Section VI: Unconventional Missions and Other Evolving Services

The commander of the 51st Medical Detachment Veterinary Medicine, 248th Medical Detachment, checks an opened mouth of an unconscious young tiger March 24, 2010, at the Baghdad Zoo. The cooperation of Iraqi zoo workers and US Army veterinary forces during nation-building efforts at the zoo (eg, treating a tiger cub patient) was necessary to rebuild the zoo and save unconventional patients' lives.

Photograph: By Sergeant Phillip Valentine. https://www.army.mil/article/36504/iraqi_us_veterinarians_partner_to_help_baghdad_zoo_animals. Accessed April 26, 2018.

Chapter 17

VETERINARY SUPPORT IN THE IRREGULAR WARFARE ENVIRONMENT

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> "I have veterinarians, a large veterinarian corps within my civil affairs. Obviously, when you get out in the rural populations, the animals, the livestock, are key to their livelihood. Our ability to teach them good veterinary skills, to help them reduce the level of disease in their livestock, that kind of makes us local heroes. That's an important piece of it."[1]
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> —Admiral William H. McRaven, Commander, US Special Operations Command

INTRODUCTION

Joint Publication 1, *Doctrine for the Armed Forces of the United States*, defines irregular warfare as "a violent struggle among state and nonstate actors for legitimacy and influence over the relevant population."[2(pI-6)] Irregular warfare can be population centric (counterinsurgency and stability operations) or focused on counterterrorism.[3] The preceding chapters of this textbook discuss and outline the doctrinal mission and core functions of the Department of Defense (DoD) Veterinary Service. This chapter captures the nontraditional functions of Veterinary Corps officers in support of counterinsurgency operations, stability operations, and counterterrorism efforts (Figure 17-1).

These responsibilities, outlined in DoD Directive 6000.04E, *Department of Defense Public and Animal Health Services*, include providing "veterinary coordination, manning, and support to plan and conduct agricultural, veterinary public health, and animal health activities across the range of military operations"; supporting "Department of Defense stability operations and medical stability operations"; and providing support for "global health strategic goals, to include veterinary and public health support to the National Strategy for Countering Biologic Threats."[4(pp6,7)] This language makes explicit the DoD Veterinary Service's responsibilities to engage in capacity-building activities targeting civilian and military populations, in addition to the traditional force health protection operational functions.

Veterinary Corps officers have a long history of applying their professional skills and health service support capabilities to stabilize and influence local populations in support of broader operational and

Figure 17-1. South Sudanese Ministry of Animal Resources and Fisheries staff work with veterinary personnel from the Sudanese People's Liberation Army and advisors from US Army Africa on initiating a national vaccination plan in Mundari cattle camps around the capital city of Juba in December 2013.
Photograph courtesy of Master Sergeant Sandra Reeves, 82nd Civil Affairs Battalion.

strategic military objectives.[5] Building capacity in the agriculture and public health sectors and non-traditional health service support roles are growing components of the Veterinary Service's mission. These missions will continue to grow as the DoD transitions its force structure into the 21st century.[4] According to Colonel Bob Walters, past director of the DoD Veterinary Service Activity, "there was a rapid growth of Veterinary Corps officer requirements in special operations from six officer authorizations in 2006 to over 20 in 2013." Colonel Walters continues, "approximately 10% of the Veterinary Corps officer population, in the Active Component and Reserve Component, had a primary responsibility to support operations in the irregular warfare environment during my tenure" (Colonel [Retired] Bob Walters, Director, DoD Veterinary Service Activity, 2009–2015, personal communication with Paul Hollier, chapter author, August 25, 2014).

In his keynote speech at Sovereign Challenge VIII in December 2011, Admiral William H. McRaven highlighted the important role played by the Veterinary Service in the irregular warfare environment. The work done by Army veterinarians to build animal health capacity and improve the livelihoods of rural populations pays tremendous operational dividends and helps achieve theater strategic and operational goals.[1] Veterinary Service personnel can continue to accomplish this task by leveraging clinical knowledge, skills, and abilities and broadening their professional competency in global veterinary medicine, evidence-based operational medicine, and risk communication.

HEALTH SERVICE SUPPORT AND RISK COMMUNICATION

DoD Veterinary Corps personnel provide food protection and defense capabilities to prevent disease and conserve combat power for conventional missions and in the irregular warfare environment. The irregular warfare environment presents unique health protection and defense challenges because food plays an important role in cross-cultural communication. Through sharing food, common bonds are formed, enhancing communication and building trust. Although building relationships is central in population-centric irregular warfare, the consumption of many local foods greatly increases the risk of food-borne illness (Figure 17-2).

For example, consider a civil affairs team engaging with key leaders in an Afghan village. As the team sits on a carpet with village elders, they pass around several food and drink items: chai, panna (bread), milk, cheese, and cookies. Should the team refuse the generosity of these community leaders? If they eat these items, what are the risks? Will refusing to eat insult the elders and hinder the mission? These questions highlight the balance between the risk of food-borne illness and the benefits of shared meals in forming bonds and establishing trust across cultures. In this situation, the benefits of consuming local food, which would probably not meet the approved food source military standard, outweigh the risk of food-borne illness. Nevertheless, service members need to understand the short-term and long-term risks associated with food to enhance their ability to assess situations and make informed, real-time food choices. Civil Affairs and Special Forces units have Veterinary Corps officers assigned at the battalion, brigade, and group levels within the medical staff section who provide consultation and training on ways to mitigate the risk of food-borne illness during key leader engagements.

The complex food sourcing needs of multinational operations and training exercises occurring around the world has surpassed the capacity of the DoD-approved food sources program. An important tool used by veterinary personnel to communicate risks to key leaders and commanders in the irregular warfare environment is a food and water risk assessment. As commanders develop their troop feeding programs, they can request a food and water risk assessment.

Figure 17-2. US soldiers with the 115th Mobile Public Affairs Detachment share a meal with Afghan National Army (ANA) soldiers on Forward Operating Base (FOB) Fenty, Nangarhar province, Afghanistan, December 4, 2012. The meal was served before a meeting between US Army and ANA public affairs officers to coordinate the arrival of local media onto the FOB.
US Army photo by Specialist Jenny Lui/Released. https://www.dvidshub.net/image/802621/afghan-meal#.U5duttzn-1s. Accessed December 4, 2017.

During these assessments, Veterinary Service personnel assess food establishments (eg, hotels, caterers, and production facilities) to determine the food-related risks associated with each, define the overall risk for each facility, make recommendations to the establishment, and communicate risk to commanders.

The Veterinary Corps, US Army Public Health Command, and Army Medical Department Center and School have developed risk communication strategies and innovative ways to collaborate across organizations to package and deliver risk communication products to prevent disease. Lessons learned from rabies and food safety risk communication campaigns show how collaborative efforts can protect service members. Also, collaborative communication efforts like those related to the Shiga toxin-producing *Escherichia coli* food-borne outbreak in Europe show how a robust interagency team can forge unified risk communication messages that can mitigate the further spread of disease.[6]

Operating in the irregular warfare environment carries an inherent risk. Veterinary personnel are not decision-makers when it comes to selecting risk mitigation measures. They serve as communicators providing expertise, describing and weighing risks, and ultimately empowering commanders and individuals to weigh operational goals against personal risk to make informed decisions. (For more information about food-borne illness risk assessments and rabies-safety campaign strategies used during deployments, see Chapter 9, Food Safety and Food Defense, and Chapter 12, Rabies and Continued Military Concerns.)

VETERINARY SUPPORT TO TACTICAL CANINE PROGRAMS

Special Operations forces recognized the potential of developing a canine capability just prior to the initiation of Operation Enduring Freedom in Afghanistan.[7] With the growth of Special Operations canine programs after the beginning of Operation Enduring Freedom and Operation Iraqi Freedom, a nontraditional type of military working dog was developed, called the Special Operations forces multipurpose canine.

The multipurpose canine is a working dog capable of multiple uses in varied environments and operations. The multipurpose canine's two main roles are explosive detection and patrol. These are also common roles for conventional military working dogs; however, the manner in which multipurpose canines are trained, deployed, and used in the operational environment is quite different from their conventional counterparts. The employment of the multipurpose canine on the battlefield is grounded in precision, validated end-user requirements, ethical use, and adaptability.[8] As a result, the multipurpose canine has proven itself an invaluable asset and force multiplier for special operations.

Just as multipurpose canines are nontraditional in their roles, so are the veterinary personnel who care for them. Providing veterinary care to multipurpose canines requires a detailed understanding of the Special Operations organizational structure and the nature of the missions, operational environment, and methods in which the multipurpose canine is used. The Veterinary Corps officer and animal care specialist fill roles analogous to occupational medicine specialist and nurse, canine medic, sports team physician, athletic trainer, flight surgeon, training officer, and noncommissioned officer, and, when the need dictates, canine handler. They provide canine veterinary care and act as advisors directly to the Special Operations unit.

Assignment of military veterinarians and animal care specialists directly to Special Operations tactical canine units provides immediate access to veterinary care, allowing rapid diagnosis, treatment, and, most importantly, rapid return to duty. Veterinary personnel become familiar with individual canines' health status and behavior, and because they work directly with the canine, its handler, and its trainer on a daily basis, veterinary personnel can recognize and address slight changes in performance, behavior, and nutritional status without having to take canines or handlers out of their working environment, thereby reducing distractions and maintaining a mission focus.

In addition to clinical care of multipurpose canines, Special Operations veterinary personnel are integrally involved with research and development on canine preventive medicine, emergency care, canine tactical combat casualty care, and other aspects of managing canine care in a combat environment. While ensuring high standards of care in compliance with DoD standards, special operations tactical canine units and veterinary personnel are not constrained by rigid clinical protocols. Lessons learned and evidence-based research help tactical canine programs rapidly evolve and safely extend the effective range of multipurpose canine capabilities on the battlefield.

The Tactical Canine Program Team

Assignments of veterinary personnel in tactical canine programs have evolved to meet mission requirements. Some units have only a veterinarian, while others have only an animal care specialist. While most of these positions are filled by military personnel, some are filled by civilian employees. Other units have a

combination of veterinarians, technicians, military personnel, and civilian staff. This variation is due to availability of billets, funding, and requirements of the tactical canine program. Typical tactical canine program team members are the Special Operations veterinarian, the independent duty veterinary technician, the canine handler, and the Special Operations paramedic.

The **Special Operations veterinarian** is an operational medicine expert and case manager responsible for preparing the medical team to take appropriate preventive medicine actions throughout the deployment cycle and to manage a working dog casualty from point of injury to final disposition. Whatever the operating environment, the Special Operations veterinarian understands the effects of the environment on the multipurpose canine in his or her care and uses this understanding to mitigate or treat any potential issues that may impact canine health or potentially degrade canine performance. The Special Operations veterinarian also maintains an understanding of regulatory, transportation, and medical evacuation procedures.

The **independent duty veterinary technician** (IDVT) is a 68T (military occupational specialty) animal care specialist in the rank of E7 or above who may be assigned to a Special Operations unit.[9] IDVTs assist the veterinarian, restrain the canine for examination, and carry out prescribed medical orders to dispense or administer medications to multipurpose canines. IDVTs also provide care to multipurpose canines remotely with a supervising veterinarian. In addition to functioning as the team medic for the multipurpose canine, IDVTs serve as veterinary operations planners, veterinary care trainers, and veterinary facility program managers, filling many management and leadership roles that are traditionally carried out by veterinarians. IDVTs also function as staff noncommissioned officers, assist with research and development activities, give formal military or professional veterinary presentations, and interact directly with Special Operations unit commanders and staff.

IDVTs understand the operational veterinary needs of Special Operations tactical canine teams and provide a bridge between enlisted canine program personnel and the special operations veterinarian. They interface with the canine teams throughout the deployment cycle and during medical evacuation. In most cases, the IDVT is the first person that the handler communicates with after initial stabilization of a canine casualty. The IDVT assists in arranging medical evacuation, referral for follow-on specialty care, and movement of a replacement dog into theater if needed. In nonlife-threatening (or routine) injury or illness, the team communicates directly with the IVDT for advice on field treatment, patient monitoring, and when or where to seek further veterinary care. Considering that the nearest veterinary care in theater might be hours away by helicopter, availability of on-call veterinary consultation significantly increases unit efficacy. This is especially beneficial when the veterinary advice comes from someone familiar with the physical condition of multipurpose canine and the capabilities and personalities of canine handlers.

Canine handlers usually receive basic first aid and limited trauma training during their canine handler certification. Some handlers have more extensive and indepth medical training and receive continuing education on a routine basis. Along with the canine handler, Army Special Operations medics, independent duty corpsmen, and pararescue jumpers generally provide initial emergency medical care to injured multipurpose canines during combat or other remote operations.

Special Operations paramedic trainees get an indepth introduction to canine medical care while attending the medical qualification course at the Joint Special Operations Medical Training Center at Ft Bragg, North Carolina. While attending the Special Operations Combat Medic course, students receive classroom and hands-on training for canine physical exams, fluid therapy, and tactical combat casualty care. During the Special Forces Medical Sergeant and Special Operations Independent Duty Corpsman courses, the Special Operations medics' canine training is expanded to include fundamentals of preventive medicine, common noncombat-related diseases and medical conditions, and proper records-keeping and program management.

The Special Operations Combat Medic Skill Sustainment course is a biennial recertification course for all Special Forces Medical Sergeant course graduates and Air Force pararescue jumpers. During this refresher course, Special Operations medics receive a cursory review of canine trauma and discuss lessons learned from personal experiences downrange. This not only provides the students with a broader scope of canine medicine, but also gives the Joint Special Operations Medical Training Center instructors accurate feedback on course material in order to maintain the most up-to-date and applicable information for current operations.

Combat Trauma and Canine Tactical Combat Casualty Care

Tactical combat casualty care was first described in 1996 by Butler et al in a manuscript titled "Tactical Combat Casualty Care in Special Operations." Published in *Military Medicine*, the article presented the

results of a 2-year review of the effectiveness of civilian advanced trauma life support on the battlefield.[10] This review initiated a paradigm shift from adapting civilian clinical practices for combat to developing tactically appropriate algorithms.

Tactical combat casualty care has three objectives: (1) treat the patient, (2) prevent additional casualties, and (3) complete the mission. In contrast, advanced trauma life support focuses only on the first objective. The 75th Ranger Regiment adopted tactical combat casualty care in 1998, making it a priority to train all personnel assigned to the regiment. In 2011, Kowtal et al published "Eliminating Preventable Death on the Battlefield," highlighting the success of tactical combat casualty care in significantly reducing preventable deaths on the battlefield.[11] Tactical combat casualty care is now the military standard.

Tactical combat casualty care outlines recommended actions that increase the success of casualty care and can be easily adapted to the canine patient on the battlefield. Many Special Operations units follow the "massive hemorrhage, airway, respiration, circulation, hypothermia and head trauma, and evacuation"[12(p3)] or MARCHE protocol to teach assessment and treat injuries systematically. The combat trauma protocol has replaced the previous "airway, breathing, and circulation"[13(p2)] or the ABCs method taught in basic first aid courses. Combat trauma protocol for canines has been adapted from the protocol for human patients found in the *Ranger Medic Handbook* by the Department of Defense, 2011 edition.

Canine tactical combat casualty care follows the same tactical care domains as tactical combat casualty care: care under fire, tactical field care, and tactical evacuation care. (For more information about the types of canine evacuations available for both military and other working dogs, see Chapter 4, Medical Evacuation of the Military Working Dog.)

Care Under Fire

This domain of care (care under fire) involves movement of the casualty to cover. If tactically feasible, a muzzle may be applied (see muzzle discussion in right column), and life-threatening hemorrhage is controlled. Generally, tourniquets have been the mainstay of this phase and the greatest advancement in human tactical combat casualty care because of the high proportion of extremity injuries in current conflicts.[14] However, based on limited data on combat injuries in dogs,[15] canines do not generally require tourniquet application in extremity injury to control bleeding. If massive bleeding is obvious, a quick pressure bandage should suffice; however, tourniquets are recommended with traumatic amputations or partial amputations. Most important is for the handler to remain engaged in combat operations and seek cover until it is feasible to lend aid to the downed multipurpose canine.

Tactical Field Care

This domain involves a thorough head-to-toe examination. Raking the hands through the fur from the head to the hindquarters helps identify wounds of the thorax and abdomen. Any tactical vest or equipment must be removed to properly assess the thorax. It is often helpful to remove collars, but it is important to maintain at least one method of control (collar, vest, or harness). Technical interventions, emergency surgical procedures, and drug administration predominate this phase of care.

Tactical Evacuation Care

This domain of care incorporates treatment provided during medical evacuation or casualty evacuation from the battlefield. All interventions outlined in previous domains of care are appropriate during transport; however, during tactical evacuation, medical personnel may or may not be present to provide continued care. Additionally, many medical evacuation personnel do not have specific training in managing canine casualties. The multipurpose canine handler or designee should stay with the multipurpose canine through the roles of care for safety and restraint (although this is not specified in doctrine at the time of writing, October 2017). Special Operations units generally cross-train personnel to be capable of handling a multipurpose canine in the event a handler is incapacitated or otherwise unable to evacuate with his or her injured or ill canine.

If a muzzle has not already been placed on the injured multipurpose canine, one should be placed before transport for safety. A muzzle disarms the canine weapon system (equivalent to removing a soldier's weapon when consciousness is impaired). Multipurpose canines may become unpredictable when injured and will bite even with impaired consciousness, and safety for the animal care team is paramount at all levels of care.

A regular cage muzzle (hard style) is preferable for placement on an injured dog because this style allows the canine to pant with limited restriction. The soft mesh-style or "medical muzzles," which are easier to carry while on patrol, can restrict a canine's ability to pant and could contribute to hypoxia or hyperthermia. If the mesh-style muzzle is all that is available, it may be advisable to leave the multipurpose canine unmuzzled until a painful procedure is anticipated.

Many Special Operations units utilize canine combat cards and canine casualty cards. Combat cards outline drug dosages, vital signs, and interventions unique to canine patients, as well as normal ranges for vitals and laboratory tests. These cards facilitate treatments in stressful combat environments and potentially minimize complications of incorrect drug administration. The information on the combat cards also helps human healthcare providers triage and treat multipurpose canines in the absence of veterinary personnel. Canine casualty cards are comparable to human casualty cards and allow proper tracking of wounds, changes in condition over time, and all interventions.

Canine patients differ from human patients in anatomy, physiology, and pharmacokinetics; however, the principles of trauma treatment are universal. Key differences with regard to canine tactical combat casualty care guidelines and emergency care are outlined in Exhibit 17-1. Knowledge of these key differences, as well as prior training, will increase the success of resuscitative efforts for multipurpose canines.

EXHIBIT 17-1.

KEY DIFFERENCES BETWEEN CANINE AND HUMAN TACTICAL COMBAT CASUALTY CARE GUIDELINES

1. Tourniquets are not generally needed for extremity wounds unless traumatic amputation or partial amputation has occurred. Canine extremities do not bleed profusely like human limbs, and pressure bandages suffice to control bleeding.
2. Nasopharyngeal airways are not effective. Unconscious military working dogs (MWDs) should have their heads extended in a straight line, with their neck and tongue gently pulled forward to decrease the chance of obstructions.
3. Definitive airway support is accomplished through orotracheal intubation, which is much easier to perform in canines than in humans. However, MWDs may chew endotracheal tubes (ETTs) in half after regaining consciousness, dislodging them deeper in the trachea.
4. Orotracheal intubation is performed with the canine in sternal recumbency, mouth opened wide, neck extended, and tongue externalized. The ETT is placed between the arytenoids (similar to humans). Most MWDs require a size 9 to 10 ETT, but a 7 to 8 ETT can be used if it is the only size available. Tracheotomy, versus cricothyrotomy, is the generally preferred method of surgical airway in canines; however, cricothyrotomy has been performed successfully by Special Operations Forces medics on injured multipurpose canines on the battlefield with no adverse effects. Tracheotomy is performed similar to cricothyrotomy, but in the proximal third of the ventral neck instead of through the cricothyroid membrane. A size 6 tracheotomy tube is ideally placed between the third and fifth tracheal ring.
5. Due to the canines' quadrupedal stance, the hemithoraces, and thus lung fields, are anatomically on the left and right sides laterally, as opposed to both hemithoraces visualized anteriorally in people. This has implications for anatomical placement of interventions. Placing an MWD sternally (chest to the ground) is the often most comfortable for the patient and helps visualize bilateral rise and fall of the chest.
6. Needle thoracocentesis is performed between the 6th and 8th intercostal space, at the most convex portion of the chest wall. Canines' thin mediastinum often ruptures, making bilateral decompression necessary. Bilateral decompression is routinely performed regardless of location of entrance wound or suspected affected side of pneumothorax.
7. Occlusive dressings for penetrating chest wounds are difficult to place due to hair. It is often advised to place petrolatum gauze directly to the wound and/or lubricating gel on the hair around the wound before placing a seal. It is appropriate to circumferentially place a wrap around the thorax if a seal is difficult to achieve.
8. Fluid resuscitation should be reserved for MWDs experiencing severe shock. Many studies establish a reduced need for fluid resuscitation prior to arrival at definitive care. However, when indicated, low-volume hypotensive resuscitation with colloid or crystalloid solution to an endpoint of a palpable femoral pulse should be initiated either intravenously or intraosseously.
9. Intravenous catheterization is best achieved through the cephalic vein in the front limb, between the elbow and carpus.
10. Intraosseous catheterization is most easily attained in the medial tibial crest and proximal humeral head.

Exhibit material adapted from US Special Operations Command (Army unit) (USSOCOM) human Tactical Casualty Combat Care (TCCC) guidelines, developed by the ad hoc USSOCOM K9 (canine) TCCC Committee, October 2010.

Vignette 17-1. Multipurpose Canine Breston: Tactical Combat Casualty Care Adapted to a Critically Injured Special Operations Multipurpose Canine

Care Under Fire. A 5-year-old intact male Belgian Malinois multipurpose canine incurred a gunshot wound to the thorax during a firefight at night in Afghanistan. Breston was working off leash when he was injured and immediately returned to his handler. The handler quickly assessed the dog but could not see a specific wound or immediate life-threatening injury so continued returning fire as appropriate. Within a few minutes of the injury, Breston displayed dyspnea and collapsed, losing spontaneous respiration and palpable femoral pulse.

Tactical Field Care. The handler called to the Air Force pararescue jumper paramedic for assistance. The handler and paramedic moved Breston to cover, removed his tactical vest, and found a 2-cm penetrating wound on the caudal right hemithorax and a 4-cm wound in the cranial right hemithorax, thought to be entrance and exit wounds on the same side of the dog. They covered the wounds with occlusive dressings and performed needle decompression of the right thorax to relieve suspected tension pneumothorax. Needle decompression resulted in immediate increase in level of consciousness and return of spontaneous breathing and palpable femoral pulse.

Enroute Care and Tactical Evacuation. The firefight continued for approximately 90 minutes, followed by a 5-kilometer exfiltration on foot, during which Breston had to be carried. Initial attempts to carry him on a litter were unsuccessful; he fell off the litter into water while being carried across a stream. After exfiltration of the team, Breston was evacuated on a nonmedical helicopter, with enroute care provided by a special operations physician and flight medic. During the course of the 90-minute firefight and 90-minute evacuation, Breston lost consciousness and spontaneous breathing three additional times. Each time, he was revived with needle decompression of the thorax. He also received supplemental oxygen by mask. He was evacuated straight to a combat support hospital, where continued treatment was provided by medical personnel until the veterinarian arrived.

Damage Control Resuscitation and Hospital-Based Care. On arrival at the combat support hospital, Breston's rectal temperature was 91° F (normal range is typically 99°–102.5° F), so protocols to actively warm him and combat hypothermia were applied. Additional treatment included placement of a thoracotomy tube, oxygen support, antibiotics, intravenous fluid therapy, and pain control.

Medical Evacuation to Continental United States. Four days after Breston was injured, the thoracotomy tube was removed, and he was escorted home by a Special Operations IDVT via aeromedical evacuation to the Dog Center Europe in Kaiserslauten, Germany, for initial stabilization, then on to the United States for further care. Altitude restrictions of 5,000-feet cabin pressure were applied on the evacuation aircraft because of Breston's history of tension pneumothorax.

US Treatment and Return to Duty. Upon arriving home, the special operations veterinarian responsible for Breston's care facilitated a thorough evaluation by veterinary specialists, including cardiothoracic ultrasound. The Special Operations veterinarian advised Breston's canine program managers that, despite a life-threatening injury and having "died" four times on the battlefield 1 week earlier, Breston was fit for return to duty once his body wall injuries from entrance and exit wounds were healed. Breston returned to duty 21 days after his initial injury and was immediately returned to Afghanistan, where he successfully completed the remainder of his deployment without incident.

Operational Hazards and Performance Considerations

The operating environment of the multipurpose canine presents challenges for the canine handler team as well as the veterinary care team. Understanding the challenges of operating in extreme heat and humidity, extreme cold and high altitudes, and maritime and airborne environments is essential to maintaining multipurpose canines at their peak performance.

Extreme Heat and Humidity, Desert and Tropical Environments

Multipurpose canines may be at increased risk for exertional heat injury due to the intense physical nature of the work, harsh working environments, necessity of wearing tactical gear, or extensive work in a muzzle. As noted earlier, veterinary references describe normal canine temperature as between 99° and 102.5° F. These references also define heat injury as occurring when rectal temperature reaches 106.0° F. However, over the last 40 years, at least four independent studies in canine working breeds have similarly shown that (*a*) the rectal and core temperatures of working dogs can reach 108.0° F during exercise with no adverse effect and (*b*) the rectal temperature of a well-conditioned multipurpose canine can routinely reach or exceed 106.0° F during exercise with no apparent adverse effect.[16–19]

Special Operations veterinary personnel work with their canine teams to establish normal working temperature ranges of individual canines and take into account appearance, behavior, and performance changes before concluding that an elevated rectal temperature is clinically significant.[20] Instead of focusing on complicated treatment protocols, training for handlers on management of heat injury emphasizes recognition of hazardous working conditions and subtle changes in performance and behavior that indicate a multipurpose canine's status and heat tolerance at any given point in time. Instruction on field treatment is clear and concise: cool down the canine as quickly as possible with whatever resources are available and follow up with the veterinary team.

Adequate conditioning and acclimation at or above the level of expected work are possibly the most effective methods of preventing heat injury in multipurpose

canines. However, with rapid deployment of multipurpose canines for contingency missions, extended periods of acclimation may not be possible. In these cases, additional measures must be taken to prevent heat injury while effectively extending the operational range of the multipurpose canine.

Tactical canine teams have used a variety of methods for prevention of heat injury with varying success, including the use of cooling vests and prehydration with subcutaneous fluids. Anecdotally, Special Operations canine handlers have reported that cooling vests were too bulky and not practical in an operational setting, and the handlers worried that the vest's weight and bulk counteracted any cooling effect. Human studies of the effectiveness of cooling vests echo dog handlers' anecdotes; the human studies show that some cooling vests help maintain a lower body temperature, but, in certain conditions, the vests are ineffective and may even be detrimental to cooling.[21,22] Prehydration with subcutaneous fluid administration before and during extended operations has been used extensively in dogs deployed to Iraq and Afghanistan, as well as in hot weather US training environments. Handlers have reported that prehydration improves multipurpose canine performance and endurance. Also, Gordon reported that the use of subcutaneous fluid prehydration in search and rescue dogs deployed to hot environments subjectively appeared to benefit canine performance.[23]

Extreme Cold, Mountain, and High-Altitude Environments

The mountain environment poses several health hazards to multipurpose canines, including hypoxia, extreme cold, and rough terrain. No canine cases of acute mountain sickness, high-altitude pulmonary edema, or high-altitude cerebral edema have been documented in the literature. However, there are anecdotal reports of canines having acute or subtle decreases in performance at higher altitudes in Afghanistan, likely due to the effects of hypoxia at higher altitude, based on the signs reported by the handlers, absence of other clinical signs, and improved condition on descent to a lower altitude (personal knowledge, Colonel Janice Baker, chapter author). Canine "altitude sickness" has also been reported anecdotally by veterinarians working in high-altitude areas of the United States, but little is documented in the veterinary literature on this condition. Experimental studies in canines taken from sea level to high altitudes yield conflicting evidence regarding physiologic changes. Some studies demonstrated that pulmonary arterial pressures and pulmonary vascular resistance nearly doubled in canines taken to altitudes between 3,100 and 3,300 meters (10,170–14,107 feet),[24,25] but other studies showed no significant increase in pulmonary arterial pressure in canines at 4,500 meters (14,764 feet).[26]

With conflicting results regarding the canine's susceptibility to debilitating effects of rapid ascent to high altitude and the lack of significant morbidity or mortality reported in military working dogs, there is little evidence on which to base concrete medical guidelines. Thus, there are currently no general recommendations for preventing or treating altitude-related conditions in multipurpose canines. Special Operations handlers and medics are instructed that, although such effects have not been reported in multipurpose canines, high altitude can affect performance and may cause conditions such as acute mountain sickness, high-altitude pulmonary edema, or high-altitude cerebral edema. Signs of decreased performance, including rapid or labored respiratory efforts, coughing, or decrease in mental alertness, should be addressed rapidly, just as with a human patient. For mild cases, returning to a lower altitude may be sufficient treatment. There is insufficient evidence that pretreatment with pharmacologic agents is effective.

Canines deployed to forward operating bases at higher altitudes should be allowed to acclimate for 1 to 2 weeks if operationally feasible. A 1998 study in search and rescue dogs concluded that search time to find mock victims significantly increased at high altitudes compared to sea level but did not specify whether this was due to decrease in physical performance versus other environmental factors that might increase the difficulty of detecting scents.[27] The effect of rapid ascent to high altitudes on canines' ability to detect explosive scents has not been determined; therefore, it is advisable to test the canine in a training situation at the high-altitude deployment location prior to the dog's operational use.

Strenuous endurance exercise in athletic canines in extremely cold weather (between 0° and -40° F) has been shown to cause airway remodeling and responses similar to cold weather-induced asthma in humans.[28] Frostbite is common in sled dogs working for prolonged periods in conditions of ice and snow, typically affecting the prepuce and skin folds or the flank (Figure 17-3). However, frostbite has not been reported as a significant finding in military working dogs operating in cold weather in Afghanistan, likely because these canines are exposed to subzero temperatures for shorter periods than sled dogs.

Trauma from working on rugged terrain is also likely. Although not unique to mountain environments, hypoxia and fatigue may predispose multipurpose

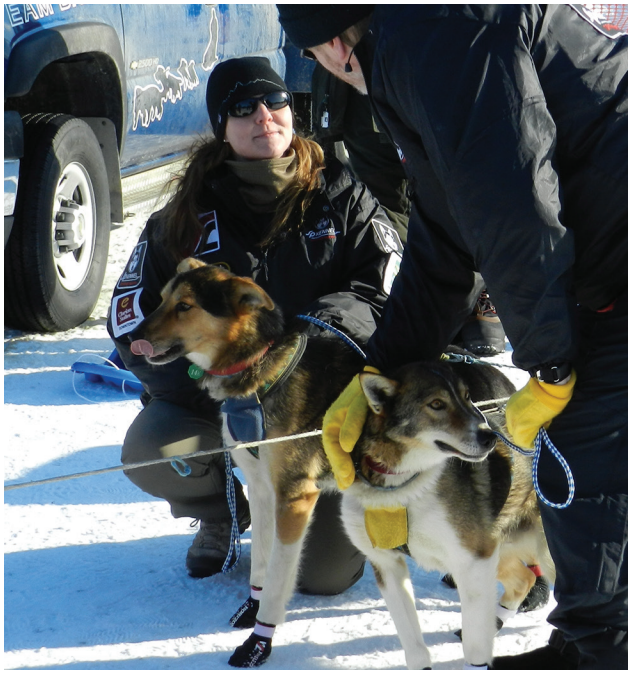

Figure 17-3. A Special Operations independent duty veterinary technician works with racing sled dogs to study the effect of cold weather on health and athletic performance in canines.
Photograph courtesy of Lieutenant Colonel Janice Baker, chapter author.

canines to injury. The seriousness of traumatic injuries in mountain environments may be increased if evacuation is delayed. Special operations paramedics operating in these areas must be prepared to provide prolonged care for an injured multipurpose canine, and the team must be prepared to carry the canine casualty over rough terrain during movement to exfiltration.

Maritime Environments

Naval special warfare canine teams operate in a variety of environments, including salt water and freshwater. While US Navy Sea Air Land teams, commonly known as SEALs, and other forces that conduct these special missions have extensive training and specialized equipment, the Navy special warfare canine comes equipped primarily with the drive for self-preservation in water. Accidental drowning, salt water ingestion, and hypothermia are the biggest concerns for the multipurpose canine in a maritime environment.

Lessons learned have shown that not all canines have an innate ability to swim, so canines that operate in maritime environments must receive water training. Modified flotation devices can reduce cases of accidental drowning. The physiologic effects of salt water drowning or near-drowning have been described in canines.[29–38] Canines swimming in the ocean have the potential to ingest or aspirate salt water, even when water is calm and swimming occurs without struggle. Preliminary data on physiologic effects of working dogs swimming in the ocean shows that canines will occasionally swallow water while swimming, but 1 hour post-swim no adverse clinical signs and no appreciable change in electrolyte values were observed. Self-limiting vomiting and diarrhea were the most common results of limited salt water ingestion, and these reactions usually resolved completely within 24 hours after exposure.

When swimming in cold water, hypothermia is a concern. Special Operations soldiers may wear wet suits or dry suits during cold water operations. The canine's fur may effectively act as an anatomical wet suit, protecting them from hypothermia to some degree. Preliminary data in canines swimming in 54° F water showed an initial rise in body temperature, presumably due to the work of swimming. However, once out of the water, the canines' body temperatures dropped significantly to slightly below normal, to approximately 97° F (Figure 17-4) (unpublished study results, Colonel Janice Baker, chapter author, study conducted during her Joint Special Operations Command, 2005–2009).

Figure 17-4. A Special Operations independent duty veterinary technician monitors core temperature of a Navy special warfare multipurpose canine during maritime training.
Photograph courtesy of Lieutenant Colonel Janice Baker, chapter author.

Airborne and Air Assault Operations

Multipurpose canines may be inserted into operational areas with their handlers by parachute, fast rope, or rappelling techniques. These methods of insertion pose risks of blunt trauma from falls, as well as ocular trauma from rotor wash or wind during ascent. Protecting canines' eyes with goggles may help decrease the risk of ocular injury. Risk of trauma is increased to both the canine and the handler if the canine struggles or resists insertion procedures.

Multipurpose canines are evaluated for suitability for multiple tasks during their training, and their behavioral response to these types of procedures will determine if they are suitable for airborne operations. Multipurpose canines that acclimate well to being lifted, hanging free by their harness, and undergoing transport in aircraft and that can execute their duties of detection or patrol immediately after insertion without showing signs of anxiety or distraction are most suitable for airborne and similar operations.

The altitude at which multipurpose canines can be inserted safely, without the use of supplemental oxygen, is unknown. It is likely that medical concerns for soldiers during rapid descent from high altitude also apply to multipurpose canines.

Canine Emergency Planning and Tactical Medical Evacuation

Planning for canine casualties is an essential part of pre-mission planning for any operation involving multipurpose canines.[39–41] As previously noted in this chapter, when a multipurpose canine is injured, evacuation to veterinary care is managed like evacuation to medical care for human casualties. Further evacuation out of theater is managed using the same resources and methods as for human casualties.

Capabilities Assessment and Threat-Based Planning

Prior to an operation, medical planners assess the available tactical evacuation platforms and medical facilities and advise the operational commander on their plan in the pre-mission brief. Threat-based medical planning helps focus preparation of medical supplies and training on the injuries or illnesses that are most likely to occur on a given mission, while ensuring preparedness for worst-case situations.[42] Again, planning for treatment and evacuation of a multipurpose canine casualty occurs in the same manner, and, in most cases, is exactly the same plan as for human casualties.

A capability assessment considers the capabilities of military or host nation veterinary services in the location of deployment, as well as the medical threat to multipurpose canines in the operating environment. Special operations veterinarians and IDVTs work closely with their units and conventional veterinary forces in theater to ensure canine casualty and evacuation plans are up-to-date and accurate. These personnel conduct site surveys of their unit's kennels and military veterinary facilities along all roles of care and assist medical operations planners in developing canine casualty evacuation plans. For continental US training away from their home station, Special Operations veterinary personnel often perform the same type of site survey, capabilities assessment, and evacuation planning (to local military veterinary treatment facilities or civilian veterinary emergency facilities) in advance to ensure the availability of immediate and appropriate care in the event of an emergency.

Veterinary treatment facilities are located throughout a theater of operations, often adjacent to a medical treatment facility. Many forward operating bases do not have veterinarians but do have medical treatment facilities capable of initial resuscitation treatment of canine trauma. In the initial response to a combined mass casualty event, in which both human and canine service members are injured, it is not operationally feasible to evacuate human casualties to one location and canine casualties to a veterinarian at another location. In these situations, the canine casualty plan, included in the medical casualty plan, stipulates that an injured canine be treated like any other injured team member and be evacuated using the same plan and evacuation resources as for human casualties. (See Chapter 4, Medical Evacuation of the Military Working Dog, for more detailed information about the types and locations of veterinary medical treatment facilities and casualty plans available to various types of deployed canines.)

Site Surveys and Capability Assessments

Veterinary capabilities in theater are constantly being reviewed, changed, updated, and validated to meet current and future veterinary medical requirements. Special Operations veterinary personnel visit veterinary treatment facilities on a routine basis to perform capabilities assessment and ensure the accuracy of their canine casualty evacuation plans and communication procedures between the unit and the facility. The capabilities of each location are evaluated for the level of care that can be provided at either the veterinary treatment facility or medical treatment facility, or a combination of both. (Chapter 4, Medical Evacuation of the Military Working Dog, provides more indepth information about the levels of care available for injured or ill deployed canines.)

The tactical evacuation plans resulting from these assessments will vary across locations. Plans may recommend over-flying a closer treatment facility to higher level of care farther away or flying to the closest location with a medical treatment facility, regardless of whether there is a co-located veterinary treatment facility. These evacuation plans are fluid, and the final decision about evacuation destinations will be based on the immediate tactical environment and the judgment of the canine handler or medical provider caring for the canine casualty.

Because Special Operations veterinary personnel are not always deployed with their unit, multipurpose canine handlers and medical operations personnel in theater communicate with theater veterinarians or veterinary operations noncommissioned officers regularly to ensure veterinary support is available at the designated veterinary treatment facility locations. Special Operations veterinary personnel provide multipurpose canine handlers and medical providers training on emergency veterinary care and tactical evacuation procedures prior to deployment. This training includes guidance on building a good working relationship with conventional veterinary units supporting the dogs during deployment.

Tactical Evacuation of Injured or Ill Multipurpose Canines

Army Field Manual (FM) 4-02.2, *Medical Evacuation*, and FM 8-10.6, *Medical Evacuation in a Theater of Operations*, state that the use of air or ground evacuation assets may be used to transport injured or ill military working dogs based on mission and capability.[43,44] Dedicated medical evacuation platforms may be the preferred method of evacuation, by either ground or air, because these resources have standard medical supplies and equipment that can be used to treat an injured multipurpose canine. Prior training that includes training from Special Operations veterinary personnel, multipurpose canine handlers, and medical evacuation air and ground ambulance crews familiarizes the canines and their handlers with the ambulance platform and the air or ground ambulance crews with transport and handling of a canine within the vehicle.

Transport of a casualty from the point of injury to a medical or veterinary treatment facility may occur on a dedicated medical evacuation platform (MEDEVAC) or a nonstandard or nonmedical platform (CASEVAC). The more current term, tactical evacuation or TACEVAC, is used to indicate evacuation from point of injury to medical or veterinary care regardless of the medical capability of the evacuation platform.

As noted earlier in this chapter, most multipurpose canine casualties will be escorted by a Special Operations paramedic and, whenever possible, the handler as well. Treatment may consist of continued reassessment and monitoring or further resuscitative care; nonveterinary personnel have successfully provided advanced life-saving treatments during this phase of care, including needle decompression for tension pneumothorax, intravenous or intraosseous fluid administration, and emergency surgical airway.[15]

Also, as noted earlier, when a multipurpose canine is initially injured, the condition of the canine casualty is assessed and treated following the principles of canine tactical combat casualty (similar to the procedures for human casualties). When the initial steps of care under fire and tactical field care are completed and medical personnel or the canine handler determine that immediate evacuation is needed, the canine casualty is prepared for transport.

Depending on the operational environment, ground or air evacuation assets may not be able to access the area at the point of injury. Having the means to carry an injured multipurpose canine is crucial. Human litters are not well suited for canine casualties because conscious canine casualties are often not amendable to lying down or being restrained by the litter straps and easily slide off human litters (see Vignette 17-1). Some Special Operations canine handlers carry specially designed canine litters; others improvise litters for these situations or resort to carrying the canine casualty by hand. Prior scenario-based training in canine casualty evacuation prepares a team to use best methods if canine evacuation is needed in combat and increases the multipurpose canine's confidence to comply with being carried in this manner.

The unpredictable nature of a canine's possible fight-or-flight response also makes it essential to ensure the canine casualty cannot escape from the evacuation platform. A canine casualty might take drastic measures to escape, including through the cockpit or open gunner window or ramp. Even if the canine casualty appears unconscious, the aircraft or vehicle doors must be closed and the canine secured to the aircraft or vehicle by its tactical vest or other means.

If the canine casualty does not need immediate enroute care, securing it in a crate usually provides the most secure method of transport during evacuation. If a crate is not available or does not fit in the platform, a deployment bag or other medium-sized gear bag can be used to create a field-expedient "dog bag" to contain the canine casualty, with the bag closed up to the canine's neck and its head protruding from the bag. This method, also used for containing a multipurpose canine during airborne operations, keeps the canine from running away, works as an improvised litter, and protects others on the aircraft from being scratched by the dog's exposed feet (claws). Multipurpose canines typically tolerate this rigging.

Enroute Care

After arrival and stabilization at the first fixed-medical or veterinary treatment facility, the multipurpose canine may require further evacuation. It is recommended that both Special Operations and conventional veterinary personnel keep a medical evacuation aid bag and body armor or other personal protective gear ready at all times near their respective treatment areas, so they can rapidly respond to the need for emergency patient transfer via air or ground.

Veterinary care of canine casualties aboard air or ground evacuation platforms may be limited and difficult because of noise, low or no light, vibration, cramped spaces, and noncompliance of the canine casualty.[45] Prior familiarization with the working capabilities and limitations of various evacuation platforms is essential.

Canine Evacuation on Nonstandard Platforms

Nonmedical platforms of evacuation are routinely used in special operations medicine for tactical evacuation when medical assets are not available or cannot be used because of continued hostile fire. The use of nonmedical platforms is often less than ideal for several reasons, the first being that using them to evacuate a canine casualty takes valuable assets away from the fight. Second, they are generally not well equipped with medical supplies or monitoring equipment. Third, air assets may not be able to fly in adverse weather. Finally, nonmedical ground assets may not provide protection from the elements, usually have limited space, and are slower than air platforms.

When a multipurpose canine is injured, the tactical evacuation plan is implemented to transport the canine casualty from point of injury to the human or veterinary treatment facility designated during premission planning. Depending on the injuries and/or recovery time needed, the Special Operations unit veterinary personnel, in conjunction with the attending veterinarian in theater, will decide if the canine casualty will be transported back to home station for recovery or remain in theater for recovery and return to duty. A Special operations Unit's canine program may elect to have the handler remain in theater as a tactical team member even if his multipurpose canine is evacuated out of theater. In many cases, a canine casualty will immediately be replaced by another multipurpose canine. This practice differs from the "one handler, one dog" doctrine of conventional military working dog teams.

Selected Special Operations veterinary personnel have training and experience in basic noncombat handling of multipurpose canines because these personnel may be tasked to escort a replacement canine into theater and then escort the canine casualty to the Dog Center Europe and subsequently to the continental United States. When adequately coordinated with the aeromedical evacuation system out of Germany, the exchange can be a tail-side swap of multipurpose canines on the same medical evacuation aircraft, allowing the escorting veterinary personnel to complete the exchange and return home relatively quickly. With such delivery of the replacement multipurpose canine, a Special Operations unit is returned to full capacity within 48 hours of the canine injury.

Use of Human Medical Resources

Whenever possible and tactically sound, an injured multipurpose canine should be evacuated to the care of a veterinarian. However, past and current conflicts have shown that this is not always immediately possible.[15,40,41] While 64F clinical veterinary specialists are assigned in theater, they are often located at large centralized bases far from the operational areas in which multipurpose canines are employed. Many canine casualties would not survive the lengthy evacuation to the specialist's location without immediate resuscitative treatment. In these cases, the Special Operations veterinary and medical planners might choose to evacuate a canine casualty to the nearest human medical treatment facility capable of providing resuscitative trauma care. Many successful cases have been reported of canine casualties evacuated straight to a medical treatment facility and treated by a human trauma team remotely or in conjunction with a veterinarian.[15]

The deployed veterinarian, if co-located, assists the human trauma team and acts as an advocate for the canine casualty (rather than managing a complex trauma case without prior training or experience). This type of collaboration can effectively evolve a basic veterinary capability into an advanced trauma capability. (Chapter 4, Medical Evacuation of the Military Working Dog, presents examples of veterinary and human medical personnel working together at various treatment facilities to care for injured canines and, in some cases, their handlers.)

BUILDING ANIMAL HEALTH CAPACITY

In a population-centric model of irregular warfare, veterinary services have a role in building animal health capacity. By building capacity in agriculture, public health, and animal health, livelihoods can be improved, food sources can be stabilized, and the threat of zoonotic diseases can be minimized. These

activities and intended outcomes support stability operations objectives in economic development and restoration of essential services, as well as helping to gain support from local populations in counterinsurgency operations. However, building animal health capacity in a global setting requires understanding of the global animal health environment and how activities and engagement can be leveraged to improve animal health systems. Perhaps more importantly, veterinary personnel must understand how animal health activities can support—or disrupt—international and interagency efforts.

Global Animal Health Environment

Multiple organizations are engaged in building global animal health capacity. Conducting animal health activities in the irregular warfare environment requires an understanding of the local, national, and international animal health systems, as well as the stakeholders and their priorities. Understanding the global animal health environment is best explained through the missions of major international and domestic organizations focused on improving animal health systems. These organizations include the World Organization for Animal Health, the Food and Agriculture Organization of the United Nations, and each partner nation's ministry of agriculture.

World Organization for Animal Health

The World Trade Organization was created in 1995, institutionalizing previously ad hoc free trade agreements and globalizing the world's approach to commerce. Members of the World Trade Organization agree to abide by international rules intended to reduce barriers to international trade (eg, customs, tariffs, and taxes).[46] Very few situations allow a country to block trade with another country that shares most favored nation status; however, plant and animal diseases that threaten economic security are valid justifications to implement trade restrictions. The World Organization for Animal Health is the intergovernmental organization that monitors economically important animal diseases and, in effect, regulates global animal agriculture trade through World Trade Organization-delegated authority.[47]

The World Organization for Animal Health describes four functional domains of national veterinary services: (1) human, physical, and financial resources; (2) technical authority and capability; (3) interactions with interested parties; and (4) ability to access markets through compliance with relevant international standards. The World Organization for Animal Health conducts assessments of national veterinary services along the four functional domains, utilizing the Performance of Veterinary Services tool, which can also be used to focus domestic and international donor resources on validated gaps in the national veterinary service system. A Performance of Veterinary Services report and ensuing investment can help a country comply with international standards and subsequently access global animal agriculture markets.[48]

Food and Agriculture Organization of the United Nations

Forty-four nations met in 1943 and committed to the establishment of an organization dedicated to strengthening food and agriculture systems. The United Nations Food and Agriculture Organization was created to focus on achieving food security for all people. Its mandate is to raise levels of nutrition, improve agricultural productivity, better the lives of rural populations, and contribute to the growth of the world economy.[49]

Ministries of Agriculture

A partner nation's ministry of agriculture (equivalent to the US Department of Agriculture) is the primary government organization responsible for national veterinary services. The ministry is often organized into three tiers (ie, national, regional, and district) and has multiple regulatory as well as disease response and mitigation responsibilities. Some countries' animal health systems rely solely on government-operated veterinary services that provide for the public and private good, while other countries rely on a mix of government-operated and privatized veterinary service delivery systems.

Animal Health Activities and Engagements

Understanding how veterinary services are delivered at the local level is as important as recognizing global animal health partners and stakeholders. This knowledge assists in planning activities that synergize rather than disrupt existing systems and animal health capacity-building efforts. For example, if the Food and Agriculture Organization is partnered with a local nongovernmental organization working to sustainably enhance the capacity of community animal health workers to deliver services in a market-based fee-for-service system, then a US Army-sponsored veterinary civic action program that provides free veterinary services in the same area will undermine the ongoing initiative to improve animal health and the economic

well-being of the local population. A better approach would be a coordinated or collaborative effort with the Food and Agriculture Organization that augments efforts to enhance the capacity of community animal health workers.

Joint Publication 1, *Doctrine for the Armed Forces of the United States*, defines military engagement as "the routine contact and interaction between individuals or elements of the Armed Forces of the United States and those of another nation's armed forces, domestic or foreign civilian authorities or agencies to build trust and confidence, share information, and coordinate mutual activities."[2(pI-15)] In the military engagement model, Veterinary Corps officers conduct activities focused on building local animal health capacity in cooperation with partner nation military and civilian veterinary service personnel. Framing an animal health activity as a military engagement allows Veterinary Service personnel to explain the means by which animal health outcomes of improved economic, food, and health security are tied to operational objectives in the irregular warfare environment.

If the partner nation is willing to share its Performance of Veterinary Services report, it can be referenced for planning animal health activities or engagements that extend or augment existing programs that are working to bridge gaps in the national veterinary service system. In the tactical environment, activities and engagements typically focus on human, physical, and financial resources through the transfer of knowledge and sharing of best practices with professional and paraprofessional veterinary personnel.

Activities and engagements that target animal health systems in the partner nation seek to improve economic, food, and health security of individuals and local communities. The outputs and outcomes of these activities can be linked to US defense, diplomatic, and development objectives at the strategic, operational, and tactical levels. Vignette 17-2 illustrates an example of an animal health activity that targets outcomes to mitigate communicable disease risks in remote villages in Uganda, supporting broader US strategic objectives to combat pandemic threats.

Vignette 17-2. One Health Team Combats Animal-To-Human Disease Transmission

LUWERO DISTRICT, Uganda - Living on a planet with more than seven billion people and countless more animals, viruses have many options to invade—and they're not picky. Viruses often jump from animals to humans, causing many diseases ranging from avian flu to Lyme disease, West Nile virus to severe acute respiratory syndrome (SARS).

The US Agency for International Development (USAID) estimates that more than 60 percent of emerging infectious diseases in humans are transmitted from animals in a process called zoonoses. Though some diseases transmit from livestock, many more—at least 74 percent—come from wildlife, which is most likely a result of human encroachment into animals' habitats. Making matters worse, some diseases, such as anthrax, can be harvested for bio-terrorism.

With the opportunity to make a difference in this fight, human and animal healthcare experts from Combined Joint Task Force-Horn of Africa (CJTF-HOA) Surgeon Cell, 411th Civil Affairs Battalion (CA Bn), the Uganda People's Defense Force (UPDF), and their civilian counterparts recently launched a program called One Health in Luwero district, Uganda.

Traditionally, One Health recognizes the impact of zoonoses and how the health of humans, animals and ecosystems, like nations, are interconnected. Overall, One Health is a whole-of-government program coordinated by the Ugandan government, the UPDF and USAID.

"One Health is a good concept we need to advance," said Maj. (Dr.) Godwin B. Bagyenzi, director of medical research for the UPDF. Previously, medical professionals, veterinarians, environmental specialists and wildlife scientists worked separately, he said, "but because the high percent of diseases challenging mankind are emitting from animals, we need to work together."

US Army Maj. Thamus J. Morgan, a veterinarian with the 411th CA Bn., which is supporting CJTF-HOA, said everyone should be concerned about preventing disease in Uganda, including Americans.

"I can leave here, get on a plane, and be back in the United States within 19 hours," said Morgan. "That's a very long time to pass on a virus. If we can stop an outbreak here, then we are going to prevent a whole lot of other people from dying."

To combat such threats, One Health uses a mix of classroom instruction and practical field exercises to prepare others in the fight against infectious diseases. Dozens of Luwero district animal and human healthcare experts, handpicked by local health officials, joined the UPDF and US soldiers every morning to review basic diagnosis of various diseases, treatment plans, and preventive measures. Participants then fanned out across the district to test their newly acquired skills.

"This training has boosted our knowledge about zoonotic diseases," said Serunkuuma Daniel, a Luwero District vector control officer. "I'm more than happy because the community now has people who are technically aware of diseases, how to prevent them and can do a lot to make sure epidemics are combated before they spread."

Since inadequate sanitation contributes to the spread of disease, One Health also included a review of human hygiene and water and food sanitation procedures at ranches, farms, households, and medical facilities.

"Probably the greatest success story is the linkage of all diseases to sanitation," said U.S. Army Col. (Dr.) Richard Birdsong, a physician with the 411th CA Bn. "Safe water, safe food are key to preventing disease."

Program coordinators chose the Luwero district for One Health because the area has experienced two Ebola outbreaks within the past year. Ebola is a highly contagious, often-fatal virus which is believed to be transmitted to people from animals, although the exact origin, locations, and natural habitat of Ebola remain unknown. The virus can be transmitted from person to person in several ways, including direct

contact with the blood or secretions of an infected person or through contact with objects, such as needles, that have been contaminated with infected secretions.

"This is the epicenter or 'tip of the spear' of where an outbreak took place last year," said Morgan, who is from Clinton, Conn. She said the information will be collected, analyzed, and shared with citizens to prevent another outbreak.

"It's a new culture. Under One Health, we learned we can't leave out the vets," said Col. Dr. Samuel Kasule, the UPDF director for public health. "We realize diseases come from the life circle of man, animal and environment."

Protecting humans often starts by protecting animals, prompting One Health participants to visit several ranches and farms to learn how to identify disease in livestock. For example, one ranch located in the remote Kitendeli area measures six square miles and raises cattle, pigs and poultry.

"Not treating livestock for disease would be disastrous," said Dr. Kawule Leonard, the Kitendeli ranch veterinarian and production manager. "What we produce on the farms will target humans. Not putting this in to consideration is a very big risk to the market and ultimately humans, who are consuming the products."

Humphrey Kabugo, a monitoring and evaluation officer for USAID's Emerging Pandemic Threats Program, said he was pleased with One Health's accomplishments in addressing the interconnectedness of human and animal life.

"Individuals are much more prepared to work together from different disciplines to respond to outbreaks so that the impact on human life, animal life and the environment is reduced," said Kabugo.

The partnership is working, said Kabugo, "and the best is yet to come."

News article by Petty Officer First Class Thomas Ouellette. Reproduced from http://www.hoa.africom.mil/Story/7769/one-health-team-combats-animaltohuman-disease-transmission and the Defense Video and Imagery Distribution System. Accessed October 13, 2017.

Sustained and coordinated activities and engagements conducted within the framework of existing country programs in collaboration with interagency and international partners maximize the efficiency of invested resources and reduce redundancy. For example, a local animal health project that intends to increase animal-source protein production and consumption, secure livelihoods of livestock owners, and mitigate the risk of zoonotic disease will directly benefit local populations, supporting a tactical military objective in counterinsurgency operations. This same animal health activity can meet the common objectives of interagency diplomatic and development partners through pooling of common resources, expertise, and logistics.

Vignette 17-3 illustrates interagency collaboration to meet common US objectives of food and economic security in Sulu, Philippines.

Vignette 17-3. Armed Forces of the Philippines, Joint Special Operations Task Force-Philippines, and US Department of Agriculture Participate in Sulu Agricultural Seminar

JOLO, Philippines - More than 100 faculty members and students from Mindanao State University, Sulu, Philippines, participated on June 1 in a historic Veterinary/Agricultural Seminar at the Sulu Area Coordination Center.

Hosted by Sulu's provincial government, the seminar, which was the first of its kind in conflict-affected Sulu province, featured Philip Shull, a foreign service agricultural counselor from the US Department of Agriculture and veterinarians from the Armed Forces of the Philippines and Joint Special Operations Task Force-Philippines.

Shull said he hopes the seminar will help Sulu barangays develop a closer relationship with the Philippine government and draw attention to the value of the resources at the US Embassy for agricultural advice and support programs.

"We hope they see the US as a positive partner with the Philippine government and a positive force in the lives and communities of the Filipino people," Shull said. "And we are hopeful that in the future we will be able to do regular outreach seminars like this and bring in experts who can convey information that is critical and will have a quick and direct impact on their lives, their livelihood, and their families."

Also in attendance were Sulu Governor Abdusakur Tan and members of the Philippine Department of Agriculture, the Philippines Bureau of Fisheries and Aquatic Resources, and the Sulu Area Coordination Center.

The US Army veterinarian assigned to JSOTF-P said the goal of the seminar was to engage the local government in partnership with the US Embassy and the AFP and eventually help facilitate this kind of civic assistance with increasingly greater local government participation and sponsorship.

"The presence of the USDA team was critical because it helped marry provincial-level assets with their national-level counterparts," said another JSOTF-P team member. "These relationships will help Sulu coordinate future seminars and subject matter information exchanges, enhancing the knowledge and capacity of the local farmers of Sulu."

In addition to giving practical advice on farming techniques, the speakers used samples, pamphlets and handouts to increase awareness of common livestock diseases and toxic plants in southern Mindanao and introduce new uses for familiar agricultural products, including home remedies for common illnesses.

"We appreciate and welcome so many groups coming together sharing their thoughts, resources, and enthusiasm for agriculture," said Fazlur Abdullah, Sulu ACC director. "The mission of the governor is to enhance, develop and improve our natural resources. Opening up to the outside world, floating ideas, doing community outreach will help us help ourselves and instill confidence in our people. Our goal is food sufficiency. We should be producing our own food."

Abdullah said he hopes these seminars will be conducted in the future "soon and often."

News article by Petty Officer 1st Class Cassandra Thompson. Reproduced from https://www.dvidshub.net/news/72716/afp-jsotf-p-and-usda-participate-sulu-agricultural-seminar. Defense Video and Imagery Distribution System. Accessed October 13, 2017.

Animal Health Surveillance Capacity

The DoD participates in US interagency efforts to build global health surveillance capacity.[50] DoD global health surveillance capacity-building efforts are primarily conducted to protect the health of the force; however, partner nation surveillance system improvements have a broader impact on global public health. Force health protection efforts to prevent zoonotic diseases require strengthening and integration of animal health and human health surveillance systems. The surveillance capacity that targets zoonotic disease will also impact the partner nation's veterinary services capacity to deal with economically important transboundary animal diseases, supporting efforts to alleviate economic and food insecurity. Building animal health surveillance capacity for identification of and response to zoonotic diseases can be expanded to nonzoonotic transboundary animal diseases and support the economic development activities of stability operations or enhance livelihoods to influence local populations in support of counterinsurgency operations.

DoD overseas laboratories and defense agencies play an important role in building partner nation surveillance capacity.[50] Efficiently functioning national veterinary services are necessary for access to global markets that trade animal-source products. DoD animal health activities conducted in the tactical environment often focus on building local capacity in the delivery of veterinary services. In the strategic environment, DoD animal health activities and engagements may focus on enhancing animal health surveillance systems. In the technical authority and capability domain of the Performance of Veterinary Services framework, the DoD has the capacity to conduct animal health activities and engagements that target veterinary laboratory diagnostic services, laboratory quality assurance, and epidemiologic surveillance and early detection. Enhancing these partner nation veterinary services capabilities supports the US National Security Strategy global health and food security initiatives.[51]

For example, in 2006, mortality in Afghan poultry significantly increased, and H5N1 avian influenza was suspected. The threat of H5N1 avian influenza was considered a risk to force health and public health. Although H5N1 avian influenza poses a serious health risk to individuals who have close contact with dead or dying poultry, the greater threat was to the economic and food security of Afghans who depend on poultry as a protein source and for supplemental income. The US Embassy in Afghanistan, with concurrence from the World Health Organization, the Food and Agriculture Organization, and the Afghanistan Ministry of Agriculture, requested diagnostic support from the DoD.

In response, Navy Medical Research Unit 3 dispatched a Veterinary Corps comparative medicine specialist (Lieutenant Colonel Samuel Yingst) with a portable real-time polymerase chain reaction diagnostic capability to provide technical assistance. H5-type avian influenza was identified using what is believed to be the first polymerase chain reaction assay conducted in Afghanistan. Although the pathogenicity was suggestive of H5N1, Afghanistan Ministry of Agriculture officials decided to wait for reference laboratory confirmation before acting. Samples were sent to the World Organization for Animal Health and the Food and Agriculture Organization reference laboratory in Padova, Italy. Two weeks later, the Navy Medical Research Unit 3 diagnostic results were confirmed and containment efforts began. Over 30,000 poultry were culled in the effort to contain the disease, but the total number of poultry lost to the outbreak was never well enumerated (personal knowledge, Lieutenant Colonel Samuel Yingst, chapter author and then Deputy Head of Virology at Naval Medical Research Unit 3, dispatched to Afghanistan, 2006–2008, now retired).

The outcome of this activity was confidence in the technical capability of Navy Medical Research Unit 3 and an illustration of the importance of in-country rapid diagnostic capabilities for control of animal diseases. Afghan Ministry of Agriculture, Irrigation, and Livestock requested that Navy Medical Research Unit 3 provide long-term technical support to establish polymerase chain reaction diagnostic capacity within Afghanistan's central veterinary diagnostic and research laboratory in collaboration with the Food and Agriculture Organization.

Such support was established before a second H5N1 avian influenza outbreak in February 2007. The geographical pattern of the outbreak was similar to the previous year, but because of early identification and response, fewer than 15,000 poultry were culled to contain the outbreak (personal knowledge, Lieutenant Colonel Samuel Yingst, chapter author and Deputy Head of Virology at Navy Medical Research Unit 3, dispatched to Afghanistan, 2006–2008, now retired).

The Navy Medical Research Unit 3 capacity-building effort is an example of a force health protection initiative that had an impact on economic and food

security for the Afghan people. The polymerase chain reaction capability established in the Afghanistan central veterinary diagnostic and research laboratory was expanded for rapid diagnosis of nonzoonotic transboundary animal diseases such as Newcastle disease and mycoplasma in poultry, as well as foot and mouth disease in hoofstock and peste des petits ruminants in small ruminants, putting Afghanistan on a pathway to meet international standards and open global markets to Afghan animal-source products.

SELECTION, TRAINING, AND EDUCATION CONSIDERATIONS

As noted earlier in this chapter, Veterinary Corps authorizations in the US Special Operations Command, US Army Civil Affairs and Psychological Operations Command, and the conventionally aligned Civil Affairs Brigade account for approximately 10% of the DoD Veterinary Corps officer authorizations (Colonel [Retired] Bob Walters, Director, Department of Defense Veterinary Service Activity, 2009–2015, personal communication with Paul Hollier, chapter author, August 25, 2014). Veterinary Corps officers assigned to Special Operations and Civil Affairs units are utilized in unconventional ways, are selected based on experience and personality, and receive additional professional skills through on-the-job training or specialized training events.

Selection Criteria and Value

It is commonly believed that medical personnel who have successfully completed an early career assignment in a Special Operations unit are more likely to be successful in other Special Operations medical staff officer positions. This observation led to the development of the S1 skill identifier, Army Medical Department Special Operations Officer (Exhibit 17-2).

The S1 skill identifier does not outline a particular set of skills or competence; rather, it recognizes that certain experiences and personality traits are better suited to support Special Operations and Civil Affairs units during rapidly evolving missions in irregular warfare. Special Operations and Civil Affairs veterinary personnel have been described as practical, reliable, self-sufficient, and slightly peculiar. These traits may serve as predictors of a successful assignment, but, ultimately, selection for more senior assignments in Special Operations and Civil Affairs is judged by a veterinary officer's ability to fit in with the operators they support.

In addition to soft skills and personality traits, Veterinary Corps personnel assigned to Special Operations and Civil Affairs require expertise and competency in canine operational medicine and global veterinary medicine. These skills and competencies are not part of the veterinary professional education system or the general Veterinary Corps officer education and training life cycle. Therefore, Veterinary Corps officers who are assigned to support irregular warfare operations must acquire additional skills and competencies through on-the-job training or specialized military courses in these fields.

Canine Operational Medicine

Canine operational medicine refers to the team approach to military working dog health and performance throughout the deployment cycle, leveraging principles of veterinary preventive medicine, veterinary occupational health, veterinary operational planning, and case management of canine casualties from point of injury to return to duty.

The American College of Occupational and Environmental Medicine states that occupational and environmental medicine physicians enhance the health

EXHIBIT 17-2.

S1 SKILL IDENTIFIER: ARMY MEDICAL DEPARTMENT SPECIAL OPERATIONS OFFICER

The S1 skill identifier was established to identify personnel who have one of the following qualifications:

1. Served 12 months in an active duty capacity in any Army Medical Department (AMEDD) area of concentration with a Special Operations Forces (SOF)-designated unit.
2. Participated in an SOF-designated unit deployment or mission for 4 consecutive months.
3. Qualified in Special Forces, Civil Affairs, or psychological operations through formal schooling.
4. For US Army Reserve AMEDD officers, completed a cumulative 24 months of assignment in an SOF-designated unit.

Reproduced from *Fiscal year 2011 officer military occupational classification and structure (MOCS) personnel reclassification actions*, MILPER Message Number 10-123. Published May 3, 2010.

of workers through preventive medicine, clinical care, disability management, research, and education.[52] These same competencies are essential parts of an integrated health support package that maintains health and readiness and extends the range of multipurpose canines. In order to provide realistic and accurate guidance on management of ill or injured canines to Special Operations units, veterinary personnel must have a comprehensive understanding of the working requirements, environmental hazards, capabilities, and limitations of the tactical canine team. In addition to a solid foundation of veterinary medical skills, Special Operations veterinarians apply operational medicine principles, including combat medicine, battlefield care, and medical evacuation, to the canine populations they support.

Maintaining operational readiness of multipurpose canines requires effective case management and a broad understanding of relevant veterinary specialties and available resources to decrease return to duty time and training distractions. An understanding of the operational environment and the physiologic limits of multipurpose canines are also essential. Tactical canine programs are unique, and the normal limits of multipurpose canines sometimes extend beyond the ranges acceptable in companion animal medicine.

The tolerance of individual multipurpose canines to environmental extremes can vary, however, and the operational environment offers additional clinical challenges. Veterinary personnel must therefore understand not only qualities of the working dog population, but also an individual canine's response to desert, tropical, maritime, mountain, and airborne operational environments. As noted earlier in this chapter, the effects of high altitude, cold weather, extreme heat, and salt water exposure have the ability to affect—either limit or possibly enhance—the operational effectiveness of tactical canine teams.[15,19,53] Other unique aspects of canine care include toxicity of ingested explosive materials that military working dogs are trained to detect, the effect of environmental noise and vibration from rotary or fixed-winged transport, and acoustic problems associated with blast overpressure. The delayed access to veterinary care for ballistic injuries in the combat environment is also a unique treatment challenge for military working dog populations.[14]

Human occupational hazards receive extensive research in military medicine; however, this is not the case in military veterinary medicine. Depsite the lack of evidence, a Special Operations veterinarian is required to advise tactical canine program personnel on prevention and management of occupational hazards inherent—or perceived—in extreme operating environments. Therefore, Special Operations veterinarians must stay current in medical literature and have the flexibility to merge evidence-based medicine with empirical practices rapidly adapted from lessons learned on the battlefield.

The Veterinary Support to Tactical Canine Programs course is an initiative in the Special Operations veterinary community to aggregate and deliver canine operational medicine competencies in a scenario-based training environment. Graduates of the program course are able to perform the following tasks:

- conduct a train-the-trainer course in canine tactical combat casualty care;
- develop low-cost and realistic training aids out of commonly available materials;
- conduct realistic scenario-based training for canine handlers and human medical personnel;
- manage care of a critically wounded canine casualty from point of injury through return to duty;
- manage a combined mass casualty event with multiple human and canine casualties;
- conduct a site survey and develop a comprehensive veterinary support plan for a canine training event;
- understand the occupational hazards of military working dogs and utilize evidence-based practice to recommend prevention and treatment guidelines;
- communicate risk to canine handlers, program leadership, and other veterinary personnel; and
- develop a culmination training exercise for veterinarians, canine handlers, and human medical providers, pulling together all the principles of canine operational medicine

(personal knowledge, Colonel Janice Baker, chapter author, Course Developer and Director of the Veterinary Support to Tactical Canine Programs Course, 2011–2017).

The competencies gained in the Veterinary Support to Tactical Canine Programs course, along with on-the-job training and mentoring from senior special operations veterinarians, are essential to providing comprehensive care packages and performance enhancement for multipurpose canines in the irregular warfare environment.

Global Veterinary Medicine

As previously discussed, in population-centric irregular warfare, animal health systems serve as targets for capacity-building activities and engagements

intended to impact economic, food, and health security. Veterinary Corps officers have animal health and public health expertise relevant to global animal health, but additional expertise is required to operationalize these skills to impact security and stability objectives in the irregular warfare environment.

The American Veterinary Medical Association Council on Education has established competencies for veterinary professionals to practice in the United States. Army Veterinary Corps personnel who are trained in the United States have validated clinical skills that enable them to apply for state licensure and practice clinical medicine.[54] Although some are relevant in the global animal health environment, these clinical skills are primarily focused on the delivery of veterinary care to sick animals. To plan activities and engagements that build global animal health capacity, a broader understanding of global animal health systems is required.

The World Organization for Animal Health has identified competencies for international veterinary graduates required for a global network of national veterinary service systems.[55] These globally focused competencies include clinical competence as well as preventive medicine, public health, and regulatory competence. The World Organization for Animal Health developed these competencies to ensure graduates of international veterinary training programs can function in the global animal health environment; however, these competencies do not completely prepare a Veterinary Corps officer to plan and deliver capacity-building activities in cooperation with the partner nation to enhance components of the national veterinary service system.

Conducting animal health activities and engagements in support of stability operations and other operations in the irregular warfare environment requires Veterinary Corps officers to identify partner nation counterparts and the systems in which they operate, evaluate those systems, and design and implement activities with intended outputs and outcomes that support military goals and objectives. Acknowledging gaps in the veterinary professional and military education systems, the Army Veterinary Service, in collaboration with the University of Georgia, developed two 40-hour courses to supplement the Veterinary Corps officer training and education life cycle.

First in the series is the Veterinary Support to Stability Operations Assessment and Production Systems course. This course focuses on expanding students' understanding of international animal production systems and assessment methodologies. A graduate of the course is expected to be able to master the following objectives:

- explain the importance of smallholder animal health in basic agricultural production and marketing systems for poultry, small ruminants, and large ruminants in developing nations;
- utilize participatory assessment methodologies in a simulated environment to describe and differentiate "reality," "perceived reality," and "observed reality," as well as conducting a site survey to identify potential problems;
- apply basic field epidemiology study designs and appropriate statistical tests, and explain how they can be used contextually;
- summarize the legalities and limitations of working with foreign governments, other US federal agencies, and nongovernmental organizations in stability operations;
- explain assessment findings to host nation government officials, host nation village community members, and military audiences using appropriate formats for different audiences;
- develop and communicate civil information within current operating systems used by the US government, the DoD, and nongovernmental organizations; and
- convey national security relevance of veterinary support to stability operations activities to global interagency partners

(personal knowledge, Lieutenant Colonel Paul Hollier, chapter author, Course Developer and Director of the Veterinary Support to Stability Operations Courses, 2009–2013).

Second in the series is the Veterinary Support to Stability Operations Global Veterinary Medicine course. This course focuses on expanding students' understanding of the global animal health environment and project planning methodologies. A graduate of the course will master these objectives:

- describe how globalization has provided economic opportunities for agriculture in developing nations and how animal health is key to this success;
- articulate the difference between active and passive surveillance and how these systems are used and explain the application of surveillance in national and international public health, as well as its role in agricultural trade policy;
- demonstrate an understanding of how political history, national cultures, and educational systems differ from country to country and can impact efforts;

- develop a concept of operation using the program action logic model and demonstrate how this tool can be used to identify and plan projects and programs that will synergize with existing national, intergovernmental, and nongovernmental organization efforts;
- conduct training in field necropsy, sample collection, and basic laboratory testing for effective diagnostics in resource-poor settings; and
- explain pertinent clinicopathologic and diagnostic features of selected transboundary diseases

(personal knowledge, Lieutenant Colonel Paul Hollier, chapter author, Course Developer and Director of the Veterinary Support to Stability Operations Courses, 2009–2013).

Completing the course series provides the Veterinary Corps officer a basic level of competence to operate in and design and implement capacity-building activities in the global animal health environment. Some Veterinary Corps officers also take advantage of the veterinary preventive medicine track of the Army Medical Department's Long-Term Health and Education Training program to develop more specialized competence in global veterinary medicine. These skills are important to Veterinary Corps officers operating in the irregular warfare environment, as well as to the future of the veterinary profession in a globalized world.

SUMMARY

The DoD's 2012 publication *Sustaining US Global Leadership: Priorities for 21st Century Defense*[56] outlines a transition period for the US military as it withdraws from over a decade of sustained operation in Afghanistan and Iraq. Its guidance deemphasizes large stability operations as they were conducted in Iraq and Afghanistan; however, the competencies developed in these conflicts in risk communication, canine operational medicine, and global veterinary medicine have enduring relevance, even if military strategies shift away from nation-building in certain theaters. The Army Veterinary Service will continue to operationalize professional skills, abilities, and competencies to protect animal health and promote public health in a way that meets the objectives of military commanders. Veterinary expertise is in short supply globally, and the DoD can leverage a pool of highly trained experts to meet national security goals and objectives.

The US Army Veterinary Corps continues to expand its relevance in the DoD by leveraging skills and expanding capabilities that are unique to the veterinary community.[6] The DoD is encountering increased global challenges with emerging diseases, food supply shortages, bioterrorism, natural disasters, land transition, famine, and poverty. To meet these challenges, The Army Veterinary Service is adapting its functional capability to support the irregular warrior and operations in the irregular warfare environment. The Army Veterinary Service is also faced with the opportunity to lead cross-disciplinary efforts to build sustainable animal health and public health capacity in support of US, partner nation, and coalition forces security strategies.

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