

past tactics. First, there is the speculative method, which, from the study of armaments, new inventions, weapon testing, and incidents on the battlefield, tries to identify and analyze the changes that have taken place in tactical principles from previous battles. Second, there is the method that concentrates on actual war experiences. This method also considers the modifications to tactical principles that new arms and appliances may produce, but it is more concerned with the similar conditions that ruled the past battles. This method traces the continuities in tactical principles.

The professional soldier should be a student of both methods, for the study of history matures the professional's judgment and perception without involving him in the actual violence of past battles. It gives the professional soldier an appreciation of the realities of combat, and recognizes that man is the fundamental instrument of war. The vivid descriptions of how rain, mud, protective clothing, fatigue, and the leader's will affected soldiers and tactics at Agincourt and in Vietnam can take on new meaning. Combined with a sound study of current tac-

tical principles, these will enable the professional leader to discriminate between what he can accept as applicable to the present day and what he must reject as inappropriate.

Currently, the analysis of tactical lessons in military history has taken on a variety of forms to supplement the available historical monographs: staff rides, map exercises, terrain models, visual effects, and copies of original correspondence. Each of these, however, remains closely associated with the historical time period of the particular battle. Thus, this kind of analysis is only the first step in uncovering and understanding the tactical lessons of the past.

The next step is to concentrate on the leaders. The student must place himself in the commanders' shoes and in their minds. He must examine their backgrounds and experiences, and then reconstruct their thought processes during the battle. This is not something new. Frederick II of Prussia implored his officers to go beyond memorizing the military exploits of any commander and "work hard mainly to examine thoroughly his overall views and particularly to learn how

to think in the same way."

The student can also gain experience through an imaginative participation in the experiences of others. When he is studying, or out on a staff ride to a battlefield, he should not only envision the past tactical situation but also speculate about those tactical lessons that may be applicable today.

Studying military history with imagination and vision is the key to applying the tactical lessons of the past to the tactical challenges of the present. By exercising their minds in this manner, professional soldiers gain experience, and this is what distinguishes the competent professional from Prince Eugene's mule.

A constant dialogue between the lessons of the past and the tactical challenges of the present and future can heighten our ability to recognize those challenges, analyze all the possibilities and then take decisive action.

---

Major John L. Lane is an assistant professor in the Department of History, United States Military Academy. He has served in a variety of infantry assignments with the 82d Airborne Division and the 1st Armored Division. A 1975 graduate of USMA, he also holds a master's degree in history from Stanford University.

---

# Aerial Photography

CAPTAIN EUGENE J. PALKA

All branches of the military service rely upon the products of aerial photography. Although rapid and highly technological advances have been made in the systems used to acquire and produce air photos, the two principal military applications of aerial photography are still map-making and intelligence.

The military applications of aerial photography date back to the Civil War when innovative commanders tried to use "balloon photography" to obtain information about enemy positions. It was not until World War I, however, that aerial photography was first recognized as a military

necessity. By then, it had become apparent that, apart from its immediate application to intelligence activities, aerial photographs could be used to produce new maps or to revise outdated ones in a relatively short time.

World War II provided the conditions under which aerial photography was able to grow from an art into a science. Military usage was based upon involvement in worldwide operations, the need for both strategical and tactical intelligence, and the requirement for thousands of time-sensitive maps. It was during this period when aerial photography achieved paramount

importance with the rapid development of photogrammetry, for which aerial photos provided the basic source of map data.

In addition to its value to map-making, some sources have concluded, aerial photography during the war provided military experts with almost 90 percent of their intelligence information.

The development of military aerial reconnaissance capabilities continued through the Korean conflict and the Cuban crisis. In Vietnam, practically every movement made by U.S. troops demanded aerial reconnaissance, because the terrain greatly favored the guerrilla tactics

of the Vietcong. (They traveled lightly under the cover and concealment of the jungle, continuously attempting to exploit the element of surprise and then disengage.)

Today, in its intelligence role, the aerial camera is the eye of the Army, and it supplies vital information about terrain and enemy positions and activities. Moreover, photo reconnaissance provides a substantial portion of the intelligence and targeting information for military planning and operations.

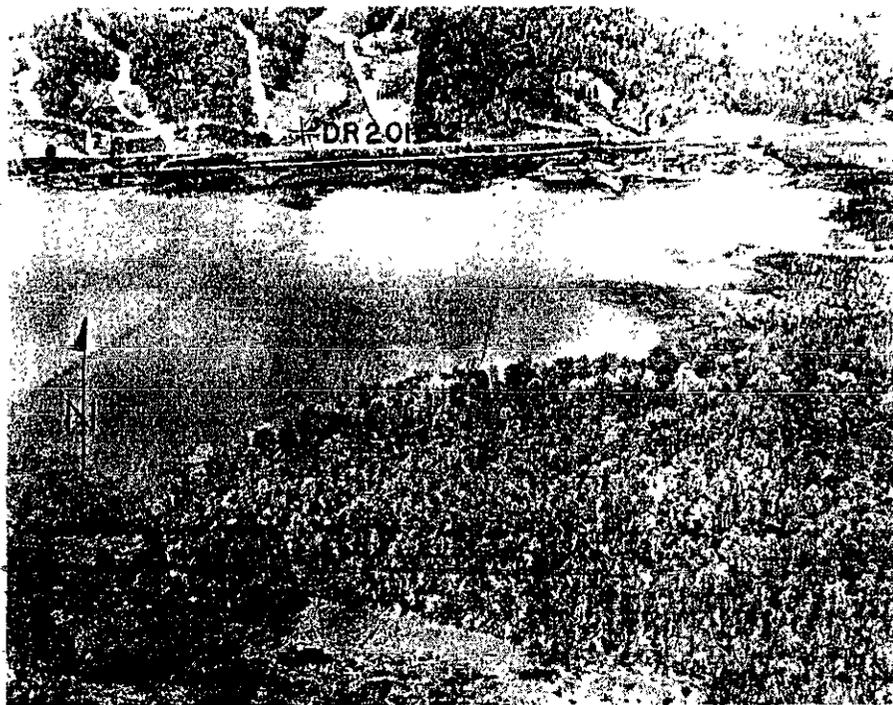
Photo reconnaissance is used at all three levels of war, strategic, operational, and tactical. The strategic and operational levels involve the highest echelons of all branches of the military services and are focused upon national goals and interests. The tactical level involves the employment of the specific techniques that smaller units use to win battles and engagements in support of operational or strategic objectives.

Applications of aerial photography at the tactical level are governed by the intelligence information that the military commander and his unit must have to accomplish their mission. This is the information that is of the greatest interest to infantry units. Such information is time sensitive, pertains to a particular piece of terrain or activity, and involves the principles of war.

Today, therefore, the acquisition and interpretation of aerial photographs are integral parts of the planning phase of each mission. Moreover, advances in technology have enabled military commanders to obtain this critical information more quickly.

## AIRCRAFT

Many aircraft have proved capable of conducting photo reconnaissance missions. The selection of a particular aircraft to fly a mission is based upon such criteria as the distance from the operating base to the target, the presence of enemy anti-aircraft guns, the proximity of enemy air-interceptor aircraft, the weather conditions, the time of day, the type of information desired, the area of coverage required, the armament necessary, and the time available. In general, the aircraft



Aerial photograph shows obstacles (shrubs and ditches) in landing zone.

selected must be able to deal with the specific challenges posed by a given scenario, obtain the desired coverage, and return to its base safely without being detected.

Avoiding detection by enemy radar or weapon systems is a key aspect of a reconnaissance mission, since detection could result in the destruction of the aircraft, delay the coverage data, or, most important, reveal the intentions of friendly units whose success may have depended upon achieving surprise. Consequently, photo reconnaissance aircraft try to fly either at high altitudes where they are less likely to be intercepted or at low (treetop) levels where it is more difficult for enemy radar or other tracking devices to detect them.

Air Force or Navy fighter-photo aircraft that generally fly at lower altitudes are usually equipped with vertical, oblique, and panoramic cameras. They also have side-looking airborne radar (SLAR), while the higher altitude aircraft do not always have this capability. Currently, almost all reconnaissance aircraft have passive radar and an infrared capability.

Helicopters may be the aircraft most widely used by tactical units for photo missions. Unlike the UH-1H (Huey) helicopter of the 1960s and 1970s, the UH-60 Black Hawk has superior stability, is twice

as fast, can reach high altitudes, and is equipped with excellent navigational equipment. Moreover, since it is usually organic to infantry units, it offers a much faster response time between the initial request for aerial photo coverage and the finished products. The Black Hawk also has certain special qualities that enable it to avoid enemy detection and radar—a vertical take-off capability, extended fuel range, and maneuverability that improves contour and nap-of-the-earth flying techniques.

During the planning phase of any tactical operation, all available intelligence information is collected and thoroughly analyzed. Such operational studies are designed to facilitate the planning and execution of offensive and defensive maneuvers; the estimation and prevention of equivalent enemy operations; and the evaluation of the enemy's intentions, capabilities, and dispositions.

The types of photographic coverage normally requested to supplement operational planning include vertical photographs and both high-angle and low-angle oblique photographs. Since these three types of coverage are based upon the orientation of the camera axis, each can offer different yet significant information about the same area.

Vertical photos are taken with the op-

tical axis of the camera held in a vertical position (perpendicular to the ground). The type of oblique shot depends upon the camera's degree of angular inclination from the vertical. High oblique photos include the apparent horizon of the earth, because the camera is inclined at a much greater angle from the vertical than it is for low oblique shots, which do not include the apparent horizon.

Vertical photos are frequently used to produce photomaps, to which grid lines, place names, and marginal data are usually added. Such maps are extremely valuable to infantry units, particularly to those deployed to parts of the world with which they are not familiar. These maps are also used when units are forced to operate in areas where maps are either outdated or not available at all.

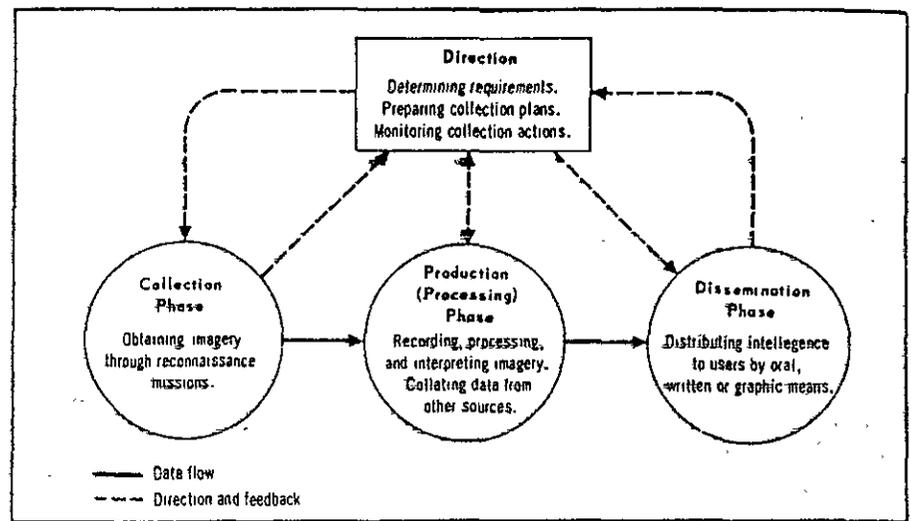
Vertical photographs are ideal for revealing hydrologic features, roads or trail networks, land use patterns, cultural features, and the density of existing vegetation. Such knowledge is critical to the planners in infantry units, because it allows them to assess the degree to which the terrain in the area may impede movement. This, in turn, allows them to predict movement rates, applicable movement formations, fatigue factors, and likely avenues of approach.

Hydrologic and cultural features and certain land uses may hinder movement, expose personnel to artillery or weapon fire, or channel units into killing zones or ambushes.

Roads and trails may provide high-speed avenues of approach for attacking units or may serve as networks over which supplies can be transported. Patterns exhibited on the photos usually allow infantry units to determine how to control major networks by simply occupying the terrain that dominates key road junctions.

High-angle oblique photos help infantry units plan flight routes and corridors for the helicopters upon which they often rely for transportation and logistic support. These shots may reveal valleys and folds and variations in tree height. Such information reveals the presence and location of cover and concealment that may be used to hide and protect the helicopters along their flight routes.

Low-angle oblique photographs are also often used in planning air assault opera-



Reconnaissance in the basic intelligence cycle.

tions for infantry units. The angle reveals the relative heights of trees, buildings, or other man-made structures adjacent to a prospective pickup or landing zone. These photographs also offer a better look at the slope of the ground and may afford a better look at any small shrubbery or obstacles in the area that could damage the tail rotor of the aircraft. This enables leaders to select the pickup and landing zones where there is the 10:1 ratio (of horizontal distance to the vertical height of the closest obstacles) that is necessary for taking off and landing large formations of helicopters.

Tactical operations in urban areas also rely upon all three types of photographic coverage. Vertical shots provide an understanding of the principal patterns of roads and other transportation networks, the relative locations of key facilities, and the variations in land use or development. Oblique coverage complements the vertical photos by showing the relative heights of buildings, the basic construction materials used, and the fields of observation the defender may have. In addition, oblique photos indicate the angle of trajectory needed to put artillery and mortar fire in among the buildings most effectively.

Obviously, getting aerial photographs to the infantry commander on the ground takes time, because they may pass through several sets of hands on the way. But the principle that applies to all tactical air photos is to expedite the process. Because the battlefield represents an extremely fluid situation to the infantry commander, attempts should be made to provide him

with the finished shots as quickly as possible after he requests them. In fact, it is not uncommon to sacrifice photographic quality or even expert interpretation when time is the most critical element of concern to a tactical unit.

An infantry battalion's requests for air photo coverage can be handled by the brigade if helicopters are to fly the mission. Otherwise, requests must be submitted to the division headquarters where representatives from the Army and Air Force jointly decide on the best method and the most suitable aircraft for the mission.

Any number of factors, therefore, can serve to slow the response time of a photo reconnaissance mission. Consequently, infantry commanders must make every attempt to anticipate upcoming missions to increase their available planning time. Ideally, of course, the required air photos should be on hand at the outset of the planning stage of an operation.

Current technology can produce aerial photos that contain an enormous amount of highly detailed intelligence information for the infantry commander. And the expertise to use such assets effectively is an absolute prerequisite for commanders in today's Army.



Captain Eugene J. Palka is an Infantry officer assigned to the Department of Geography and Computer Science at the United States Military Academy. A 1978 graduate of the Academy, he has served as a company commander and a battalion S-3 in the 101st Airborne Division (Air Assault).