Mountain and Cold Weather Warfighting: Critical Capability for the 21st Century

A Monograph

by

Lt Col Scott W. Pierce

USMC

School of Advanced Military Studies

United States Army Command and General Staff College

Fort Leavenworth, Kansas

AY 2008

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE (DD-MM-YYYY)	**2. REPORT TYPE**	**3. DATES COVERED** *(From - To)*
22-05-2008	SAMS Monograph	Sep 2007 – May 2008

4. TITLE AND SUBTITLE
Mountain and Cold Weather Warfighting: Critical Capability for the 21st Century.

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Lt Col Scott Pierce

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
School of Advanced Military Studies (SAMS)
250 Gibbon Avenue
Fort Leavenworth, KS 66027-2134

8. PERFORMING ORG REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Command and General Staff College
100 Stimson
Ft. Leavenworth, KS 66027

10. SPONSOR/MONITOR'S ACRONYM(S)
CGSC, SAMS

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for Public Release; Distribution is Unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
See Attached

15. SUBJECT TERMS
Special Operations Forces, SOF, Department of Homeland Security, DHS, USNORTHCOM, domestic terrorism, crisis management, consequence management, law enforcement, interagency

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
					Stefan J. Banach COL, U.S. Army
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			**19b. PHONE NUMBER** *(include area code)*
(U)	(U)	(U)	(U)	73	913-758-3300

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

SCHOOL OF ADVANCED MILITARY STUDIES

MONOGRAPH APPROVAL

LTC Scott Wayne Pierce

Title of Monograph: Mountain and Cold Weather Warfighting: Critical Capability for the 21st Century

This monograph was defended by the degree candidate on 11 May 2008 and approved by the monograph director and readers named below.

Approved by:

_____ Monograph Director
Lester W. Grau, LTC, (Ret).

_____ Monograph Reader
Thomas A. Bruscino, Jr., Ph.D.

_____ Monograph Reader
Michael J. Swanson, COL, AV

_____ Monograph Reader
Jacob W. Kipp, PhD.

_____ Director,
Stefan J. Banach, COL, IN School of Advanced Military Studies

_____ Director,
Robert F. Baumann, Ph.D. Graduate Degree Programs

ACKNOWLEDGMENTS

This monograph would not have been possible without the patience and mentorship of Lieutenant Colonel (Ret.) Lester Grau, of the Foreign Military Studies Office. Les graciously provided his precious time, wise guidance, and sage advice. His extensive and detailed understanding of mountain warfare, the former Soviet Union and Afghanistan, and his knowledge of research techniques and resources informed this project and kept it on track. His enthusiasm and dedication to the subject continue to inspire.

Dr. Thomas Bruscino, of the School of Advanced Military Studies, also had an important impact on this paper. His insightful commentary and rigorous approach to history were indispensable.

The voices and ideas of a generation of Marine and Navy instructors at the Marine Corps Mountain Warfare Training Center are everywhere throughout this paper. Their labors and sacrifices are deeply appreciated and bear more fruit than they realize.

Most importantly, I would like to thank my wife Tina and our children Elisa, Thomas, Jackson and Isabel. I owe them everything for their cheerful patience and support.

Finally, I would like to acknowledge that, while this paper bears the stamp of many minds, the mistakes and omissions are solely my responsibility.

Abstract

MOUNTAIN AND COLD WEATHER: CRITICAL CAPABILITY FOR THE 21ST CENTURY by Lieutenant Colonel Scott W. Pierce, USMC, 71 pages.

This monograph posits that military operations in high mountains or intense cold require forces with specialized organization, training and equipment. The author compares characteristics of military operations in mountains and cold weather, and defines the mountain/cold weather (MCW) environment. The author describes the effect of the MCW environment on each of the six warfighting functions. To illustrate the effects of the MCW environment on military operations, the author briefly reviews the cold weather Suomussalmi campaign, during the Soviet-Finnish Winter War, and the high mountain Kargil campaign, in the disputed state of Jammu and Kashmir, one of many bloody confrontations between India and Pakistan. The author summarizes and briefly describes those regions that hold both strategic importance for the United States and that are characterized by high mountains or cold climates. These regions are: Central and South Asia, the Caucasus, Iran, the Andes, and the Arctic. The author then catalogs current U.S. military MCW warfighting (MCWW) capabilities, concluding that the capacity currently resident within the U.S. Armed Forces is insufficient. Recognizing that the development of a dedicated specialized force is an inefficient and unrealistic goal for the U.S. military, the author recommends a “hedging strategy” to provide a minimally acceptable “off-the-shelf” capability to support U.S. regional combatant commanders. This hedging strategy includes the designation of a Department of Defense executive agent, a high level programs office to direct and coordinate doctrine, training and procurement, and the establishment of modern training centers. Finally, the author advocates organizing, training and equipping specialized units, designed to provide supported general purpose forces with MCW-specific expertise and equipment.

TABLE OF CONTENTS

Introduction

Mountain and cold weather (MCW) conditions present critical challenges to military operations, especially to ground combat and supporting aviation, fires and logistics.[1] Operational employment of troops who lack adequate doctrine, training or equipment for unforgiving mountain/cold weather warfighting (MCWW) is militarily ineffective and grossly inefficient in terms of the lives and materiel resources expended. The generation of a comprehensive, relevant and effective MCWW capability requires significant time, expertise, and resources. The United States has the expertise and resources, but if it waits until the need arises, it will not have the time.

Mountain and cold weather warfighting is a capability that the United States neglects at its peril.

As the world's leading military and economic power, the United States is faced with developing and implementing a comprehensive national military strategy that emphasizes global order, collective security, and extensive military-to-military engagement. The United States must deter, and if necessary, fight and defeat a large array of potential adversaries. American global responsibilities and commitments require the United States to generate and sustain military power across a broad spectrum of conflict under a wide variety of environmental conditions. As the ultimate arbiter of global security, the United States cannot always depend on the luxury of choosing where and when it will fight.

Former Chairman of the Joint Chiefs of Staff General Colin Powell, referring to the changes in underlying assumptions that accompanied the demise of the Soviet Union

---

[1] The U.S. Armed Forces do not promulgate at the individual service or joint levels any "approved" or standardized terminology or definition for mountain or cold weather warfare. Although the term "mountain warfare" is in common use, neither "mountain warfare" nor any similar term is defined in doctrine. Therefore, for the sake of brevity, this paper will use the terms "mountain/cold weather" (MCW) and "mountain/cold weather warfare" (MCWW).

and the logical shift from a bipolar balance of power to a world system dominated by the United States, observed, "You've got to step aside from the context we've been using for the past forty years, that you base [military planning] against a specific threat….We no longer have the luxury of a threat to plan for. What we plan for is that we're a superpower. We are the major player on the world stage with responsibilities around the world, with interests around the world."[2]

Recognizing this change, the 2001 Quadrennial Defense Review (QDR) directed that the armed forces shift from force structure planning and procurement based on threats to one based on capabilities.[3] During the Cold War, the United States tailored its armed forces to counter threat capabilities, primarily those of the Soviet Union. Now military force planning and programs emphasize the development of powerful and flexible capabilities to meet an extensive range of contingencies.

The 2004 version of the *National Military Strategy of the United States* declares: "the United States will conduct operations in widely diverse locations – from densely populated urban areas located in littoral regions to remote, inhospitable and austere

---

[2] "Strategy for Solo Superpower—'Pentagon Looks to Regional Contingencies,'" *Washington Post*, May 19, 1991.

[3] The Department of Defense Dictionary defines "military capability" as "the ability to achieve a specified wartime objective [for example, to] (win a war or battle, destroy a target set)." The DOD specifies four major components: force structure, modernization, readiness, and sustainability. Force structure is defined as "numbers, size, and composition of the units that comprise U.S. defense forces; e.g., divisions, ships, air wings." Modernization is the "technical sophistication of forces, units, weapon systems, and equipments." Unit readiness is said to be "the ability to provide capabilities required by the combatant commanders to execute their assigned missions. This is derived from the ability of each unit to deliver the outputs for which it was designed." And finally, sustainability is "the ability to maintain the necessary level and duration of operational activity to achieve military objectives. Sustainability is a function of providing for and maintaining those levels of ready forces, materiel, and consumables necessary to support military effort." The Joint Staff, JP 1-02, *DOD Dictionary of Military and Associated Terms*, 2001 (As amended through 04 March 2008), (Washington, D.C.: Superintendent of Documents, 2008).

locations"[4] and the 2001 Quadrennial Defense Review directs that the armed forces be able to attack "critical mobile and fixed targets at various ranges and in all weather and terrains."[5] Presumably, this includes weather and terrain combinations featuring low temperatures, high altitudes, deep snow, steep slopes, dramatic relief and complex compartmented terrain—the realm of MCWW. The bottom-line is that the United States military requires the ability to operate effectively in mountains and cold weather.

The potential MCW operating environment extends globally. Large portions of the earth's landmass are sufficiently mountainous to significantly affect military operations, and even larger portions present seasonal challenges to operations through cold temperatures, snow accumulation and stormy weather. Conflicts increasingly occur in a MCW environment. According to Michel Savini, Assistant Director-General of the United Nations Food and Agriculture Organization, "conflicts can erupt anywhere, but it is an alarming fact that in the last fifty years conflicts in mountain regions have greatly increased. Violent conflicts are now almost twice as likely to occur at high altitude."[6] Significant mountain and cold weather terrain physically dominates geopolitical hotspots, such as the Andes, Balkans and Caucasus regions, as well as Iran, Afghanistan, Kashmir and North Korea.

Many American allies and security cooperation partners in South America, Europe, the Caucasus region, South and Central Asia as well as Japan train and operate in cold weather and high mountain terrain. Geographic combatant commanders and joint

---

[4] The Chairman of the Joint Chiefs of Staff, *National Military Strategy of the United States: A Strategy for Today, a Vision for Tomorrow* (Washington, D.C.: Superintendent of Documents, 2006), 7.

[5] The Secretary of Defense, *Quadrennial Defense Review Report* (Washington, D.C., 2001), 30.

[6] Kruse, Maria, "Working for Peace in the Mountains: International Mountain Day 2004," Food and Agriculture Organization of the United Nations, 2004. http://www.fao.org/newsroom/en/news/2004/51883/index.html (accessed April 23, 2008).

force commanders require forces that can credibly train and exercise alongside these partners in support of theater security and cooperation requirements.

Several of America's potential adversaries also possess a robust MCWW capability. Great powers Russia, China and India, all have specialized mountain units and recent experience in mountain warfare. Unbiased assessment of U.S. national security requirements indicates a need for a MCWW capability. American interventions in the Russian Civil War, the Korean War and operations in Afghanistan demonstrate that whether they are ready or not, U.S. forces can find themselves fighting a MCW war. The ability to deploy, maneuver, support and sustain effective military forces in a mountainous, cold weather environment is a relevant, and perhaps even critical, competency for the United States.

Two Sides of the Same Coin

This paper addresses military operations in both mountain and cold weather environments. While one could argue that these should be mutually exclusive subjects, there is a tremendous amount of overlap between the two. The mountain and cold weather environments share many characteristics, and their effects on military operations and forces are similar. The harsh weather, limited infrastructure and poorly-developed transportation networks that are commonly found in both mountainous areas and regions with brutal winters affect military activities and human performance in similar ways.

Although mountains have a distinctive set of characteristics that affect military operations, such as steeply-angled slopes, deep and complex compartmentation and high elevations, for much of the year they possess the characteristics of a cold weather environment as well. In mountains, winter conditions begin earlier in the fall and prevail

longer in the spring, regardless of latitude.[7] In high mountains, winter weather conditions are prevalent throughout the year. Thus, high winds, snowfall and cold temperatures are usually common characteristics of both environments.

Mountain and cold weather tend to limit the development of infrastructure and road networks. Mountain terrain contains less arable and habitable land than its flatland equivalent, which in turn, tends to limit population density. Fewer people and less agricultural activity means less infrastructure and fewer roads. The planet's high, cold places tend to be empty and austere, and military operations in these regions tend to favor forces that can thrive under such conditions.

The overlap in physical characteristics of mountain and cold weather environments lead to an overlap in the capabilities required of military forces that are able to operate optimally in these regions. Examples of nearly equivalent skill sets common to both environments are: operating with limited air support due to a combination of the effects of altitude and extended periods of high winds and limited visibility; the proper employment of appropriate specialized cold weather equipment, cross-country movement over terrain that severely inhibits mobility; performance of logistical functions such as maintenance, casualty handling, and re-supply in an austere environment; and functioning under conditions of relatively limited command and control.

---

[7] This phenomenon is described by the process known as "environmental lapse rate, or the rate of decrease of air temperature as elevation increases. It is expressed as the negative of the observed change of temperature with altitude of a stationary atmosphere parcel at a specific time and specific location. Environmental lapse rate varies by time, and the inverse relationship between increasing altitude and decreasing temperature can be reversed a phenomena such as atmospheric temperature inversions. The International Civil Aviation Organization (ICAO) defines an international standard atmosphere (a model atmosphere with absolutely no moisture) with a temperature lapse rate of 3.56 °F per 1000 feet (6.49 °C per 1000 meters. See Todd S. Glickman, *Glossary of Meteorology*, 2nd ed. (Boston: American Meteorological Society, 2000), and International Civil Aviation Organization, *Manual of the ICAO Standard Atmosphere extended to 80 Kilometres (262,500 feet)*, 3d ed. (Montreal: ICAO, 1993).

Historically, military forces specially trained for a mountain environment have been the instrument of choice for Arctic and cold weather environments.[8] In particular, World War II, with its major military operations in remote corners of the planet, provided numerous examples of the interchangeability of mountain warfare and cold weather warfare skill sets. Both Axis and Allied mountain soldiers fought skillfully in cold weather environments. German mountain light infantry divisions found themselves in such disparate places as the Caucasus of the southern Soviet Union and northern Norway, Finland and Arctic Russia. The American First Special Service Force (FSSF) and 10th Mountain Division were initially trained and equipped to support potential combat operations in Norway. Although the FSSF fought first in the Aleutian campaign, it eventually found itself, like the 10th Mountain Division, spearheading difficult mountain offensives in the rugged Appenines of Italy.[9]

In the 1982 Falklands conflict between the United Kingdom and Argentina, the Royal Marines, trained for both mountain and cold weather warfare, proved adept at operating in the cold and wet of the Falklands. Royal Marines had long participated in annual winter exercises in Norway. Their doctrine and training emphasized leadership, physical fitness, small unit operations and logistical austerity. The Royal Marines fought effectively, with minimal casualties, for weeks under conditions that included living entirely in the open in the debilitating cold, wet windy climate, very limited organic and non-organic fire support, and a very long and constricted supply line. The Royal Marines

---

[8] In American usage, the term "elevation"(also known as "geometric height") refers to the vertical difference between a geographic location and a fixed reference point, most commonly "mean sea level" (MSL). In contrast the term "altitude" (also known as "geopotential height") refers to points above the Earth's surface, such as the height at which a particular aircraft flies. See *The Oxford English Dictionary*, 2d ed. Vol. I (A-bazouki) and Vol. V (dvandva-follis), (Oxford: Clarendon Press, 1989). See also *DoD Dictionary of Military and Associated Terms*.

[9] Scott R. McMichael, *A Historical Perspective on Light Infantry* (Fort Leavenworth, KS: Combat Studies Institute, 1987), 169-217.

confirmed the broad utility of MCW-trained forces in arduous environmental conditions that were sometimes mountain, sometimes cold weather, and always challenging.[10]

Military decision makers have long recognized that there are more similarities than differences between military operations in mountains and cold weather environments. Although forces specialized for both mountains and cold weather are optimized for neither, such MCW forces do provide a provide range of enhanced capabilities for military operations in either environment. Therefore, for reasons of history, logic and economy, this paper addresses mountain warfare and cold weather warfare as two sides of the same coin.

Mountain/Cold Weather Warfare, Defined

Critical decisions regarding the organization, training and equipment of forces depend on an accurate and comprehensive definition of the MCW environment. Although references to "mountain warfare," "mountain operations," "cold weather warfare" and "winter warfare" are common throughout the popular and specialized military and historical literature of warfare, no definition exists within U.S. military doctrine. The *DOD Dictionary of Military and Associated Terms* contains no reference to any of these terms, and the current Army manual *Mountain Operations* does not define its own title.[11]

In U.S. Army doctrine, mountains are commonly classified as low or high, depending on their local relief and, to some extent, elevation.[12] According to the Army's mountain field manual, *Mountain Operations*,[13] low mountains have a local relief of 300 to 900 meters (1,000 to 3,000 feet) with summits usually below the timberline, while high

---

[10] Nick Vaux, *Take that Hill!* (Washington, D.C.: Brassey's (US), 1986), 167.

[11] U. S. Army. FM 3-97.6, *Mountain Operations* (Washington, D.C.: Headquarters, Department of the Army, 2000), 1-10.

[12] Ibid.

[13] Ibid.

mountains have a local relief usually exceeding 900 meters (3,000 feet) and are characterized by barren alpine zones above the timberline. Glaciers and perennial snow cover are common in high mountains and usually present more obstacles and hazards to movement than do low mountains.

The Army's definition is problematic in its application. *Mountain Operations* states "for military purposes, they [mountains] may be [also] classified according to operational terrain levels and dismounted mobility and skill requirements." The manual further states "soil composition, surface configuration, elevation, latitude, and climatic patterns determine the specific characteristics of each major mountain range," and that military commanders "must carefully analyze" their potential area of operations by considering its specific characteristics. Unfortunately, this formulation leaves open the question of how to define a "mountain environment."[14]

The United States Geological Survey (USGS) has officially given up trying to define precisely what a mountain is. According to the USGS website, "the British Ordnance Survey once defined a mountain as having 1,000 feet of elevation and [anything] less was a hill, but the distinction was abandoned sometime in the 1920's….The U.S. Board on Geographic Names once stated that the difference between a hill and a mountain in the U.S. was 1,000 feet of local relief, but even this was abandoned in the early 1970's. Broad agreement on such questions is essentially impossible, which is why there are no official feature classification standards."[15]

Precisely defining the elevation above which military operations should be defined as military "mountain" operations is problematic. For instance, the earth contains

---

[14] Ibid., 1-11.

[15] United States Geological Survey, "USGS Frequently Asked Questions." http://www.usgs.gov/faq/list_faq_by_category/get_answer.asp?id=787 (accessed December 11, 2007).

places that are quite high, but not mountainous. The Andean *altiplano* averages 12,000 feet/3650 meters in elevation, and the Tibetan plateau is even higher, with an average elevation of 14,700 feet/4500 meters.[16] Although these places are not necessarily mountainous, to deploy directly to such altitudes from significantly lower elevations without acclimatizing could result in a unit casualty rate exceeding fifty percent, with a large loss of initial efficiency even in those soldiers who were not technically casualties.[17] According to Army medical researcher Allen Hamilton, "high altitude" begins at that elevation where "increasing altitude will produce progressively greater decrements in physiological function with increased health hazard. [18] Hamilton identifies this elevation as 8000 feet/2400 meters.[19] Although 8000 feet is not particularly high, humans residing at low elevations who ascend to this height will require significant time to acclimatize before they regain normal cardiovascular function.

The United States military has two standards—one Army, one Marine—for defining ground combat operations and training "cold weather." The Army system reflects its Alaskan experience, and identifies three categories of cold weather according to temperature: "basic cold" (-5 °F to -25 °F)/(-21 °C to -32 °C); "cold" (-35 °F to -50 °F)/(-37 °C to -46 °C); and "severe cold" (-60 °F and colder)/(-46 °C). Presumably, the gaps between the categories are transitional zones. The Marine Corps identifies four categories of cold weather: "wet cold" (40 °F to 20 °F/-4 °C to -6.5 °C); "dry cold" (20

---

[16] *Encyclopedia Brittanica Online*, s.v. "Altiplano," http://www.britannica.com/EBchecked/topic/17727/Altiplano (accessed May 18, 2008); and University of California, Santa Cruz, "Tibetan Plateau Research Suggest Uplifts Occurred in Stages," *Science Daily*, (March 26, 2008): 19; http://www.sciencedaily.com/releases/2008/03/080324173542.htm accessed May 18, 2008).

[17] Allen Hamilton, "Biomedical Aspects of Military Operations at High Altitude, Report No. USARIEM-M-30/88," U. S. Army Research Institute of Environmental Medicine, Natick, 1988, 9.

[18] Ibid.

[19] Ibid., 12.

°F to -5 °F/-7 °C to -21 °C); “intense cold” (-5 °F to -25 °F/-21 °C to -32 °C); and “extreme cold” (below -25 °F/32 °C) The Marine Corps adopted this system as an outcome of a conference with Norwegian military authorities in the early 1980s, and it adheres closely to Norwegian military classifications.[20]

Temperatures between 40 °F (-4 °C) and -5 °F (-21 °C), while they can be uncomfortable and even dangerous given certain conditions, are a normal part of a temperate climate and basically-trained troops have historically been able to manage the challenges associated with these temperatures. But intense cold, that is temperatures lower than -5 °F (-21 °C), will quickly cause significant casualties if it is not mitigated by a combination of experience, training and equipment. Forces that conduct military operations during periods of very low temperatures require specialized training and equipment to enable them to do so effectively.

A Working Definition

An accurate and comprehensive military definition of the MCW environment should take into account the principal natural environmental factors that affect military operations. Environmental factors specific to the MCW environment are elevation above mean sea level (MSL), local elevation differential, slope angle, compartmentation, temperature, and snow depth.

The purpose of defining a separate domain of “mountain/cold weather warfare” is to provide as basis support identification of specific attributes (whether in terms of training, equipment, and so forth) that are required for a military force to effectively operate in such an environment. A useful definition of the MCW environment should be discriminating. It must clearly delineate the difference between a MCW environment and

[20] Joseph A. Crookston, “Marine Corps Roles and Missions: A Case for Specialization,” Student research paper, Marine Corps Command and Staff College, 1987, 14.

other environments; it should not be too inclusive. A definition that is very broad loses its utility.

Therefore, this paper recommends a military definition of the term "mountain/cold weather environment" as an environment characterized by one or more of the following attributes:

(1) persistent ambient air temperatures below -5° F (-21° C);

(2) persistent mean snow depths of approximately 20 inches (one-half meter);

(3) significant glaciated terrain;

(4) rugged, severely compartmented terrain, combining mean slope angles of 45 degrees with elevation differentials exceeding 1000 feet (300 meters) with peaks exceeding 8000 feet (2430 meters) above sea level.[21]

Defining what the MCW environment is also clarifies what it is not. For instance, temperatures approaching zero degrees Fahrenheit and light snow cover are a normal part of a temperate climate winter, and should be within the normal range of abilities of conventionally trained U.S forces. Hilly, compartmented terrain at moderate elevations, while it presents physical and mental challenges, and imposes difficulties across the warfighting functions, of itself does not pose challenges to ground forces that require significant specialized mountain training and equipment. Many of the world's high plains exceed 8000 feet, but are nonetheless suitable for conventional operations, unless covered in deep snow or beset by dangerously cold temperatures. This definition of the MCW environment, although it requires judgment in its application, is designed to identify only those cold weather conditions, or mountain conditions, or combinations of the two that require specialized training and equipment for forces to effectively engage in ground combat operations.

---

[21] Hamilton, "Biomedical Aspects," 3.

Characteristics of Mountain/Cold Weather Warfare

With minor variations in wording, the U.S. Army and U.S. Marine Corps, and the DoD as a whole recognize six "warfighting functions." They are movement and maneuver, fires, sustainment, intelligence, command and control, and force protection.[22] The warfighting functions describe operational requirements for military forces across the spectrum of conflict, from humanitarian assistance to high intensity conventional warfare, and in any environment, including MCW. With the warfighting functions as a sort of "taxonomic filter," this paper will briefly outline the critical effects the MCW environment has on the ability of an operational force to function

Movement and Maneuver

Clausewitz begins his discussion of friction by saying, "If one has never personally experienced war, one cannot understand in what the difficulties constantly mentioned really consist, nor why a commander should need any brilliance and exceptional ability."[23] The same could be said of movement in a MCW environment, even when the enemy is not present. The difficulties cannot be fully comprehended without personal experience. What appears at first glance to be simple and straightforward is invariably tortuous and complex.

Scarce and poorly-maintained roads, steep slopes, cliffs, forests, alluvial marshes, acres of boulders, many of which are as large as cars or even small houses, all conspire to bring the motion of both dismounted infantrymen and vehicles to a halt. Snow accumulation can exceed tens of feet, and cover thousands of square miles. Terrain that

---

[22] U. S. Marine Corps, MCDP 1-0, *Marine Corps Operations* (Washington, D.C.: Department of the Navy, 2001), A-1.

[23] Carl von Clausewitz, *On War* ed., trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1976), 119.

offers reasonable cross-country mobility to tactical vehicles, when covered with deep snow, becomes impassible even to hard-marching dismounted infantry. Even those roads and bridges that do exist are often inadequate to support the heavy vehicles and higher traffic volume associated with military operations.

The planner's panacea to rough terrain, the helicopter, fares little better than ground vehicles in this environment.[24] Terrain and weather factors often severely limit the ability to transport, support and sustain troops by helicopter. Factors such as high operating altitudes, scarce or unsuitable landing zones, poor visibility, high winds, and the difficulty of protecting friendly aircraft from enemy antiaircraft artillery and man-portable surface-to-air missiles make such operations problematic. Additionally, winter-specific factors such as white-out from snow stirred up by rotor-wash, belly-landing in deep snow, and the difficulties of maintaining aircraft in a cold, austere environment can impose other limitations on helicopter operations.

Traveling on foot through mountains, even in summer conditions, carries with it a host of problems, most of which are beyond the range of normal experience. Consider the experience of Major Roger Crombie, who led his rifle company on a tactical, cross country movement during Operation Anaconda in the foothills of Afghanistan's Hindu Kush mountains: "I think it was a huge gut check when we were told to move up seven kilometers north in that terrain. I thought we had a good physical training program and so it wasn't the physical aspect of it; but a 12-mile foot march just doesn't give you the gut check that moving seven kilometers in extremely rough terrain does, and I don't know how you replicate that. I almost wish we had gone through some kind of crucible event

---

[24] *Mountain Operations*, 2-73.

before that."[25]

A simple movement from "Point A" to "Point B" becomes a trip of epic proportions. Fear, pain, confusion and frustration reign among the uninitiated. Men who are physically strong and normally self-possessed can become unusually emotional, or conversely, withdrawn, uncommunicative and fearful.[26]

Paths through the mountains are few, usually well-known, and are therefore often subject to enemy observation, ambush, mining or targeting for indirect fire, and don't necessarily lead to where the soldier needs go anyway. Traveling cross country off-trail requires bushwhacking through terrain that poses difficulties beyond the imagination of someone who has never had to do so. The summer mountain traveler moving corss-country may, in the course of a single day, push through swampy thickets of willow and brush endemic to canyon bottoms, hack his way through dense mountain alder or scrub oak, navigate through dark, primeval forests, pick his way through acres of huge jumbled boulders clinging to fifty degree slopes, edge along cliffs with drop-offs of hundreds or thousands of feet, cross steep, ice-glazed snow fields or glaciers where a misstep might lead to a slide off a precipice, or into a crevasse or water-filled moat, and surmount multiple ridges requiring thousands vertical feet gain and lost. The difficulties of such a journey increase by orders of magnitude when made at night, in bad weather.

Now add to the Herculean task of individual movement the burden of hauling the normal impedimenta of war: weapons; ammunition ranging from small arms to mines, explosives, mortar rounds, and assault rockets; optical aids like binoculars and night

---

[25] Crombie, Roger, "Interview with Roger Crombie," *Operational Leadership Experiences in the Global War on Terrorism* (Fort Leavenworth, KS: Combat Studies Institute, 2006), 13.

[26] Louis E. Benderet and Barbara Shukitt-Hale, "Cognitive Performance, Mood and Neurological Status at High Terrestrial Elevation," Chap. 23 in *Medical Aspects of Harsh Environments* vol. 2 ed. Kent P. Pandolf and Robert E. Burr, (Washington, D.C.: Department of the Army, 2002) 729, 747.

vision devices; gas masks and chemical protection suits; radios, batteries, and position location systems; helmets and body armor; and medical equipment. To survive and sustain themselves, soldiers must haul rations and water, insulating and protective clothing, sleeping bags and tentage. Multiply the difficulties geometrically when moving not one individual, but a platoon of a few dozen, a company of a hundred or a battalion of a thousand, each struggling to watch his footing, carry his burden, keep up with the man in front. Only now can the real challenge of the battlefield be addressed: locate and defeat the enemy.

Fires

The warfighting function “fires,” which encompasses the gamut of supporting fires types and functions, is similarly affected by the MCW environment. Mobility of artillery, heavy mortars and Multiple Launch Rocket Systems (MLRS), whether towed, self-propelled, airborne or heliborne, is very limited. Firing positions in narrow mountain valleys and canyons are at a premium. In winter, even when relatively flat ground providing adequate space for battery firing positions can be located and cleared of snow, firing tables and software are not designed for high altitudes, high winds and low temperatures. This limitation results in a higher probability of error. Firing is slower, since crews must return their guns to the flat trajectory loading position after each shot, although the guns are often used for high angle fire. Cold artillery or mortar shells detonate with lower order, and shells that impact snow-covered terrain are more likely to be duds, or to have their blast and fragmentation absorbed. Mortar base plates will not seat in rocky or frozen ground, and transportation constraints will limit the number of rounds available for fire support tasks.

Aerial fires, whether delivered from fixed or rotary wing aircraft, are also subject to significant limitations. Attack helicopters are adversely affected by operating altitudes

near or exceeding their design limitation, as well as high winds and poor visibility from rain, snow and fog.[27] Attack helicopters are especially vulnerable to ground fire, since the compartmented, complex terrain found in mountains provides a multitude of sites from which ground troops can employ antiaircraft artillery, surface-to-air missiles, or even rocket propelled grenades and machineguns.

The primary affect of MCW terrain on the ability of fixed wing aircraft to deliver close air support is limited visibility. Although poor weather has the same effect on the ability of fixed wing aircrews to see the battlefield that it does on that of rotary wing aircrews, the ability of high speed fixed wing aircraft to deliver close air support is especially degraded in mountains. The complex compartmentation of mountain terrain, coupled with the ground speed of military jet aircraft, makes it difficult for aircrew to spot targets and friendly troops on the ground, or even to orient themselves to the terrain.[28]

Sustainment

Sustainment, or logistics, defined as the "science of planning and carrying out the movement and maintenance of forces," is absolutely critical to the success of a MCW campaign.[29] Simply stated logistics includes supply, maintenance, transportation, general engineering, health services, and other services, including legal, exchange, food, disbursing, postal, billeting, religious, mortuary, and morale and recreation.[30] Each has

---

[27] See, for instance, Lester W. Grau and Michael A. Gress, *The Soviet-Afghan War; How a Superpower Fought and Lost*, (Lawrence: University Press of Kansas, 2002), 210, and Richard W. Stewart, *The U.S. Army in Afghanista:, Operation ENDURING FREEDOM, October 2001-March 2002*, (Washington, D.C.: Superintendent of Documents, 2004), 38, 41.

[28] *Mountain Operations*, 3-15.

[29] *DOD Dictionary of Military and Associated Terms*.

[30] U.S. Marine Corps, MCDP-4 *Logistics* (Washington, D.C.: The Secretary of the Navy, 1997), 47.

special considerations that must be addressed in detail during the planning process at each level of command, and fully supported well in advance of operations by research and development, acquisitions and contract support.

Time and again, the historical record bears out the dependence of MCWW operations on robust logistics. Reasons for the high degree of importance of logistics are many. The effects of harsh weather and difficult terrain on troops and equipment increase requirements for certain classes and rates of re-supply. The paucity of roads and inherent restrictions on rotary wing lift support present significant problems in sustaining forward forces, and stress engineering and transportation systems.

Marginally sustained ground combat units will perform well below potential, and risk catastrophic failure. The destruction of two Soviet divisions in a few weeks during December, 1939 and January, 1940 by a brigade-sized task force of Finnish light infantry reservists, as well as the sharp defeat suffered by Pakistani forces in 1999 in Kashmir by the Indian Army largely can be attributed to sustainment systems that were not properly adapted to the terrain and weather. Recent U. S. operations in the Balkans and Afghanistan highlight the limitations that logistics pose on combat units.

Intelligence

While sustainment tells a commander what he can do, intelligence generally tells the commander what he should do. Because maneuver in an MCW environment is time consuming and because mistakes in disposition are not easily retrieved, information regarding enemy, terrain and weather must be thorough, current, and properly analyzed whenever possible before committing significant forces. Mountain and cold weather warfare areas of operation will often be relatively large, tending to “swallow up” ground forces and organic reconnaissance. Therefore, all forms of reconnaissance and surveillance will be in high demand: ground reconnaissance, human intelligence teams,

signals intelligence, sensors and imagery. Planners should understand that relative to a force committed to a temperate, non-mountain environment, a MCW force requires a higher concentration of intelligence collection capability.

There is little doubt that given even the surveillance technologies available to the U.S. joint force commander in the early 21st century, human intelligence is still at a premium. Whether from military reconnaissance, clandestine operatives or indigenous locals, detailed information regarding the area of operations is all-important. Although ground reconnaissance is especially challenging to conduct, support and sustain in a MCW environment, the fact that reconnaissance units can be tasked and controlled by the commander to answer priority information requirements ensures that conventional and special reconnaissance units, specifically trained for the environment, will be high demand assets during MCW operations.

Command and Control

The function of command and control in a MCW environment presents unique challenges. Directing forces on the MCW battlefield cuts to the heart of leadership, and communications, the critical "voice of command," is particularly difficult, especially given the massive volumes of information on which U. S. forces depend. Any military force which is dedicated to successful MCWW operations must commit itself to solving the problems inherent in command and control.

Perhaps the greatest requirement of conducting operations in a MCW environment is the requirement for experienced, competent, leadership at all levels, from the small unit fire team or its equivalent to the joint force commander and his staff. According to the *MCDP 1-0, Marine Corps Operations*, "command has two vital components, decisionmaking and leadership." To arrive at sound decisions, leaders must have an accurate situational understanding of the effects of the environment on both

friendly and enemy forces, and this situational understanding can only be gained by experience. The admonition that personal experience is necessary to comprehend the environment is even more crucial for the leader than for the led. And the MCW environment makes extraordinary demands on any leader, both personally and professionally. Vigorous, aggressive leadership, tempered and shaped by experiential understanding is nowhere else as critical to success and as difficult to achieve as in MCWW.

The challenge of training leaders for the environment goes beyond theory and familiarization. Most personnel go through four stages of comprehension and adaptation during MCWW training.[31] The first stage is a reinforcement of their natural fears—fear of cold, fear of heights, fear of extraordinary physical demands. The next stage consists of internalizing various techniques, skills and adaptive strategies designed to cope with the environment (as separate from the enemy) as an individual and member of a small team. The third stage is a refinement of individual and small unit skills, as well as a shift in focus from personal survival and mobility to functional combat and specialty techniques and procedures, adapted to the environment. Finally, personnel learn to integrate their military skills with the demands of the environment, and superior units and personnel continue to challenge themselves to achieve increasingly high standards of combat efficiency once they have achieved the minimal, "passing" level of comprehension, adaptation and proficiency. Units and commanders who have reached their training potential in a MCW environment are fully proficient in the requisite skill sets, and have undergone a shift in paradigm. Instead of seeing mountain and cold weather as obstacles to be overcome, they see the environment (which after all, equally

[31] Personal observation of the author, based on his two years as the Officer in Charge of the USMC Mountain Leaders Course (1996-1998) and three years as the Operations Officer of the Marine Corps Mountain Warfare Training Center (2003-2006).

affects the enemy) as an advantage, and therefore are able to leverage the environment to their advantage.

Unfortunately, in the U. S. Armed Forces, most troops receive at most only cursory training—generally focused on avoidance and prevention of cold injuries, or perhaps some form of adventure training such as rappelling or playing on an artificial climbing wall. Even leaders rarely progress past some form of basic "familiarization training." Such familiarization training rarely takes them mentally and emotionally beyond the first stage—that of "fear reinforcement." The leader whose MCW training has been limited to environmental familiarization is overly impressed with the difficulties of surviving and moving in the environment, let alone conducting a full range of combat operations against a thinking, capable enemy. Institutionalized risk aversion, mistaking overprotectiveness for troop welfare, assuming the enemy has similar environmental limitations as ourselves, and a fundamental misunderstanding of the nature of the MCW environment can easily become bound up together, with the result that military leaders come to view mountains as largely impassible terrain, and intense cold as a severe hazard. In this mode of thinking, mountains and cold weather are best avoided, instead of exploited for their effects on the enemy.

Constraints to control on the modern, networked, digitized, wide bandwidth battlefield are also significant. In a mountain environment, terrain compartmentation and dead space limit the flexibility and usefulness of very high frequency (VHF) and ultra high frequency (UHF) radio communications, which depend primarily on line of sight signals. The trend in modern military tactical communications is toward heavy reliance on satellite communications in lieu of long haul and local high frequency (HF). However, the demands for bandwidth on the tactical battlefield can quickly overwhelm the number of satellite channels available. Worse, the potential for interdiction of communications satellites or severe jamming in a high intensity, peer competitor war means that loss of

critical satellite connectivity could catastrophically limit the ability to employ satellite-dependent communications systems. Standard tactical VHF communications are feasible given sufficient retransmission sites. But each site requires operators, radios, batteries, generators, and transportation support, all of which are in short supply. Since retransmission sites are generally located on high ground in order to achieve their greatest effect, they are difficult to conceal and subject to attack by direct and indirect fires or ground assault. Hence, long-term retransmission sites must also be defensive positions, with all that entails. The difficulties multiply during maneuver, because the retransmission sites must displace to support maneuver element communications requirements. Retransmission site displacements require lift, whether by helicopter, vehicle, pack animal, porters, or a combination thereof.[32]

The other major challenge of control is interoperability between branches, services and allied and coalition partners. Doctrine is a fundamental normative instrument of interoperability, and establishes common expectations. Unless all parts of the committed force understand and adhere to a common operating doctrine that has been validated through experience and experimentation, commanders and personnel throughout the force will differ widely in their estimates of what can be accomplished.

Force Protection

According to the *DOD Dictionary of Military and Associated Terms*, force protection is "preservation of the effectiveness and survivability of mission-related military and nonmilitary personnel, equipment, facilities, information, and infrastructure deployed or located within or outside the boundaries of a given operational area."

---

[32] Lester W. Grau and Jason Falivene, "Mountain Combat: Hard to Move, Hard to Shoot, Even Harder to Communicate," *Journal of Slavic Military Studies* 19, no. 3, (September, 2006): 619-625.

Protection, of course, takes on added importance in a MCW environment, since the harshness of conditions will rapidly degrade the capability of troops and their equipment and systems in the absence of a considerable array of active and passive measures taken to counteract its effects.

Cold weather is the most obvious environmental effect requiring protective measures. Intense cold temperatures can be more catastrophic to the unprepared than a severe chemical attack, as demonstrated by the slaughter of thousands of Chinese soldiers by cold temperatures in Korea in fall of 1950.[33] And perhaps even more debilitating than intense cold is the hellish combination of precipitation and temperature that Marine Corps doctrine designates "wet cold." Extended periods of "wet cold" during which personnel, their clothing and tentage, vehicles, footpaths and unimproved roads are repeatedly soaked and frozen by cycles of freezing air temperatures and heavy, wet snow or sleet can rapidly debilitate a military force in the open. A host of cold weather injuries lurk, waiting to ambush the unprepared: chilblains, trench foot, frostbite, and hypothermia can result in the injury, evacuation, and even death of soldiers.[34] Specialized clothing, equipment, and shelters, adjustments to training, tactics, techniques and procedures, and acclimatization of troops are just a few of the measures required for a military force to operate effectively in cold weather. Leadership is always critical in the selection and enforcement of the appropriate protective measures.

High elevations present perhaps the most inhospitable and debilitating environment for land warfare to be found anywhere on earth. In addition to the cold weather and stormy weather commonly found in high mountains, several other

---

[33] For instance, the Chinese 26th Army recorded a casualty rate from frostbite of over 90 percent. Lynn Montross and Nicholas Canzona, *The Chosin Reservoir Campaign*, vol. 3, *U.S. Marine Operations in Korea* (Nashville: The Battery Press, 1956), 354.

[34] Ninety-eight percent of a Royal Marine rifle company was found to be suffering from cold weather injuries at the conclusion of the Falklands conflict. Vaux, *Take that Hill!*, 237.

environmental conditions found at high elevations present protection challenges. Rugged mountain terrain imposes a heavier than usual cardiovascular burden on troops, especially those unaccustomed to such terrain. Cliffs, falling rocks, and uneven ground greatly increase the probability of injury or death. Lightning strikes on troops caught on exposed slopes and ridges are a very real hazard during thunderstorms. Solar radiation, relatively unfiltered by thin, dry, cold air, and often intensified by reflective snow and ice, will strike the unprotected with severe, debilitating sunburn and snow blindness. High mountains will rapidly degrade a force which does not take adequate protective measures.

Atmospheric pressure declines inversely to altitude. As one gains elevation, less oxygen is available for physiological tasks. Between sea level and 8000 feet (2430 meters), atmospheric oxygen decreases 29 percent, and between sea level and 18,000 feet, atmospheric oxygen decreases 52 percent.[35] Above 8000 feet (2430 meters), increasing elevation produces increasingly serious physiological stresses with attendant health risks. Although human physiological adaptation is possible up to altitudes of 18,000 feet (5500 meters), acclimatization requires increasing amounts of time as altitude increases, and above 18,000 feet (5500 meters), long-term physiological adaptation has not been observed.[36] The effects of high altitude and the requirement to acclimatize are significant factors on the mountain battlefield.

Effects of the Environment on Military Operations

Mountains and cold weather have a distinct and significant impact on military operations. The inexperienced generally have one of two initial reactions when faced with campaigning in mountains or cold, wintry weather: they discount the effects of such conditions, or they are overawed. In either case, novices of all ranks make mistakes that

---

[35] Hamilton, “Biomedical Aspects,” 5

[36] Ibid., 3

contain the potential to cost unnecessary casualties, mistakes that may lead to defeat. This paper uses two brief case studies to illustrate the effects of MCW on military operations: the "Winter War," and the "Kargil Conflict." The Winter War highlights the devastation that intense cold has on an untrained force, and the Kargil Conflict underlines the difficulties of high mountain campaigning.

The Winter War, 1939-1940

The non-aggression pact between the Soviets and Germans, signed in 1939, gave the Soviets a free hand in the Baltic states. In the autumn of 1939, following the destruction of Poland by the Soviets and Germans, Stalin forced Estonia, Latvia and Lithuania to acquiesce to demands to become protectorates, and in late October, the Soviet government demanded severe territorial and economic concessions from the Finns.[37] Unlike the Baltic states, the Finns refused to give in to Stalin, and on 30 November, 1939, the Soviets invaded Finland.[38]

The Finns, with only 35,000 regular troops and fewer than 150,000 reservists, and with almost no operational depth from which to defend, held nearly 1.2 million Soviets at bay for four months. The Soviets were superior in just about every measurable way: they boasted overwhelming numbers, and more and better artillery, armor and aviation. The Soviet senior leadership had been decimated by Stalin's purges, but had just concluded successful campaigns against the Japanese on the Manchurian border and against the Poles in cooperation with the Germans. But despite the Soviet superiority, the Finns fought so well that the Soviets settled for much less than their original demands. The Finnish success was due to many factors, but significant among them was the ability

---

[37] Henry A. Kissinger, *Diplomacy* (New York: Simon and Schuster, 1994), 34.

[38] William A. Trotter, *A Frozen Hell: The Russo-Finnish Winter War of 1939-1940* (Chapel Hill: Algonquin Books, 1991), 48.

of Finnish forces to operate for extended periods in deep snow and extreme cold.

The battle of Suomussalmi vividly illustrates the effects of Finnish cold weather proficiency on the hapless Soviet forces. Suomussalmi is the collective name for a series of connected tactical engagements in the vicinity of the municipality of Suomussalmi, in east-central Finland during December 1939 and January, 1940.

It pitted about 55,000 well-equipped Soviets from two divisions--the 163d Rifle and 44th Motorized Rifle--against one-fifth as many Finnish reservists. The Finnish high command, focused on the developing Soviet attempt to seize south-eastern Finland, were surprised by the remote location of the Soviet attack, and fed forces into the battle piecemeal as they became available, eventually forming a division out of three partial light infantry brigades and some smaller separate units. However, the critical portions of the battle were fought by a beleaguered provisional task force containing significantly fewer soldiers. [39]

Suomussalmi is perhaps the classical cold weather battle. During the month-long fight, mean snow depths ranged from about 6.4 inches (16 cm)to 16 inches (40 cm), with waist-deep snow drifts, and approximate average daily temperatures ranged from 23° F/-5° C to 0° F/-17° C with the lowest overnight temperature being about -22° F /-30° C.[40] The outcome of the battle was this: the Finns destroyed both Soviet divisions, thus defeating the Soviet Ninth Army in the process. They killed or captured over half of all the Soviets engaged (approximately 30,000) and captured intact most of the Soviet

---

[39] Ibid., 169.

[40] Ibid., 145. Amateur observers almost always exaggerate temperature extremes. See the excellent website "www.winterwar.com," which contains information from original Finnish records, translated into English by the website's author. For weather data, winterwar.com cites *Suomen meteorologinen vuosikirja 1939, osa 1 ja 2*, (*The Meteorology Yearbook of Finland 1939, vol. 1 and 2*) and *Suomen meteorologinen vuosikirja 1940, osa 1 ja 2*, (*The Meteorology Yearbook of Finland 1940, vol. 1 and 2*), both published by the Finnish Weather Institute in 1953 and 1955, respectively. http://www.winterwar.com/other/weather.htm (accessed May 2, 2008).

equipment, at the cost of fewer than 1000 Finns killed, 1700 wounded, and 600 missing.

The Finns were better in cold weather warfighting due to five factors. First, the Finns were well acclimatized to the conditions. Second and third, the Finns were far more mobile and better supplied, in real terms, than the Soviet opposition. Fourth, Finnish tactics suited their advantages in environmental proficiency, mobility and sustainment. Finally, the Finns fought on their home territory—they knew the terrain and ultimately, were fighting for their homes. The Finnish ability to operate in low temperatures, relative to the Soviets, as well as their relatively high degree of all-terrain mobility via ski and sledge was the primary reason for their success in this series of engagements.

The Finns were backwoodsmen. The Finnish rank-and-file reservist, constituting the majority of the Finnish Army who fought at Suomussalmi, came largely from a rural background. In the Finland of the 1930s, this meant that they lived close to nature, and that they were inured to the environment. As William Trotter states, "When Finns are not brooding about the grimness of nature, they are apt to exult in their mastery of it…Most adults are excellent cross-country skiers. Even the most cosmopolitan city-bred Finn is apt to… [in every season] camp, hike or practice the recondite sport of orienteering out in the forests and fells."[41]

They knew how to take care of themselves in the dark and cold boreal forests of the Finnish winter. The hapless Soviet troops, who hailed mainly from the steppe of Central Asia and the cities, towns and collective farms of the Ukraine, were completely out of their element, and the Soviet training apparatus had not prepared them for such conditions.

The Finns moved well cross-country in the snow and cold. They were proficient skiers. But they also worked out the nuts-and-bolts doctrine of how to sustain tactical

---

[41] Ibid.

forces engaged in forest fighting in the depths of the sub-arctic winter. The Finnish government, though it had been unable to afford sufficient trucks, artillery, aircraft and tanks, had outfitted its army with essential equipment—warm, well-adapted, camouflaged clothing, tents and stoves, and sledges with which to move equipment, weapons and ammunition. Although the Finns entered the Winter War short even of individual equipment, they had developed to a high degree the fundamental link between tactical proficiency and logistical systems.

The Finns employed a technique they called motti tactics. "Motti"refers to a pile of logs "held in place by stakes, destined to be chopped or sawn into convenient lengths of firewood."[42] "Motti" illustrates the approach the Finns took to defeat the Soviets. Because the Soviets were largely tied to the very limited and minimally-maintained road network in central Finland, the Finns, with their superior dismounted mobility, were able to block and fix the lead elements of the Soviet columns, while circling to the rear of the columns and cutting them off from relief. Having staked out their Soviet "motti" the Finns then cut the enemy columns into segments and defeated them in detail, taking advantage of the killing power of the cold and massing at selected times and places to overwhelm the freezing and isolated Soviets. To the Soviets, stunned by the intense cold, the Finns, who lurked unseen in the forests and as often as not announced their presence with the crack of a fatal rifle shot, seemed more like malevolent ghosts than hastily mobilized reservists. The fact that the Finns made a habit of targeting the easily-spotted Soviet field kitchens with rifle and machinegun fire says much about their understanding of the effect of cold on enemy morale and physical well-being. The mobile field kitchens, as the only sources of hot food available to the Soviets, were magnets for the freezing solders. The Finns killed and wounded Soviet soldiers congregated around these mobile

[42] Ibid., 131.

kitchens, and then destroyed the field kitchens, so that the Soviet soldiers were made weaker and thus died in even greater numbers.

The Soviets remained trapped on the roads. Although some Russian skis were captured by the Finns, the Soviets had not trained their troops to ski, so the skis and the ski training manuals remained stacked in the trucks where the Finns found them. The Soviets did attempt to strike out cross country on foot to secure their flanks and push back their Finnish tormentors, but snow drifts and the danger of Finns in the woods, coupled with a Soviet inability to navigate in the gloomy, seemingly featureless forests, caused the Soviets to remain within a few hundred meters of the roads. Their inability or unwillingness to maneuver significant forces off road doomed the Soviet forces to defeat and worse.

The Soviet troops and their leaders were however, remarkably tough and brave. They stubbornly held their positions for weeks without relief after being surrounded, in bitter cold and with dwindling food and ammunition. They were well-equipped for modern warfare, and technologically advanced, compared to the Finns. But their physical and mental toughness and their material superiority proved insufficient to save them from defeat and slaughter. As Finnish professor Tomas Ries states: “The fact that even this was not enough was due to the qualitative factor in war. The Red Army's far greater quantity of men and material, and the vastly more modern technology of their weapons, was more than outweighed by the determination and skill of Finland's defenders, combined with a geography and climate which neutralized the Soviet technological superiority.”[43] At Suomussalmi, a technologically-superior force suffered catastrophic encirclement and destruction. The lessons of Suomussalmi should resonate for the United

---

[43] Tomas Ries, “Lessons of the Winter War,” *Virtual Finland-Your Window on Finland*, (Helsinki: Ministry of Foreign Affairs, 2001). http://virtual.finland.fi/netcomm/news/showarticle.asp?intNWSAID=25949 (accessed April 22, 2008)

States.

In fact, just ten years after the Soviet disaster in the frozen forests of central Finland, the United States Army suffered a major tactical defeat in the cold, barren hills of North Korea, in what the Finns would have described as a motti battle. Elements of the 31st Regimental Combat Team and the 32d Regimental Combat Team, known as Task Force Faith, were surrounded and destroyed by Chinese forces in early December, 1950, in circumstances eerily similar to those at Suomussalmi. The encircled task force, road-bound and burdened with hundreds of wounded, short of ammunition and fuel, numbed by temperatures as low as -25° F, attempted to fight its way out of the pocket, but was instead fixed by road blocks, and destroyed in detail. Individuals and small groups of soldiers exfiltrated the pocket and made their way to friendly Marine positions (also surrounded) a few miles away. Of the approximately 3000 U.S. and South Korean soldiers in the task force, more than 1000 were killed, captured or missing. Of those who were able to escape the pocket, 1500 were immediately evacuated by air with wounds, an overwhelming proportion with severe frostbite. Of the 3000 soldiers in Task Force Faith in late November, only a few hundred stunned, cold and weary men remained to be formed into a provisional battalion for the breakout from the Chosin area in early December.[44] Every vehicle, artillery piece and crew-served mortar and machinegun was captured, destroyed or otherwise lost.[45] The U.S. Army task force engaged was effectively destroyed as a military organization. No nation's army is exempt from the harsh realities imposed by cold weather, mountain terrain and a determined enemy.

---

[44] Roy E. Appleman, *East of Chosin* (College Station, TX: Texas A&M University Press, 1987), 303.

[45] Ibid., 300.

The Kargil Campaign, 1999

The Kargil Campaign is one of the best examples of modern offensive warfare at high elevations. It illustrates the effects of high mountain fighting on troops and equipment, and highlights a number of lessons learned.

Beginning in late February, 1999, Pakistan infiltrated several brigades of a specially-trained and recruited mountain force, the Northern Light Infantry (NLI), reinforced by Islamist guerrillas and Pashtun mercenaries about three miles (5000 meters) across the Kashmiri Line of Control (LOC). They occupied an 85-mile (140 kilometer) swath of Indian territory along a series of mountain ridges that ranged from 13,100 feet (4000 meters) to 16,400-feet (5000 meters)—some of which overlooks the Indian main supply route, Highway 1A. The Srinigar-Leh Highway, as Highway 1A is often called, is critical to the Indian Army, since it is the sole ground resupply route for forces engaged in the twenty-four year struggle with the Pakistani Army across Siachen Glacier.[46]

During the summer months, the complex and massive system of ridges was normally occupied by Indian troops, but their habit was to wait for the winter snow pack to diminish before they took up their usual outposts. The NLI beat them to the punch, and occupied 580 square miles (1500 square kilometers) of what had been Indian-controlled territory. The Pakistanis infiltrated in small, platoon-sized groups of about thirty, purposefully avoiding the most trafficable terrain. They approached largely on foot, using porters and pack animals to move their heavier equipment, but they also used their French-built Puma and Lama helicopters, masked by terrain, to insert personnel and equipment at higher altitudes. The Pakistanis also managed to bring a number of disassembled 105 mm field guns to firing positions blasted into the ridge tops. With this

---

[46] Eric S. Margolis, *War at the Top of the World: the Struggle for Afghanistan, Kashmir and Tibet* (New York: Routledge, 2000), 139.

artillery, they could bring fire down onto Highway 1A.[47]

The Pakistanis, moving up to the high country under winter conditions, suffered from both the altitude and the cold. Although most of the Pakistanis were acclimatized to the altitude and their leadership understood the requirements of troops at high altitudes from their experience in Siachen, the size of the incursion exceeded their capacity to logistically support it.[48] Thus, once battle was joined, the Pakistanis had little access to replacements or resupply, and casualty evacuation was problematic.

Although Pakistan's intentions have never been fully disclosed in open source material, analysts have surmised that the Pakistanis banked on their assumption that their mountain positions were nearly unassailable, and that they occupied the strip of inhospitable territory to give themselves a bargaining chip to use at the inevitable international peace conference after the cease fire.[49]

At first, the Indians were slow to react. The commander of 3d Division, the unit responsible for securing that portion of the border, ignored weeks of indicators that something was amiss: sightings, unusual Pakistani intelligence gathering activities, troop concentrations near the border in Pakistani controlled territory, helicopters flying in Indian-controlled air space with sling-loaded equipment, and the construction of an all-weather road from Gultari, near Skardu in Pakistan, to the LOC.[50] An Indian patrol sent to investigate the sightings apparently "disappeared," although in fact it was ambushed and annihilated. The Indian 3d Division commander even went ahead with plans to detach one of his division's brigades for counterinsurgency operations in the Kashmir

---

[47] Rahul Bedi, "Paying to Keep the High Ground," *Jane's Intelligence Review* 11, no. 10, (October 1999): 27.

[48] Marcus Acosta, "High Altitude Warfare: The Kargil Conflict and the Future," Masters Thesis, Naval Post Graduate School, 2003, 32.

[49] Ibid.

[50] Ibid., 28.

Valley.

In fact, according to *Jane's Intelligence Review*, earlier that year, "a wargame staged by senior [Indian] commanders dismissed the possibility of Tiger Hills being occupied as 'ridiculous,' an option not even worth considering."[51] When the intrusion was detected, it was dismissed as a "local incursion" by rag-tag Pakistani and Afghan militants, and two battalions were ordered to "bring them [the Pakistanis] down by the scruffs of their necks." The Indian battalions were battered by the well-prepared NLI, and three weeks of attempts to regain the high ground yielded nothing but hundreds of Indian casualties, with over 100 killed-in-action. The two Indian battalions handed this task were neither equipped nor acclimatized for fighting at high elevations, and they lacked robust logistics and fire support.[52]

In May, the Indians, awakening to the realities of the situation, put the machinery of their massive defense establishment in gear. They deployed mountain-trained divisions and regiments to the region, supported by over 100 artillery pieces and many batteries of rocket launchers, and they went on a "panic-buying" spree of high altitude gear to adequately support their deploying units.

With the necessary assets in place, with the troops from the hot, low and dusty Indian plains finally properly acclimatized and outfitted, with sufficient sustainment on hand, and with command of the air assured, the Indian Army began to crowbar the Pakistanis out of their positions. But even with their overwhelming force, it proved to be a difficult task.

As poorly-supported as the Pakistanis were, with supplies of food and ammunition barely adequate for a few days, with crude defensive positions built on the

---

[51] Ibid., 27.

[52] Ibid, 27-28.

easily targeted ridge lines, with ranks already decimated by altitude sickness and frostbite, they managed to drag the campaign out for weeks. The fierce series of engagements to seize the Pakistani strong points lasted weeks, and cost the lives of 487 Indian soldiers. Seven hundred Pakistani bodies were left in their positions, and Nawaz Sharif, the Pakistani prime minister, later wrote that 4000 Pakistani soldiers had perished. The mini-war didn't wind down until U.S. President Bill Clinton, concerned at the prospect of nuclear war between the two belligerents, invited Nawaz Sharif to Washington and firmly told him to withdraw his troops behind the LOC or face debilitating U.S.-led international sanctions and pressure.

Kargil provides a number of lessons. At the operational level of war, perhaps the most critical is to not discount suspicious enemy activity, even if it indicates that the enemy is preparing to do something "irrational" in "impassible" terrain. The Indian intelligence service didn't notice when the Pakistani Army purchased 50,000 sets of snow boots and winter clothing from European manufacturers in the year prior to the incursion, local Urdu language newspapers on the Pakistani side of the border were abuzz with news of elevated military and the aviation intelligence agency failed to monitor the border with its photo reconnaissance and electronic intelligence aircraft between January and April, 1999. Indian intelligence was a complete failure, but the signs were there to be read.

At the tactical level of war, the lessons are not new; rather they are confirmations of what has been learned many times over. First, artillery and the high angle firing mortars are critical to supporting maneuvering troops in the mountains. The complexion of the operation and the balance of combat power shifted dramatically when the Indians deployed their artillery to the region. For instance, the commander of the 8th Mountain Division's artillery brigade, Brigadier Singh, became known as the "Mad Bull of Dras," for his enthusiastic application of overwhelming firepower. Likening it to using a

"sledgehammer to shell a peanut," Singh would mass dozens of guns against a single target, pounding it with thousands of rounds while infantry maneuvered up the steep, bare ground to assault positions in close proximity to the enemy. It was fire support like Singh's that made the Indian victories at Kargil possible.[53]

On the other hand, close air support (CAS) was a major disappointment. In the first two days of fighting, two MiG fighters and one Mi-17 helicopter were lost to Stinger missiles, and thereafter, almost all Indian aircraft remained 10,000-15,000 feet (3300-4570 meters) above ground level. Unguided munitions, delivered from aircraft flying at such altitudes, were ineffective, and dangerous to friendly troops. Laser-guided bombs, which the Indians had in short supply, proved "slightly more" effective, but they did not transform the battle from its essential, infantry-artillery nature.

Regardless of the aerial platform or the munition employed, air crew coordination with ground elements, and their training and experience flying close air support (CAS) missions are essential to the delivery of effective aerial fires. An Indian senior officer stated, "The Indian Air Force (IAF) has not trained itself for close support tasks with the army." He went on to say the "IAF consistently denied the use of attack helicopters, which would have proven highly effective against the intruders."[54] Close air support was a bust at Kargil.

Perhaps most striking is the difficulty both Pakistanis and Indians had adjusting to the environment. Despite long experience in the even higher and more rugged and demanding Siachen Glacier area, both armies struggled to adapt. For instance, Indian troops were rushed from low valley elevations of a few thousand feet to 12,000 feet (3650 meters) to 15,000 feet (4670 meters) with no opportunity to acclimatize, many with

---

[53] Ibid., 57.

[54] Ibid., 31.

no cold weather equipment or even sleeping bags, to endure overnight temperatures as low as 10 °F (-12 °C).

Many Indian units, tasked with approaching their objectives via routes crossing (or taking advantage of) technical mountaineering terrain, had no trained assault climbers or equipment, and had to conduct the training under combat conditions, with the obvious loss of efficiency and resulting casualties. The Indian Minister of Defense, George Fernandes, described seeing "unimaginable conditions" during a visit to the operations area.[55]

The experiences of the Indians at Kargil were reflected in microcosm by the 10th Mountain Division-led Operation Anaconda in 2002. Anaconda, conducted at elevations (8,000 to 11,000 feet), considerably lower than elevations in the Kargil Conflict. During Anaconda, elements of Combined Joint Task Force (CJTF) Mountain in conjunction with Afghan militia, attempted to trap Al Qaeda elements (including, possibly Al Qaeda kingpin Osama Bin Laden) in mountainous terrain near the Pakistani border. The CJTF was composed primarily of regular U.S. Army and Canadian infantry, Army aviation, USSOCOM elements and Afghan militiamen, coalition special forces, and supported by a variety of U.S. Air Force aircraft. Although most critical analysis of Anaconda has focused on close air support planning and coordination doctrine, and the command and control issues of directing such a diversified joint and combined force, many of the most basic lessons of ground combat in mountainous terrain were relearned under fire.

The battle was supposed to unfold with reconnaissance teams moving into overwatch positions, followed by infantry and Afghan units moving into blocking positions, in three concentric rings, trapping the Al Qaeda fighters in the Shah-i-Kot Valley. Following occupation of the blocking positions, Afghan militia, closely advised

---

[55] Ibid., 46.

by their Special Forces and Central Intelligence Agency (CIA) paramilitary handlers, would move through the villages in the valley, rooting out the trapped Al Qaeda fighters. Three Special Forces teams would target any leakers trying to flee into Pakistan.[56]

Unfortunately, the Al Qaeda fighters had organized a previously well-developed system of caves and defensive positions in the hills overlooking the valley into a formidable defensive system. After the initial phases of the U.S. attack, the enemy's dispositions and intentions became clear, and the battle focused on clearing the high ridge east of the valley. However, this was difficult and time consuming for the heavily-laden, unacclimatized infantrymen, who had to contend with Al Qaeda fighters [who] skillfully used the terrain to mask their positions and movement and employed mortars to advantage…."[57]

Just like their Indian counterparts three years before, American infantrymen went into the fight having been fed gross underestimations of the enemy's strength, dispositions and intentions.[58] Limited in the initial deployment to Afghanistan by strategic lift, expecting a short fight against a weak, fleeing enemy located in a valley, and anticipating abundant close air support, CJTF Mountain did not arrange for supporting artillery fires, and the assault battalions did not bring adequate mortars or mortar ammunition. The American soldiers, accustomed by training to riding in trucks or helicopters to attack positions near their objectives, were grossly overloaded, and were not physically or mentally prepared for the difficulty of dismounted mountain movement.[59] Leaders at every level were neither sufficiently experienced nor trained to

---

[56] Stewart, *The U.S. Army in Afghanistan*, 32-33.

[57] Ibid., 42-43.

[58] Sean Naylor, *Not a Good Day to Die: The Untold Story of Operation Anaconda* (New York: Berkley Books, 2005), 171.

[59] Ibid., 355.

accurately assess effects of the environment on friendly and enemy forces.

But the American soldiers did fight through the difficulties to at least a partial victory. Although estimates differ wildly, many of the enemy were killed and Americans had met Al Qaeda face-to-face and prevailed. But the primary purpose of Anaconda, the entrapment and complete destruction of Al Qaeda forces located in the Shah-i-Kot Valley, was not accomplished. In fact, given the overwhelming qualitative advantage of the United States in intelligence gathering, aviation and fire support, that a significant proportion of Al Qaeda fighters stood and fought, and then withdrew into Pakistan in reasonable order may well have been a propaganda victory for Al Qaeda. What kind of victory may have been won with commanders, staffs, soldiers and pilots who were organized, trained, and equipped for MCWW.

Strategic Mountain/Cold Weather Regions

The United States is a global power with global interests, and those global interests may require, at short notice, the application of U.S. military power anywhere in the world. Recognizing this, the United States has developed a military that leads any other nation in the world by orders of magnitude in the ability to generate and strategically move significant military forces, and to sustain and support those forces in theater. That the United States occupies a militarily dominant position is rightfully a source of considerable pride, both nationally and within the military establishment. But U.S. forces, once deployed, must be tactically effective when they arrive in theater and comes to grips with the enemy and the environment. The United States has learned this lesson repeatedly, in places like Korea and Vietnam.

It is prudent for the DoD to assess the most likely areas where U.S. forces might be committed, and within the constraints posed by the requirement to be a balanced and

cost effective force, prepare to fight and win in these places. Such an assessment should include a careful study of the operating environment, including terrain, weather, population and infrastructure. Based on this assessment, the Armed Forces would develop doctrine, training and equipment for designated forces.

Large portions of the planet are mountainous or at least seasonally cold and snowy. Some are of urgent interest to the United States, others are not. In many cases, these areas lag behind in development, and this backwardness contributes to their instability. Mountain peoples have earned a well-deserved reputation for their prowess as warriors, and for their fractious tribalism. The harsh climate of mountain regions and the isolating effects of mountain terrain tend to produce similar qualities in mountain people, regardless of geography, language and ethnicity. As Eric Margolis states in his book about South Asian conflict, *War at the Top of the World*, "Highland Scots, and Gheg tribesmen of northern Albania, would feel quite at home in an Afghan raiding party…".[60]

For centuries, the great powers generally ignored mountainous and polar regions. The traditional view was that mountains are wasteland, and that the people who inhabit them are ignorant and treacherous—perhaps, like Gurkhas or Swiss, valuable mercenary soldiers, but of little use otherwise. And the polar regions remained shrouded in mystery, frozen and inaccessible except as places to be exploited for their wildlife or to assert national prestige through the vehicle of exploratory expeditions.

But times have changed. In an age of increasingly probable nuclear terrorism, modern nations can no longer suffer mountain tribesmen to dwell in "ungoverned" territory, since too often, such ungoverned places are incubators of extremism. The break-up of the Soviet Union has left vast, mountainous former Soviet republics fragmented and vulnerable to corrupt, authoritarian oligarchs. Central Asia has become a

---

[60] Margolis, *War at the Top of the World*, 12.

strategic void that nuclear regional powers like China and India are racing to fill. Polar ice is melting, revealing oil, minerals and new shipping routes, grabbing the interest of several Russia and the United States. Much of the world's strategic "key terrain" is now found among the narrow passes, jagged peaks and fierce tribes of the mountains, or in the dark, cold regions at the ends of the earth.

South and Central Asia

The impact of the Indian sub-continent with the Asia mainland has produced a massive disturbance in the surface of the earth, including all or parts of the following countries: Russia, Kazakhstan, Uzbekistan, Afghanistan, Tajikistan, Kyrgyzstan, Pakistan, China (Tibet, Xinjiang), Nepal, Bhutan, India and Burma. This Himalayan system of mountains contains the world's highest peaks and the world's largest non-polar glacier systems. From the Himalaya flow three of the world's major river systems, the Indus, the Ganges and the Yangtze. The Himalayan system includes the "Pamir Knot"—the Karakoram, the Hindu Kush, the Toba Kakar, the Tian Shan, Kunlun, as well as outlying ranges such as the Altai and the Hengduan Shan. The Himalaya mountain range proper is vast, stretching some 1500 miles (2400 kilometers) east to west and 190 miles (300 kilometers) north to south, but the tectonically-related Himalayan "mountain system" is quite literally, the size of a continent.

The Himalayan mountain system is the strategic high ground of the planet. This region is at the confluence of four nuclear powers: Russian, China, India and Pakistan, with India and Pakistan in open conflict over the ultimate fate of the former princely state of Jammu and Kashmir. Afghanistan is the site of ongoing U.S. and allied combat operations, and the nearly ungoverned regions of Pakistan adjacent to the Afghan border provides enemy recruits and bases for the conflict in Afghanistan. Native ethnic unrest, sometimes violent, against China's central government, continues in Tibet and the

Xinjiang. The Ferghana Valley, linking the mountain republic of Kyrgyzstan with Uzbekistan, is a source of potential Islamic separatism. Authoritarian governance and corruption in the former Soviet republics are detrimental to long term regional stability, and militant Islamism festers in pockets throughout the region.

The conflict between Pakistan and India has complex historical causes, and the fighting that erupts from time to time in Jammu and Kashmir holds the potential to elevate to full spectrum conventional war or even a nuclear exchange. Since 1984, India and Pakistan have conducted combat operations in the Siachen Glacier area, near K2, the world's second highest mountain. Siachen is the scene of history's highest ground combat operations with fighting taking place at elevations as high as 22,000 feet (6705 meters). The related Kargil conflict fought in the spring and summer of 1999, provides an example of modern conventional operations in high mountains, as Indian troops stormed a series of Pakistani-occupied peaks between 13,100 feet (4000 meters) and 17,300 feet (5300 meters) to reestablish the 1972 Line-of –Control.

According to influential military affairs analyst, Michael O'Hanlon, a Pakistani internal collapse (which could be triggered by a significant setback in Kashmir) "ranks very high on the list" of military scenarios that would undoubtedly involve the vital interests of the United States, short of a direct threat to its territory." O'Hanlon posits a scenario in which the threat of imminent nuclear war generates the conditions for a "stabilization mission in Kashmir." O'Hanlon envisions "initial stabilization forces in the general range of 100,000, with the U.S. contribution perhaps 30,000 to 50,000"….with the capability for "robust monitoring of border regions, as well as capable counter-insurgent/counterterrorist strike forces."[61] A "robust capability"

---

[61] House Armed Services Committee, *Panel of Regional Conflicts for the Committee Defense Review*, Testimony of Michael O'Hanlon, 109th Cong., 1st sess., October 26, 2005, 5-7.

implies, of course, a military force able to control the high terrain and passes that comprise the borders of Kashmir.

The events of September 11, 2001 dramatically demonstrated the strategic importance of Central Asia to the United States, as Americans quickly learned that the terrorist attacks had been conceived, planned and directed from Afghanistan. The subsequent battles known as Tora Bora and Anaconda, as well as the ongoing foreign internal defense operations by U.S. and North Atlantic Treaty Organization (NATO) forces highlight the ongoing importance of Afghanistan to U.S. interests. Although the United States has focused on Iraq since 2002, the fact that Afghanistan is not yet stabilized is a matter of growing strategic concern.

America's closest peer competitors, China and Russia, are the major players in Central Asia. The Russians jealously maintain their influence with their former Central Asian republics, and directly compete with the United States for basing rights economic access. The Shanghai Cooperation Organization (SCO), initiated by the Chinese, has grown to be a major regional influence, with member nations Russia, Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan, and observer nations India, Iran, and Pakistan. Collectively, the nations of the SCO hold 25 percent of the world's population and are the world's largest producers and consumers of energy. The SCO has begun negotiations with the Afghan government to accept Afghanistan as an SCO participant. The SCO now conducts annual combined military security exercises, and many view the SCO as a counterweight to the United States influence in South and Central Asia, as well as to U.S.-dominated NATO.

Central Asia is vital to American interests. According to Central Asia policy expert and U.S. Army War College professor Stephen Blank, Central Asia may well be "a region where competing systems for international order are fully engaged. It may well be the case that what transpires in Central Asia, i.e. competition between international

powers, will shape the future order of the world."[62] Central Asia is the most mountainous region in the world, and the coldest apart from the polar regions. If Central Asia is vital to American interests, it is also in American interests to develop a robust MCWW capability.

The Caucasus

The Caucasus mountain system formed from the tectonic collision of the Arabian plate with the Eurasian plate, and is a geological cousin of the Himalayas. They form the boundary between Europe and Asia in the corridor between the Caspian basin and the Black Sea, stretching for 745 miles (1200 kilometers) northwest to southeast and are massive, high mountains. For instance, the highest, Mount Elbrus, is 18,506 feet (5,641 meters), and there are dozens of peaks above 13,100 feet (4000 meters), as well as over 2100 glaciers.

The Caucasus region is comprised of Russia, Armenia, Georgia, Azerbaijan, and the disputed territory of Nagorno-Karabakh. The Caucasus is bordered by NATO ally but increasingly Islamist Turkey, and hotspots Iraq, Iran, Afghanistan and the oil-rich Caspian Basin.

Caucasian Russia is an ethnically and politically tumultuous region, with the breakaway province of Chechnya still under military occupation after a series of rebellions by Chechen insurgents against Russian forces. Other Russian federal subjects in the Caucasus, such as Dagestan, Ingushetia, and North Ossetia, also have large Muslim populations and have spawned their own violent separatist movements.

Georgia is a key regional friend of the United States, and has formally requested to begin the process to join NATO. Georgia and Russia dispute the status of the two

---

[62] Blank, Stephen, "The Strategic Importance of Central Asia: An American View," *Parameters*, Vol. XXXVIII, No. 1, Spring 2008, 73.

Georgian breakaway territories of South Ossetia and Abkhazia. Although the Russia and Georgia maintain diplomatic relations, their relationship is characterized by border incidents, mysterious shoot-downs of aircraft and public finger pointing. The United Nations keeps an observer group in the disputed territories. The United States military has a close relationship with the Georgian military, and has maintained a security training detachment in Georgia since 2002, and Georgia has been a staunch supporter of American involvement in Iraq. Relations between Russia and Georgia will be tense for the foreseeable future.

Muslim Azerbaijan and Christian Armenia fought a bloody but inconclusive war in the early 1990s to determine the status of the breakaway territory of Nagorno Karabakh. The war featured religiously-motivated Afghan and Chechen volunteers on the Azerbaijani side, and Ukrainian mercenaries on the Georgian side. Nagorno Karabakh is a very mountainous ("Nagorno" means "highland"), mostly ethnic Armenian, autonomous enclave within Azerbaijani territory. Although the two sides have adhered to a Russian-brokered cease fire since 1994, the Azerbaijanis have not accepted as permanent the loss of territory, and the issue remains a potential trigger for a regional war with religious overtones.

The recently completed Baku-Tiblisi-Ceyhan (BTC) oil pipeline illustrates the tensions in the region. The BTC originates in Baku, Azerbaijan, traverses Georgia, and terminates at Ceyhan, Turkey. When proposals were first floated for a pipeline from the former Soviet republic of Azerbaijan to Western markets, for reasons of national security, newly independent Azerbaijan vetoed routing the pipeline through Russian and Armenian territory, . The United States, perennially at odds with Tehran, objected to moving the oil through a new Iranian pipeline. Turkey wanted the pipeline to pass through its territory, but several of the financiers expressed strong reservations, since the route would take it through Kurdish ethnic territory, risking chronic sabotage. Russians claimed the BTC

was the leading edge of American hegemony, and the pipeline certainly does increase Western influence in the region. The politics of the BTC encapsulates regional faultlines in microcosm.

The Caucasus region is a crossroads of critical U.S. strategic interests. The stage is crowded with players—competitors like Russia and Iran, and friends such as Azerbaijan and Georgia. United States interest in the region is compounded by its massive petroleum reserves and production facilities, so essential to global energy supplies. It is faultlines like these that may trigger a U.S. military involvement in the region, in which case, a robust mountain capability would almost certainly be required.

Iran

Iran is one of the most mountainous countries in the world. Its two major mountain ranges, the Zagros and Alburz, come from the same source as the Himalayas and Causasus—the collision of the Arabian and Eurasian plates. The mountains of Iran are even higher and more rugged than the Caucasus, and Mount Davarand, at 18,405 feet (5610 meters) is the highest mountain in Eurasia, outside of the Himalayan mountain system. Iran is a large country—about one-fifth the size of the United States.

Iran has internal problems. Ethnic Azeris compose nearly 25 percent of the population, and although they are well-integrated, an Azeri nationalist movement is coalescing. The economy is weak, and despite Iranian's vast petroleum reserves, it has chronic gasoline shortages, a high unemployment rate, and poor government services.

Since the 1979 seizure of the U.S. Embassy in Tehran by Iranian militants, the United States has not had diplomatic relations with Iran and at the time of this writing (2008), relations are particularly poor. Iran is in violation of United Nations resolutions 1737 and 1747, which demand that it halt the enrichment of uranium. The United States has also determined that Iran is a state sponsor of terrorism and is actively aiding U.S.

enemies in Iraq and Afghanistan. When asked to do so, senior U.S. officials refuse to rule out the use of force against Iran.

The Andes

The Andes mountain chain in South America is a result of the collision of the South American plate with the Nazca plate. The Andes stretch for 4400 miles from north to south along the western edge of the South American continent, are up to 300 miles wide, and contain peaks second only to those of the Himalayan mountain system in elevation. The Andes dominate the geography of South America, rising in Venezuela in the north, and running through Colombia, Peru, Bolivia Chile and Argentina.

The Andes are consistently high and rugged, with peaks at least 13,100 feet (4000 meters) in each country they appear, and over 855 peaks exceeding 16,400 feet (5000 meters). Even in otherwise tropical nations such as Venezuela, the Andes contain massive glaciers and large alpine zones. The "foothills" of such high mountains often exceed 12,000 feet (3650 meters), and require extensive acclimatization. The capital city of Bolivia, La Paz, is over 11,900 feet (3630 meters). By way of comparison, 12,000 feet is 2000 feet above the authorized operating altitude for U.S. naval helicopter pilots without supplemental oxygen.[63]

The United States first identified this politically turbulent region among its vital interests in 1823, when it proclaimed the Monroe Doctrine. In recent years, the United States has provided Foreign Internal Defense (FID) assistance to a number of Latin American countries engaged in the suppression of imported communist insurgencies, as well as counter narcotics operations. The United States has provided training and education to generations of South American military officers. Venezuela is a major oil

[63] U.S. Navy, OPNAVINST 3710.7T, *NATOPS General Flight and Operating Instructions* (Washington, DC: Department of the Navy, 2004), 8-5.

exporter and its eccentric and vociferously anti-American president is rapidly destabilizing his nation's economy and the vital petroleum it produces for the U.S. market.[64]

The most likely scenario to draw U.S. forces into mountain operations in South America is probably related to a broad destabilization of Colombia or Peru with the potential for large scale narco-terrorism directed against U.S. vital interests. For instance, a significant threat of collapse of the Colombian polity as a result of Marxist Revolutionary Armed Forces of Colombia, or Fuerzas Armadas Revolucionarias de Colombia (FARC) actions might result in circumstances that could lead to U.S. intervention to bolster the Colombian government.

Another scenario could develop from the recent tensions between Colombia and two of her neighbors. In March, 2008, Colombian troops mounted a cross border raid into Ecuador, attacking a FARC sanctuary camp, and killing FARC's number two man, Raul Reyes. Colombia claimed that evidence gathered during the raid proved that Ecuador was aiding the FARC. The president of Venezuela, supporting Ecuador in the dispute, moved troops to marshaling areas near the Colombian border, and tensions increased as Ecuador and Venezuela rattled swords at Colombia.[65] If actual conventional interstate warfare broke out and America's ally, Colombia, were in danger of defeat, it is possible that the United States would come to Colombia's aid.

The Arctic

The recent reduction in the northern polar ice pack has raised the old question of

---

[64] Andrei Illiarnov, "A Long Term Project for Russia," *Russia in Global Affairs*, no. 3, (July-September 2005). http://eng.globalaffairs.ru/printver/939.html (accessed May 12, 2008).

[65] Cable News Network, "Venezuela Resetting New Ties with Colombia," *International CNN.com/World*, March 9, 2008. http://edition.cnn.com/2008/WORLD/americas/03/09/venezuela.colombia/index.html (accessed May 18, 2008).

Arctic sovereignty. The United States, Russia, Norway, Denmark and Canada all have major territorial possessions that border the Arctic Ocean, and each is determined to protect its sovereignty and ensure that it has access to the increasingly accessible riches to be found in the region.

During the Cold War, the Arctic Ocean was an important theater in the struggle between the Soviet Union and NATO. The United States and Canada erected a series of radar stations with interlocking search areas along the Arctic coast to provide early warning of Soviet air intrusion or missile launch. Norway and the Soviet Union engaged in an uneasy standoff in the Svalbard Archipelago, and Denmark underlined its claim to sovereignty in Greenland with a permanent base and wide-ranging dogsled patrols. U.S and Soviet submarines played cat-and-mouse games under the Arctic ice cap, and NATO troops practiced reinforcing the Norwegians in north Norway. But tensions melted with the demise of the Soviet Union in December, 1989, and the Arctic returned to its status as a strategic backwater.

But that has begun to change. According to the United Nations Maritime Convention, each of the five Arctic nations has rights to a 200-mile economic zone extending from its continental shelf into the Arctic Ocean.[66] But the Russians are attempting to extend their *de facto* territory. In July, 2007, two Russian mini-submarines journeyed to the seabed directly under the North Pole, planted a rust-proof titanium flag, and claimed the North Pole.[67] According to a report in the June 12, 2007, issue of *Time*, the Russian claim to the North Pole is a reinterpretation of the Maritime Convention, or at

---

[66] The Times of London, "Arctic Military Bases Signal New Cold War," *TimesOnline*, August 11, 2007. http://www.timesonline.co.uk/tol/news/world/us_and_americas/article2238243.ece (accessed March 18, 2008).

[67] Ibid.

least a reinterpretation of the data on which it rests.[68] The official Russian position is that their continental shelf is linked via an undersea geological structure called the Lomonosov Ridge, effectively giving them claim to an area of the Arctic seabed more than twice the size of France.[69]

There are two major motivating factors behind Russia's drive to increase its share of the Arctic pie. The first is Russian nationalism. President Vladimir Putin remains popular, largely because he has pledged to return Russia to great power status. Claiming Arctic waters and the highly symbolic North Pole, in the face of opposition from the other Arctic nations, especially the United States, is a part of that process. Territory and confrontation are two important elements of great power status. Another reason for Putin's popularity among Russians is his success in restoring Russia's prosperity based on oil and high oil prices. And petroleum is the second reason for Russia's Arctic claims.

The area in the Arctic Basin claimed by Russia contains an estimated "10 billion tons of oil and natural gas deposits." And a U.S Geological Survey (USGS) report states that as much as twenty-five percent of the world's oil and gas reserves may be in the Arctic.[70] So, as oil and gas demand rises, and Arctic sea navigability increases due to a diminishing ice pack, nations will naturally be driven to compete for access to the natural resources in the region. This competition is a potential source of military tension and perhaps conflict.

The conservative government of Canadian Prime Minister Stephen Harper was voted into power partially on Harper's claim that he would intensify Canada's sovereignty claims in the region. Harper stated immediately after the Russian bid to claim

---

[68] Yuri Zarakhovich, "Russia Claims the North Pole," *Time*, July 12, 2007. (http://www.time.com/time/world/article/0,8599,1642905,00.html (accessed March 18, 2007.)

[69] Ibid.

[70] Times of London, "Arctic Military Base Signals New Cold War."

the North Pole, “Protecting national sovereignty, the integrity of our borders, is the first and foremost responsibility of a national government.”[71] He also reiterated that Canada would build a new base for an Arctic fleet of “six to eight” icebreaking warships to patrol the Northwest Passage, and that a cold weather training base would also be established on the Arctic Ocean.

Although these up-ticks in international tension in the Arctic are not definite signs of an armed confrontation, they certainly increase the potential for future conflict. As critical commodities like hydrocarbons become increasingly scarce, competition for them will naturally increase. If one actor miscalculates and steps over an invisible line, conflict may result, as in the Argentinean underestimation of the British response in the Falkland conflict.

Current U.S. Mountain/Cold Weather Warfighting Capability

The Army and the Marine Corps have not completely ignored MCWW capabilities. They have developed doctrine, and they maintain training facilities and instructors, and procure equipment. But how effective is the current effort?

According to the Department of Defense, doctrine is those “fundamental principles by which the military forces or elements thereof guide their actions in support of national objectives. It is authoritative but requires judgment in application.”[72] The Army and Marine Corps have published a large body of manuals, directives, training circulars, and handbooks that go into considerable detail on MCW techniques and procedures. These publications describe the MCW environment, and delineate the considerations for employment of troops, fire support and logistical assets. They provide tips on the best way to walk on a slope, put on skis, find the North Star, and tie knots.

---

[71] Ibid.

[72] Joint Staff, *DOD Dictionary of Military and Associated Terms.*

Some even address basic tactics. And some U.S. personnel are trained to understand and apply this doctrine.

As Muhammed Malik noted in 2004, U.S. forces do not train to fight in mountains. Rather, individual soldiers train to survive and move.[73] Current U.S. MCWW doctrine does not address how forces will organize, train and equip so that they can fight and win in high mountains, in deep snow, and in low temperatures. The U.S. Armed Forces have no overarching organizing concept for MCWW.

Does the U. S. Armed Forces have any MCWW-capable units? A working definition of a MCWW unit is: a military unit, organized, trained, equipped and sustained to accomplish its mission under MCW conditions. Using this definition, the United States has no MCWW-capable units. Although the Army does have a division with the word "mountain" in its name and though there are other organizations within the U. S. armed forces that are sometimes thought of as "mountain" or cold weather specialists, none are actually organized, trained and equipped as such. This should not be taken to mean that the United States Armed Forces does not conduct MCWW training, or that, U.S. forces are inherently incapable of conducting tactical tasks under MCW conditions, but it does mean that it has no inherent, specialized capability to conduct MCWW. The lack of specialized units does means that when U.S forces must fight under MCW conditions, they will be less efficient and less capable, and this degradation may very well prevent accomplishment of assigned missions as well as unnecessarily cost lives.

United States Army

The 10th Mountain Division, though it carries the heraldic lineage of its World War II namesake, is not specifically trained, organized or equipped for MCW conditions.

---

[73] Muhammed A. Malik, "Mountain Warfare: The Need for Specialist Training," Student paper, U.S. Army Command and General Staff College, 2004, 47.

10th Mountain Division is located at Fort Drum, New York. Fort Drum is known for its cold, snowy winters. Although exposing personnel to a cold climate and training them to execute the actions required to mitigate its effects may have some slight effect on the ability of the division to operate in winter conditions, it is no substitute for specialized training. The division has no specific requirement to organize, train or equip for cold weather conditions.

In addition to the 10th Mountain Division, the U. S. Army does have a number of units stationed in places like Colorado and Alaska. But like the 10th Mountain Division, these units are not specialized for MCW combat operations.

United States Marine Corps

The U. S. Marine Corps also has no specialized MCW units. Although Marine units regularly participate in winter exercises in Norway, the forces that do so receive familiarization training for cold weather conditions only immediately prior to or during their deployment. Their dismounted oversnow mobility is limited. For motorized off-road travel, they rely on host-nation tracked BV-206 Small Unit Support Vehicles (SUSV) with contracted or reservist Norwegian drivers.

One unit that does have an inherent, but very limited “mountain” capability is the Marine Expeditionary Unit (MEU). The MEU is a brigade-sized, air-ground task force that is normally deployed on amphibious shipping for six months on a rotating basis. The MEU is formed about six months before it deploys, and is task organized with an infantry battalion, logistics battalion and composite helicopter squadron.

The MEU’s mountain warfare capability consists of a platoon of specially trained assault climbers, sourced from a reinforced rifle company that also receives climbing familiarization training. The assault climber platoon is organized, trained and equipped to conduct cliff reconnaissance and cliff assault planning, and to prepare fixed rope or

caving ladder assault lanes over a three hundred foot near vertical terrain obstacle for the follow-on reinforced rifle company. However, the assault climber platoon is specially trained during the MEU's predeployment training, and is disbanded following the MEU's return from deployment. And assault climbing is only a small portion of the many skill sets required for MCWW.

United States Special Operations Command

United States Special Operations Command (USSOCOM) consists of elements contributed from the U. S. Army, Navy, Marine Corps and Air Force. Each has actual or potential ability to conduct aspects of MCWW.

The Army contribution to USSOCOM is the U. S. Army Special Operations Command (USASOC). Special Forces, 75th Ranger Regiment, Psychological Operations and Civil Affairs units are all part of USASOC. Of these, the Special Forces and Rangers have some MCWW capability.

The Special Forces traces its roots to the First Special Service Force (FSSF), the United States and Canadian combined unit that was organized, trained and equipped to play a leading role in the projected invasion of Norway by Allied forces during World War II, and the Special Forces attempt to maintain this tradition. The 10th Special Forces Group, based at Fort Carson Colorado, in the foothills of the Colorado Rockies, is the USASOC executive agent for mountain warfare training. During peacetime, each special forces group maintains a specialized mountain "operational detachment 'A' (ODA)." An ODA is a twelve-man team commanded by a captain, and is the basic tactical unit of U.S Army special forces.

The 75th Ranger Regiment consists of highly disciplined light infantry Although not specialized in MCWW, the three battalions of the regiment, like Marine infantry battalions, do conduct basic mountain familiarization training when time and facilities are

available.

Naval Special Warfare (NSW) community personnel, like their Special Forces counterparts, sometimes train under MCW conditions. But NSW does not contain units that are inherently specialized for MCW, even at the small unit level.

U.S. Air Force pararescue personnel are required to undergo mountaineering training in the Pararescue Recovery Specialist Course, and pararescue personnel and detachments conduct MCW combat search and rescue (CSAR) and search and rescue (SAR) training and operations.

In 2003, the U. S. Marine Corps organized, trained and equipped Marine Special Operations Command Detachment One, the first Marine combat forces contribution to USSOCOM. Anticipating deployment to mountainous regions of Afghanistan, Detachment One conducted mountain training, but was subsequently employed in urban operations in Iraq. The successor to Detachment One, Marine Special Operations Command, currently has no specific requirement for MCW capabilities, although, like other assigned USSOCOM force, MCW training may be conducted on an "as required" basis.

The bottom line is that no significant USSOCOM MCWW capability exists. Although, as a general rule, USSOCOM operational personnel are relatively mature, physically fit, and trained to operate under austere conditions, and while a smattering of those personnel have MCW training or operation experience, USSOCOM possesses no significant forces that are organized, trained or equipped to conduct MCWW.

National Guard and Reserve

Although National Guard units are not designated as mountain units, some of the skill sets of particular Guard units do provide a level of mountain proficiency. For instance, several Air National Guard helicopter squadrons in or near mountainous states

support civil search and rescue (SAR) agencies, performing search team insertion and extraction, logistic support, aerial search, and hoist-recovery of victims and bodies. In fact, because of habitual military support to civil authorities for SAR, most military bases located near mountainous areas have proficient mountain SAR helicopter crews.

The Vermont National Guard was formerly the home of the 3d Battalion, 172d Infantry (Mountain), the only conventional unit in the U.S. Armed Forces that attempted to focus on training for mountain warfare. Uniquely, the headquarters and headquarters company came from the Vermont National Guard, and each of its rifle companies came from the National Guards of the surrounding New England states. Much o its unit culture and esprit was rooted in the mountain warfare mission. However, the battalion was disbanded in 2006, in order to comply with the Army's plan for a modular Army and Guard.

Service Training Capability

Mountain warfare training in the United States exists, but it is generally focused on individual or small unit skills, and does not stress the integration of the warfighting functions. The Army conducts formal individual MCW training in Vermont, at the Vermont National Guard Mountain Warfare School (AMWS), in Alaska, and at the Northern Warfare Training Center (NWTC), and helicopter air crew training in Colorado, at the Colorado Army National Guard's High Altitude Aviation Training Site (HAATS). The Marine Corps conducts individual and collective MCWW training at the Marine Corps Mountain Warfare Training Center (MCMWTC) in the Sierra Nevada range near Bridgeport, California, as well as assault climber platoon training and certification through the Special Operations Training Groups located at Camp Lejeune, North Carolina and Camp Pendleton, California. Naval Special Warfare (NSW) conducts individual and platoon training at a small site on Kodiak Island, Alaska, and at a site in

southern California. Tenth Special Forces Group, designated as the USASOC proponent for military mountaineering, maintains an equipment locker and a small training cadre at Fort Carson, Colorado.

The MCW training at the AMWS is designed for individuals who will return to their units and act as informal subject matter experts. Areas of emphasis are survival skills and mountain mobility, with an emphasis on physical fitness, moderate rock and ice climbing, and snowshoeing. The Army Mountain Warfare School also provides mobile training team support to units that cannot travel to Vermont.

The subjects taught at the NWTC are similar to those taught at the AMWS. While AMWS is the proponent for Army-wide MCW training, NWTC is focused primarily on "winter-proofing" soldiers so that they can conduct training in the winter in Alaska without suffering cold injuries. None of the training at either of these sites is designed to train units, nor is the training focused on warfighting. They are proficient at providing a background in the MCW environment and teaching soldiers the basics of how to survive and move in under MCW conditions.

The Marine counterpart to AMWS, MCMWTC, teaches several courses for individuals depending on the season. Leaders and unit instructors learn mountain and winter mobility, small unit sustainment, and small unit tactics in summer or winter 35-training day courses. Other courses include: MCW medicine, mountain sniping, animal packing, as well as advanced instruction in glacier travel, avalanche assessment and MCWW unit planning. The MCMWTC provides mountain familiarization for Embedded Training Teams (ETTs) conducting pre-deployment training to prepare to serve as advisors to the Afghan National Army (ANA). For infantry battalions, MCMWTC provides two-to-four-week collective MCW training packages in survival, mobility, sustainment, command and control and small unit operations. Although MCMWTC teaches MCWW planning considerations for each of the warfighting functions, apart

from units contained within infantry battalion task forces, it does not train aviation, artillery, logistics, engineer, or other maneuver support units. MCMWTC does not train the Marine Air-Ground Task Force, the basic Marine warfighting element, at any level. Collective training is very much oriented toward pure light infantry.

With the increased tempo brought on by the Global War on Terror (GWOT), training conducted by USSOCOM elements varies widely, and is often ad hoc. Even prior to the GWOT, USSOCOM training was an on-again, off-again affair, and the available throughput never matched the demand. And like most American MCW training individual survival and mobility skills substitute for the generation of a relevant capability.

The Way Ahead

Some nations have been driven by the imperatives of history and geography to develop MCW military forces. The Nordic and Alpine nations of Europe, the descendants of Caucasian hill-tribes, the new and old nations of south and central Asia—all have, or used to have, mortal enemies "on the other side of the hill." Consequently, they developed a capability to fight in mountains and cold weather.

The United States has a different history. America's occasional fighting forays into high mountains, high latitudes, and low temperatures, like the counterinsurgency experience, have been generally short-lived and then quickly forgotten. But in an era highlighted by the "arc of instability" the United States cannot afford to cede a third or more of the earth's land mass. It cannot afford to give up the high ground. The United States should develop a MCWW capability.

As it should, the U.S. Armed Forces accepts the introduction of new capabilities with a large measure of circumspection. The Department of Defense has erected a multitude of "gates" through which any major capability is supposed to pass before it is

"acquired." This is understandable, since so-called "good ideas" are abundant, and time and money are not. Foremost among these is the Joint Capabilities Integration Development System (JCIDS).

The Joint Capabilities Integration Development System

The Department of Defense is responsible to the National Command Authorities for the development of acquisition requirements and evaluation criteria for future programs. Beginning in 2002, the DoD developed JCIDS to generate solutions to gaps in U.S. military capability. The JCIDS directive articulates the DoD's shift from threat-based to capabilities-based approaches to identify and generate new military capabilities. The JCIDS process provides a means by which each of the four services, various JFCs, and other agencies are able to fulfill the capability shortfalls identified by combatant commanders. The Secretary of Defense directed the development of this process so that DoD and service acquisitions personnel and force developers would more effectively coordinate and prioritize service requirements, JCIDS is an attempt to apply joint concepts to the services' statutory requirement to "organize, train and equip." Although JCIDS is the bureaucracy's tool for technological systems acquisitions, it is the primary means by which services generate new capabilities. JCIDS is also the mechanism that assists decision-makers to identify whether the services should remedy a capability-gap with a materiel or non-materiel solution. JCIDS, then, is an important component of the DOTMLPF construct, since JCIDS considers whether a solution to a perceived capability gap can be solved by a combination of the elements of DOTMLPF: doctrine, organization, training, materiel, personnel and facilities.

The JCIDS process theoretically begins when combatant commanders consult with the Office of the Secretary of Defense (OSD) to identify and define warfighting requirements, presumably in the context of existing or anticipated contingency plans

(CONPLANS) and operation plans (OPLANS). This ensures that the JCIDS supports not only the combatant commander, but overall U.S. strategy as well.

The JCIDS process is formally initiated by the development of joint integrating concepts and their embedded capabilities. The Joint Chiefs of Staff refine the requirement during joint quarterly readiness reviews, generating an integrated priority list. The Vice Chairman and the vice chiefs of staff of the services form a Joint Requirements Oversight Council (JROC) that validates the requirement and decides how to produce the identified capability.

Underlying the JCIDS directive are a few critical requirements. They are essential to moving a major initiative from concept to capability. These requirements are:

1. The concept must fill a perceived gap in capability, preferably in more than one combatant commander's area of responsibility.

2. The concept needs a proponent within the Armed Forces.

3. The concept needs a sponsor at the political level.

The hypothesis of this paper is that a gap does exist in the U.S. Armed Force's capability to conduct MCWW, and consequently, the United States military should take steps to develop a more robust MCWW capability. But what steps should be taken, and what shape should this capability take?

While it is beyond the scope of this paper to precisely define the capability, nonetheless, the broad outlines are discernable. Relatively modest improvements will provide the foundation for the development of a relevant and robust capability.

Executive Agency, the First Step

First, a service or component must take ownership of the effort to develop a MCWW capability. Such "ownership," or proponency, is essentially speculative. Working "on spec" does not necessarily always pay off. But, the incipient development

of a serious and relevant MCWW capability is the required first step to the designation of the service's DoD component as "DoD executive agent." Potential candidates for proponency and subsequent executive agency are the Departments of the Army or Navy, the Army or Marine Corps, or USSOCOM. Each has the requisite authority or resources and each would be sufficiently affected by development of MCWW capability that assignment as executive agent for MCWW by the Secretary of Defense is justified.

The DoD defines "executive agent" as:

> "a term used to indicate a delegation of authority by the Secretary of Defense to a subordinate to act on behalf of the Secretary of Defense. Designation as executive agent, in and of itself, confers no authority. The exact nature and scope of the authority delegated must be stated in the document designating the executive agent. An executive agent may be limited to providing only administration and support or coordinating common functions, or it may be delegated authority, direction, and control over specified resources for specified purposes.[74]

The executive agent for development of MCWW should be authorized and directed to:

1. coordinate and submit joint MCWW doctrine for approval to U.S. Joint Forces Command;

2. accredit MCWW training;

3. establish certification standards for MCWW units;

4. coordinate between service acquisition agencies for materiel solutions;

5. propose "Programs of Record" to Congress and develop Program Objective Memoranda for joint MCWW materiel, facilities and training.

Designation of a robust executive agent is the critical and essential step for the eventual generation of a MCWW capability. For instance, without the Army in authoritative control of airborne doctrine and parachute training, there is little chance that the United States Armed Forces would have retained the capability to air drop significant forces. Other services can and do insert personnel by parachute, but the Army writes the doctrine and oversees the training. This system works. The authority to work closely with

[74] Joint Staff, *DOD Dictionary of Military and Associated Terms.*

supported combatant commanders, sister services, and Congress, to lead the development of joint doctrine and to control significant funding streams is necessary to develop a MCWW capability that supports the combatant commanders in their execution of global U. S. military strategy.

Developing a Capability

The keystone of the MCWW capability is executive agency, but what shape would the capability itself take? A few assumptions are in order. First, the emphasis of MCWW training should be on accomplishing specific military individual and collective tasks to standard, under demanding MCW environmental conditions. Second, the development of wholesale specialized units devoted to MCWW training is unrealistic. American ground combat forces, whether Army or Marine, are balanced, general purpose, rapidly deployable forces and should remain so, to support the many operational requirements that they must fulfill. The required standards should be outlined in doctrine. Third, although the bulk of functions in a MCWW-capable organization can be accomplished by general purpose personnel and units, some functions should be performed by specialist personnel and units. Fourth, the development of the necessary expertise and mind-set to build doctrine, train personnel and serve in MCWW specialist roles requires a career-length experience track. Based on these assumptions a MCWW capability would resemble the following.

The executive agent would designate a general officer with a senior executive service deputy and a robust staff to head an oversight and coordination office within the parent service's development command. This general officer would coordinate all activities pertaining to the development of the MCWW capability—funding, procurement, doctrine development, and training and education functions, and he would also serve as an advocate for the capability development process to Congress, the Office

of the Secretary of Defense (OSD), the Joint Chiefs of Staff, Interagency partners, and senior personnel within his own and other services.

The executive agent would coordinate the establishment of a system of modern training centers. The training centers would provide the necessary variety of environments, with high altitudes, glaciated alpine terrain, and periodic intense cold, as well as the training areas and ranges necessary to support an extensive and comprehensive training program. The training centers would take full advantage of modern modeling and simulation technology to add realism and validation to training exercises and doctrine development, and would be candidates for Joint National Training Capability certification. Each training center would be staffed with observer-controllers, role playing opposing forces, and support and maintenance personnel, and each would be equipped with the necessary equipment to outfit each solder and each training unit with the appropriate MCW equipment, and each would have a simulation center node for units to exercise with other units.

Among the personnel and units permanently stationed at or in close proximity to the training centers would be “enablers.” Enablers are those specialized personnel and units that provide the requisite added capability to a general purpose organization to enable it to execute MCWW missions. For instance, the Royal Marines provide several certified “mountain leaders” to each rifle company to enable it to move safely through mountainous or avalanche-prone terrain. Enablers might include special operations, reconnaissance, engineer, medical, aviation, communications, mule packers, and specialized equipment maintainers, who would come under the tactical control of a unit during normal training, but whose wartime task would be to augment a particular unit to give it the necessary expertise to accomplish technically difficult missions—to take such a unit from “MCWW-familiarized” to MCWW-capable.

The training centers would have the capability to train battalion or brigade-sized

units, with associated aviation and sustainment units. The training centers might also have the capacity to provide permanent station facilities for comparably-sized units.

Personnel management and support of this kind of organization is critical. The potential for the development of an insular, disconnected mountain “mafia” or “tribal” sub-culture exists, but the requirement for personnel to periodically return to the MCW community is essential to the maintenance and development of the complex skill sets required. Although specialized personnel could and should make a contribution to the force as a whole by serving in school, staff and command billets outside of the MCWW field, they must serve several tours in the field in the course of a career to ensure currency and refresh their perishable skills.

Conclusion

Mountain and cold weather warfare has a long history, and that history clearly demonstrates that those who ignore it are doomed to fail when fate places them in such an environment. This paper has broadly outlined the challenges of MCWW and shown that the United States does not have the ability to efficiently and effectively wage war in mountains or cold weather against a competent, acclimatized enemy. This paper has further shown that the United States has vital national interests in mountainous, cold places like Central Asia and the Arctic, and charted a basic strategy to begin to mitigate the dangerous lack of American MCWW

Another area for further historical research include the unique political and organizational problems of establishing, training, equipping and sustaining the World War II 10th Mountain Division. Historical analysis of the Army’s organizational experience with the remarkable experiment of the 10th Mountain Division will provide important lessons for the development of future MCWW forces.

One other historical aspect of the American experience with MCWW that will

provide insights is that of the Marine experience in the defense of NATO's northern flank, in Norway. The slow and halting, but generally positive development of Marine cold weather capability during the 1980s is probably a rich source of lessons on the problems associated with turning young Americans into Arctic warriors.

Although the United States military is technologically-oriented, and naturally turns to materiel solutions to solve tactical problems, it does realize that technology rarely solves problems by itself. Technology is complementary, not comprehensive. To overcome a wily, determined enemy who is at home in mountains or cold weather, it takes well-led, highly trained, mentally adaptable, properly equipped and supremely fit soldiers, who know how to lead, move, shoot, communicate and take care of themselves and each other among high peaks and in bitter cold. These soldiers, supported by a full array of surveillance, communications and logistics technology, and the responsive and deadly fire support that the U.S. military provides so well, are the force that the United States will need in the years to come.

BIBLIOGRAPHY

Books

Alexander, Joseph and Bartlett, Merrill L. *Sea Soldiers in the Cold War.* Annapolis: Naval Institute Press, 1995.

Appleman, Roy E. *East of Chosin: Entrapment and Breakout in Korea, 1950*. College Station: Texas A & M University Press, 1987.

Baumann, Robert H. *Russian-Soviet Unconventional Wars in the Caucasus, Central Asia, and Afghanistan*. Fort Leavenworth: Combat Studies Institute, U.S. Army Command and General Staff College, 1995.

Center of Military History. *Operation Enduring Freedom: October 2001 – March 2002.* Washington, D.C.: U. S. Army Center of Military History, 2004.

Chew, Allen F. *The White Death: The Epic of the Soviet-Finnish Winter War.* East Lansing: Michigan State University Press, 1971.

Chew, Allen F., *Fighting the Russians in Winter: Three Case Studies*. Fort Leavenworth: Combat Studies Institute, 1981.

Clausewitz, Carl von. *On War*. Ed. and trans. Michael Howard and Peter Paret. Princeton: Princeton University Press, 1976.

Department of the Army, *Warfare in the Far North*. Washington, D.C.: Department of the Army, 1951.

Donnelly, C. N., C. E. Chojecki, C. T. Fearn, M. E. Kelly, M. J. Orr, E. P. Takle, and P. H. Vigor. *Soviet Amphibious Warfare and War on the Northern Flank.* The Hague: SHAPE Technical Centre, 1984.

Falls, Cyril. *The Battle of Caporetto*. Philadelphia: J. B. Lippincott Company, 1966.

Feur, A. B. *Packs On! Memoirs of the 10th Mountain Division in WWII*. Mechanicsburg, PA: Stackpole Books, 2004.

Gephardt, James F. *The Petsamo-Kirkenes Operation: Soviet Breakthrough and Pursuit in the Arctic, October 1944*. Fort Leavenworth: Combat Studies Institute, U.S. Army Command and General Staff College, 1989.

Grau, Lester, trans. and ed. *The Bear Went Over the Mountain: Soviet Combat Tactics in Afghanistan.* Washington, DC: National Defense University Press, 1996. (Originally published in Russian as Combat Actions of Soviet Forces in the Republic of Afghanistan:

A Thematic Collection of Tactical Examples, Frunze Academy, ed. Moscow: Frunze Academy Press, 1991.

Grau, Lester and Jalali, Ali Ahmad, *The Other Side of the Mountain: Mujahideen Tactics in the Soviet-Afghan War*. Quantico: USMC Studies and Analysis Division, 1995.

Grau, Lester and Gress, Michael, *The Soviet Afghan War: How a Superpower Fought and Lost,* by the Russian General Staff. Lawrence: University of Kansas Press, 2002.

Harper, Frank. *Military Ski Manual*. Harrisburg: The Military Service Publishing Company, 1943.

Hawkins, Charles and Love, Robert R, ed. *The New Great Game: Chinese Views on Central Asia*. Fort Leavenworth: Foreign Military Studies Office, 2006.

Kanwal, Gurmeet. *Heroes of Kargil*. New Delhi: Army Headquarters, 2002.

Leonov, Viktor. *Blood on the Shores: Soviet Naval Commandos in World War II*. Trans. and ed. James F. Gebhardt. Annapolis: Naval Institute Press, 1993.

Lund, John. Don't Rock the Boat: Reinforcing Norway in Peace and in War. Santa Monica: The RAND Corporation, 1989.

MacDonald, Charles B. and Mathews, Sidney T. *Three Battles: Arnaville, Altuzzo and Schmidt.* Washington: Office of the Chief of Military History, 1952.

McMichael, Scott R. *A Historical Perspective on Light Infantry*. Fort Leavenworth: Combat Studies Institute, U.S. Army Command and General Staff College, 1987.

Mearsheimer, John J. *The Tragedy of Great Power Politics*. New York: Norton, 2001.

Naylor, Sean. *Not a Good Day to Die: the Untold Story of Operation Anaconda*. New York: Berkeley Books, 2005.

Nooy, Geert de. The *Clausewitzian Dictum and the Future of Western Military Strategy*. The Hague: Kluwer Law International, 1997.

Oliker, Olga and Szayna, Thomas S. Faultlines of Conflict in Central Asia and the South Caucasus: Implications for the U.S. Army. Santa Monica: The RAND Corporation, 2003.

Rommel, Erwin. *Attacks*. Provo: Athena Press, 1979.

Scales, Robert H. *Firepower in Limited War*. Washington: National Defense University Press, 1990.

Schepe, Gerhard. *Mountain Warfare in Europe*. Kingston: Queen's University, Centre for International Relations, 1983.

Scott, Harriet F. and Scott, William F. *The Armed Forces of the USSR*. Westview Press, Boulder, CO., 1979.

Stanton, Shelby L. *Ten Corps in Korea, 1950*. Novato: Presidio Press, 1989.

Thompson, Julian. *No Picnic. 3 Commando Brigade in the South Atlantic: 1982.* London: Leo Cooper in association with Secker and Warburg, 1985

Vaux, Nick. Take that Hill: Royal Marines in the Falklands War. Washington D.C.: Brassey's, 1986.

Ziemke, Earl F. *The German Northern Theater of Operations 1940-1945*. Department of the Army Pamphlet No.20-271. Washington, D. C.: U. S. Government Printing Office, 1959.

Doctrinal Publications

U. S. Department of Defense. Joint Publication 1-02, DOD Dictionary of Military and Associated Terms. As amended through 17 October 2007. Washington, D.C.: Joint Staff, 2007.

U. S. Army. *Field Manual 3-97.6, Mountain Operations.* Washington, D.C.: Headquarters, Department of the Army, 2000.

U. S. Army. *Field Manual 3-97.61, Military Mountaineering.* Washington, D.C.: Headquarters, Department of the Army, 2002.

U. S. Army. *Training Circular 90-11-1, Military Skiing*. Washington, D.C.: Headquarters, Department of the Army, 1981.

U. S. Marine Corps. *OH 8-5 Cold Weather Operations Handbook, OH 8-5*. Quantico: Marine Corps Development and Education Command, 1979.

U. S. Marine Corps. *Fleet Marine Force Manual 7-21, Tactical Fundamentals for Cold Weather Warfighting.* Quantico: Marine Corps Development and Education Command, 1979.

Articles and Monographs

Acosta, Marcus C. “High Altitude Warfare: The Kargil Conflict and the Future.” Student thesis, Naval Post Graduate School, 2003.

Allen, Steve N. “Cold Weather Contradictions.” *Marine Corps Gazette* 69.7 (1985): 28

Alexander, Joseph H. "The Role of Marines in the Defense of North Norway.” *US Naval Institute Proceedings* 110 (1984): 180-193.

Amphibious Warfare School Conference Group on Afghanistan. “Battle Study: The Soviet War in Afghanistan.” *Marine Corps Gazette* 70.7 (1986) 58-65.

Anonymous. “NORWAY Teamwork 76.” *Marine Corps Gazette* 62.7 (1978): 20-27.

Anonymous. “Northern Flank Could Come Unglued.” *Marine Corps Gazette* 63.8 (1979) 10.

Apker, David, Gay Hammerman, Paul Martell, Lucille Petterson. “Cold-Weather Combat: Analogies to Chemical Combat.” Institute for Defense Analyses, 1985.

Hamilton, Allan J. M.D. “Biomedical Aspects of Military Operations at High Altitude, Report No. USARIEM-M-30/88.” U. S. Army Research Institute of Environmental Medicine, 1988.

Bailey, Timothy J. “Why not Afghanistan?” *Marine Corps Gazette* 91.8 (2007): 14-17.

Bechtol, John G. “Fighting the Cold: The Need for Standing Cold Weather Combat Capabilities.” Student research paper, Naval War College, 2002.

Bittner, Donald F. "British Army's WWII Experience Casts Doubt on Corps' Ability to Fight in the Arctic." *Marine Corps Gazette* 61.7 (1977): 28-34.

Broberg, Scott E. “Are We Properly Prepared for Helicopter Operations in Afghanistan?” *Marine Corps Gazette* 86.5 (2004): 70-74.

Burr, R. E. “Medical Aspects of Cold Weather Operations: A Handbook for Medical Officers.” U. S. Army Research Institute of Environmental Medicine, 1993.

Calvin, James Barnard. “The China - India Border War (1962).” Student research paper, Marine

Corps Command and Staff College, 1984.

Cerreta, M. D. "Cold Weather Conference in Norway." *Marine Corps Gazette* 66.7 (1982): 19-20.

Clough, M. F. "'Good to Go' Arctic Warriors." *Marine Corps Gazette* 69.9 (1985): 65-70.

Crookston, Joseph A. “Marine Corps Roles and Missions: A Case for Specialization.” Student research paper, Marine Corps Command and Staff College, 1987.

Curtis, W. C., Norman Kingsley, M. F. Clough, P. D. Tucker. “Combating the Cold: Letters to the Editor.” *Marine Corps Gazette* 69.3 (1985): 17-18.

Darack, Ed. “From Bridgeport to Blessing.” *Marine Corps Gazette* 90.8 (2006): 54-57.

Darack, Ed. “A Short March to the Hindu Kush.” *Alpinist* 18 (2006): 58-65.

Deubler, W. F. “Combat Service Support--A Concept of Operations for Cold Weather Operations.” Student research paper, Marine Corps Command and Staff College, 1984.

Durrant, Jerry L. “In Every Clime and Place: USMC Cold Weather Doctrine.” Student monograph, School of Advanced Military Studies, U. S. Army Command and General Staff College, 1991.

Edwards, Sean J. A. “Swarming and the Future of Warfare.” Doctoral thesis, Pardee Graduate School, Santa Monica: The RAND Corporation, 2004.

German General Staff. “Mountain Warfare Operational Lessons Learned.” (Unpublished manuscript MS P-034, in two volumes, Fort Leavenworth Combined Arms Library archives.)

Govan, Thomas P. *Training in Mountain and Winter Warfare*, Study No. 23, Washington, DC: Headquarter, Army Ground Forces, 1946

Grau, Lester and Vázquez, Hernán. “Ground Combat at High Altitude.” *Military Review*, October-November, 2002.

Green, Eric J. "Continuity in Arctic Units." Marine Corps Gazette 70.2 (1986): 36-38.

Greer, Jon D. “Mountain Infantry – Is there a Need?” Masters thesis, U. S. Army Command and General Staff College, 1988.

Hamilton, Allan J. “Biomedical Aspects of Military Operations at High Altitude.” U. S. Army Research Institute of Environmental Medicine, 1988.

Hagtvedt, Arne O. “Traveling Light on Skis.” *Marine Corps Gazette* 69.9 (1985) 67.

Haynes, S.E. "Now is the Time for a Marine Corps Cold Weather Brigade." Marine Corps Gazette 64.2 (1980): 19-20.

Hildreth, Reed C. “The Landing Force in Minnesota.” *Marine Corps Gazette* 68.1 (1984): 29-31.

Hoffman, Jon T. “The Lessons and Legacy of the Campaign in Italy.” *Marine Corps Gazette* 78.1 (1994): 65-69.

Hudson, L. E. “One if by Land, Two if by Sea; when it starts to Snow, then Attack by Ski.” *Marine Corps Gazette* 61.3 (1977) 49-53.

Hyndman, Jerry. Impact of Cold Weather on MAGTF Amphibious Operations during the Mid-Range Study. Headquarters, U.S. Marine Corps, Washington, D.C. Contract No. M00027-80-C-0021, Report No. (SCN) 70-80-03.

Jones, Thomas S. "Cold Weather Takes Priority." *Marine Corps Gazette* 68.12 (1984): 38-52.

Karlsen, Knut. “Operations in Cold Weather: A Need for Ear-marked Units.” Student research paper, Marine Corps Command and Staff College, 1987.

Kleveman, Lutz. The New Great Game: Blood and Oil in Central Asia. New York: Grove Press, 2003.

Kubasko, Wayne P. “Field Artillery Operations in the Arctic.” Student essay, U. S. Army War College, 1987.

Leach, Sean. "'Can-Do' Won't Do in Norway." *Marine Corps Gazette* 62.9 (1978): 52-56.

Lederer, P. R. “Cold Weather Training.” *Marine Corps Gazette* 69.6 (1985): 31.

Malik, Muhammad. “Mountain Warfare–The Need for Specialized Training.” *Military Review*, September–October, 2004.

Mattin, P. R., “Mountain and Cold Weather Warfare Training in the RMC: “Owning the Environment,’” Memorandum prepared at the direction of Headquarters, Royal Marines, in the possession of the author, 2001.

Natonski, Richard F., “Cold Weather Combat: What Is The Marine Corps Doing About It?” Student research paper, Marine Corps Command and Staff College, 1988.

Nicholson, Mark, “Deadly Mountain Mission Awaits Nato's Nimblest Fighting Unit,” *Financial Times*, March 21, 2002. http://specials.ft.com/attackonterrorism/FT3TICAH0ZC.html (accessed November 4, 2006).

Northrop Services, Inc. “Norwegian-U.S. Cold Weather Conference Final Report.” Northrop Services, Inc., 1987.

O’Hanlon, Michael. “Scenarios for Future Conflicts,” Presentation, Johns Hopkins University Unrestricted Warfare Symposium, March 20, 2007. http://www.jhuapl.edu/ urw_symposium/pages/proceedings/2007/papers/OHanlon.pdf (accessed October 6, 2007)

O’Hanlon, Michael. “Testimony before the House Armed Services Committee (Panel of Regional Conflicts for the Committee Defense Review), October 26, 2005.” (www.brookings.edu/views/testimony/ohanlon/20051026_arms.pdf (accessed May 3, 2008)

Olcott, Martha Brill. *Central Asia’s Second Chance*. Washington, D.C.: Carnegie Endowment for International Peace, 2005.

Pirnie, Bruce R., Alan Vick, Adam Grissom, Karl P. Mueller, David T. Orletsky. “Beyond Close Air Support: Forging a New Air-Ground Partnership.” The Rand Corporation, 2005.

Qadir, Shaukat. “An Analysis of the Kargil Conflict 1999.” *Royal United Services Institute Journal*, April, 2002.

Semadeni, Erhard. “Mountain Warfare in the European Alps: The Impact of Soviet Offensive Capabilities on Established Infantry Defensive Tactics.” Fort Leavenworth: U.S. Army Training and Doctrine Command, 1981.

Sharma, Dwarika P. “Pakistan upgrading mountain warfare training,” The Times of India, October 23, 2000. http://www.jammu-kashmir.com/archives/ archives2000/ kashmir20001023c.html (accessed November 4, 2006).

Smith, Norman H. “Arctic Maneuvers 1984.” *Marine Corps Gazette* 68.12 (1984): 30-37.

Stalder, Keith J. “The Air War in Afghanistan.” Student research paper, Marine Corps Command and Staff College, 1985.

Steele, Robert D. “First to Fight, but not Fighting Smart: A Skeptical Assessment of Marine Corps Effectiveness in the 21st Century.” *Marine Corps Gazette* 83.5 (1999) 85-92.

Sray, John E. “Mountain Warfare: The Russian Perspective,” Foreign Military Studies Office, March, 1994. http://fmso.leavenworth.army.mil/documents/mountain.htm (accessed September 24, 2007).

The Times of London. “Arctic Military Bases Signal New Cold War,” *Times Online*, August 11, 2007. http://www.timesonline.co.uk/tol/news/world/us_and_americas/article2238243.ece (accessed March 18, 2008).

U. S. Army Cold Regions Research and Engineering Laboratory. “Proceedings of the International Conference of Cold Weather Military Operations U.S. Army CRREL Special Report 9-95).” 1995.

Vaughn, Richard. “Cold Memories: An Examination of U. S. Army Doctrine for Combat in Cold Regions.” Masters thesis, U. S. Army Command and General Staff College, 1988.

Vest, Jason. “Mountain Division: Why the U.S. can't match the British at high altitudes.” *The American Prospect*, (March 21, 2002). http://www.prospect.org/webfeatures/2002/03/vest-j-03-21.html (accessed October 26, 2001).

Vrabel, Michael J. “Can We Move the Men and Equipment to North Norway in Time?” Student research paper, Marine Corps Command and Staff College, 1988.

Washington Post. “Strategy for Solo Superpower—‘Pentagon Looks to Regional Contingencies.’” May 19, 1991.

Wilder, Carol. “Weather as the Decisive Factor of the Aleutian Campaign, June 1942 – August 1943.” Masters thesis, U. S. Army Command and General Staff College, 1993.

Wishnick, Elizabeth. “Strategic Consequences of the Iraq War: U.S. Security Interests In Central Asia Reassessed. Monograph, Strategic Studies Institute, U. S. Army War College, 2004.

Zuppardo, Joseph C. “Graphical Comparison of U. S. Standard Atmospheres and Military Standard Climactic Extremes.” Aeronautical Systems Center, Wright-Patterson AFB.

Online Journals

Spacewar. “Chinese Troops in Tajikistan for Mountain Warfare Drill.” (September 14, 2006). http://www.spacewar.com/reports/a060914165233.jiysf3ny.html (accessed September 24, 2007).

Strategic Affairs. “Notes on Mountain Warfare.” (December 1, 2000). http://www.stratmag.com/issueDec-1/page07.htm (accessed September 24, 2007).

Nawroz, Yahya Mohammed and Grau, Lester. “The Soviet War in Afghanistan: History and Harbinger of Future War?” *Strategic Affairs*, 2001. http://www.stratmag.com/issue2Oct-1/page07.htm (accessed September 25, 2007).

Andrew, Martin. “The Resurgence of PLA Light Infantry.” *The Jamestown Foundation* issue 18, vol. 6 (September 6, 2006). http://www.jamestown.org/publications_details.php?volume_id=415&issue_id=3845&article_id=2371417 (accessed September 25, 2007).

Woodson, Michael S. “Understanding Mountain Warfare Training.” *DefenseWatch*, (October 3, 2005). http://www.military.com/opinion/0,15202,78075_2,00.html (accessed September 24, 2007).

Web logs

http://www.geocities.com/equipmentshop/realmountaindivision.htm (accessed 24 September, 2007).

Miscellaneous

Mattis, James N. LtGen James N. Mattis, Deputy Commandant for Combat Development and Integration, United States Marine Corps, Before the House Armed Services Committee Subcommittee on Tactical Air and Land Forces, Concerning 2007 Budget Request And FYDP on April 4, 2006. Washington, D.C.: House Armed Services Committee, Tactical Air and Land Subcommittee, 2006.

United States Geological Survey, “USGS Frequently Asked Questions.” http://www.usgs.gov/faq/list_faq_by_category/get_answer.asp?id=787 (accessed December 11, 2007).