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The Impact of Terrain on Strategy

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THE IMPACT OF TERRAIN ON STRATEGY

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by

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On this fifth day in your *Strategic Planning Study*, I consider it a high privilege to discuss with this distinguished group *The Impact of Terrain* on *Strategy*. My good friend, Admiral Chester Wood, with whom I served on the faculty of the National War College, addressed you last Tuesday on the subject of *Military Aspects of the National Estimate*. On Wednesday, General Decker's splendid address examined *The Army's Role in General and Limited War*. As a logical extension of that topic, it seems appropriate for us to discuss the problem of terrain in relation to strategy. This is a subject that has won battles, campaigns, and wars for those who respected and understood it; on the other hand, its neglect has brought superior forces to their knees. It is one of the most important subjects in the wide spectrum of military strategy, but also one of the least esteemed and most frequently overlooked. Just as the ever-changing complexion of the seas demands respect of the navigator, so the complex and sometimes whimsical characteristics of the terrain demands respect of the strategist. In view of the fact that successful strategy depends on sound tactics for its execution, I ask you to consider first with me the impact of terrain on tactics.

Acknowledgement is made of the valuable assistance from Mr. David B. Doan of the Military Geology Branch, U.S. Geological Survey, Department of Interior, Washington, D.C.

In this highest institution of learning in the Department of the Navy, each of you has had to master the art of navigation. Let us begin our study of terrain, therefore, by conceiving a hypothetical, featureless world analogous to the flat and watery domain of the navigator.

What would be the nature of warfare if the entire earth were as smooth as a billiard ball, with no mountains, valleys, rivers, or oceans? On such a level waste, land warfare would resemble classic sea warfare. In such an unprecedented environment we might profitably examine the teachings of Clausewitz, Douhet, and McKinder, and that classic authority on naval warfare, Admiral Mahan, for we should have real need of strategic guidance. There would be no place to hide in a contest between land-going *naval* task forces ranging over the surface, consequently, scanning the horizon, and speed and maneuver would be crucial factors. Land operations would resemble a game of checkers with all moves clearly visible.

If we add oceans to this hypothetical planet, the strategic situation is immediately complicated. Different vehicles are required for land and water. Land vehicles are denied access to many islands, or even continents, when there are no waterways. Our checker game has become more complex. It is as though half the game were played on red squares and half on black, with certain rights of capture or destruction honored across the many boundaries between the two colors. Routes of access or approach become very important. Areas where many routes coincide, such as an isthmus joining large land masses, or a channel from one large body of water to another, have major military significance. This simple dual environment would encourage feints, backdoor attacks, amphibious redeployments, and flanking assaults. It would be a fast game, with only two kinds of environment, the wet and the dry. Obviously, then, exploitation of sea routes would be a major element of strategy.

Our example is oversimplified unless we include variations in weather and climate. Oceans freeze at the poles, and the equatorial areas are hot and humid. Climatic phenomena, such as temperature and rain, cause great ice sheets in one region and deserts in another. Physical protection requires new procedures, logistics becomes complex, and the propitious moment for an assault often depends on the sun, the moon, the season of the year, and the position of the tides. The smooth, artificial land of this hypothetical world must be transformed into what it really is: a complex of mountains, valleys, hills, and plains.

Next, we must introduce lakes, rivers, and marshes. To the military obstacles of hills and mountains, we add numerous other obstacles that are the consequences of drainage. Vegetation must also be given a place, including everything from dense forest to open grassland. We must analyze the land surface with respect to types of soil and roughness of ground, since some soils are dry and firm, while others are moist and slippery. Finally, we must take into account the cultural environment: roads, urban areas, railways, and the like. Our analogy drawn from naval warfare now becomes less suitable. The complexities of relief, drainage, vegetation, and other obstructions impose a discipline in which the long way around may be the fastest.

In effect, our original checkerboard analogy is no longer applicable. Even the game of chess is far simpler than the strategy and tactics of warfare. In 1747, Frederick the Great admonished his generals that a knowledge of the country and an eye for the terrain were important enough to warrant leaving the strategist's chessboard for a look at the countryside.

I have indicated some of the variables (Fig. 1) affecting the absolute character of terrain, making it favorable or unfavorable for military operations. They are governed in turn by the interaction of two

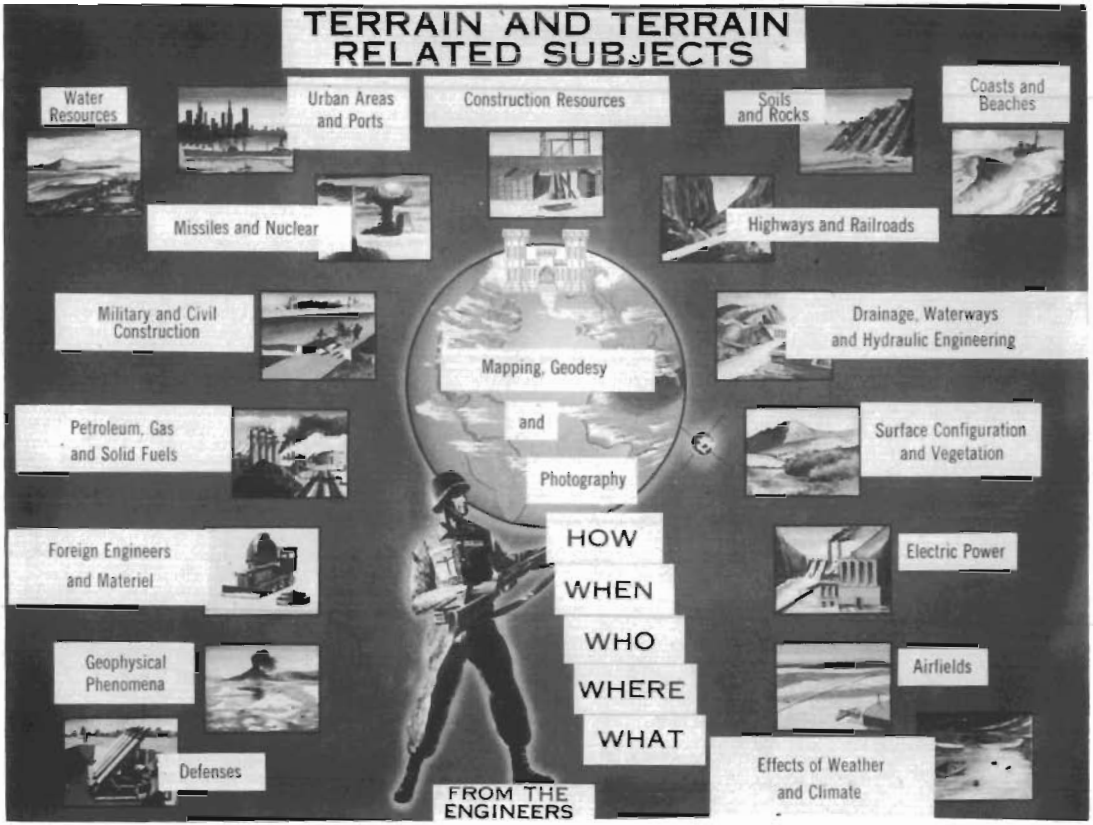

TERRAIN AND TERRAIN RELATED SUBJECTS
Water Resources
Urban Areas and Ports
Construction Resources
Soils and Rocks
Coasts and Beaches
Missiles and Nuclear
Highways and Railroads
Military and Civil Construction
Drainage, Waterways and Hydraulic Engineering
Mapping, Geodesy
and
Photography
Petroleum, Gas and Solid Fuels
Surface Configuration and Vegetation
HOW
WHEN
WHO
WHERE
WHAT
Foreign Engineers and Materiel
Electric Power
Geophysical Phenomena
Airfields
Defenses
Effects of Weather and Climate
FROM THE ENGINEERS

Figure 1

complementary factors—the static and the kinetic. Static factors include the slope angles and relief of an area, the underlying bedrock, the soils, the overall pattern and characteristics of drainage, and the distribution of plants. No one would claim, of course, that these static factors do not change; however, the change is gradual. Kinetic factors, on the other hand, change rapidly, and in some cases, abruptly; they include, for example, rain, fog, temperature, dust, and foliage.

Neither the static nor the kinetic factors are themselves terrain as such, but they do interact in predictable ways with one another to produce environments that influence military planning. Impermeable soil in combination with poor drainage and heavy rain results in floods and quagmires that can paralyze movement. Add another kinetic factor, low temperature, and the outcome can be a frozen plain permitting surface movement in areas normally impassable. In areas of sparse vegetation, aridity in conjunction with high winds can loosen dry soil from the surface and create dust storms.

In each case, the kinetic factors act on the static factors to produce a terrain element. It is characteristic of these terrain elements, moreover, that they change much more slowly than the kinetic factors that generate them; mud remains long after the rain ceases, and dust hangs in the air long after the wind calms.

The significance of a terrain element may also change with advances in technology. A forest that would have been no obstacle to a foot soldier in the American Revolution, or to a mounted cavalryman in the Civil War, may prohibit passage by a tank today; furthermore, the same forest would probably become a deathtrap from fire and blow-down in nuclear war. Conversely, a broad marsh that prohibited crossing by foot troops in wet weather, or by horsemen even in dry

weather, might present no obstacle to the ducted-fan, zero-ground pressure vehicles now being developed.

Examples are legion of the successful exploitation of terrain to gain an advantage both in offense and defense. An attacker with a stronger force seeks mobility and speed to close with the enemy and destroy him. His desire is to reduce opposition rapidly, secure the element of surprise, and move to his objective before the defense has time to rally. I had the privilege of serving for two years with the British Eighth Army in the Western Desert, and was at first surprised to find that both Alexander and Montgomery had British naval doctrine in their libraries. Later, when I had learned something of desert warfare, the reason became obvious. In the North African Desert War from 1940 to 1942, when logistics permitted either side to embark on an offensive, the terrain was almost entirely in the attackers' favor. Once dislodged from prepared positions, a defending force had virtually no alternative but retreat. Obstacles to movement were few and far between in the zone of operations, which is a wide, coastal plain, bounded on the south by the great dune-covered expanse of the central desert. An attacker could exploit this type of terrain until his momentum was overcome by the sheer magnitude of logistic problems. On many occasions, it was simply a matter of his running out of gas. Historically, the four-year cycles of advance and retreat of the British Eighth Army in the face of the Afrika Korps were similar to the stretching of a logistic rubber band, which snapped the attacker back to his base whenever it became overextended.

For centuries the cavalry charge was employed, where suitable, to penetrate rapidly into contested terrain. But the man on horseback was compelled to forsake cover and concealment for the advantage of mobility. The charge of the Light Brigade at Balaklava, into a valley ringed with Russian artillery and infantry, is a classic example of the misuse of

terrain in attack. The Russians had good observation and fields of fire, while the Light Brigade had only their lances and sabres.

Terrain is exploited in an entirely different manner by a weak or defending force. Such a force must use cover and concealment to maximum advantage in order to prevent the attacker from knowing the size and disposition of the defense. Restricted mobility of the attacking force is extremely desirable, as are good fields of fire in front of the defense positions. Hilly or mountainous areas, heavily forested country, and marshes and swamps are potentially strong defensive positions. Historical examples are numerous.

In the American Revolution, the British and Hessians marched in conventional columns and swung into line to join battle. Their scarlet coats, white trousers, and crossed cartridge belts aided enemy observation. The Continentals, inconspicuous in their homespun or animal skins, practiced unconventional warfare and took maximum advantage of cover and concealment. Although the British considered this warfare neither sporting nor cricket, they had failed to learn the lessons of terrain. They were confronted by the same tactics and the same principles of concealment employed so successfully against the Roman Legions. Unable to adapt his tactics to the dense Teutoburger Forest, Caesar suffered a resounding defeat at the hands of the barbaric German tribes and was driven back across the Rhine. Had he been able to adjust his tactics to the terrain, and win the war, he might have Romanized the German tribes, unified Germany and France, and altered the history of Europe.

To continue these examples, terrain helped defeat the Italian invasion of Greece through Albania in October of 1941. Bad weather, lack of established routes, and poor cross-country movement conditions favored the defender and harassed the attacker. The Italian planners deliberately chose unfavorable timing

and terrain in order to catch the unsuspecting Greeks by surprise. The Italians, however, had overestimated their ability to cope with these adverse conditions. They bogged down badly. Hostile weather grounded Italian air support, and the ground troops were defeated decisively by small defending Greek forces that took every advantage of the terrain.

In spite of the best defenses, superior forces can be defeated in their own prepared positions when the attacker makes ingenious use of timing and fits his operations to the terrain. In their 1956 invasion of Egypt, Israeli forces turned the tables on the defenders by simply attacking with the sun at their backs. A number of successful surprise attacks were launched against Egyptian strongpoints precisely at sunrise or sunset, when the brightness of the glaring desert terrain was blinding.

Past civilizations have attempted to alter the terrain on an enormous scale for defensive purposes. The Great Wall of China was an ambitious barrier against the bellicose tribes of inner Asia. Hadrian's Wall, built by the Romans in Britain, restrained the savage Celts from overrunning the Roman colony. The Maginot Line in France and the Siegfried Line in Germany were more than simple walls; they were highly complex gun positions, strongpoints, interconnecting fortifications, underground facilities, and tank barriers. The mobility of armored forces reduced both of those historic defense lines by envelopment rather than by penetration.

Although another type of obstacle, the modern anti-tank minefield, is still quite vulnerable to skillful detection and penetration, we are about to witness in the next few years the ultimate in man-made barriers. Our present atomic demolition munitions, supplemented by those under development, will enable us to preposition overlapping nuclear barrier patterns in such depth as to impede aggressive land movement by any known method.

At the other end of the spectrum of modern warfare are those small bands of insurgents that employ the highly sophisticated doctrine of guerrilla tactics. They depend on terrain elements for their success perhaps to a greater extent than do conventional forces. An area that discourages observation and movement even by foot troops is ideal for guerrilla operations. Such operations were carried on with conspicuous success by the Russians against the Germans in 1941-42. Russian strikes from extensive swamps and forests continually menaced the German rear. Filipinos and Americans also carried on effective guerrilla activity against the Japanese throughout the entire occupation of the Philippines. As a phase of their counterguerrilla operations in Malaya, the British prepared very large-scale terrain maps and studied every natural or man-made detail that related to cover, concealment, and drainage. By combining this knowledge with information on guerrilla strength in a given area, they were able to flush the guerrillas from hiding, starve them out, or surprise them while in movement. On the other hand, Castro's forces in Eastern Cuba knew every detail of the terrain, and were able to use this knowledge to outmaneuver and defeat the attempts of the Batista Government forces to dislodge them.

So much for the effects of terrain upon essentially tactical operations, both offensive and defensive. Let us now consider the impact of terrain on strategy as such.

Because of its long history of warfare, Europe furnishes useful examples of strategic terrain in the forms of strategic gates and corridors (Fig. 2). Control of the land on either side of the water gateway at Gibraltar controls the entrance to the Mediterranean. The Sicilian Straits, which divide the Mediterranean into two parts, were taken from the Axis as soon as possible in World War II. Possession of those two water gateways governed access to the


STRATEGIC TERRAIN OF EUROPE
BELGIUM CORRIDOR
HESSIAN CORRIDOR
LORRAINE GAP
MORAVIAN GATE
RHINE CORRIDOR
LINZ CORRIDOR
BELFORT GAP
RHONE CORRIDOR
LJUBLIANA GAP
TOULOUSE GAP
MORAVA-VARDAR GAP

Figure 2

coast of Southern Europe. Mastery of the Dardanelles-Bosporus gateway to the Black Sea was essential to British efforts to aid Russia in World War I. British naval attempts to force the passage without control of the land on either side were a failure. Moreover, this effort attracted several Turkish army divisions to the scene; as a result, the amphibious landings at Gallipoli were anticipated and defeated.

It is well known that the English Channel has been an obstacle to invasions and counterinvasions since time immemorial. To the north, the Skagerrak and Kattegat provide the only entrance to the Baltic. Hitler took Norway in 1940 partly in order to control the Skagerrak and protect Swedish iron ore shipments to Germany. In every case, terrain adjacent to these waterways acquires strategic significance in proportion to the importance of the waterways themselves.

In Western Europe there are several important gates and corridors. The Toulouse Gap, between the Pyrenees and the Central Massif of France, affords passage from the Mediterranean to the French Atlantic Coast. The Rhone Corridor is a passageway from the French Mediterranean Coast to Eastern France and Southwest Germany. The Belfort Gap leads from Eastern France into the Rhine Valley. The Lorraine Gap connects the Moselle Valley of France with the Rhine Valley near Strasbourg. The Belgian Corridor, between the Ardennes and the coast, will be discussed later in some detail. The Rhine Valley itself is a corridor 20 miles wide and 150 miles long leading to the Hessian Corridor, which in turn gives access to the North German Plain.

To the east, Eastern Czechoslovakia and Hungary are penetrated by the Linz Corridor. The Moravian Gateway leads north into the North European Plain. In the south, the Ljubljana Gap is not actually a corridor, but it does offer a route connecting the north coast of the Adriatic with the Hungarian Plain. The

Morava-Vardar Corridor affords access from the Aegean Coast to the Hungarian Plain, but is winding and partly obstructed. Still farther east, in Asia Minor, the classic Syrian Corridor (Fig. 3) has been one of the great historical routes of military conquest. With Egyptian culture at its western end and Sumerian culture to the east, this fertile crescent, bounded by the Kurdistan Mountains to the north and the Arabian Desert to the south, became a teeming crossroads of civilization. Each of the corridors mentioned thus far has been utilized as a route for the movement of armies throughout recorded history.

To return to Western Europe, the Paris Basin is guarded to the northeast, east and southeast by a series of concentric, semicircular scarps facing outward and having more gentle inward slopes. These scarps disappear northward toward the Ardennes and Belgium, and southward the terrain becomes hostile to movement as the hills and mountains become more rugged. In 1814, the Allies converged on Napoleon in this ridged area with one column from the north and two from the east. Although movement among the ridges was difficult for the Allies, Napoleon wore his army to exhaustion rushing from one invading column to another, even though he had interior lines of communications.

In 1914, the Germans achieved surprise and almost captured Paris by violating Belgium's neutrality and moving rapidly through her favorable terrain into France. They were stopped, however, and war again raged among those concentric ridges. Both sides threw in millions of men and used the defensive characteristics of the terrain to the utmost. This same terrain, which favored an attack toward the east, was a factor in breaking the Hindenburg Line and defeating the Germans.

In 1940, the Germans again struck rapidly with highly mobile armor through the Ardennes and outflanked

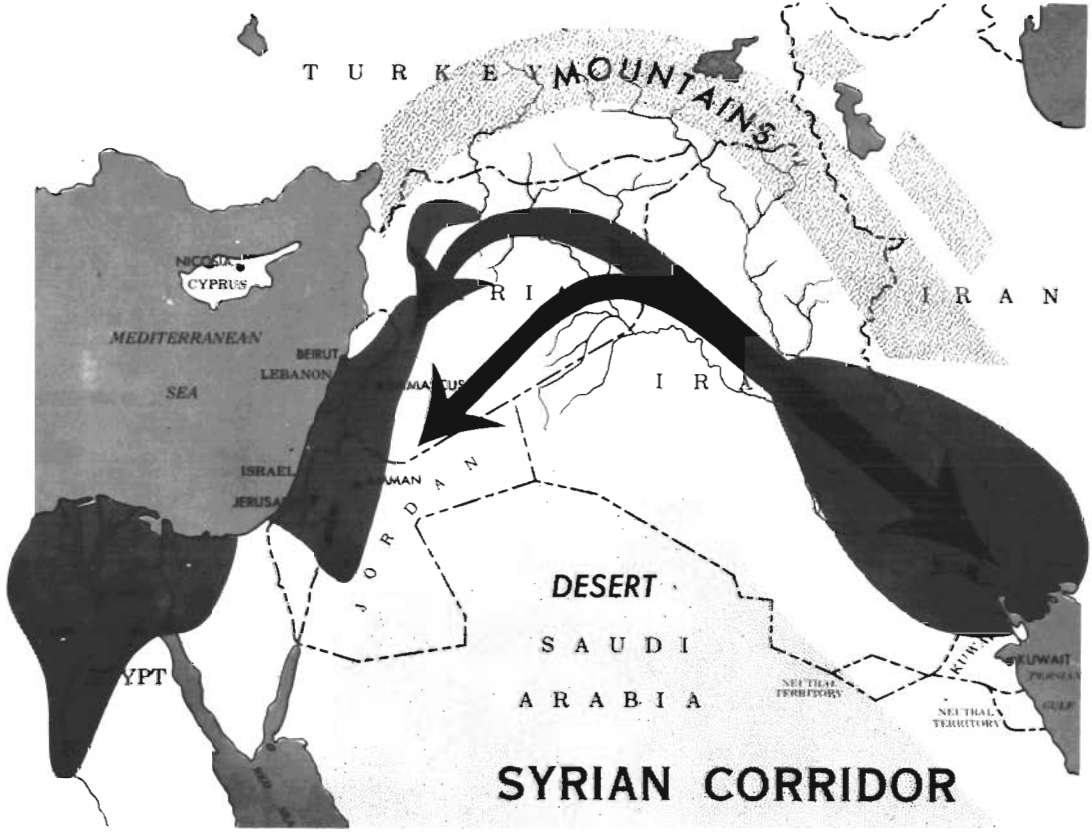

T U R K E Y
MOUNTAINS
I R A N
CYPRUS
MEDITERRANEAN
SEA
BEIRUT
LEBANON
ISRAEL
JORDAN
DESERT
S A U D I
A R A B I A
SYRIAN CORRIDOR

Figure 3

the Maginot Line. In 1945, the Allies penetrated Germany through the same area. In all these conflicts, terrain ruled out easy access back and forth between countries except through the Belgian Corridor between the Ardennes and the coast. As a consequence, many major battles have been fought here rather than farther inland to the south, where the terrain, with few exceptions, hinders the attacker and favors the defender.

The selection of Normandy as the site for the massive amphibious assault for our principle invasion of Europe involved a colossal double deception. The German General Staff believed the invasion would be along the narrowest part of the English Channel near Calais, because of easier terrain and probable economy of effort. Heavy forces were committed to the defense of this area. Both Rommel, who was in charge of the north coast forces, and Hitler, correctly suspected the landing would be in Normandy, but felt it would concentrate on the capture of either Cherbourg or Le Havre. Rommel believed a self-sustaining amphibious landing was beyond the capability of the Allies, and believed they would require one of these two major ports immediately. He could not be sure which would be the objective and had to prepare to hurdle the Seine in either direction. This uncertainty complicated his initial planning and movement. He scarcely could have suspected that the Normandy landings would be logistically supported by the innovation of a floating harbor protected by sunken blockships. As a result, the Allies were able to exploit his weakness in the middle by driving directly inland to secure the beachhead.

Subsequent Allied landings in Southern France, termed Operation Dragoon, drove up the Rhone Corridor to protect the southern flank of the Normandy invasion. Mr. Churchill and the British Chiefs of Staff opposed these landings, and advocated diverting resources for this operation to an offensive through

the Ljubljana Gap in an effort to beat the Russians to Vienna and Budapest. Although this undoubtedly would have proved desirable politically, if successful, the uncertainties of terrain in this so-called *gap*, which is very narrow and winding, would have entailed considerable risk of failure. The many railway tunnels could have been destroyed easily by the Germans, and the one existing two-lane road could have provided logistic support for only a few Allied divisions. Properly defended, this corridor would have become a defile, and an Allied force would have been like the German Navy at Jutland in World War I—its "T" would have been crossed.

The troubles that beset Napoleon and Hitler at the gates of Moscow are further classic examples of the impact of terrain on strategy. Napoleon was a splendid tactician and map reader, but he was out of his European element in dealing with the Russians. They retreated before the French all the way to Moscow, and then set fire to the city and departed. After considerable effort, the French had captured a place that had no cheering crowds, no people, no facilities or supplies, and no particular value. The temperature fell, the snow fell, the French fell, defeated because they had conquered more terrain than they could manage.

Hitler's problems with the Russians also were rooted in an inadequate comprehension of Russian terrain. German army successes against the USSR in the period from June to October 1941 resulted, in large part, from favorable terrain conditions that permitted mobile armored divisions to roll eastward. The Germans timed their invasion for June, when they could rely on dry soils after the spring thaws, and yet have as much time as possible before winter. They had excellent mobility and drove all the way to the suburbs of Moscow. The Russians withdrew rapidly, leaving only scorched earth and guerrillas. All was well until the beginning of winter, when the lack of cold-weather

clothing and low-temperature lubricants caused German men and machinery to freeze. One day's mud became the next day's frozen ground. Assaults were delayed while tanks were liberated from frozen mud with crowbars and blow torches. Logistic problems became critical, yet Hitler would not tolerate withdrawal to terrain having more favorable defensive characteristics. Artificial strongpoints at the limit of advance were to be held at all cost. As you know, Russian attacks succeeded. Hitler's refusal to accept the discipline of terrain on military operations prevented him from defeating a weaker Russian army and winning what was almost a sure thing.

Turning to other places in the world, the islands of the Pacific are of great strategic significance because they constitute few small land areas in the midst of an ocean covering much of that part of the globe. In World War II, the strategy of assaulting only a few key Japanese bases up through the Central Pacific, rather than conquering all heavily defended terrain along the way, provided the best access to Tokyo. Initially, New Guinea, Guadalcanal, and Tarawa were strongly attacked to pin down major Japanese forces. The Army, Navy, and Marine team then assaulted selected islands, one by one, in the Gilberts, Marshalls, Marianas, and Ryukyus, developed them as bases, and used them to neutralize resistance in the area by maintaining air and sea superiority. The Japanese were good students of terrain and dug in deeply on most islands. Moreover, the islands were usually too small for effective tactical movement, frequently necessitating direct frontal assault from the moment of attack to the moment of victory. Conquest of all of these strongpoints would have been impractical. Ocean areas between islands furnished very fine maneuvering space for carrier task forces, the sea-going analogs of mobile armored forces on land. With their assistance, the remaining Japanese bases were successfully neutralized.

Fortified to command the Straits of Malacca and the southern entrance to the South China Sea, Singapore had long been the pivot of British strategy in Southeast Asia. The naval and air base located there was intended to protect Australia and the neighboring British and Dutch islands, as well as the Pacific entrance to the Indian Ocean. The British (and all of us) assumed the rough terrain and dense jungles of Malaya precluded any large-scale overland attack from the north. But the Japanese shrewdly avoided a direct naval assault on Singapore, and landed 400 miles to the north under protective air cover. They fought down the west side of the Malay Peninsula, using small leapfrogging amphibious operations where necessary, and captured Singapore from the direction that was supposed to be protected by terrain.

Korea presents a somewhat similar terrain situation. Strategically, Korea has, in places, a narrow plain along the south and west coasts, and one or two poorly defined interior corridors. Mobility is difficult in comparison to terrain in Europe and Russia during World War II. After much painful movement up and down the peninsula, strategy was devised in the spring of 1952 to select a static front with desirable terrain characteristics. By choosing terrain that afforded very favorable observation and highly convergent fields of fire for all weapons, and then digging in, the United Nations forces established a stable and powerful defensive line across the peninsula. The Communist Chinese threw many divisions against this line, only to have them decimated. Bluntly expressed, it was a killer operation that channeled them into the place of slaughter. The Chinese had neither the naval capability nor the air supremacy necessary to land forces behind the United Nations' defense line. After one or two months of almost incredible Communist Chinese losses, the Chinese abruptly suggested through their Russian colleagues in the United Nations that armistice negotiations be opened.

Passing on to further examples, Suez and Panama have a strategic value that is perhaps unrivaled, the former being the only land bridge between Europe and Africa, the latter connecting North and South America. Each includes similar artificial water gateways between principal oceans of the world. Violence in one form or another has erupted frequently at both of these global crossroads. Suez has been a scene of strife for centuries, and its ground has been trod by the armies of Egypt, Assyria, Persia, Rome, Germany, France, Britain, and Israel. Similarly, the Spanish conquistadors, Henry Morgan, and the world situation today point up the significance of the Panamanian.

The permanence of political boundaries has always depended heavily on terrain. Switzerland and Poland are clear examples. Switzerland has strong mountain barriers at its perimeter; therefore, it has been able to survive as an independent state because access is extremely difficult. Relatively easy defense has allowed the Swiss nation to remain serene in the midst of epic struggles between France, Italy, and Germany. On the other hand, Poland is difficult to defend in spite of the fortitude of the Polish people, since her borders afford excellent mobility and access on several sides. From the standpoint of terrain, these borders can be defended about as well as that which separates Kansas from Nebraska. Proof of this thesis lies in the location of historic invasion routes from barbarian days to the present (Fig. 4). Switzerland has endured while Poland has been overrun and partitioned repeatedly.

The present supernational boundary between the Soviet Bloc and Western countries is reinforced least by terrain barriers through Germany, which makes it possibly the most vulnerable area. Elsewhere this boundary is more secure, as in the mountainous areas between the Balkans and Greece, the Caucasus between the USSR and Turkey, and the Kopet Mountains between the USSR and Iran.

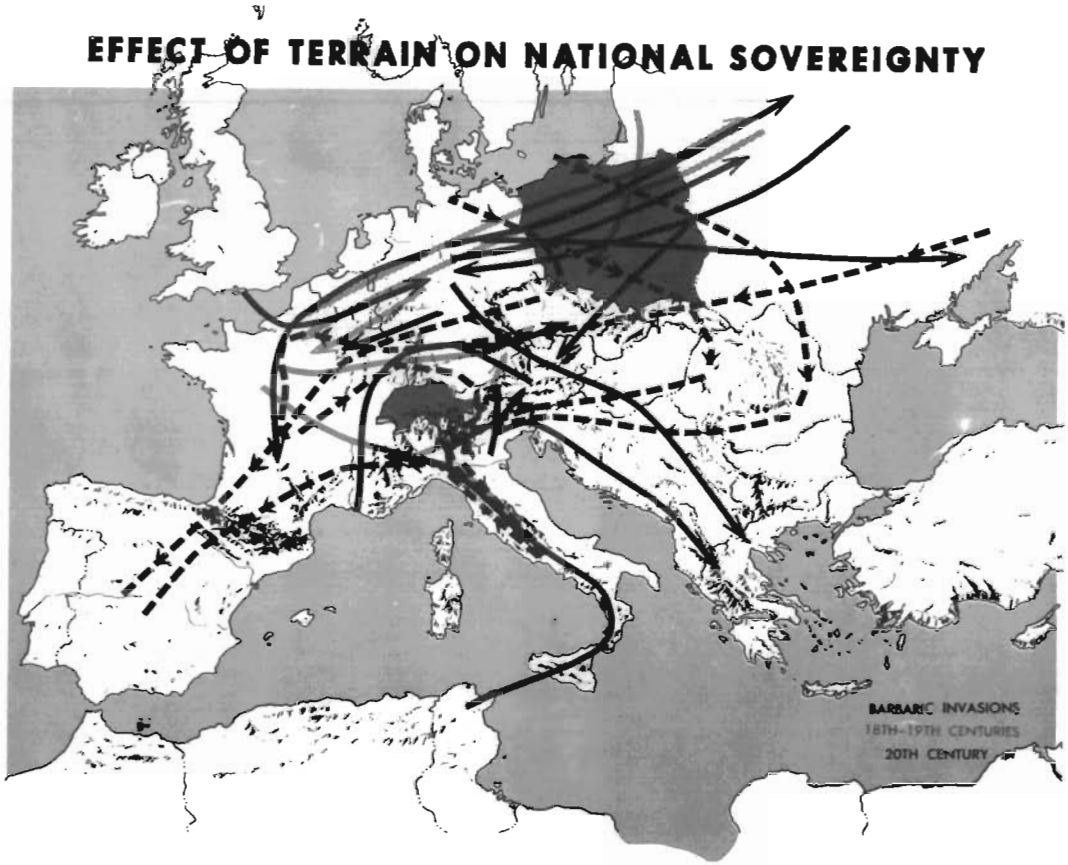

EFFECT OF TERRAIN ON NATIONAL SOVEREIGNTY
BARBARIC INVASIONS
18TH-19TH CENTURIES
20TH CENTURY

Figure 4

Now that submarine transit of the Arctic Ocean under the pole has been established by the U.S. Navy, the Bering Strait has become a global gateway of strategic importance. Opposite sides of this strait are controlled by the two great powers of our time. In the event of conflict, who will control the strait itself? Whose missile-bearing submarines will be able to use it? There is no doubt that it will be of enormous value to the country having control of it. It is sobering to reflect that the few miles of water separating Alaska from the Soviet Union are frozen every year. In February, moreover, the North Polar Cap is frozen solid and is contiguous to the USSR, North America, and Greenland. Although this ice is not land, it can be used as terrain. Thus for a part of each year, America has what may be called a strategic terrain connection with the USSR in the direction of closest approach. Technology has made, or soon will make, access feasible in either direction over the polar area. At that time, protection of the United States by large oceans will no longer be a reality. U.S. vulnerability to land attack will be an inescapable factor for consideration in future strategic planning.

Greenland is also of special strategic significance in its location and terrain characteristics. Field work during recent years has demonstrated that it is possible to live, work, and carry out military operations on the icecap. For the most part, this area is still unexploited, but could provide staging or dispersal areas for aircraft on the line of closest approach between the eastern United States and the Western USSR. With atomic energy available to provide power and heat for such installations, we have yet another vista to consider. Our certain advantage lies in either utilizing this terrain or denying its use to others; otherwise, it will be used against us.

The effect of terrain on strategy in the nuclear age will require increasing analysis with the growth

of our capacity for the use of nuclear explosives and tactical nuclear weapons. In general, areas of high relief can provide shielding against direct blast, heat, and radiation effects. Blowdown and fire storms in forests will make these areas hazardous. The development of an effectively clean nuclear explosive will permit construction engineers in the near future to excavate large quantities of earth for cents instead of dollars per cubic yard. Nuclear explosives in the near future will be serving as construction tools to make alterations in the terrain—craters, landslides, new ports, harbors, river channels and canals—of a scope and magnitude never before visualized by man. I leave to your imagination the effect of such artificial terrain features on the strategy of nations in the next two decades.

With his usual military sagacity, Machiavelli once said: "In peace, soldiers must learn the nature of the land, how steep the mountains are, how the valleys debouch, where the plains lie, and understand the nature of rivers and swamps—then by means of the knowledge and experience gained in one locality, one can easily understand any other that it may be necessary to observe." Machiavelli could have scarcely realized how pertinent his maxim would be today, for we have turned from the earth to the moon. Analysis of our satellite's terrain has become an urgent task in the space age.

The terrain features on the lunar surface have been subjected in recent months to the most exhaustive analysis and classification. We can identify the area of the Alphonsus Crater, a small lunar feature which soon may become the target for the first landing of a human being on any body in outer space. These illustrations (Fig. 5-8) suggest how the terrain of this lunar crater would look to an astronaut decelerating his space capsule prior to a landing in the Alphonsus Crater. Perhaps this last example emphasizes more dramatically than any we have considered today, the

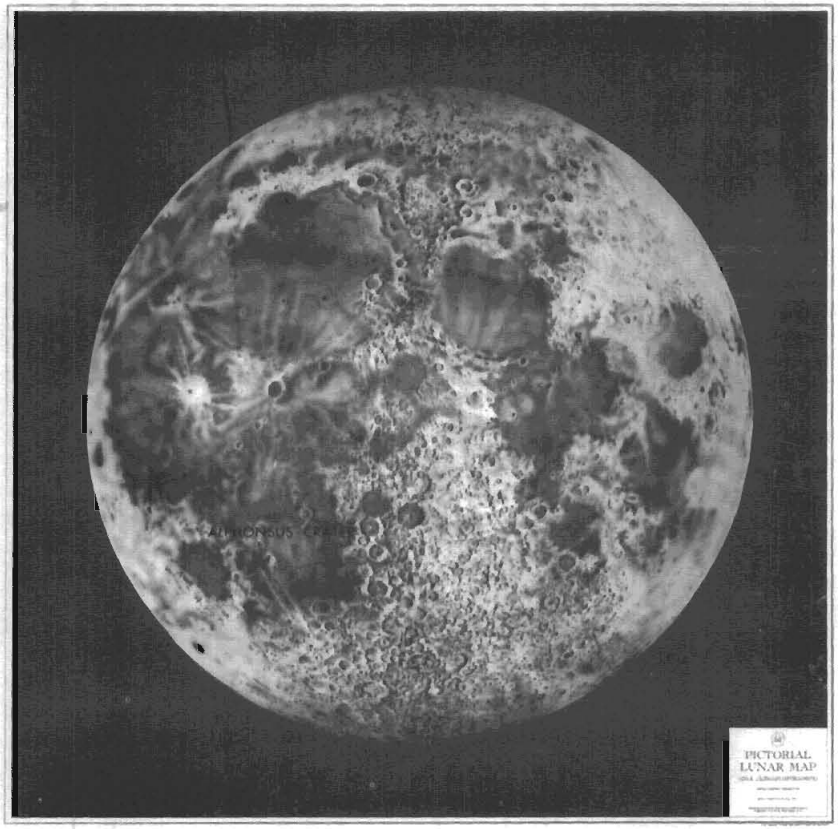


Figure 5

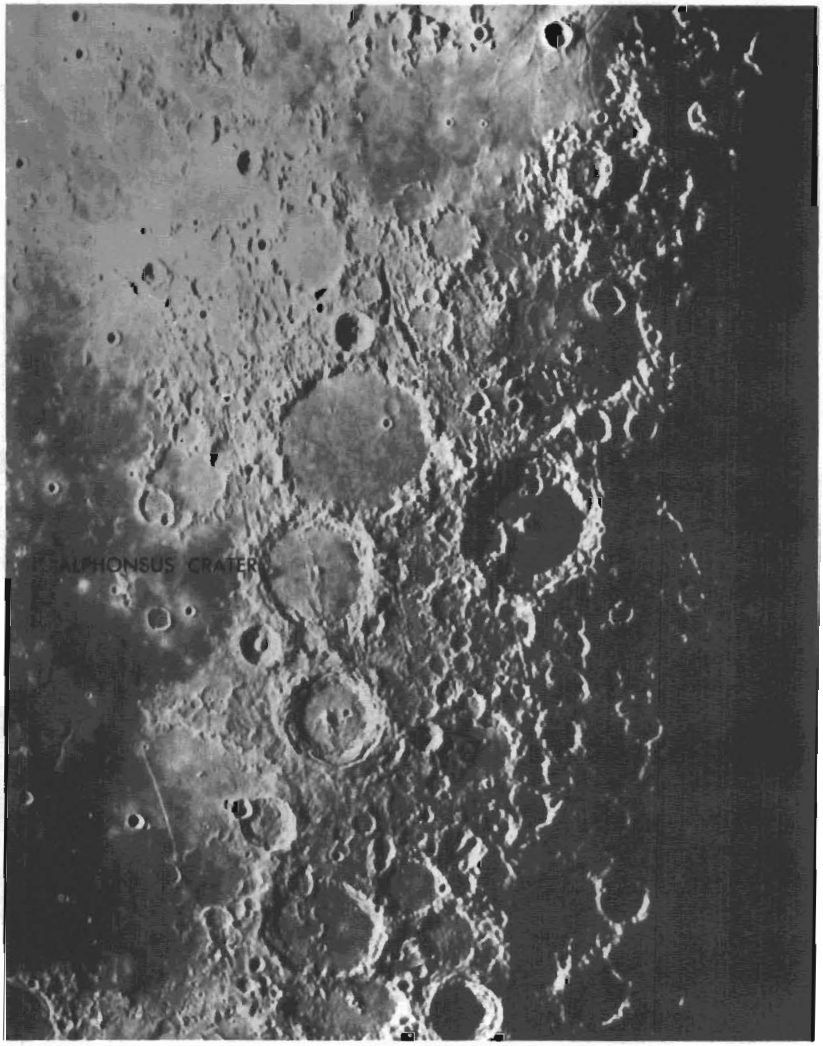


Figure 6

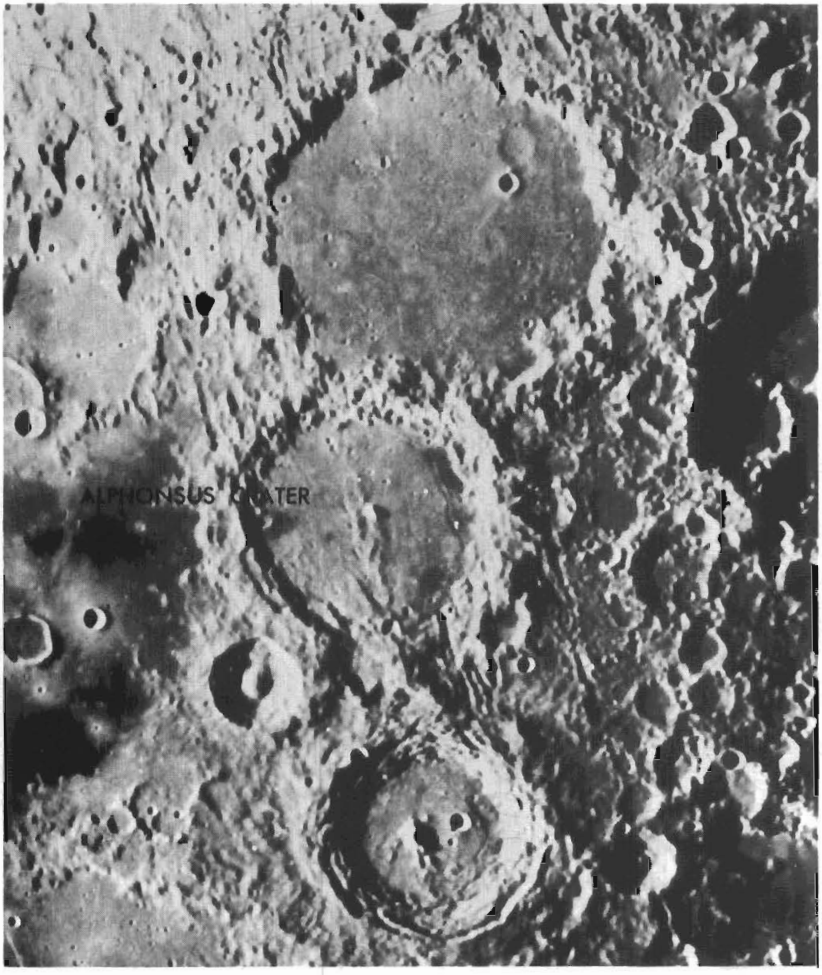


Figure 7

Figure 8

incontrovertible fact that neglect of terrain in strategic planning could well mean defeat in war. What, then, are we doing as a nation to profit from these cold, hard lessons of the past?

General Decker mentioned to you earlier this week the Army's new ROAD concept. The letters R O A D form the acronym for the term "Reorganization Objectives, Army, Divisions," a study through which the Army has met directly the need for tailoring organizations and equipment to diversified terrain. Let me describe how Army forces under the ROAD concept would actually be fitted to a specific area of operations in Southeast Asia. A small region in Indo-China (Fig. 9) can exhibit at once wholly different types terrain. Such variety would demand organizational flexibility of a high order for the efficient operation of land forces. In the new ROAD concept, flexibility is achieved by attaching infantry, mechanized, tank, and airborne battalions to the division base (Fig. 10) battalions in whatever combination is appropriate for the terrain on which the division will operate. This division base, with minor variation, is common to all divisions. Only the types and numbers of maneuver battalions that are attached to each division will vary.

In the marshy delta of the Red River, only infantry battalions (Fig. 11) would be added to the division base, since neither armor nor heavy vehicles could maneuver in the swamps and rice paddies. As forces progressed inland, they would come to the lower slopes of the foothills. The terrain might permit the use of infantry, mechanized, and tank battalions (Fig. 12), with all combined in the same division. Moving farther inland to the higher regions, units would reach mountainous jungles. At this point, most of the battalions would be infantry (Fig. 13), but a few widely separated roads would permit the use of some armor to support them while they were moving along these roads. Continuing west, troops would encounter the Mekong River. Since it is unfordable,

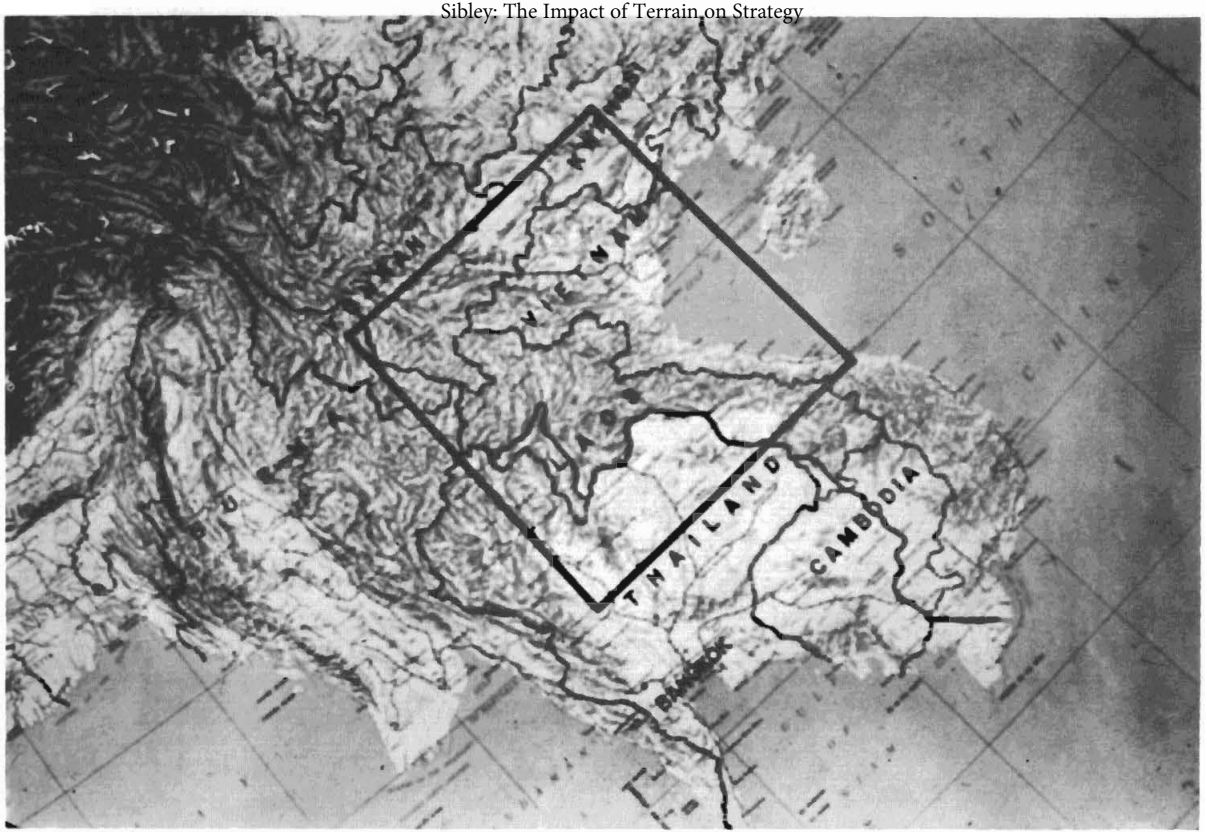
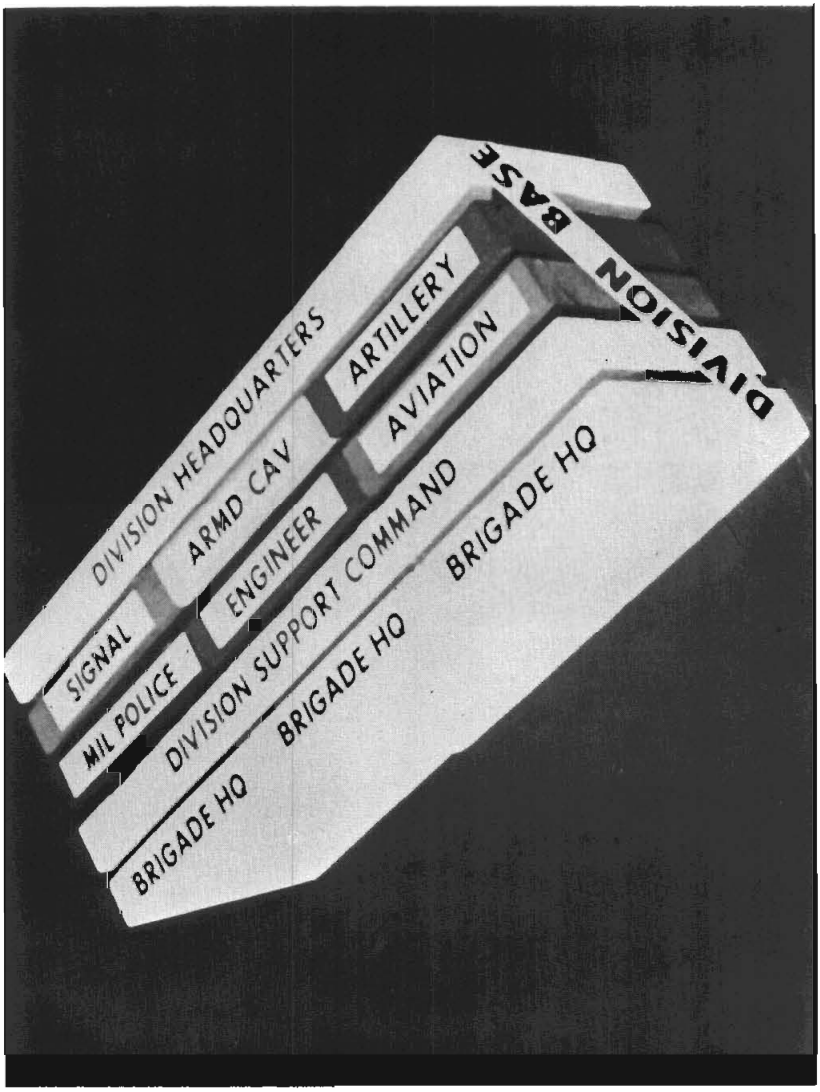


Figure 9


DIVISION BASE
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MIL POLICE
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Figure 10

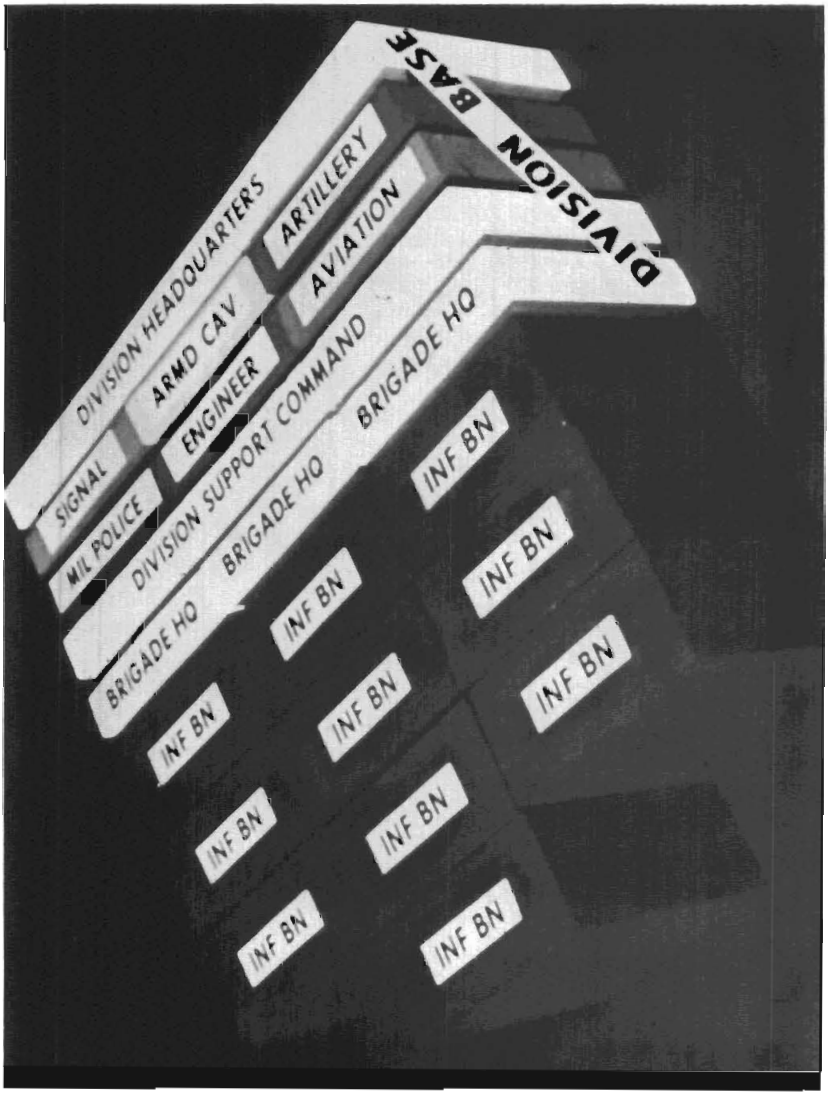
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Figure 11

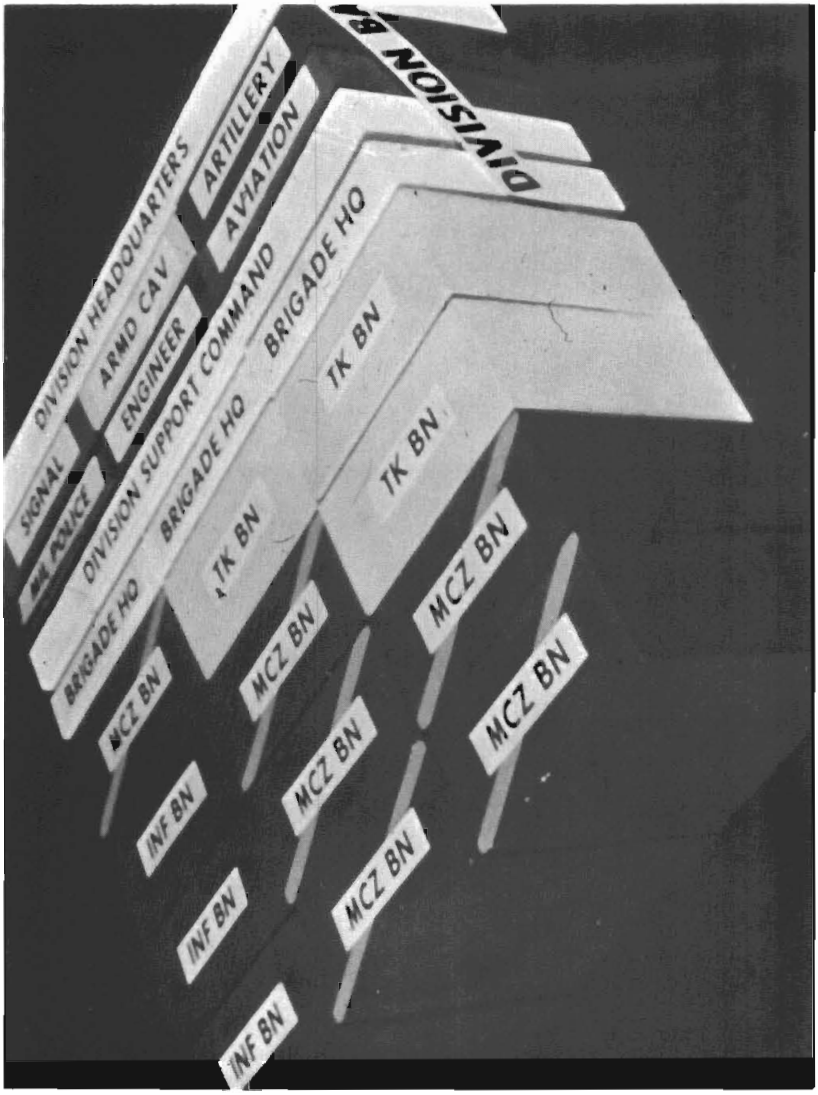
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Figure 12

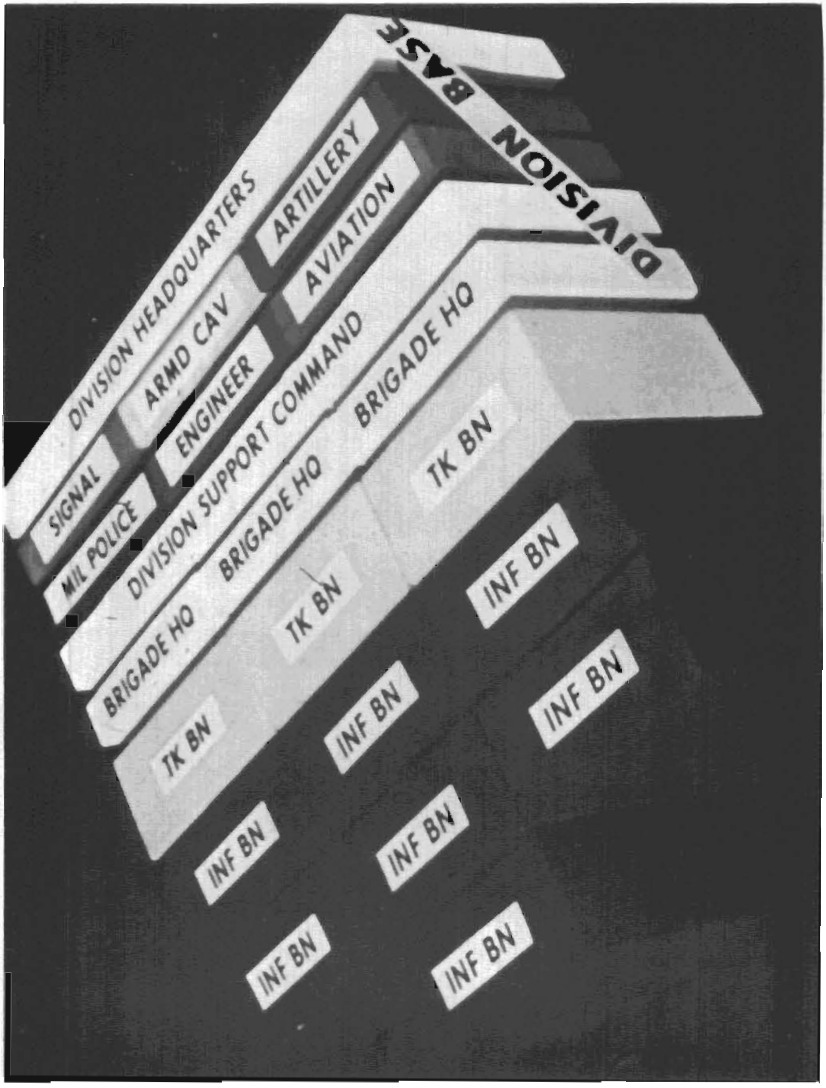
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Figure 13

and in some places over a mile wide, airborne elements (Fig. 14) could be employed advantageously to fix a bridgehead on the far side. South of the Mekong, in the semiarid plains of Northern Thailand and Burma, ideal terrain exists for armored movement. Hence the ROAD division employed there would include tank battalions and mechanized battalions (Fig. 15).

Those of us in the Marine Corps and the Army to whom this appears startlingly revolutionary may be a little shocked to learn that the ROAD division is a present reality. The two new divisions that President Kennedy said would be integrated into the regular army this spring will be brought under the TO&E's of the ROAD concept. These days, when the real war being fought against us by the Communist aggressors is the sublimited and sinister guerrilla aggression around the periphery of their world island, the discipline of terrain on military operations is momentous. The finest minds in the military services have been brought to bear on this revolutionary ROAD solution to the problem of terrain. These composite ROAD divisions will provide the flexible maneuverability for counterguerrilla operations in any terrain environment, and at the same time preserve our capability to fight a conventional or a nuclear war.

As sailors, you have long recognized the importance of navigation to the success of naval operations. Today we need navigators, geophysicists, and particularly terrain specialists, if we are to survive as a nation. I say to you members of this distinguished war college with all the vigor at my command, young officers of all services must learn terrain or learn Russian.

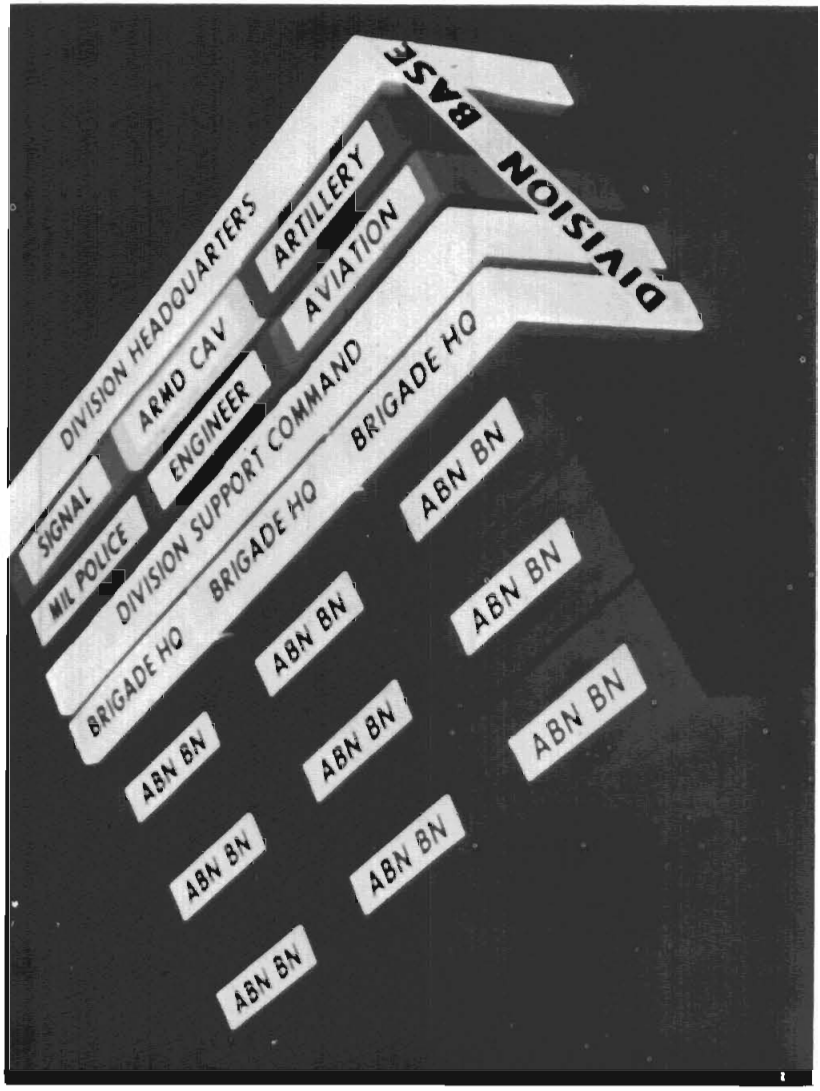
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Figure 14

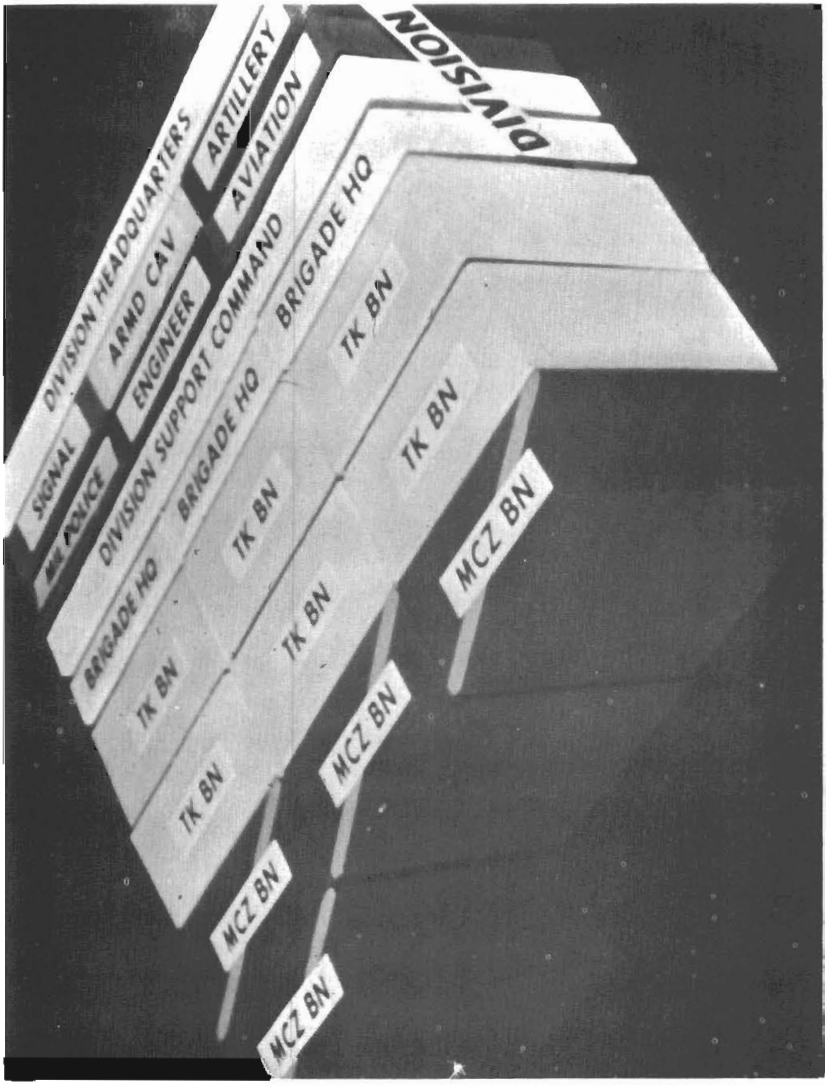
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Figure 15

BIOGRAPHIC SKETCH

Major General Alden K. Sibley, U.S. Army

General Sibley graduated from the U.S. Military Academy in 1933, was commissioned in the U.S. Corps of Engineers and was selected as a Rhodes Scholar attending Magdalen College, Oxford University, England, where he took three degrees in theoretical and nuclear physics. In 1935 he conducted a scientific expedition around the world to measure and study cosmic rays.

Returning to the United States in 1936, General Sibley commanded the 1st Battalion, 5th Engineer Regiment, at Fort Belvoir, Va., and graduated from the Engineer School in 1937. From 1937 to 1938 he served as a White House Aide to President Roosevelt. In the three years before the United States entered World War II, he served as Executive Officer during construction of the Conchas Dam in New Mexico, Chief of Construction Inspection of the John Martin Dam in Colorado, and Executive Officer of the St. Lawrence Seaway and Power Project in Massena, New York.

On 7 December 1941 General Sibley's departure via the Pacific to become Chief Engineer of the U.S. Military North African Mission was delayed by the attack on Pearl Harbor. Arriving the following month in Egypt, he shortly became District Engineer of the North African Engineer District. Subsequently, he became Assistant Chief of Staff, G-4, and then Deputy Chief of Staff of the Middle East Theater of Operations. He then assumed command of the Eritrea Base Command in Asmara in East Africa.

In 1943 he served as Chief of the Army Component of the Joint British-United States Operations Planning Group of the Middle East Theater. Later in 1943 he

commanded the Tripoli Base Command in North Africa. General Sibley was ordered to London, England, in November 1943, as Executive Officer to the Assistant Chief of Staff, G-4, European Theater of Operations. In early 1944, transferred to Supreme Headquarters, Allied Expeditionary Force (SHAEF), in London, he participated in planning the Normandy invasion.

Two months after the war's end, in October 1945, General Sibley was designated a member of the War Department General Staff and returned to the United States as Assistant Deputy to the Acting Chief of Staff, G-4, in Washington. In 1946 he served as a member on the Joint Logistics Plans Committee of the Joint Chiefs of Staff, and later as Chief of the Strategic Logistics Branch, WDGS, and Chief of the Army Planning Coordination Group in the Office of the Chief of Staff. For his work on the War Department Command Installation Board during this period he was awarded the Oak Leaf Cluster to the Army Commendation Ribbon. In 1950, at the direction of the Secretary of the Army, he established the Army Policy Council and served as its first Military Secretary for the following two and one-half years. During this period he served as a Special Assistant to the Under Secretary of the Army for politico-military affairs.

In 1952 General Sibley returned to Paris, France, as Chief of the Logistics Plans Branch, SHAPE. During nearly three years in this assignment he visited the Defense Ministries of eight of the fifteen NATO allies from Ankara, Turkey, to Ottawa, Canada, and prepared plans for the logistic support of the forces assigned to the Supreme Commander. In 1955 he returned to the United States to serve as Director of the Educational Development Division on the faculty of the National War College. During the following two years in this assignment, he served additionally as Chief of Staff of the U.S. Delegation for Negotiation with the Federal Republic of Germany in Bonn, and the U.S. Delegation for Philippine Base Negotiations in Manila.

General Sibley became Division Engineer of the U.S. Army Engineer Division, New England, in April 1957. In August 1960 he was assigned to duty in Vietnam as Deputy Chief for Logistics and Administration with the MAAG there. He departed from the New England Division of the U.S. Army Corps of Engineers in September 1960 to attend an orientation course at the Military Assistance Institute in Washington en route to this new assignment. In October 1961 General Sibley returned to the United States as Deputy Chief of Engineers for Military Operation, Washington, D.C.

In 1957 he was awarded the Diamond Jubilee Anniversary Medal of the American Society of Mechanical Engineers, and in July 1959 he received Honorable Mention by the Toulmin Medal Committee of the Society of American Military Engineers for his article, *Nuclear Energy: The Challenge to Think.* His writings have appeared in publications in the United States and abroad, including the NATO sponsored *Revue Militaire Generale* published in Paris, France.