oklahoma* (BB-37) and LCDR Thomas E. Crowley, aboard USS *Arizona* (BB-39).

Less than a month later, the Surgeon General directed that all dental officers become proficient in the treatment of casualties, so that in addition to carrying out their regular duties they could assist in sick bays and operating rooms, administer supportive therapy, and give anesthetics. Dental officers, assisted by dental technicians, performed such duties heroically and, in some instances, at the cost of their lives.

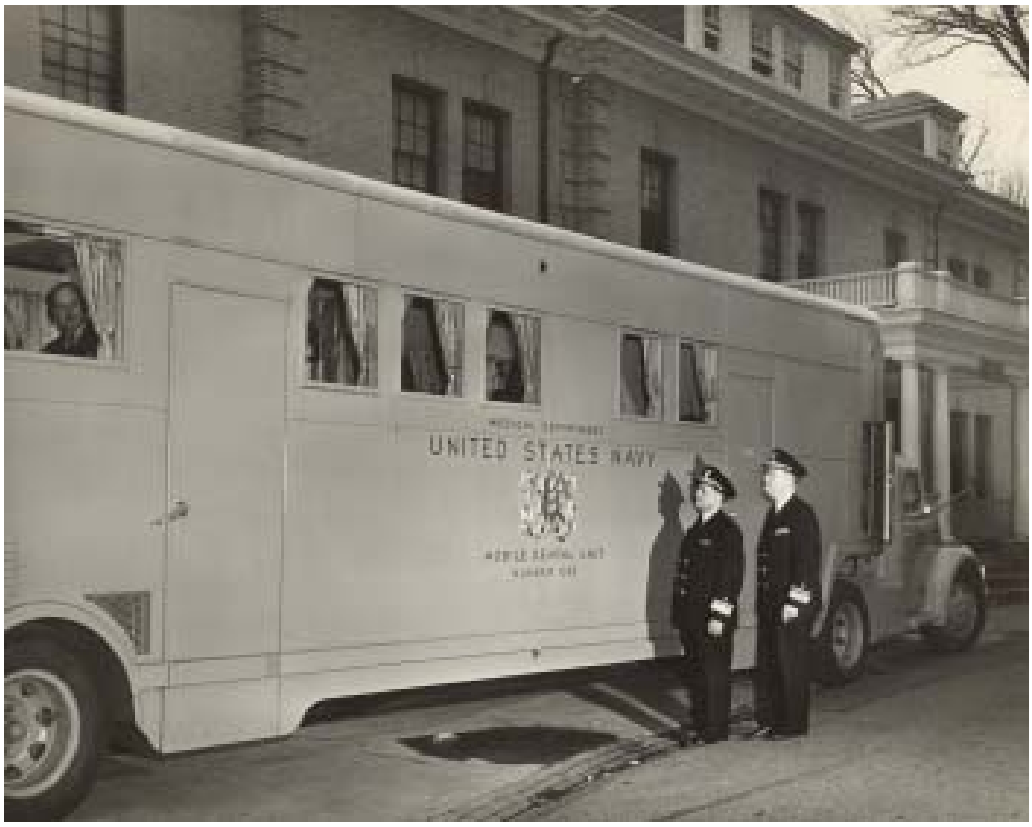
Because of the overwhelming need for manpower, the dental requirements for acceptance into service were lowered in May 1942. As a result, the Dental Corps began a massive rehabilitation program, which would last throughout the war, to make Navy and Marine Corps personnel dentally fit before they could be transferred overseas.

Many dental officers were killed in action aboard warships and in major battles at Guadalcanal, Tarawa, Saipan, and Iwo Jima. For their heroic efforts, 93 dental officers received personal awards, to include the Silver Star, Legion of Merit, Navy and Marine Corps Medal, and the Bronze Star.

By the end of the war 7,026 dental officers were serving on active duty

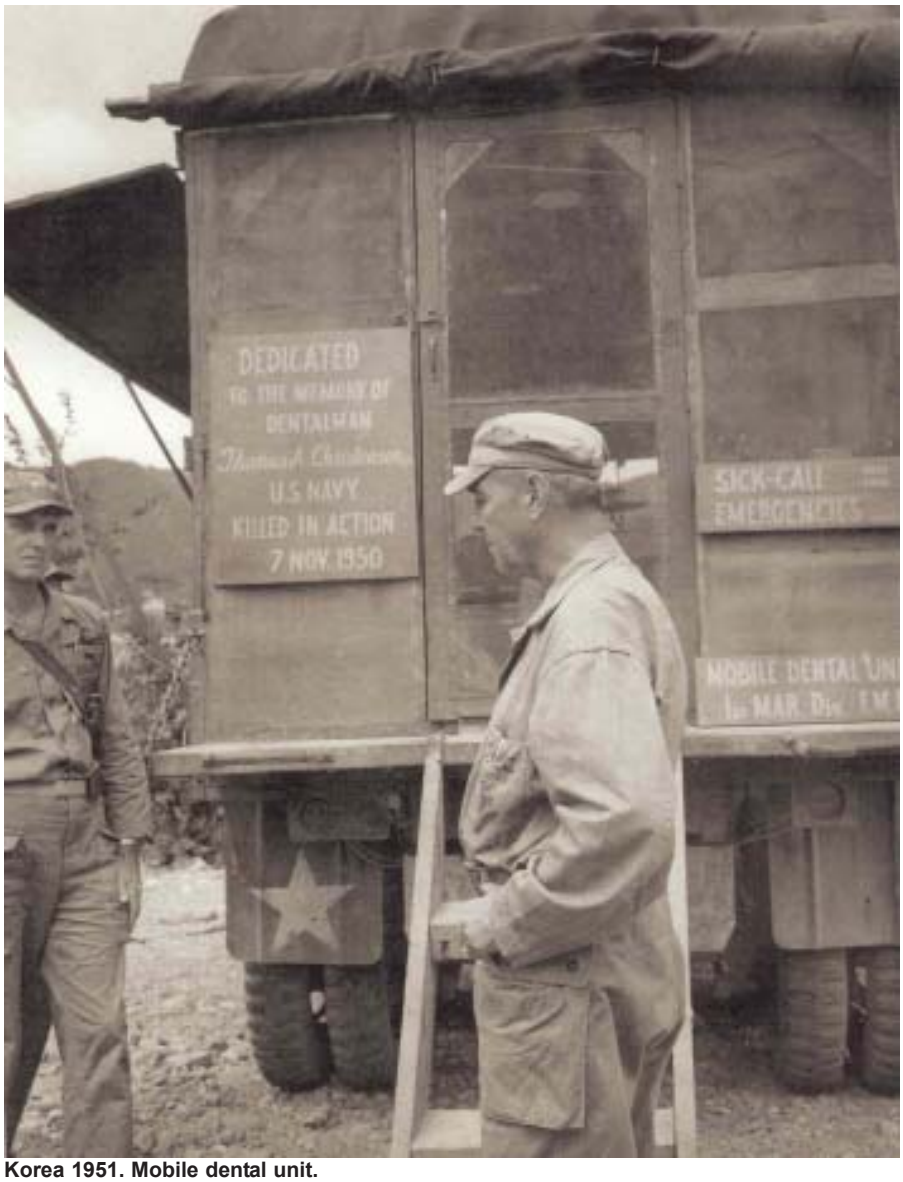
Circa 1925. Dental operatory.
Naval Dental School, Washington, DC.

**Circa 1930. Main operating clinic.
Naval Dental School, Washington, DC.**



BUMED 1944. RADM J.C. Agnew, MC, Assistant Chief BUMED (left), and RADM A.G. Lyle, DC, Inspector of Dental Activities, examine the Navy's new mobile dental unit.

Saipan 1944. Division Dental Clinic.



Korea 1951. Mobile dental unit.

USS *Reeves* (DLG-24) 1974. Using portable Marine field dental equipment set up on the fantail, three Sailors practice brushing their teeth.

Saudi Arabia 1991. Navy dental technicians work on patients in a field hospital during Operation Desert Storm.

and 1,545 dental facilities were in operation. Dental technicians on duty numbered 11,339. Among the dental officers and technicians on duty were 1,200 WAVES. One of these WAVES, LT Sara G. Krout, DC, USNR, was the first female dental officer in the Armed Forces.

World War II marked other events in the history of the Dental Corps such as the commissioning of the Naval Dental School as part of the National Naval Medical Center, Bethesda, MD, in 1942. On 18 December 1942, President Roosevelt approved the rank of rear admiral for dental officers. Former Medal of Honor recipient, CAPT Alexander G. Lyle became the first dental officer to be promoted to this rank.

CDR Sara G. Krout

In the postwar years dental technician training was greatly enhanced by the establishment in 1948 of dental technician schools at the Naval Training Centers, Great Lakes, IL, and San Diego, CA. Naval dental clinics were established. These clinics with dental officers in command would provide dental care for all personnel within a given area. The first such clinic was established at the Naval Shipyard, Brooklyn, NY, on 13 March 1946.

On 27 June 1950, President Truman ordered the armed forces into action in Korea. As the 1st Marine Division deployed, dental officers and dental technicians marched with Marines onto the battlefield, providing dental and medical support forward. Korea marked the first time in history that enlisted men of the Navy wore dental rating badges into combat. One such man was DN Thomas A. Christianson, awarded the Navy Cross posthumously for his gallant efforts while serving with the 1st Amphibious Tractor Battalion. At the peak of the action, 1,900 dental officers and about 4,700 technicians were on duty. As in World War I and World War II, dental personnel served heroically. Fifteen dental officers earned personal commendations, to include the Silver Star, Bronze Star, and Commendation Ribbon with Combat V.

Revolutionizing the field of dentistry worldwide, researchers at the Naval Dental School developed pioneer models of the dental air turbine hand piece and ultrasonic vibrating instruments. These concepts were a tremendous leap forward for the dental profession. Today, these prototypes are displayed at the Smithsonian Institution in Washington, DC.

By the beginning of the 1960s, Navy dentistry operated from 160 shore-based facilities and aboard 156 ships. To support Marine Corps operations, Navy dentistry developed innovative ways to take its skills to the field. Able to deploy nine mobile dental units on trailers, dental research and development personnel also developed more powerful rotary instruments and a field x-ray and developing unit.

These field dental capabilities proved their worth when a detachment of the 3rd Dental Company deployed with Marines to Vietnam in June 1965. Many more dental teams would follow. Between 1965 and 1973, Dental Corps personnel from the 1st, 3rd, and 11th Dental Companies, along with detachments of the 15th Dental Company, deployed to Vietnam in support of Marine Ground and Air Combat Units.

In addition to caring for Marines, dental personnel participated in many civic action programs rendering humanitarian aid to Vietnamese civilians. They were also busily training Vietnamese dentists in basic and advanced dental procedures as part of the "Vietnamization" program. At the peak of the Vietnam War, there were 420 dental officers and 790 dental technicians—approximately one-fifth of the Dental Corps— deployed with Marine units.

In 1975, the nuclear powered aircraft carrier, USS *Nimitz* (CVN-68) was commissioned with the most modern and capable dental facility afloat, supporting seven dental operating rooms, a prosthetic laboratory, central sterilization room, x-ray suite, and preventive dentistry room. When a Navy jet crashed on *Nimitz*'s flight deck on 26 May 1981, killing 14 and injuring 48, dental personnel were integral to the mass casualty response and the overall team effort by the Medical and Dental Departments.

The tragic bombing of Marine Headquarters and Barracks of Battal-

ion Landing Team 1/8 of the 24th Marine Amphibious Unit at the Beirut International Airport in 1983 left 241 American servicemen dead. The only on-scene Navy physician was killed, along with 18 hospital corpsmen. Two dental officers assigned to the 24th Marine Amphibious Unit coordinated emergency trauma care with 15 hospital corpsmen, treating 65 casualties in the first 2 hours following the explosion. Both were later awarded Bronze Stars for their leadership and emergency medical services. Additional dental personnel aboard USS *Iwo Jima* (LPH-2) joined medical teams ashore to provide care and support for survivors.

In July 1984, The Navy began conversion of two supertankers to hospital ships. USNS *Mercy* (T-AH 19) and USNS *Comfort* (T-AH 20) were placed in service in December 1986 and August 1987 respectively. With 1,000 beds and 12 operating rooms, each ship can provide comprehensive dental services in two operating rooms, four dental treatment rooms, and a dental laboratory. In the mid 1980s, when the battleships *Iowa* (BB-61), *New Jersey* (BB-62), *Missouri* (BB-63) and *Wisconsin* (BB-64) were re-commissioned, dental spaces were upgraded to provide high quality dental support underway.

In March 1986, the Naval Dental School moved into its new spaces in Building 2 on the National Naval Medical Center campus in Bethesda, MD. What had begun as the Dental Department of the Naval Medical School in 1923 has evolved into a state of the art, fully accredited, postgraduate dental school recognized as one of the best in the world.

With the Iraqi invasion of Kuwait in August 1990, and the commitment of U.S. forces to the region, detachments of the 1st, 2nd, and 3d Dental Battalions deployed in support of the 1st and 2nd Marine Divisions. Dental Battalion personnel ultimately established 21 dental clinics in 3 countries, in such places as the Marine airfield at Sheik Iza, Bahrain, the Port of Jubail in Saudi Arabia, and in the desert sands of northern Saudi Arabia and Kuwait. The hospital ships *Comfort* and *Mercy* brought their dental assets to the war effort, and active and reserve dental personnel were deployed with each of the three Fleet Hospitals. In all, more than 90 dental officers and 300 dental technicians deployed in support of Desert Shield and Storm.

In 1992 civil unrest in Somalia erupted into all-out tribal war. In December, Marines of the 1st Force Service Support Group arrived in Mogadishu and personnel from the 1st Dental Battalion provided dental care for Marines in country. In support of the State Department's peacekeeping efforts, they also provided humanitarian dental care to Somali citizens.

In June 1998, the Dental Corps answered the call to provide care in Port-au Prince, Haiti. CDR Steve Clarke, DC, was put in charge as Commander, Medical Task Force, 2nd Medical Battalion, to deploy to Haiti. This was a unit composed of 65 medical and dental personnel from the Navy, Marine Corps, and Army. For the next 6 months the unit provided advanced health service support to assigned U.S. Support Group military personnel, United Nations personnel, and specified contracted civilian employees. In addition, the Medical Task Force conducted humanitarian assistance missions in the Republic of Haiti.

The events of 11 September brought the dawn of a new era and changed life in America. At the Pentagon, Tri-service Branch Dental Clinic personnel were among the first responders to the carnage. Without regard for personal safety, five members ran into the burning building to save life and limb, while others began initial triage and treatment of the injured.

Today, the Dental Corps continues to maintain high operational readiness for operations in Afghanistan and worldwide, while it trains for all contingencies. Dental is aggressively integrating with both medical and line communities to prepare for our latest challenge—homeland defense. They deploy routinely with Marine Expeditionary Units and aboard 120 ships, where, beyond their dental duties, they assume roles in triage and surgical support at Marine Battalion aid stations and battle dressing stations. Dental personnel continue to play a significant role in peace keeping and nation building through humanitarian assistance and disaster relief missions in third world countries.

Continuing its rich tradition, the Dental Corps continuously strives to improve on all fronts. Proud in uniform, outstanding in performance, and dedicated to provide the best for our Sailors and Marines, the Navy Dental Corps completes another successful chapter in its history . . . and sprints into the next. ❑

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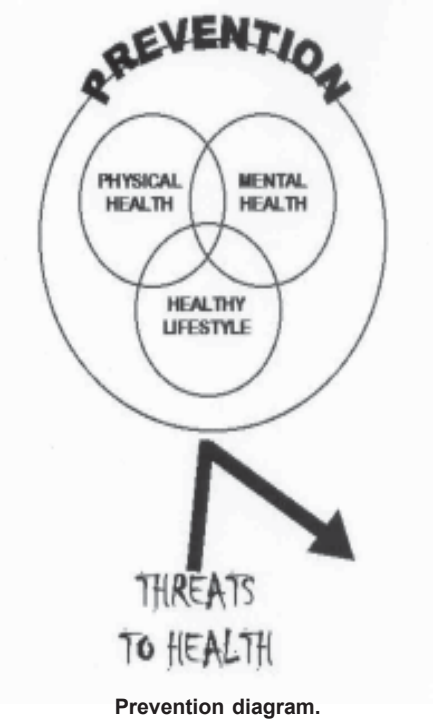
CAPT Turner is Commanding Officer, National Naval Dental Center, Bethesda, MD.

CDR Peters is the OIC, Naval War College Dental Annex, Newport, RI.

RADM Shaffer is former Chief of the Navy Dental Corps, November 1987 to January 1989

Mr. Sobocinski is Assistant Historian (M09H),Bureau of Medicine and Surgery, Washington, DC.



Prevention diagram.

Operation Determined Vigilance

CAPT C. Forrest Faison III, MC, USN
LT Michael J. Yablonsky, MC, USNR
HM2 Gaspare J. Corrao, USN
HM3 Austin H. Curnow, USN

The traditional paradigm of operational healthcare delivery is sick call-based. We wait for Marines and Sailors to get sick then try to fix them at sick call. While we are very efficient in this interventional healthcare model, the fact remains that someone is sick or injured before we intervene. To be sure, we have some surveillance and prevention programs, but few of these are benchmarked against best industry practice or have efficacy metrics. Finally, we do paper-based historical reporting since we lack the information systems to allow us to track and report, in real time, the health, medical readiness, and other important medically related indicators to commanders.

Since 11 September, it is clear that we can no longer afford to practice sick call-based medicine and do historical reporting if we are to optimize medical support to the mission in today's current geopolitical environment. Rightsizing and increasing specialization have increased the criticality of every Marine and Sailor as well as Navy medicine's responsibility to do everything it can to ensure that people remain healthy, medically ready, and on the job. To do this, we must embrace preventive healthcare and adopt new business practices and tools that enable real time tracking and reporting of relevant medical information.

The Third Force Service Support Group (3d FSSG) developed and implemented a new medical program, "Operation Determined Vigilance." The program adopts effective preventive healthcare as our primary healthcare delivery paradigm. At the same time we developed and implemented the business rules and supporting information systems that allowed us to implement e-health, web-enabled healthcare operations, and do real time readiness tracking. This allows us to report on the medical status of all 5,000 Marines and Sailors in the group.

The 3d FSSG is the logistic arm of 3d Marine Expeditionary Force, the Corps' only permanent OCONUS force and first strike capability in the Pacific Area of Responsibility (AOR), arguably one of the world's most volatile areas. Two of the three remaining communist countries are in this AOR. This AOR is also the site of much of the world's political unrest. Beyond Afghanistan, there are several countries with political unrest, including several with histories of terrorist activity. Further, 70 percent of the world's natural disasters occur here, significantly increasing an already high risk of geopolitical instability in this region. Since the world's economy is dependent on Asian stability, Marine Corps presence provides a stabilizing influence and rapid response force, if needed. As such, the 3d FSSG participated in over 70 operational deployments last year with a higher operational tempo this year.

To adopt effective prevention, we reviewed numerous data sources and found that 16 conditions ("threats to health") accounted for over 95 percent of 3d FSSG illness and injury. Table 1 lists those conditions. We also included nuclear, biological, and chemically-related illness as a serious threat to force effectiveness if utilized. Less than one-third had an existing prevention program. None were benchmarked or had efficacy metrics. To this end, we completely reinvented prevention programs to ensure (1) they mapped to conditions

causing illness and injury and (2) they were effective and represented best industry practice.

Effective prevention involves changing behavior to avoid illness and injury where possible. The average 3d FSSG Marine or Sailor is 21 years old. We know, from behavioral psychology, that the most important influence in getting them to change their behavior is peer influence. Effective prevention must be peer-driven. For this, we looked to our junior hospital corpsmen and started a program within Operation Determined Vigilance called the "Guru Program."

The Guru Program empowers our most junior corpsmen to champion prevention. We identified hard-charging junior corpsmen, nominated by their senior enlisted, to become "gurus" (subject experts) for each of the threats to health. Paired with mentors, they were empowered to develop effective prevention programs which we piloted, then spread throughout the group. Guru qualifications were simply (1) hard charging with senior enlisted support, (2) in their early 20's, and (3) willing to become actively involved. We assigned a senior enlisted as career mentor to guide them, monitor their career development, and act as champion in the senior enlisted community.

The Group Surgeon's Office was the senior sponsor and procured the necessary resources for the programs, as required. Further, the office worked closely with the commanding general and staff for supporting policy changes and command involvement necessary to drive change throughout the organization. Using our most junior corpsmen allowed us to achieve organizational alignment on the 3d FSSG Healthcare Team.

Finally, empowering the junior personnel and making them valued team members caused morale to soar exponentially and we saw significant increases in re-enlistments, tour extensions, college enrollment, advancement, and other measures. A tour was no longer "a year on the rock."

Each prevention program had five components:

(1) **Benchmarked best industry prevention activities**. The gurus evaluated ongoing prevention programs for their specific threat to health from elsewhere. Of these, they identified those with proven objective benefit which were adaptable to 3d FSSG. Then, they developed implementation and resource plans for initial piloting, then wide scale dissemination;

(2) **Commander's brief**. Prevention success is dependent on command support. The gurus developed and presented commander's briefs on their specific threat to increase awareness and support;

(3) **Marketing plan**. Most 3d FSSG illness and injury occurs after normal working hours. However, most prevention training occurs during work. We needed to ensure the prevention message carried into the after-work environment and was packaged so Marines would pay attention.

The gurus examined civilian marketing practices targeting their peers, and adapted those to their prevention programs. We partnered with the Naval Hospital, Marine Corps Community Services, and others for support and resources;

(4) **Metric**. The gurus identified at least one quantifiable efficacy measure, lacking from previous prevention programs; and

(5) **Training**. Effective training is a critical adjunct to good prevention. Like most, our training was lecture-based. We gave 21 lectures a year, only 20 percent of which discussed the threats to health. We know, from the educational literature, that the average person retains less than 5 percent of lecture-based information 2 weeks later. We were devoting over 100,000 annual man-hours to training that was not effective, not retained, and did not help change behavior. We re-invented training.

In re-inventing training, one significant fact distinguishes this current generation: familiarity with computers. They like computers and also like computer-based games. We exploited this fact. HM2 Brian May from 3d Medical Battalion developed the Better Education System Training (B.E.S.T.) program, an interactive computer-based training program. This was piloted as our primary training platform, training Marines with interactive questions and short teaching points, accompanied by eye-catching graphics. There are 17 modules, one for each threat to health.

The gurus wrote the questions and selected the graphics to optimize peer attention. Marines must complete all modules in a year.

The program was placed on the Group Surgeon website and is downloadable to any 3d FSSG computer. The way the program works: A Marine logs on electronically. Logon includes solicitation of demographic information, useful in helping us identify Marines at higher risk for certain behaviors, illnesses, and injuries based on demographics. The Marine begins answering questions

HM3 Austin Curnow, USN.

Photos provided by CAPT Faison

and gets immediate feedback and a teaching point for each answer. Incorrect questions are recycled and must be answered correctly twice for credit. Safeguards prevent cheating. When complete, the program records the percentage of questions answered correctly the first time (first pass rate). We are in the process of correlating first pass rate with subsequent behavior as a way to identify high risk Marines for intervention before illness and injury occur.

Further, Marines can complete each module in about 15 minutes vice sitting through an hour lecture, allowing us to return significant man-hours for work. In addition, Marines can be cycled out for training, avoiding work center disruption for lectures. Incentives increase participation, attention, and information retention. Finally, we can now ensure training is standardized, current, and relevant. The program also has non-medical application and is being evaluated for use by Marine Corps Bases Okinawa.

As an example of guru program success, preventable sports injuries were the number one cause of 3d FSSG injury and did not have a prevention program. Annually, total lost work time equaled the annual productivity of over 290 Marines. This did not include opportunity costs or other losses. In 3d FSSG, the Marine Corps was paying, just in base salary costs alone, over $11 million annually to Marines to recover from preventable injury.

We identified as guru a 21-year-old corpsman, HM3 Austin Curnow, an ex-wrestler with a sports-related reconstructed knee. With a GMO mentor, he evaluated numerous sports injury prevention programs, identifying several with objective benefit adaptable to 3d FSSG. These included CD-ROM exercise stretching videos for unit PT coordinators. CD-ROM training allows us to provide standardized training without additional staff. Commander briefs increase awareness and utilization.

Sports Medicine and Rehabilitation Therapy Room (SMART).

He also found Sports Medicine rooms to be effective. Partnering with a warehouse corpsman from Medical Logistics Platoon who had a Masters Degree in Exercise Physiology, HM2 Christopher Beaumont, they created Sports Medicine and Reconditioning Therapy rooms, (SMART). Piloted at one camp before spreading, they partnered with the local Naval Hospital for supplies and rotating specialist visits, Marine Corps Community Services for advertising, and Marine Corps Bases for the room and other logistic support.

The rooms are located near gyms and open during peak gym usage hours. Marines can go there, without appointment, for taping, exercise assessments, physical conditioning advice, nutrition information, and other services. Personal trainers teach safe training techniques while an aggressive outreach program at all camp events brings preventive services to likely points of injury.

Corpsmen working in the rooms undergo extensive standardized web-based didactic training and hands-on training before working in the rooms. All sports injuries are seen in the SMART rooms before normal working hours and, using peer-reviewed clinical practice guidelines, receive standardized aggressive therapy and enforced compliance. This allows us to standardize treatment on best medical practice, provide one stop shopping for all sports related issues, and single source tracking/treatment of all patients.

Further, by shifting sports-related workload from the clinic to the SMART room, we perform effective demand management for the clinic, opening appointments and other clinic resources for Marines with non-sports related illness. We improved average disposition time at the clinic. Overall productivity increased since we were seeing Marines who would not otherwise have gone to sick call for education and earlier intervention.

HM3 Curnow created a B.E.S.T. training module and also identified, as metric, overall sports-related limited and light duty rates. Finally, he researched marketing practices of Abercrombie and Fitch, Nike, and others to identify, adapt, and implement effective marketing about sports injuries. Results to date have been impressive: sports related limited duty is down over 90 percent. The average limited duty period for those who do sustain a sport-related injury has been cut by 4 months, from 7.4 months to now less than 3 months while average light duty has decreased from an average 21 days to 4 days. Sick call is down 30 percent while overall productivity between the clinic and the SMART rooms is up over 80 percent with Marines seeking education, preventive services, and earlier treatment. Approximately 25 percent of the Marines going to the SMART Room on self-referral for minor sports injuries would not have gone to the clinic. They did not like being "sick" and going to "sick call", but had no

problem going to a "SMART room." Typically, these Marines would have sustained more severe injury and ended up on either prolonged light duty or limited duty as a command loss.

While effective prevention is critical to optimizing the medical readiness of the force, it is equally important to monitor the health of the force to identify early trends or new causes of illness and injury. We adopted the World Health Organization definition of health and then developed a plan to measure the different components of health, allowing us to monitor the health of the force. In our paradigm, a Marine or Sailor is healthy is they are (1) physically healthy, (2) mentally healthy, and (3) engaging in a lifestyle supporting physical and mental health. We developed a simple, easily remembered diagram. We then identified those measures unique to our population, identifying 20 "health indicators" necessary to track/trend to monitor Group health and identify emerging trends to suggest new health threats. Table 2 lists those indicators.

Next, we identified data sources for the indicators and developed web-based databases and user interfaces, linked through the Group Surgeon's website, to collect and trend the data electronically. We created roll-up summaries for battalion commanders and the commanding general, allowing them to know, at any time and from any location, the exact health of the force.

Real time information management is critical to optimal mission support. Likewise, the success of Operation Determined Vigilance is dependent on our ability to effectively and efficiently manage information in real time to assess efficacy and allow earliest intervention when necessary. We also needed to standardize and optimize business practices and healthcare services for all our personnel scattered throughout a large AOR. This meant web-enabling healthcare operations and adopting e-health where it made good business sense. Creating a robust Group Surgeon's Website (http://www.3fssg.usmc.mil/groupsurgeon/gso2.htm) allowed us to do all this.

The website, supporting databases, user interfaces, and additional functionality were created by a corpsman with no previous training or experience, HM2 Gaspare Corrao, who taught himself web design and coding. He was assisted in a collaborative effort between the Group Surgeon's office, G6, G2, and Marine Corps Bases. Leveraging combined internet and intranet capabilities and extensive use of tiered access to provide security and patient confidentiality, we moved most healthcare operations and all reporting/information management to the web. Specific components include:

(1) Real time information for the commanding general and battalion commanders. All health indicators, medical readiness indicators, medical training status, surveillance program status, pregnancies, overseas screening deficiencies, limited duty (LIMDU) , light duty (LIGHT DU), and healthcare personnel distribution is entered by medical department representatives daily and are tracked in real time. The website compiles these into a summary view for the Commanding general on a web page only he can access. Battalion statistics are also compiled for individual battalion commanders. On the morning of 11 September, the commanding general was on a flight diverted to Vancouver. From his hotel room, he was able to log onto the website and know instantaneously and without a data call the exact and current status of all 5,000 3d FSSG Marines and Sailors for all parameters above. Concurrently, we enhanced efficiency by eradicating time-consuming paper reporting: all monthly summaries/reports are on the intranet portion of the website protected by tiered access. Immunizations, to include the anthrax vaccine, can be ordered on-line. Finally, all patient tracking files, medical briefings and other activities are web-enabled to optimize healthcare team efficiency and effectiveness.

(2) Electronic LIMDU and LIGHT DU reporting/tracking. Up to 30 percent of LIMDU and LIGHT DU Marines were previously lost in the system because of paper mis-routing. Some Marines were on LIMDU over 26 months and others had been on LIGHT DU over 14 months with no treatment plan. Further, we lacked trend analysis capability to identify recurrent or preventable illnesses. We web-enabled this process, with appropriate safeguards to protect privacy and ensure Health Insurance Portability Accountability Act (HIPAA) compliance. Physicians utilize web-based forms, completing them from a series of drop down menus. When submitted, a simultaneous copy goes to the unit, hospital, Group Surgeon's office, personnel, and the database. No one gets lost and units have a real time electronic roster of all LIMDU and LIGHT DU patients. The Surgeon's office looks for trends while commanders can view both the overall roster of LIMDU and LIGHT DU patients as well as drill down on any specific patient to see the actual report for those Marines with critical job skills.

(3) Robust provider desktop. This is the main working tool for all 3d FSSG healthcare providers. It provides links to CHCS for labs, pharmacy, and results retrieval, as well as peer-reviewed, easy-to-follow clinical practice guidelines (CPGs) for the most common medical conditions.

We've standardized and mapped the care we provide to best medical

practice and, via web-enabling, made it time and distance independent. We can also resource forecast based on standardized care plans and medical condition prevalence. CPGs are on the Internet portion of the web, enabling Marines and their families back home to see for themselves how care is provided. Further, links to credible medical resources as well as the electronic LIMDU, LIGHT DU, heat injury, and occupational injury reports are included.

Finally, to overcome distance limitations in requesting continuing education funding from the Naval School of Health Sciences, we worked with them to web-enable requests, allowing us to get same-day response vice an average 2-week response time previously. Quick response allows us to maintain maximal staffing flexibility while planning, well in advance, so we can support provider CME.

(4) Web-enabled deployment preparations. The American people have an expectation that we will provide the best care possible, regardless of location. Standardized deployment preparations are essential. We web-enabled all deployment preparations and created one-stop shopping for AMAL/ADAL information, supplementals requests, medical information, downloadable current briefs, links to credible medical area overviews, and Force Health Protection information. We cut average deployment time over 40 percent and, since implementation, have not had to do any open purchases or rear order requests for things left behind, an average savings of $10,000/deployment. On deployment, the medical team continues to use the provider desktop, ensuring one standard of care worldwide for 3d FSSG. On return, the team submits a standardized web-based after-action report, ensuring complete, comprehensive after action reporting in a relational database.

(5) "Talk with your Doc." Virtually 100 percent of 3d FSSG Marines and Sailors have internet access, either at work, in the barracks, or in base internet cafes. Beyond the fact that they deploy all over the world and need easy access to their primary care provider, many Marines coming to sick call did not need to see a healthcare provider. The average Marine was spending 1.5 hours in sick call, many not requiring the services of a healthcare provider. At an average daily clinic workload of 60-80 Marines, that equaled over 50 man-hours per day spent in sick call for issues better handled via the web. Medication refills, health information, and other needs are now available via the website. Further, e-mail links to all 3d FSSG healthcare providers allow our Marines to communicate with their doc from anywhere in the world.

Our business rule is that all patient e-mail is answered same day. Healthcare providers maintain their own web pages with information on their training and medical credentials, patient information on common conditions, and other important information.

Finally, patients can schedule routine appointments on line without busy signals, being put on hold, or sitting in sick call. When they do this, their command also gets electronic notification for staff planning. Our Marines and Sailors have better access and are on the job, not in the waiting room.

(6) Robust patient education materials. The internet is a potential threat to 3d FSSG health. There are seven new internet pages created each minute, one third of which contain medical information, much of it dubious in nature. We do not want Ma-

TABLE 1: THE 17 THREATS TO HEALTH

Sports injuries/Overuse syndromes
Alcohol abuse
Tobacco use
Stress
Poor diet
Heat injuries
Adolescent risk-taking
Suicide/Depression
Sedentary lifestyle
Herd diseases
Inadequate sleep
Sexually transmitted diseases
Environmental hazards
Infectious diseases (not herd or STD)
Supplements
Sun damage
Nuclear, biological, chemical injuries

TABLE 2: THE 20 INDICATORS OF HEALTH

Physical health

- Duty status
- Body mass index
- Resting heart rate
- Resting blood pressure
- Fasting serum cholesterol level
- Dermatologic exam within a year
- Physical Readiness Test score
- Dental Class

Mental Health

- Number of support networks
- Number of suicidal indicators
- Number of depression symptoms (as defined by DSM-IV)
- Risk-taking behavior incidents

Healthy Lifestyle

- Tobacco use
- Alcohol-related incidents
- Diet (number of fast food meals/week)
- Sexually transmitted diseases frequency
- Exercise regularity
- Family Advocacy referrals
- Heat injuries
- Work-related injuries

rines using non-credible information to make health-related decisions. As such, we provide one-stop shopping for patient information, links to credible medical references, and other patient resources. All medical information is written by junior corpsmen in peer language. Our providers also write regular articles geared toward the young Marines and Sailors on a variety of pertinent medical topics.

Further, there is information for travelers on accessing quality medical care in foreign countries as well as robust TRICARE information and links, TRICARE-on-the-road information, and links to medical resources at new duty stations for transferring personnel. Whenever new information is posted on the website, electronic notification is sent to the commanding general and all battalion commanders. We push medical information to our Marines and Sailors and make it easy for them to get credible information to guide their healthcare decisions.

Operation Determined Vigilance is dependent on the creativity, innovation, and commitment of all levels of the 3d FSSG healthcare team. To foster this wave of innovation and performance, we must take care of our people and ensure their personal and professional goals are reached. Further, if we want to optimize participation of our most junior corpsmen, we needed to change the paradigm of a tour in Okinawa from a "year on the rock" to a career-enhancing opportunity. To accomplish this, we created a program called "Circles of Leadership" where we committed to our personnel that they would leave Okinawa with measurable progress and achievement in (1) professional growth, (2) personal growth, and (3) adoption of a healthy lifestyle. We set the expectation throughout the chain that we would see the impact of unparalleled leadership on every 3d FSSG healthcare team Sailor in these areas.

Metrics were developed to help us track progress. We also adopted a lifecycle management approach to team members, starting when personnel received orders to 3d FSSG. We eliminated impersonal traditional welcome aboard letters and replaced them with a CD-ROM containing a welcome aboard video, an area overview brief, a video tour of Okinawa set to music, the driver's manual, the hospital GMO manual, and links to additional websites about Okinawa. We found that people shared these CD-ROMs with their friends and, as a result, within a year, we had many more requests for assignment to 3d FSSG than billets.

New arrivals met with their supervisor within a week of arrival and mapped out goals for their tour. These were regularly reviewed and used in counseling sessions. Spin-off programs developed, including khaki-led advancement study programs, motivational day-of-test breakfasts for personnel taking advancement tests, a Group Surgeon's Honor Roll for personnel in college, and other support programs. To date, we have attained and sustained the highest advancement rate (all rates) in III MEF, doubled college enrollment, tripled the number of personnel requesting overseas tour extensions in place, doubled retention, and attained the highest selection rate to advanced C Schools and officer programs in Group history. It's no longer a "year on the rock." By actively mentoring our people and empowering them as valued stakeholders in Operation Determined Vigilance, we also achieved a critical success component necessary for any new program: organizational buy-in and alignment.

As a result of the hard work of our most junior corpsmen, active involvement of the entire 3d FSSG healthcare team, and the unparalleled support of our commanding general and battalion commanders, we have, in less than 2 years, completely transformed 3d FSSG healthcare. Without additional funding, resources or personnel, we successfully moved from interventional to preventive healthcare operations and leveraged the web where it made good business sense to implement e-health, improve patient access and services, and optimize our preparations and support to commanders. At the same time, driving ownership of the various components of Operation Determined Vigilance to our most junior people allowed us to tap into their knowledge and experience while creating organizational alignment as a critical component of success. As a result, in an extremely complex and rapidly evolving geopolitical AOR, 3d FSSG is healthy, on the job, and ready to go. ❑

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Visual representation of commitment to people.

Future Deployable Medical Platforms for Navy Medicine

James Grefer
Neil Carey, Ph.D.

Photo courtesy of Bollinger Shipyards, Inc.

Navy medicine's hospital ships have proven their usefulness in conflicts including Operations Desert Shield and Desert Storm (1989-1991), in providing medical care to civilians in humanitarian operations like Operation Able Manner in Haiti (1987), and in providing logistics support in the 11 September 2001, World Trade Center disaster.(*1*)

Nevertheless, Navy medicine is considering alternative medical platforms for future years. The reasons include:

• Changes in the global environment that expand the traditional war fighting mission of the Navy and Marine Corps to include such missions as homeland defense, urban warfare, biological-chemical warfare, and military operations other than war (MOOTW).

• Changes in Navy and Marine Corps war fighting concepts that require them to move faster, over greater distances, and be more interspersed with the enemy than in the past.

• Changes in helicopters, landing craft, and other equipment with which Navy medicine's platforms will need to interface.

• The fact that the current hospital ships are over 25 years old.

A debate has ensued regarding potential replacement for the Navy's hospital ships. Its catalyst was an article in *U.S. Naval Institute Proceedings* by CDR Pete Marghella(*2*), who discussed characteristics of the current hospital ships that could diminish their effectiveness in future Navy/Marine Corps missions, and proposed a substitute platform as a solution.

We continue the debate in the sections that follow. First, we discuss the strengths and weaknesses of the *Mercy* class ships and present our ideas for converting two of Navy's L-class ships into potential replacement medical platforms. Second, we introduce one new idea for using a modern high-speed catamaran to augment the Navy's sea going medical platforms.

Potential Replacements for the Current Hospital Ship

The *Mercy* class hospital ship has many valuable characteristics. First, it has large medical capacity including 8 operating rooms, 80 intensive care beds, and a potential of 1,000 total beds. These ships can supply the large number of beds needed in the event of two nearly simultaneous major theater wars (MTWs).

These ships have proven to be useful medical platforms in many types of Navy operations, such as Desert Storm, Able Manner, and the 11 September, New York disaster.

Second, it is a sea-friendly platform, which facilitates surgery and patient comfort. It has the capacity to carry large amounts of blood, oxygen, and other critical medical resources. As it showed in the 11 September crisis in New York, it has the flexibility to provide logistic support for homeland defense.(*1*)

Unfortunately, the *Mercy* class of hospital ships have several significant shortcomings. One important shortcoming is lack of flexibility and speed of patient ingress. It has only one helicopter landing-pad and no easy means to bring casualties aboard from the sea.

The current hospital ship does not have the speed to keep up with an Amphibious Ready Group (ARG). Because it lacks maneuverability and has a large radar signature, it can be

High speed catamaran USS *Joint Venture* (HSV-XI) - notional troop carrier. A medical version of this high-speed vessel might transport up to 75 to 80 patients while providing resuscitative and maintenance medical care en route.

vulnerable to attack by an enemy that disregards the Geneva Convention rules or whose technology can spot but cannot discern the white hospital ship from its gray-hulled companions. Its size also limits the number of worldwide docks it can use.

Finally, it is driven by steam-powered turbine engines, which become unreliable when placed in reduced operating status, and will become obsolete as Navy ships are moving to diesel and nuclear power.

The L-Class: A Natural Choice

A converted L-class ship would be a natural choice to replace the *Mercy* class because it is already designed to move people, respond quickly to a crisis, and avoid attack by the enemy—all essential attributes for a hospital ship.

Marghella proposed converting the Navy's old LSTs into dedicated hospital ships. He lauded their multiple means of patient ingress, greater speed, and enhanced survivability. In a rebuttal, LCDR Guzman and LT Aboul-Enein(*3*) pointed out that the LSTs were very small and already very old (*Frederick* is the only LST now on active reserve). Additionally, their flat-bottom hull would not provide the sea-keeping qualities needed for surgery. Guzman and Aboul-Enein suggested that, for the above reasons, the large-deck LPHs or LHAs would be better choices. Of course, these ships would still have the disadvantages of the *Mercy* class that are related to their large size and steam-powered plants. Also, the LPHs are no longer in service.

In our 2001 CNA study(*4*), we looked at each of the L-class ships to determine which would best serve as dedicated hospital ships. Table 1 shows the characteristics of each of the active L-class ships that are important for a medical platform, such as the ship's size, propulsion, and ability to move patients. We believe that one of two choices are the most attractive options: either an LPD-17 Hospital Variant (HV) and/or a converted *Whidbey Island* class LSD.

Bryan Tomer of CNA Corporation(*5*) has proposed a hospital ship variant of the then newly contracted LPD-17. He calculated that it could have potentially 6 operating rooms, 50 intensive care and 250 intermediate care beds, and provide care for up to 50 casualties per day in a conflict (estimates of the potential medical capacity of the LPD-17 HV and the LSD medical conversion are based on proportionality of the current hospital ships combined with information gleaned from a 1978 CNO study on medical facilities.(*6*))

There are several advantages of the LPD-17 in its medical modification. Several beneficial capabilities of this class of ship involve its ability to receive, move, isolate, and egress casualties. It has two helicopter pads that are large enough to land any of the Navy's helicopters. Additionally, it has rear well-deck entry and docking for two Landing Craft Air-Cushioned (LCAC) vehicles. The ability to dock more than one LCAC at a time increases the potential to bring aboard large numbers of casualties more quickly. Casualties that were infected with contagious disease could be brought in separately and moved through an exclusive path within the ship. This could prevent contamination of the pathways within the ship and protect the medical staff and non-diseased patients.

Speed of this class of vessel is also an asset. The LPD-17 is about 30 percent faster, at 22 plus knots, than *Mercy* and it has two propeller shafts for greater maneuverability. Consequently, it could respond more quickly to conflict and could steam with an ARG. It has a smaller radar signature because it is smaller, and it has modern "stealth" technology such as an angled superstructure that is coated with radar absorbing materials. These characteristics would make an LPD-17 considerably less vulnerable to attack than *Mercy*.

A huge challenge of the LDP-17 HV would be the $800 million up-front investment cost, assuming that the new construction cost of a hospi-

tal variant would be about the same as that of the basic LPD-17.(*7*) Further, the LPD-17 HV would have about half the medical capacity of *Mercy* in terms of operating rooms and beds.

As a lower cost alternative to the LPD-17, we could consider converting some of the current *Whidbey Island* class and/or *Harpers Ferry* class LSDs into dedicated hospital ships. These LSDs would have most of the advantages of the LPD-17 HV, especially the ability to land two helicopters and dock two LCACs. We already own the LSDs and so the only construction costs would be for conversion, which would be considerably less than the LPD-17. In fact, converting an LSD could be significantly less costly than converting the *San Clemente* tankers into the current *Mercy* class hospital ships, since they would not need to be completely stripped down as the tankers were. Each of the LSDs could have about one-third of the capacity of *Mercy*.

Whidbey Island class LSDs are now between 8 and 16 years old. The standard process for obtaining a new Navy asset takes about 8 years. If we are to get a reasonable length of life from some of them as hospital ships, we would need to make a decision soon.

Medical Platform to Augment Current Assets

Navy medicine is also considering platforms that will augment, rather than replace, current medical assets. One such potential platform is a medical modification of an experimental High-Speed Vessel (HSV). Currently, the Marine Corps have been using one variety of a HSV in Okinawa as a troop carrier, to carry personnel and equipment for a small Marine Expeditionary Unit since July 2001. *Joint Venture* is another High Speed Vessel leased by the Army, Navy, Marine Corps, Special Operations Command, and Coast Guard for joint experimentation projects that explore the operational implications and opportunities of new marine technologies.

Its main advantages are high speed and maneuverability, shallow draft, and relatively low purchase price. The HSV's speed and maneuverability could allow for very quick response to a crisis with lesser vulnerability to attack than a large hospital ship. (Its two diesel-powered water jets can propel it 42 plus knots and turn it on a dime.) The vessel's shallow 12-foot draft could allow it to dock almost anywhere in the world.

In our 2001 study we considered a notional HSV converted for medical use.(*4*) We showed that, if certain problems are addressed, the HSV could be useful as a high-speed ambulance that provides high level resuscitative and maintenance care while en route to a land- or sea-based hospital. In our study, we used medical space requirements from a 1978 CNO study(*6*), and comparisons with the Navy L-Class medical facilities to estimate the HSV's potential medical capacity. We estimated that, depending upon sea conditions, the vessel could transport up to 75 or 80 casualties to a hospital or hospital ship 1,200 to 1,500 miles away in less than 48 hours, while providing simple en route surgeries and intensive care.

The medical HSV could, potentially, increase the effectiveness of the Navy's medical missions by relieving stress on other assets, such as the helicopters or L-class ships. It could facilitate small-footprint search and rescue missions. It could increase the range of the hospital ships by sailing in small or shallow waterways to gather casualties for transport.

Joint Venture (HSV-XI) was leased for 2 years at a total cost of about $20.5 million.(*8*) It has been estimated that the price tag to buy one would be in the neighborhood of $50 million, and that any military conversion would cost roughly another $50 million.(*9,10*) Using casualty flow rates provided by Navy medicine, the CNA study estimated that in a small-scale conflict the Navy would need about four or five of the HSVs working in rotation to be effective.

As we mentioned, some problems would need to be addressed for the HSV to be a practical medical platform. A critical issue would be patient ingress. In its current configuration it could only land the Navy's smaller helicopters, like the SH-60 Sea Hawk. Additionally, there is currently no known way to convey casualties from a boat to the HSV while at sea. Thus, patients would be brought aboard predominantly via helicopter or from a landing dock, the availability of which could be in question in a conflict. Another issue is where to best locate patients on the vessel. The upper deck, which was designed to comfortably carry passengers, is vibration isolated from the rest of the ship. The lower deck of the vessel, designed to carry vehicles, is not. Unless modifications are made, this would limit surgical capability in the lower deck medical spaces.

There are also problems related to the military functions of the HSV. First, it currently has no refueling or re-supply capability. Since it can only travel about 1,250 to 1,500 miles on a tank of fuel, adding this function would be important, especially in the spacious Pacific theater of operations. However, because it is made from aluminum, it is unlikely that a steel-hulled oiler could safely provide underway replenishment. It is also possible that the aluminum hull could suffer damage at high speeds in high sea conditions.(*11*)

Finally, if the HSV is to be used by the military, it would need to be equipped with some armor plating and additional watertight integrity. Adding these could negatively affect the speed and capacity of the vessel. The above issues are all technical matters that could be addressed by engineers if the Navy decided to add the HSV to its list of medical assets.

If the problems are resolved, the HSV could be a valuable platform in Navy medicine's arsenal. It could respond quickly to a crisis, avoid much of the danger experienced by the larger medical ships, and provide speedy transport of casualties while giving medical care en route to hospital facilities.

Changes in global environments and changes in warfare concepts compel the Navy to generate and assess new ideas for medical platforms. Replacements for the current *Mercy* class hospital ships should provide their high level of care; but they should also include other characteristics, such as greater speed and maneuverability, more flexible patient movement on and within the ship, and reduced vulnerability to attack, that would make them more effective in a wider variety of medical care missions.

In addition, the Navy could consider platforms to augment the hospital ships such as high-speed, seagoing ambulance, and fast, maneuverable search and rescue vessels.

SHIP	CLASS	SIZE (LxBxD)	PROPULSION	MAX SPEED	AIRCRAFT & LCAC	STATUS
T-AH 19,20	MERCY	894x106x33	STEAM 1 SHAFT	17kt	1 HELO PAD	ROS-5
LHA 1-5	TARAWA	820x106x27	STEAM 2 SHAFTS	24+kt	12 CH-46 9 CH-53 1 LCAC	ACTIVE
LHD 1-4	WASP	844x106x28	STEAM 2 SHAFTS	20+kt	42 CH-46 3 LCAC	ACTIVE
LPD 4-15	RALEIGH, CLEVELAND, TRENTON	570x84x23	STEAM 2 SHAFTS	21+kt	2 CH-46 or 2 CH-53 1 LCAC	ACTIVE
LPD 17	SAN ANTONIO	661x97x23	STEAM 2 SHAFTS	22+kt	2 LARGE HELO PADS 2-4 LCAC	UNDER CONST.
LSD 36,37,39	ANCHORAGE	553x85x20	STEAM 2 SHAFTS	21+kt	1 SMALL HELO PAD 2-4 LCAC	ACTIVE
LSD 41-50	WHIDBEY ISLAND, HARPERS FERRY	609x84x21	DIESEL 2 SHAFTS	20+kt	2 LARGE HELO PADS 2-4 LCAC	ACTIVE
LST 1184	USS FREDERICK	522x70x19	DIESEL 2 SHAFTS	20+kt	1 SMALL HELO PAD NO LCAC	ACTIVE RESERVE

Table 1

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Book Review

The First, The Few, The Forgotten: Navy and Marine Corps Women in World War I by Jean Ebbert and Mary-Beth Hall. Naval Institute Press. Annapolis, MD, 2002. 183 pages.

With their latest book, historians Jean Ebbert and Mary-Beth Hall explore the turbulent experiences of the first women to enlist in the Navy and Marine Corps. They note women began enrolling in the Navy Nurse Corps as early as May 1908, but that these women had "served with the Navy" rather than in it. Not until March 1917 were the doors opened for women to enlist. The United States had just entered World War I and Secretary of the Navy Josephus Daniels saw the need for qualified individuals in the military ranks, regardless of gender. Women answered the call to serve in large numbers.

Ebbert and Hall introduce the readers to a few of these early recruits, classified as "yeoman (F)." Among them, Loretta Perfectus Walsh, stands as the first woman to enlist in the Navy, a business college graduate, who like many of her fellow yeoman (F) had an unflinching patriotic desire. As the war raged, the Navy intensified their recruiting efforts, putting ads in newspapers. Ebbert and Hall relate the story of the poster artist Howard Chandler Christy finding his dream Navy recruiting poster model in an enlistment office. Yeoman (F) Bernice Tongate was to be immortalized with a Navy white hat and jumper standing over the words "Gee, I wish I were a man. I'd join the Navy." Ebbert and Hall show the reader that the climate of World War I America was not always politically correct.

The authors detail the process of enlistment, the ill preparedness of conducting physical exams on women, the creation of uniforms, Navy and Marine Corps policies directed at women, which all fit together to present the grand mosaic of the women's experience in the military. Female enlistments enabled the Navy to send more men to serve aboard their growing number of destroyers. At the Bureau of Medicine and Surgery it was felt that rather than bring in women that enrolled outside to fill the empty billets, they would prefer to enroll the civilian women already employed at the bureau. The Bureau felt that to have these Yeoman F woman replace the hospital corpsmen in their medical duties was inappropriate. They did however, allow the Yeoman F's to replace the absent corpsmen "on shore duty, whose duties are strictly clerical in nature."

The year 1918 marked the armistice and the Great Influenza Pandemic that wreaked havoc in war-torn Europe and the United States. Everyone was affected. The first woman to enlist, Loretta Walsh, already weakened in morale by the death of her brother who was serving in the war, caught the strain of flu that would eventually end her life.

Ebbert and Hall relate that after the war many women who served did not realize they were entitled to the same medical benefits offered to the male veterans. Many Navy hospitals continued to insist that they neither had the room nor the money to treat women veterans. In fact, in many parts of the country it was not known that women had served in the Navy and Marine Corps. Not until World War II were women recognized for their military service.

In 1924 women undertook the formation of a national organization, the National Yeoman F (NYF). In August 1928 the NYF was incorporated under the laws of the District of Columbia.

The organization's charter had three main goals: to keep in touch, to support patriotic enterprises, and to preserve their memory.

The most enterprising accomplishment was the establishment of the quarterly newsletter, the *Note Book*. This fulfilled two of the charter objectives: to keep in touch and to preserve their memory. Through 57 years the *Note Book* chronicled the accomplishments and disappointments of the first women Navy members.

As the members of the NYF grew older and their health began to fail, their numbers declined. In the last issue of the *Note Book* in December 1985 the following announcement was printed:

"This is the final issue of the Note Book. The National Yeoman F will be disbanded as of January 1st, 1986. Therefore, please do not mail obituaries or checks for dues or donations to any of the officers."

With this book the authors have shown that their memory does indeed still live on. ❑

—André B. Sobocinski is Assistant Historian (M09H), Bureau of Medicine and Surgery, Washington, DC.

Navy Medicine 1938

BUMED Archives

Naval Medical School library, now the South Rotunda of BUMED's Building 2.