

~~SECRET~~
No Foreign Dissem

*Deception techniques,
Hanoi-style.*

COMMUNIST DEFENSE AGAINST AERIAL SURVEILLANCE IN SOUTHEAST ASIA

Edward F. Puchalla

The art of deceiving or confusing aerial surveillance is virtually as old as the airplane. Techniques of deception developed greatly during World War II when all parties devoted considerable efforts to concealing or disguising troops, weapons, industries, and even cities. In the Far Eastern conflicts of the past two decades, less sophisticated, but nevertheless serviceable techniques have been employed to the same ends. In particular, the war in Southeast Asia has produced extensive and at times ingenious attempts at deception.

Communist forces in North and South Vietnam, Laos, Cambodia, and, more recently, Thailand, have relied heavily on deception to conceal their activity. Despite continual aerial reconnaissance and airstrikes, the North Vietnamese have supported insurgent wars in four countries and withstood daily bombardment of supplies and facilities within their own country. It would be impossible in a short paper to review all the environmental conditions and military equipment involved in all four countries, and our object here is rather to provide a representative sampling of the deception techniques identified in photography since intensive coverage began in 1964. Most of our examples are from North Vietnam, where bombing was intense during the 1965-68 period. The photography we will present was taken from low-flying, pilotless drones, tactical reconnaissance aircraft, such as the RF 101 and RF 4C, and from high-flying U-2 aircraft.

Deception

In much of the literature on the subject, the term "camouflage" has often been employed imprecisely to refer to all types of deception. Moreover, the term has been used to refer more or less indiscriminately to concealment, decoys, and deception. Here, we will follow the working usage of photo interpretation and employ "deception" as the generic word for any stratagem employed to confuse or mislead the enemy. From the viewpoint of aerial reconnaissance, either visual or

photographic, deception may take the form of concealment—the hiding or obscuring of objects in an existing environment without resort to further artifice; of camouflage—the application of natural or artificial materials to an object or surface with the intention of concealing, obscuring or generally misrepresenting the appearance to an aerial view; or of dummy decoys—simulated objects and installations or feigned activities created to divert attention from a genuine target or activity. In addition, the intense bombing of North Vietnam and Laos produced a fourth technique of deception, that of dispersal and innovation¹—the practice of making obvious targets difficult to destroy.

The task of the photo interpreter would be greatly complicated if it were possible for the deception specialist to control all elements of his work. Rarely, however, is such control possible, for operational requirements and laxity in discipline impose serious limitations on the effectiveness of deception measures. Obviously, operational requirements determine the placement of most military objects. A radar is useless unless sited where it can be operated effectively. A base camp hidden in the jungle must have water, and a supply depot must have transportation routes.

Deception discipline varies according to training and combat conditions. Thus, in a stable situation, time may permit more complete and ingenious deception measures than would be possible in a rapidly changing one. In Vietnam, under constant harassment from allied airstrikes, the Communist troops quickly resorted to improved deception techniques as a defensive measure. Since, however, men and machines leave traces on the ground, defensive positions require digging, and trees must be cut for access and for fields of fire—all of these and other activities are virtually certain to provide some clues for the camera to record.

This paper discusses the various techniques employed by the Communists in Southeast Asia as they apply to eight basic activities: antiaircraft and coastal defenses; aircraft and air installations; naval combatants and merchant ships; radar and communications; military facilities; POL facilities; transportation; and urban and industrial facilities.

¹ Dispersal and innovation refers to the practice of constructing or duplicating several decoys, or in some cases *bona fide* targets, and dispersing them in random fashion, near a known target or activity. For example, several road bridges and bypasses may be constructed and camouflaged at a major river crossing in order to make it difficult to identify the main bridge.

Antiaircraft Defenses

When complete concealment of an antiaircraft site in an existing environment is not possible, camouflage measures become necessary. These may vary from simple field expedients, such as placing a few branches over the site, to construction of an elaborate disguise for the weapons.

The intense allied bombardment of military activity during the early stages of the war was met with determination by the Communist deception specialist seeking to protect what the allied pilots were attempting to destroy. The camouflage objectives were to cover track activity, weapons, and support equipment. In camouflaging antiaircraft sites in heavily defended areas, the North Vietnamese have relied on the constant movement of equipment from one site to another in order to reduce the possibility of identification and subsequent interdiction. For instance, the numerous revetted sites in the Hanoi and Haiphong areas were alternately occupied and abandoned throughout the 1966-68 period. Sites located in smaller villages and agricultural areas were permanent and tended to be camouflaged at least to the extent of covering the weapon with foliage or garnished netting. Placement of vegetation in these areas helped to conceal the track activity. Quite often the revetments would be covered with freshly planted vegetation presenting a "salt and pepper effect"² when viewed on aerial photography (See Figure 1).

A particularly ingenious and effective camouflage technique was identified north of Hanoi in December 1967. Analysis of photography at that time revealed several probable 37mm antiaircraft weapons permanently emplaced within a circular revetment with dome or cupola-like coverings over each emplacement (See Figure 2). This technique affords considerable concealment, the weapon being protected by an earthen revetment and concealed completely with the exception of the gun barrel which protrudes through a slit in the covering and is camouflaged with vegetation. Depending on the nature of the materials used, this structure may also give some protection against bombing and strafing.

It seems probable that these cupolas rotate with the weapon. That is, the cupola framework appears to be supported by or attached to the rotating platform of each weapon. Although the barrels were photographed in stationary positions pointing in different directions it does not seem likely that the weapons would be connected to such a limited field of fire by permanent coverings. The only alternative

² This phrase refers to the regular pattern of planted vegetation which contrasts sharply with the surrounding natural vegetation.

~~SECRET~~

Aerial Surveillance

to the rotating cupola would be that of using the coverings for environmental protection and removing the cover when the weapons are in operation.

Dummy/decoy antiaircraft weapons have also been detected in North Vietnam. They are usually constructed in the form of small A frames, probably of wood with large poles placed on top at a slight angle to simulate gun barrels. Partial camouflage has been added to several of these sites to enhance their verisimilitude (See Figure 3).

Surface-to-Air Missile Sites

Perhaps the best deceptive technique employed in the North Vietnamese antiaircraft defenses is found at camouflaged, field-deployed, SA-2 missile sites, first observed in February 1966. More than half of the approximately 369 sites identified prior to the bombing halt in November 1968 were unrevetted. The sites have been found on plantations (Figure 4), in and around villages, and within destroyed and abandoned military barracks areas (See Figure 5). The environmental pattern is usually left undisturbed as far as possible to take advantage of the natural cover, and the vans and missiles are often covered with natural foliage. The sites are occupied for only a short period of time and then abandoned. When the more obvious revetted sites are occupied, the equipment is camouflaged with foliage and garnished netting. The missiles and related equipment are highly mobile but are seldom detected in storage, principally because of the effective use of camouflage (See Figure 6).

A less important but equally effective deception technique is the use of dummy/decoy missiles. Various artificial materials have been utilized including inflatable rubber dummy missiles, but such sites lack the fidelity found at the dummy antiaircraft sites. Figure 7 is an example of one of the better dummy/decoy sites found in North Vietnam. The lack of deception discipline is readily discernible when one compares Figure 7 with Figure 8, which lacks sufficient fidelity to be effective.

Coastal Defense Sites

The majority of revetted coastal defense sites distributed along North Vietnam's shores have utilized one or more deception techniques. In the past the most widely used form consisted of a semipermanent open emplacement partially concealed by foliage. More recently, the emplacement has been dug into the sand or back beach area, and covered by garnished netting or bamboo matting laid over a supporting structure of poles. A small amount of sand, natural foliage and

tree branches is placed on top and vegetation planted around the emplacement to help blend with the surrounding scrub brush and trees. When completed, the bunker-type emplacement is quite difficult to detect on photography and probably more so visually (See Figure 9). There have been several examples of caves dug into overhanging cliffs providing good concealment and field of fire for the weapons. However, spoilage from such excavation is readily apparent and difficult to camouflage.

Aircraft and Air Installations

Extensive camouflage and dispersal of North Vietnam's air force dates from April 1967, when allied airstrikes against major airfields began. With a few exceptions, there was no attempt at deception prior to that time. Dummy/decoy swept-wing aircraft were identified in February 1965 (See Figure 10), and some use of natural camouflage was detected in September 1966. For the most part, however, the aircraft inventory could be easily ascertained from the revetments and hardstands at the airfields. Since mid-1967, however, the North Vietnamese have used a variety of means to protect the aircraft and prevent any accurate count of the current air order of battle. Aircraft remaining at airfields were heavily camouflaged. Other aircraft were dispersed to remote areas that appeared inaccessible due to the lack of roads and track activity. Five MIG aircraft were observed in a remote field adjacent to Phuc Yen Airfield in late 1967, suggesting they may have been transported by HOOK helicopters. At Haiphong/Cat Bi Airfield in August 1966, 2 camouflaged MIG aircraft were identified within a storage area located approximately 1.5 nm northwest of the runway. The unusual location of these aircraft suggests they also were transported by HOOK helicopters (See Figure 11).

Dummy/decoys may be designed to mislead air crewmen, the photo interpreter, or both. The fidelity of the dummy will be governed largely by the purpose for which it is constructed. Very crude replicas may be sufficient to divert the attention of the fast-flying pilot, whereas only the best of replicas accompanied by features usually associated with the authentic installation will mislead the photo interpreter. The time interval during which a dummy/decoy is meant to be effective will also influence the necessary fidelity of the replica and its associated signatures (accompanying features). Dummy aircraft observed at North Vietnamese airfields range from crudely built models, easily recognizable, to high fidelity ones. A dummy/decoy fabrication area was observed in October 1967 at Hanoi Bac Mai Airfield. The wing, tail, and fuselage sections seen were nearer the

actual size of MIG aircraft than many seen elsewhere, indicating that the North Vietnamese intended to improve this form of deception.

Several well constructed dummy/decoy delta wing aircraft, probably constructed of wood, were identified at Hoa Lac Airfield in July 1967 (See Figure 12). Although realistically constructed, discrepancies are apparent when the length-width ratio of these dummies is compared to the known dimensions of the aircraft revetments they were parked in.

Several types of hangarettes have been observed at six different airfields in North Vietnam—some as early as October 1967. They consist of fabricated metal or wood supporting beams with metal, canvas, or thatch covering. Some of the hangarettes are revetted to provide additional protection from bombardment. This particular type of concealment had a distinct advantage for the North Vietnamese, since it prevented allied intelligence from estimating accurately the numbers or type of fighter aircraft stationed at these airfields. Figure 13 illustrates a typical hangarette in the early stage of construction. The supporting beams in this photo resemble construction materials that were given by the Soviets to the East German Air Force for the same purpose. The lower photo illustrates a hangarette nearing completion. An earthen revetment will be added for additional protection.

Also at Hoa Lac Airfield another deception technique was identified—dummy bomb craters painted on the runway to represent bomb damage. These images lack shadows, do not follow typical bomb pattern and, when viewed stereoscopically, lack depth. In addition, the high reflectivity of the freshly applied paint and variances in tonal quality are apparent when compared to the fresh soil debris thrown up by real bombs (See Figure 14).

The helicopters in the North Vietnam inventory are rarely observed at airfields. Since late 1966, they have been dispersed to remote agricultural areas and occasionally were very artfully camouflaged with foliage and garnished netting (See Figure 15). Several HOUND helicopters were observed dispersed adjacent to active native villages in late 1967. The practice is still widely in use.

Naval Combatants and Merchant Ships

Owing to their distinctive shapes, ships and boats usually present a very difficult problem to the deception specialist. The larger ships rarely can be adequately disguised and the effectiveness of deception methods applied to small craft depends in large part on the surroundings.

Measures commonly used to conceal and camouflage vessels in North Vietnam and the inland waterways of Laos consist of garnished netting, vegetation, natural or simulated, and disruptive paint work for distorting the outlines of the hull and superstructure.

Early allied airstrikes against naval vessels in mid-1964 caused considerable damage. After that time, it became more difficult to locate the significant combatants and large supply vessels. Extensive use of natural vegetation as camouflage was universal along the coast and the inland waterways. In mid-1968 natural and man-made caves located at off-shore islands were identified as probable concealment areas for North Vietnamese combatants. Photographic mensuration has shown that several of these caves are as large as 70 feet wide and 50 feet high, sufficient to conceal North Vietnam's largest naval combatant, the S.O.1 subchaser.

In dispersing combatants, the North Vietnamese moved their vessels into the northeast island area and along small rivers in the Haiphong and Hanoi area. They attempted to camouflage some of these with garnished netting and foliage in an effort to make them appear as an extension of the island to which they were moored (See Figure 16). Along the rivers, the vessels were moored to the heavily vegetated bank or in small, specially dug slips and canals (See Figure 17). In all cases, natural camouflage was added to the deception.

In August 1964, shortly after the much-publicized Tonkin Gulf incident, several of the North Vietnamese naval craft that were bombed and strafed were detected using smoke pots in an attempt to lead allied aircraft pilots to conclude that they were already damaged and burning (See Figure 18). Analysis of photography of these incidents revealed that this deception was quite successful.

The usual procedure in camouflaging merchant vessels is to cover them with foliage, sometimes over a framework of wood or bamboo, and netting. In the case of POL vessels, the cargo is simply covered with canvas to make the craft appear to be like any of the countless small barges and sampans observed on the rivers throughout the area. Ferry boats are usually moored a distance away from the actual crossing in addition to being heavily camouflaged with tree branches (See Figure 19). Several merchant vessels have been observed with disruptive paint designs on the hull and superstructure (See Figure 20).

Sampans of 40 tons capacity have been detected carrying POL tanks concealed under a canvas covering (See Figure 21). Since thousands of sampans are in use on North Vietnam's intercoastal

~~SECRET~~

Aerial Surveillance

waterways, this expedient is of unquestionable value to Communist logistics.

Radar and Communications

The North Vietnamese have made perhaps their biggest operational sacrifices for the sake of camouflage with respect to radar and communications facilities. Elevation and an undisturbed horizon are usually required for optimum performance of both systems, but for radar sites, the North Vietnamese have consistently chosen wooded areas or villages to conceal their equipment (See Figure 22). To increase the deception, they are also willing to cover the radar antennas with camouflage materials such as canvas, garnished netting and foliage (See Figure 23). However, sites placed in more logical surroundings can still display a degree of deception. An air warning radar site was detected on an exposed beach area near Badon, North Vietnam during 1966. The simplicity of facilities and lack of track activity provided an excellent example of deception (See Figure 24).

A camouflaged radar site situated on a mountain top at Nui Vien, North Vietnam was difficult to detect because of a total absence of associated track activity leading to the facility. A detailed analysis revealed the site was being supplied by helicopter, even to the extent of transporting the radar equipment and a K-32 crane truck to the mountain top site. The TOKEN-type radar at this site was camouflaged with garnished netting.

Because of their relatively small size, communications facilities are difficult to detect. The North Vietnamese compound the difficulty by locating sites in or near villages, and by periodically abandoning and reoccupying them.

Military Facilities

Although concentrations of Communist Vietnamese personnel offer first-priority targets for air attack, they seldom are detected directly by photoreconnaissance, and then only through surprise or during very fluid situations. Concentrations are discovered mainly through photographic detection and identification of personnel housing facilities. Deception measures for these facilities consist mainly of camouflage, since concealment alone is rarely adequate and decoys are not practical.

In the development of deception measures for temporary shelters (dugouts, semiburied buildings, and tents), the North Vietnamese have concentrated mainly on concealment, though seldom without supplementary camouflage. The dugouts and semiburied buildings

usually are covered by sod or other vegetation and, when skillfully sited in the terrain pattern, are difficult to detect.

The North Vietnamese deception specialist faces a major problem in developing effective deception measures for permanent or peacetime barracks, since the buildings usually are of a uniform design and are arranged in a regular pattern. Moreover, they are frequently situated at established military bases, about which allied intelligence usually has considerable information from other sources. Under these circumstances, deception measures aimed mainly at confusing aircrews seldom can do more than tone down the more conspicuous features through the use of such camouflage media as paint, netting, vegetation and debris. Most of the permanent North Vietnamese barracks and storage areas which were not destroyed by airstrikes prior to the bombing halt have remained abandoned. Supplies continue to be stored within the sanctuary of villages or in areas that provide natural tree cover.

In Cambodia, Communist Vietnamese forces have taken excellent advantage of the dense jungles and absence of aerial bombardment to construct numerous widely dispersed storage and support facilities (See Figure 25). Considerable effort is expended to conceal evidence of trails or vehicular tract activity leading into these installations. Figure 26 illustrates a similar pattern of dispersed facilities in Laos. However, when compared to the facility in Cambodia illustrated in Figure 25, the lack of deception is very apparent—the buildings and service road in the Laos facility are clearly visible and subject to easy detection.

Occupied storage buildings in North Vietnam are usually covered with foliage. In some cases, vegetation is planted on the roads to conceal track activity (See Figure 27). There are occasional instances of disruptive painting, particularly on storage buildings, but the practice is not prevalent (See Figure 28). The North Vietnamese have expended considerable effort to preclude detection of cave storage facilities by camouflaging the entrances. However, excavation spoilage is usually a reliable signature that is difficult to conceal. A more recent technique observed in North Vietnam is the stacking of supplies in a rectangular pattern several feet high and near a motorable road. A thatch roof is then constructed and placed on top of the supplies making them appear as a native dwelling.

POL Facilities

POL storage practices in North Vietnam underwent a complete change after bombing of POL installations began in June 1966.

Instead of the several large facilities of the prebombing era, more than 500 small tank and drum storage areas were widely dispersed throughout the country prior to the bombing halt in November 1968. These small facilities range from drums temporarily stored under trees to permanently buried tanks (See Figure 29). Drum storage has been identified along roads, in villages, and in trenches partially concealed by trees. The tanks, which vary in size from six to 25 metric ton capacity, have been observed bunkered or partially buried. One innovation has been to bury the tanks randomly in a cemetery. In normal circumstances a photo interpreter would of course usually expect to see excavations in a cemetery—but not large POL tanks lying opposite the excavations. It may be that North Vietnamese logistics and deception specialists felt that allied air crews would be unlikely to bomb cemeteries, and that these would therefore offer privileged sanctuaries for POL supplies. We have no photographic evidence to indicate that cemeteries in North Vietnam were in fact struck prior to cessation of bombing.

Transportation

Since mid-1963, Communist forces in North Vietnam and Laos, and more recently in Cambodia, have employed a variety of deception techniques in order to conceal and camouflage new roadways. Because these vital infiltration routes are difficult to maintain and are of course vulnerable to airstrikes, Communist road construction teams have depended heavily on long stretches of tree canopy to cover extensive segments of new road which must be constructed in stages. Climatic conditions in Southeast Asia have in this respect helped the Communists, since the rapid regrowth of vegetation provides a steady supply of cover material that can be utilized for concealment or as natural camouflage.

In August 1965, Communist road construction crews were observed in Laos attempting to conceal exposed segments of a new road under an overhead canopy of bamboo and natural foliage (See Figure 30). This arbor-type trellis³ was easily detected on aerial photography because it inadvertently created a distinctive grid pattern that contrasted with the surrounding heavy foliage. As a result, camouflage

³ The trellis utilized to conceal roadways in Laos is basically a series of upright supporting poles that form an arbor-like structure somewhat similar to flower arbors found in gardens throughout the United States. The arbor supports a lattice work of bamboo matting which in turn is covered with freshly-cut foliage and vegetation from the immediate area. The structure is high enough to allow passage of 2½ ton cargo trucks.

techniques employed by the Communists, such as the trellis, had a reverse effect by revealing the exact road alignment.

Conversely, rail sidings, turning wyes, and even full trains have been hidden by the trellis technique. A variation of the trellis is used in camouflaging bridge piers and abutments to blend in with the associated road or rail bed (See Figure 31).

Under normal conditions, a heavy tree canopy will effectively conceal the road alignment and can be improved by tying the tree tops together. This technique has been used to help conceal activity such as truck parks, rail sidings and storage facilities (See Figure 32). Some of these road spurs and rail sidings have been extended into villages for additional concealment.

Rail bridge approaches and rail sidings, including the cross-ties, have been covered with excessive amounts of ballast for camouflage. The result completely obscures the rail line and is very effective for insuring the continued operation of the multiple rail bypasses that are usually constructed near choke points.

The necessity for camouflaging river crossings has led to another ingenious deception technique, the vehicular cable bridge (See Figure 33). Cables which span the river crossing point from concrete anchorages embedded in the ground, are covered with decking for nighttime and occasionally daytime vehicle transit. Usually, however, the decking is removed in the daylight, leaving only the almost invisible cables. Identification of these crossing points is further hampered by implanted vegetation along approaches and service roads in the area. The longest known cable expansion bridge extended for 720 feet across the Song Lo River at Viet Tri, North Vietnam.

The cable bridge has also been modified for railroad use by suspending cables from existing bridge piers for additional strength. Another technique is to float raft-mounted rail bridge sections down stream to give the appearance of unserviceability.

Dummy cable bridges have also been detected in North Vietnam. However, the diameter of the ropes used to simulate the cables are much thicker and the lack of concrete anchorages on both sides of the river makes them easy to identify on photography (See Figure 34).

In both fluid and static military situations, motorized vehicles are an essential element of logistics which may strongly influence, or even determine, the outcome of the particular situation. As such, they offer prime targets for tactical air attack, especially when they are found in numbers.

To prevent the detection of motorized vehicles, the Communist deception specialists have used various deception methods. In most

cases, natural vegetation is used to aid deception. Frequently, vehicles are parked at random within a native village, protected by revetments, the whole covered with a foliage shelter. Wood frame-works mounted over the cab to support camouflage have been observed on a majority of the cargo trucks in Laos and North Vietnam.

Another technique is to make one type of rolling stock appear as another (See Figure 35). This is often seen when rail tank cars are disguised as boxcars by constructing a wooden frame over the car and covering it with canvas or wood.

Camouflage disruptive painting is also widely employed. It ranges from mottled patterns to actually painting crossties and rails on the top of rail cars to give the appearance of empty tracks. However, close examination by the photo interpreter will reveal a shadow being cast by the boxcar.

Dummy/decoy locomotives have also been used to deceive strike aircraft. The dummies are probably constructed of wood or bamboo and are of fair quality. Application of a dark nonreflective paint, and the attachments of foliage or garnished netting would enhance this dummy/decoy a great deal and lend a bit more fidelity.

Urban and Industrial Facilities

Large basic industries such as powerplants and steel mills are well-known, well-targeted, and were frequently bombed. The use of deception on urban and industrial facilities has been limited primarily to smaller, less obvious installations which were not the object of airstrikes. On at least one occasion, however, in October 1967, chemical smoke generators were detected in use. Figure 36 shows that they can create a smokescreen obscuring a large target area. In this case, the smoke was effective against a TV guided Walleye missile launched from allied aircraft.

The countless dams, locks, and irrigation pumping stations on North Vietnam's vital waterway system were not subjected to airstrikes. However, a number have shown signs of at least initial camouflage, perhaps in anticipation of possible future events. The most intense preparations have been observed at the irrigation pumping stations, even to the extent of covering the immediate portions of the canal with foliage or bamboo matting (See Figure 37). Although the matting conceals the pump house, additional components have been poorly camouflaged. More important, the selection of camouflage materials does not blend in with the existing environment.

Aerial Surveillance

~~SECRET~~

Conclusion

As has been mentioned, Communist deception measures against aerial reconnaissance have been devised to prevent allied intelligence from obtaining accurate information or to mislead with inaccurate information. If successful, these measures could divert attack or otherwise reduce the effectiveness of allied airstrikes.

Photography has recorded the Vietnamese Communists' skillful use of deception. The importance they attach to deception is clearly evident in the number of techniques they have devised to aid them in supplying and expanding their war of insurgency in Southeast Asia. They have been somewhat successful in diverting air attacks, but in general their efforts have failed, chiefly because of the zealous efforts of the photo interpreter.

~~SECRET~~

~~SECRET~~

Aerial Surveillance

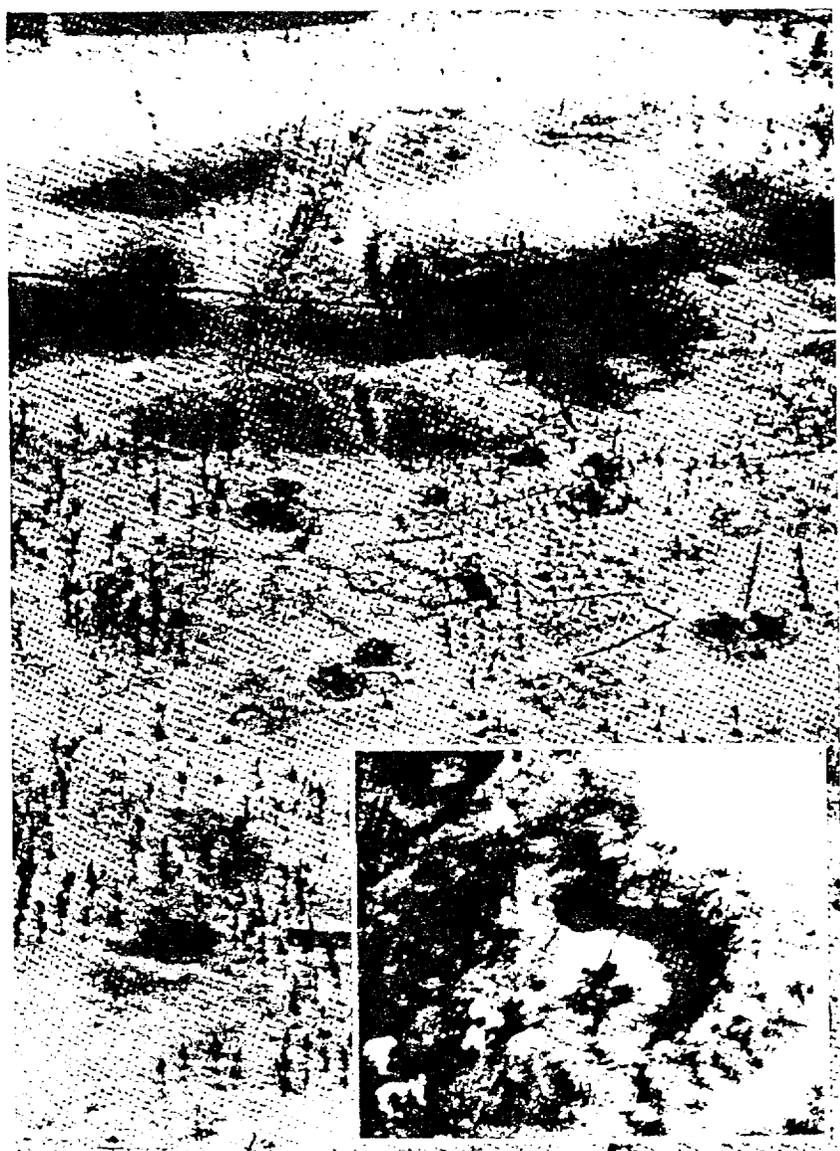


Figure 1. The automatic weapons site in this picture is camouflaged with foliage. Natural vegetation has been planted in the area to conceal revetments and track activity, resulting in a "salt and pepper" pattern that contrasts with local vegetation patterns. Inset photo shows vegetation planted on a revetment and personnel running to man the weapon.

~~SECRET~~

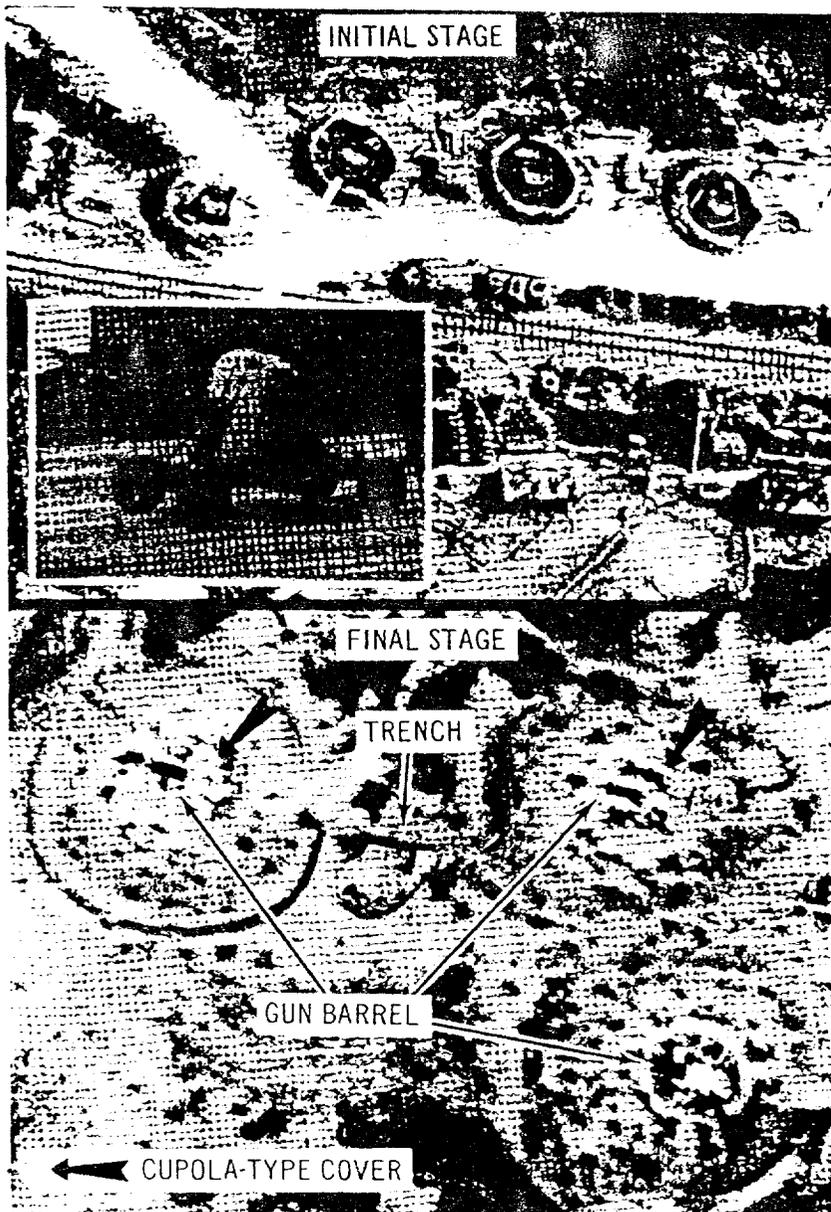


Figure 2. Top Photo shows a 37mm anti-aircraft site in initial stage of construction. Completed site in bottom photo shows cupola-type cover over each revetment and vegetation planted on the cover. Cupola conceals all but the barrel of a weapon. Inset photo shows a 37mm piece in transit.



Figure 3. This dummy/decoy anti-aircraft site is located near Hanoi. Note the dummy vans that are being supported by poles. Some foliage has been placed over the dummies and a vehicle has been driven around the site to add vehicle tracks for more authenticity.

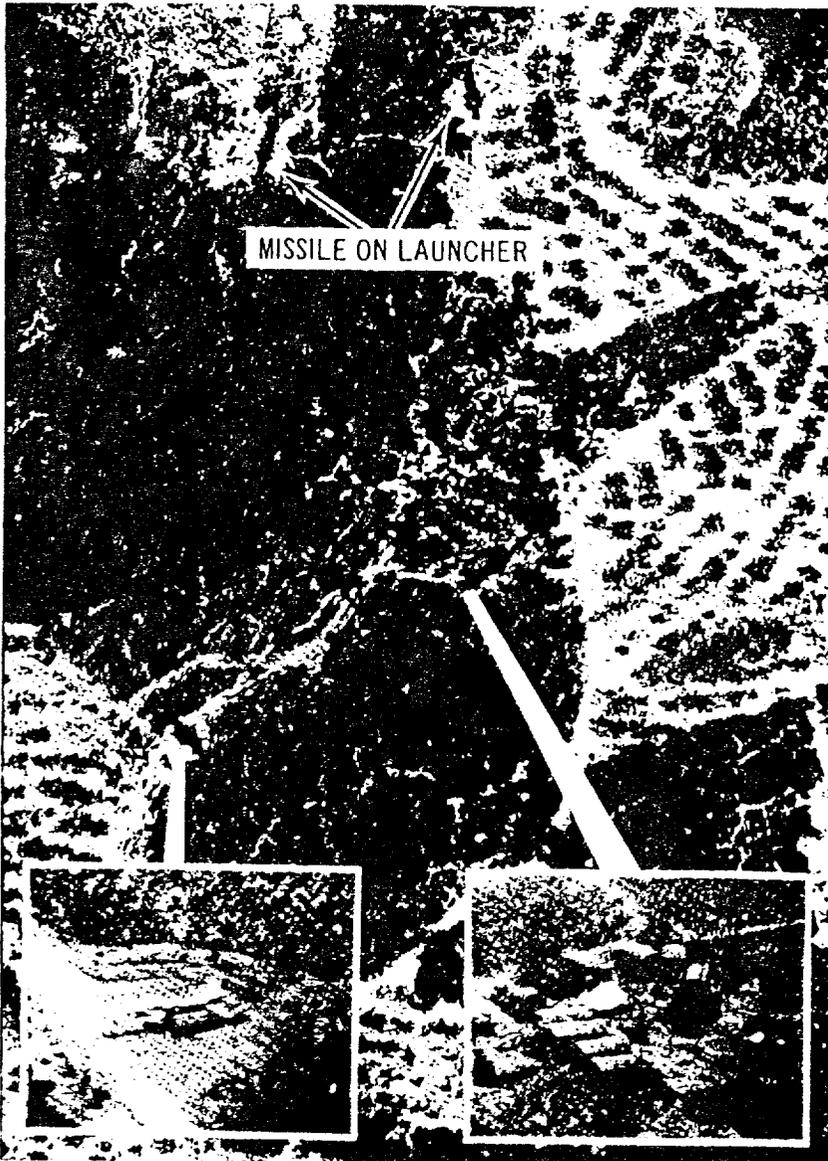


Figure 4. Alert photo interpreters identified this camouflaged field-deployed surface-to-air missile site near Vinh Linh, North Vietnam in 1966. Note how the agricultural pattern has remained undisturbed. Inset photos illustrate central guidance area with radar equipment, and a missile on launcher. Can you pick out the remaining three missiles?

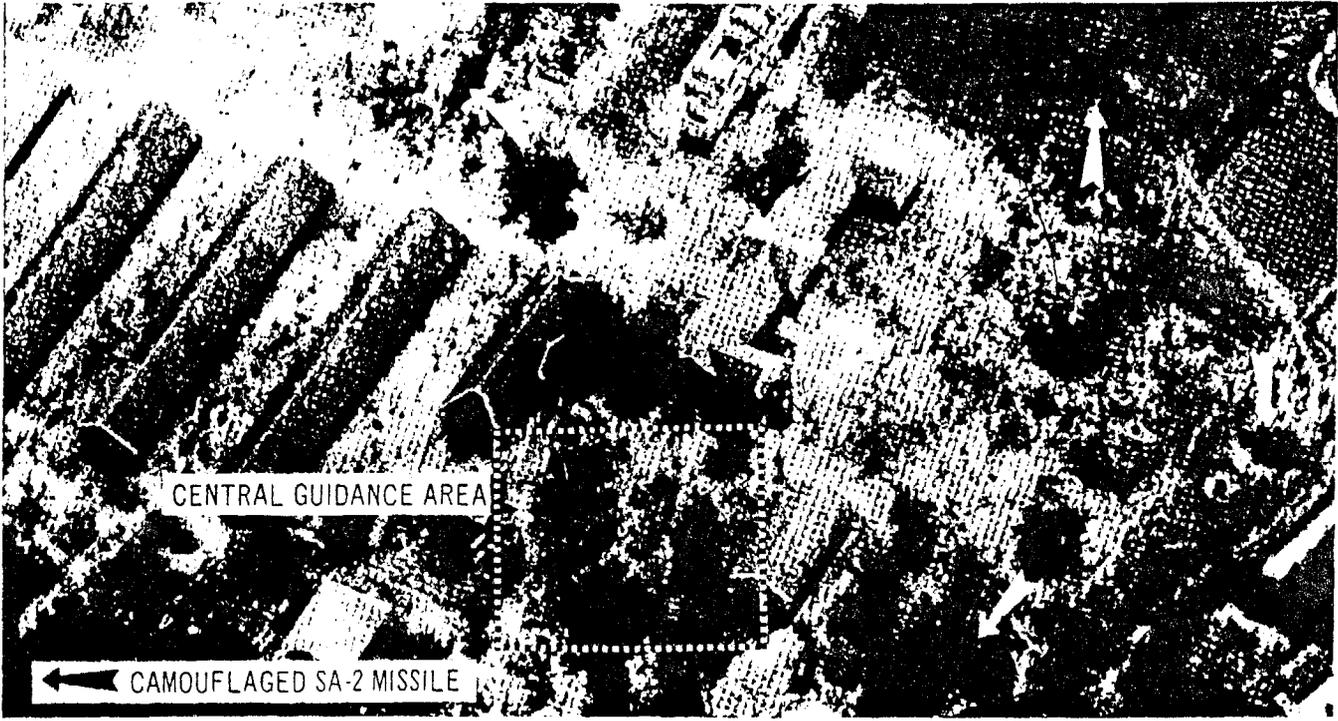


Figure 5. Bombed out barracks areas, such as the one in this photo, and abandoned villages have served as a temporary location for their field-deployed SA-2 missile sites. Note how the track activity has been kept to a minimum.

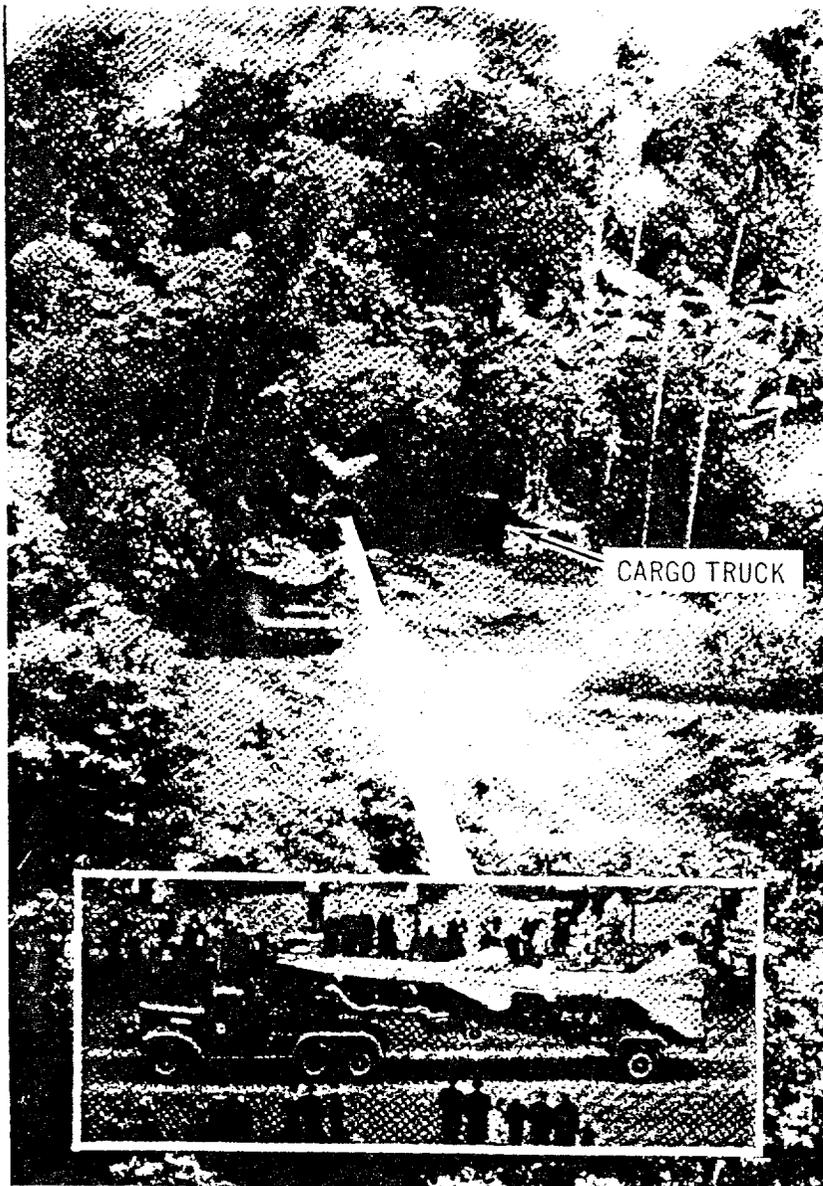


Figure 6. Because of the mobility of SA-2 missile equipment, the North Vietnamese have been quite successful camouflaging and concealing it during transit. Note the rear end of an SA-2 missile and transporter which is hardly visible under the tree canopy.

~~SECRET~~

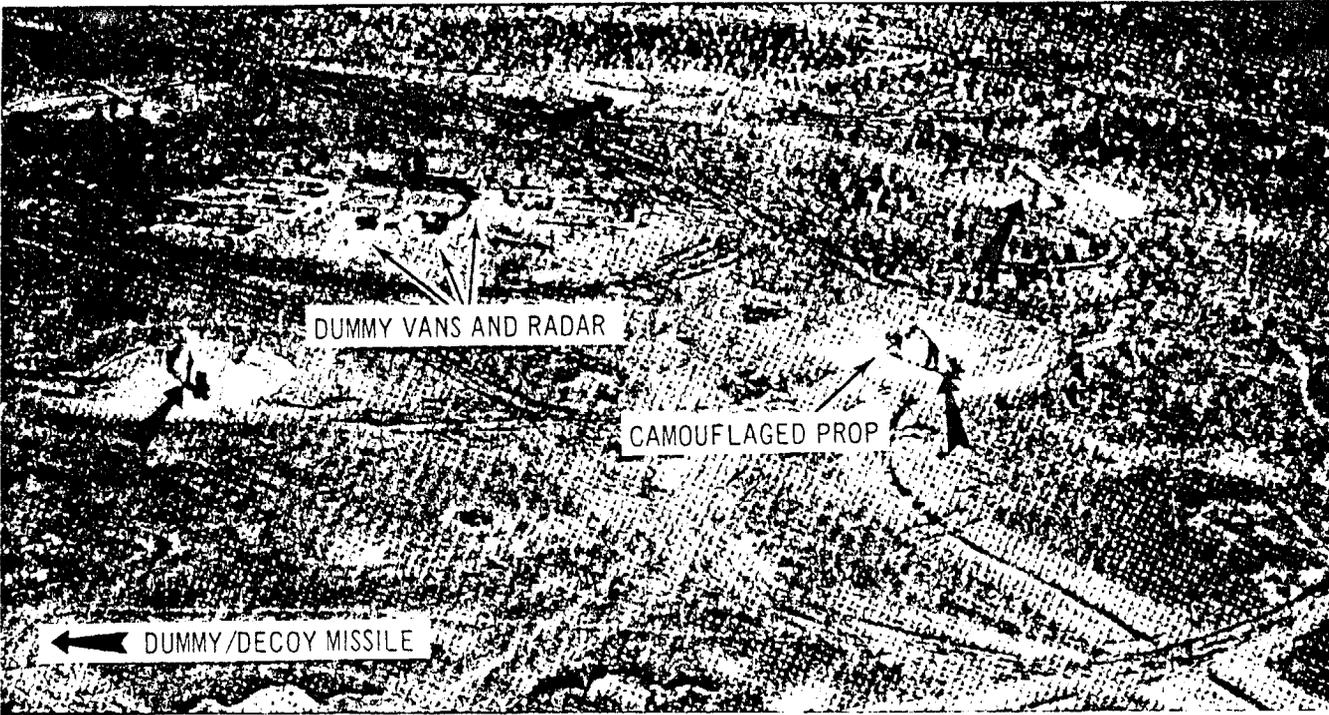


Figure 7. The photo interpreter can easily discern the dummy/decoy missiles at this site because of their lack of realism. However, fast moving pilots could be fooled by the dummy/decoys and diverted from bonafide targets.

~~SECRET~~

Aerial Surveillance

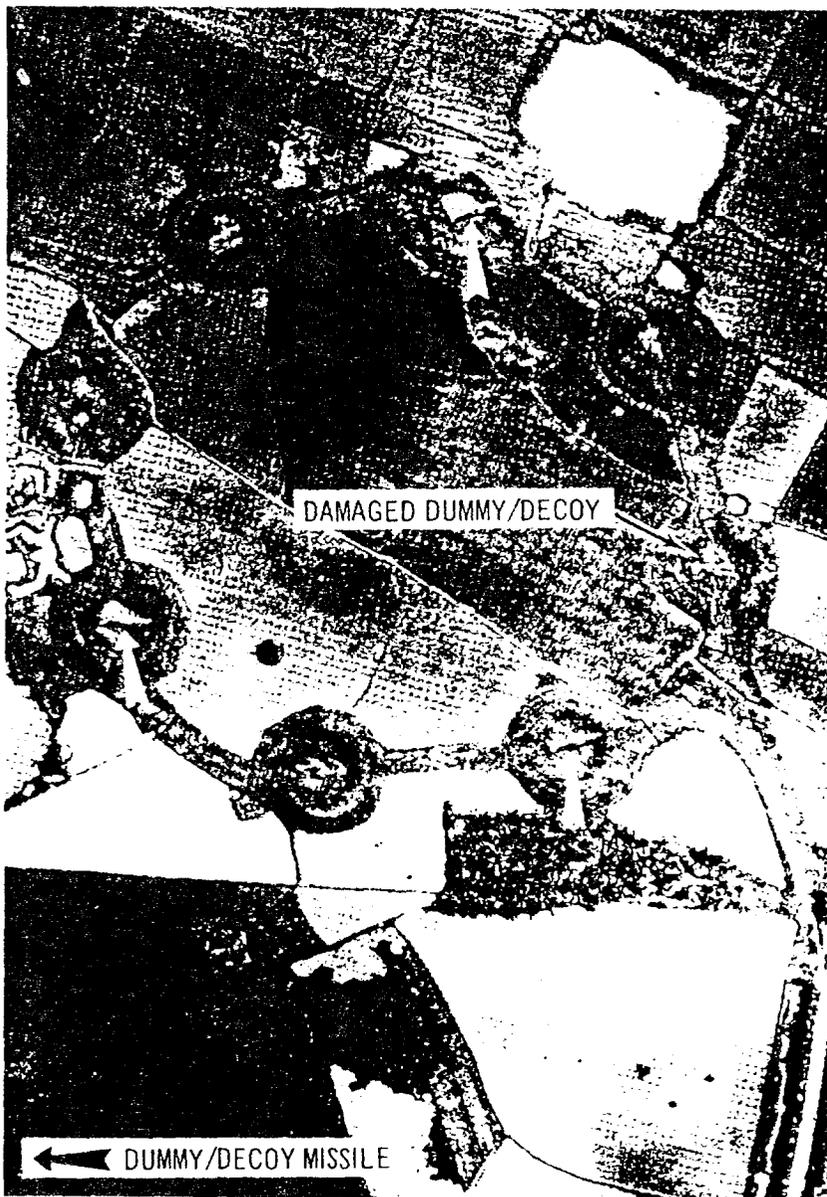


Figure 8. Total lack of track activity, missile associated equipment and the fact the revetments are too small, readily identifies this as a dummy/decoy site. Can you see the damaged dummy missile?

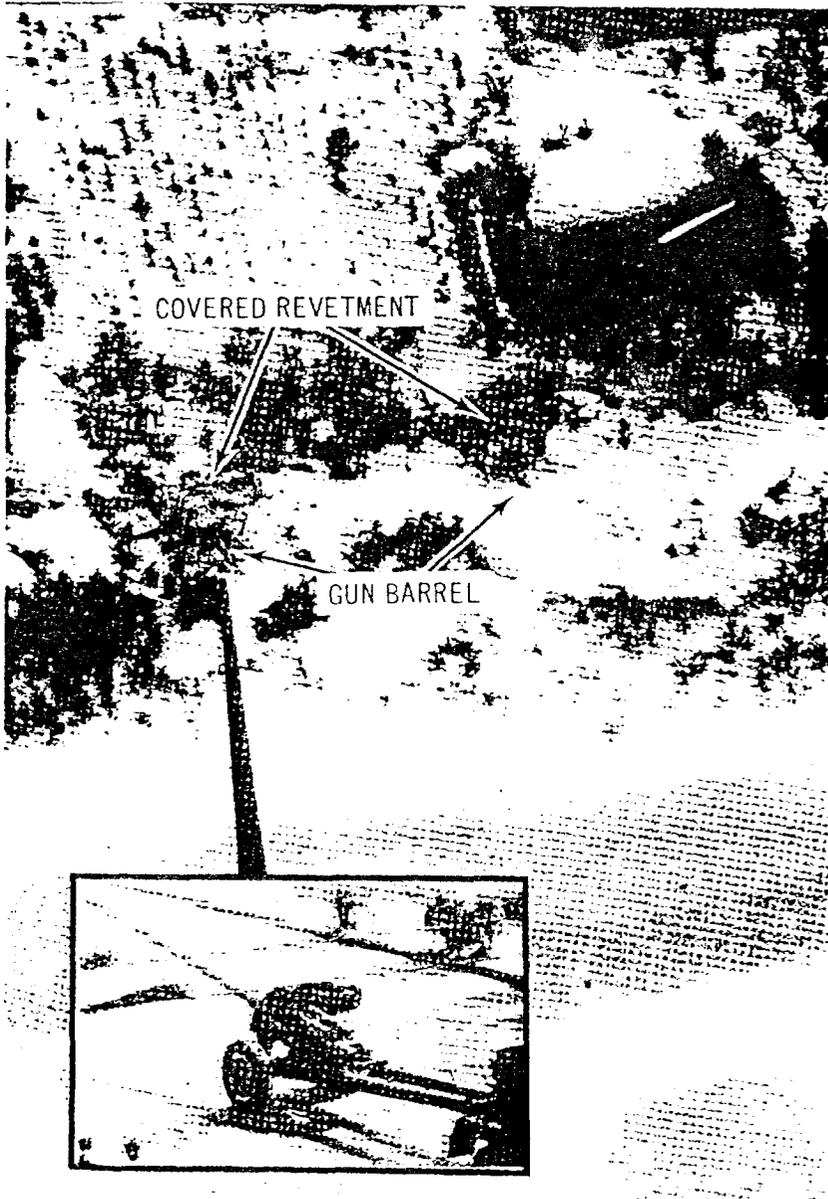


Figure 9. Only the long barrel of the probable 100mm field piece is visible at this camouflaged coastal defense site near Vinh, North Vietnam. Note how the revetment camouflage blends in with the surrounding scrub growth that predominates the general area.

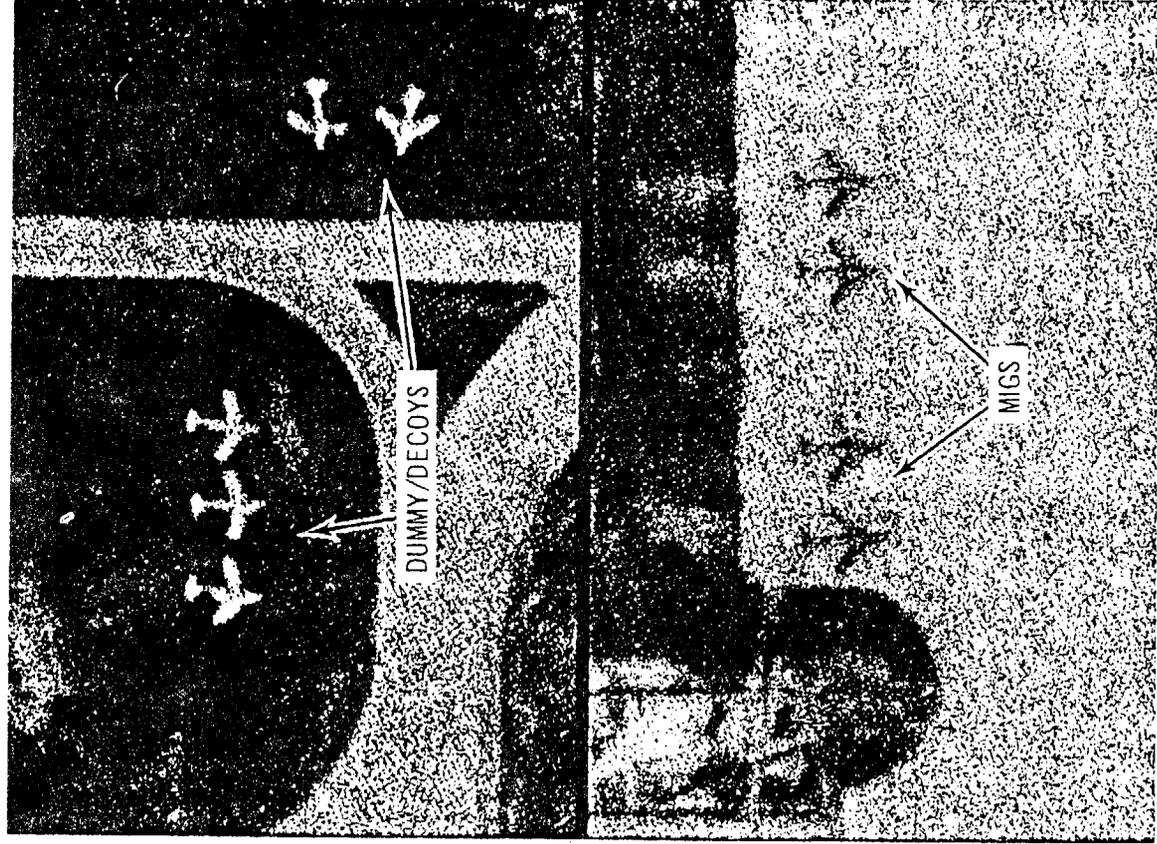


Figure 10. Upper photo reveals several dummy/decoy aircraft that were the first observed in North Vietnam. Note the uneven fuselage and inexact wing alignment. When compared with several Mig aircraft detected at the same airfield, a lack of fidelity exists (see lower photo).

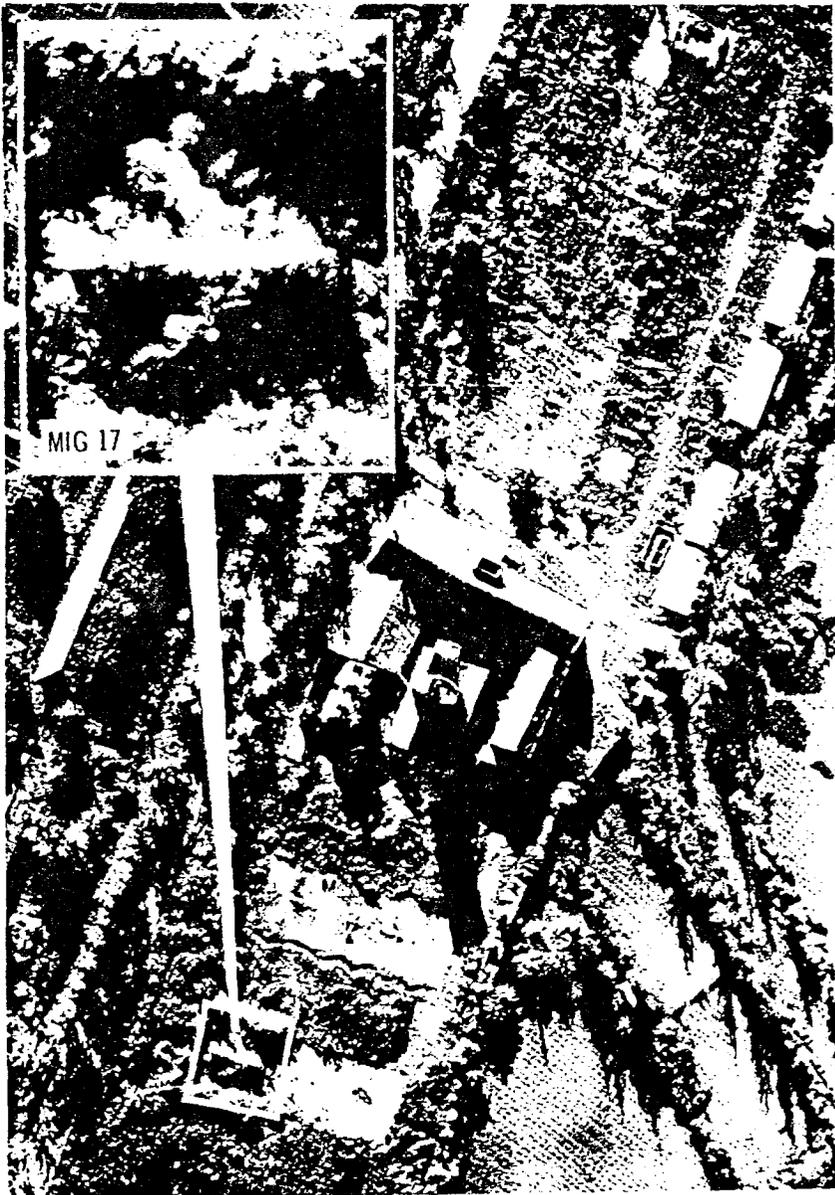


Figure 11. This camouflaged Mig aircraft located approximately 1.5 nautical miles from Haiphong/Cat Bi Airfield was probably transported into the area by Hook helicopter to avoid damage or destruction.

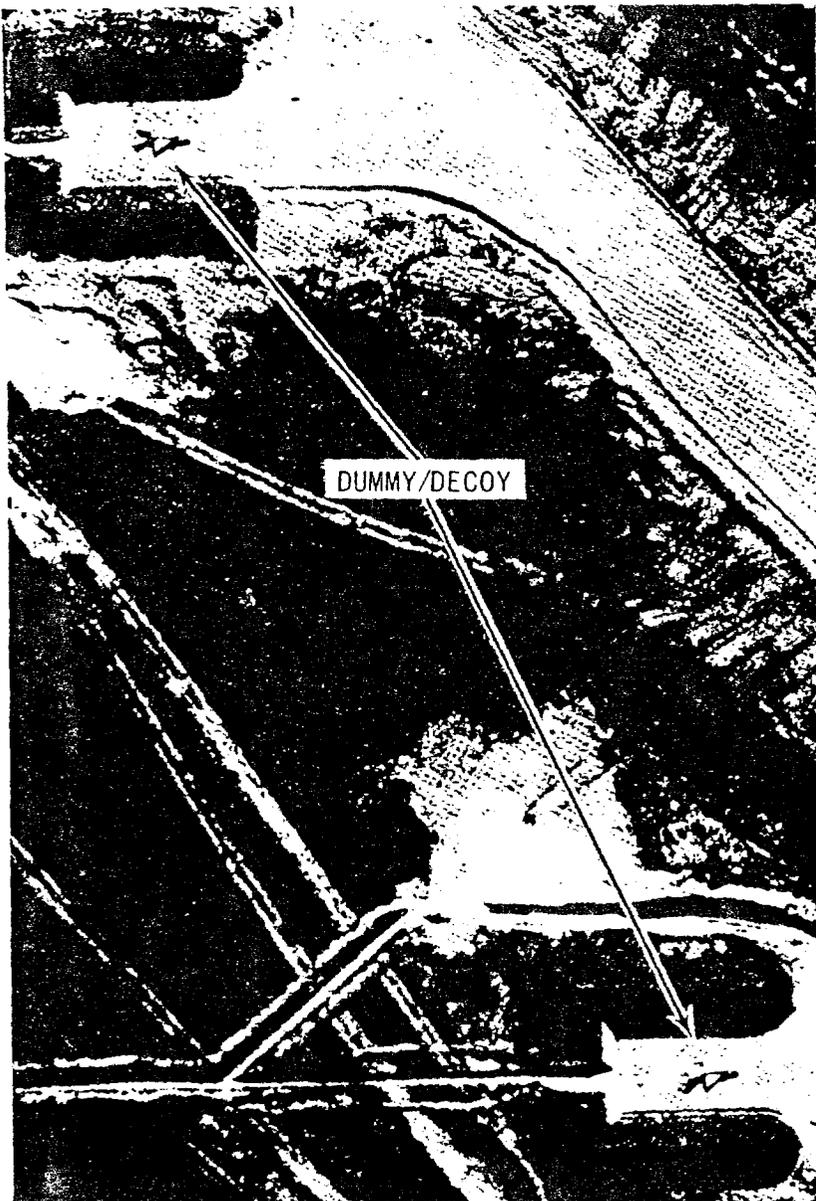


Figure 12. The dummy/decoy delta-wing aircraft observed at Hoa Lac Airfield, carry a good resemblance to Mig-21 aircraft. However, when compared to the known dimensions of the aircraft revetment, the discrepancy in size is apparent to the photo interpreter.

~~SECRET~~



Figure 13. Left photo illustrates an aircraft hangar in the early stage of construction. The right photo shows one nearing completion at the same airfield in North Vietnam.

Aerial Surveillance

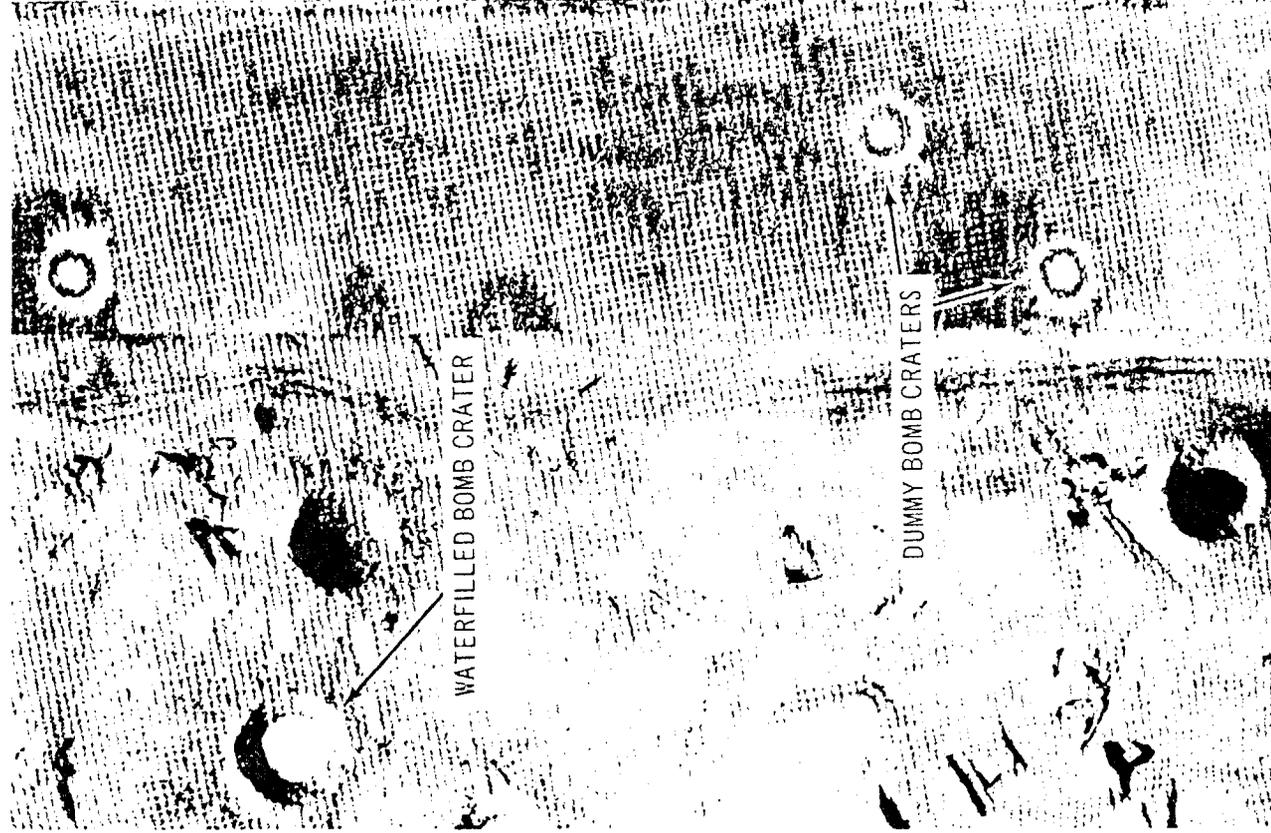


Figure 14. Lack of depth and shadow make these dummy bomb craters easy to identify.

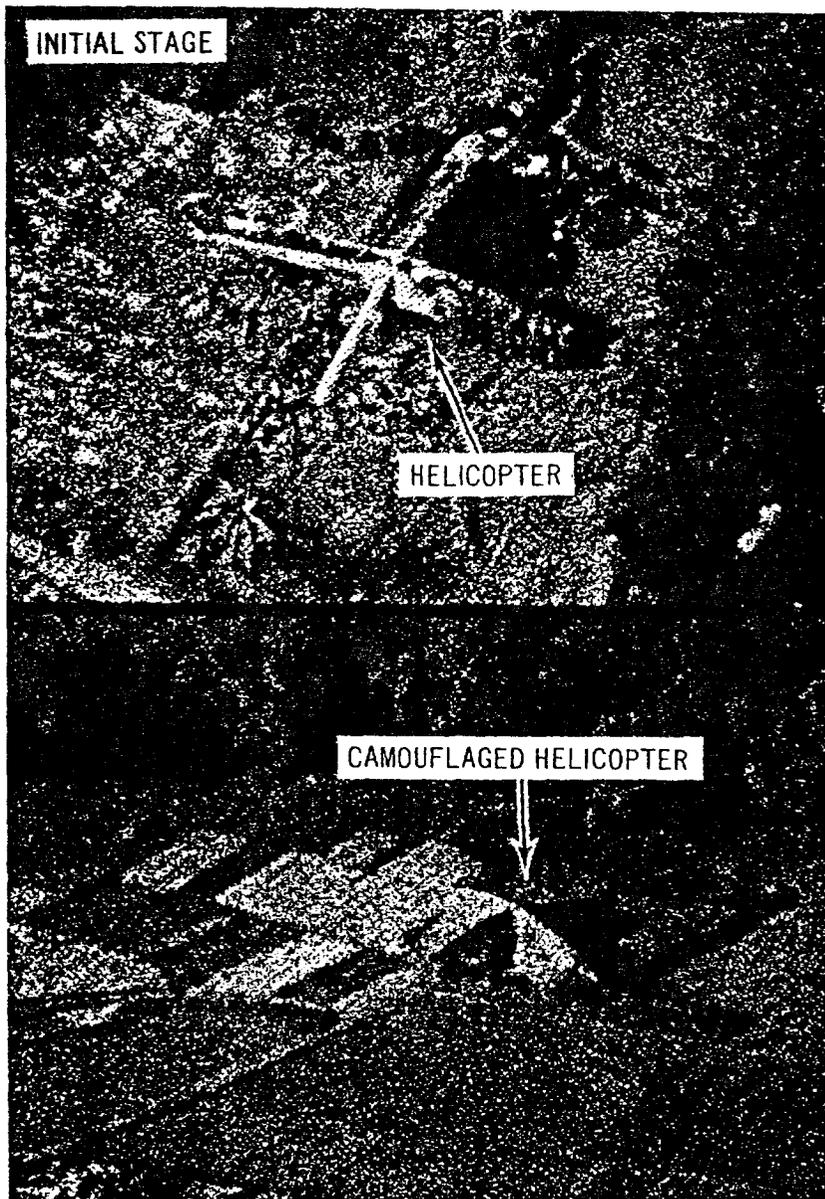


Figure 15. Prior to the cessation of bombing in North Vietnam, helicopters were frequently camouflaged and dispersed in open fields near native villages. The artful use of foliage and garnished netting makes identification difficult.



Figure 16. Although a generous application of garnished netting has helped to conceal the superstructure on this vessel, the hull silhouette of this North Vietnamese Subchaser is clearly visible moored to an offshore island in the Gulf of Tonkin.

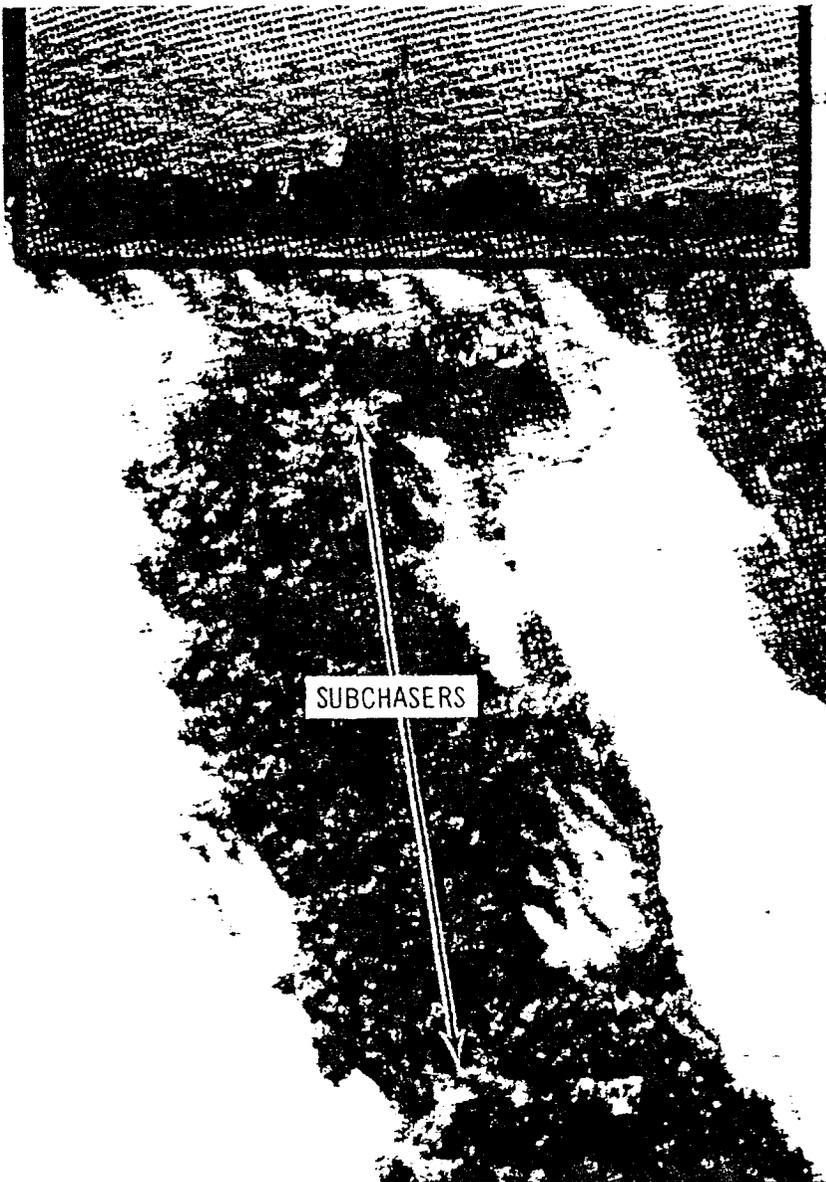


Figure 17. Another technique employed by North Vietnamese naval units is to dredge small slips into the river bank where vessels can be moored under the tree canopy. The draping of netting and foliage over the ships superstructure provides effective camouflage as illustrated in this photograph.



↑ ↑ ↑
PROBABLE SMOKE POTS

Figure 18. This North Vietnamese Swatow Gun Boat was one of several that were apparently strafed in the Gulf of Tonkin. Note the use of smoke pots presents the appearance of damage to the vessel.

~~SECRET~~

Aerial Surveillance

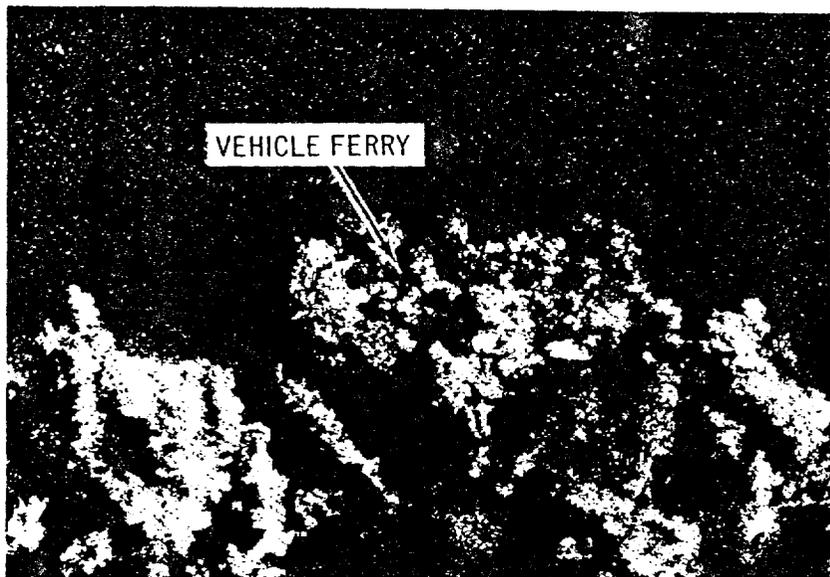


Figure 19. A vehicle ferry has been moored alongside a heavily vegetated river bank in Laos. Besides camouflaging with tree branches, the existing tree trunks are tied down to provide additional camouflage.

~~SECRET~~

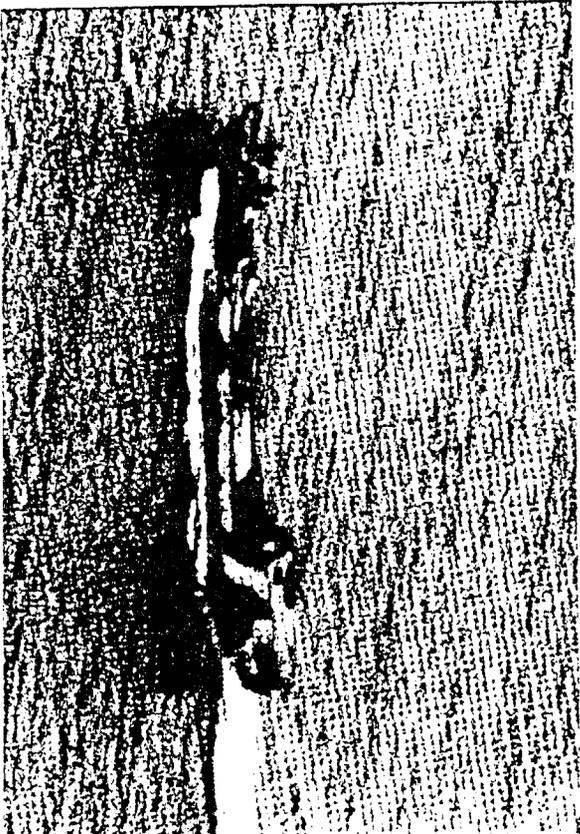


Figure 20. Some light coastal junks have been covered with camouflage disruptive paint to disrupt the hull silhouette.

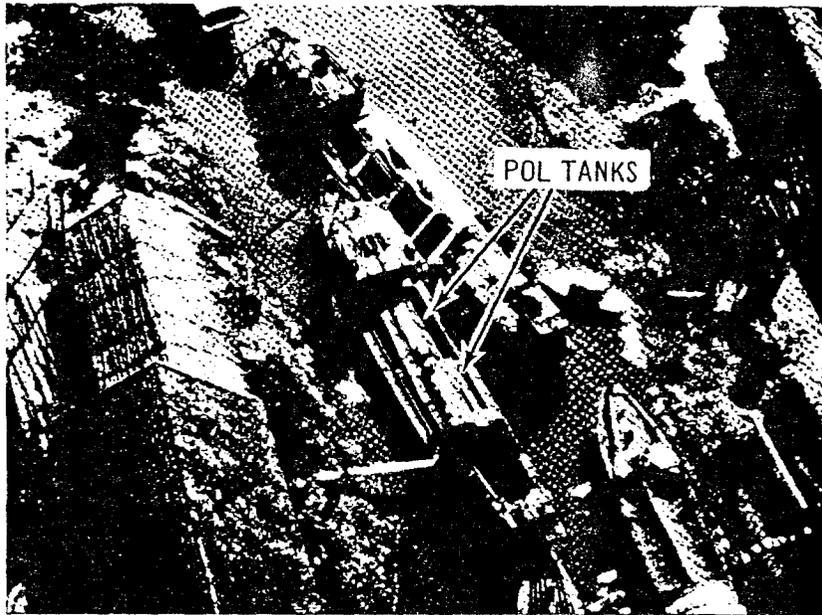


Figure 21. Several 40 ton motorized junks carrying concealed POL tanks like the ones in this photo, have been observed along numerous inland waterways in North Vietnam.

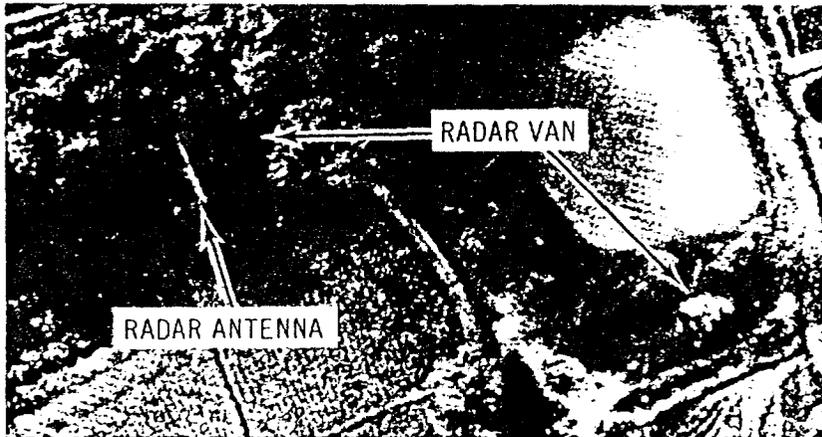


Figure 22. This aircraft warning radar van is parked in a village area. The tall trees provide dark shadows during the day that help to mask its presence. Note the electronics van is barely visible, however the yagi-type antenna can be seen extending over the tops of the adjacent trees. The photo signature that led interpreters to this site is the shadow of the radar antenna. Can you see it on the ground?

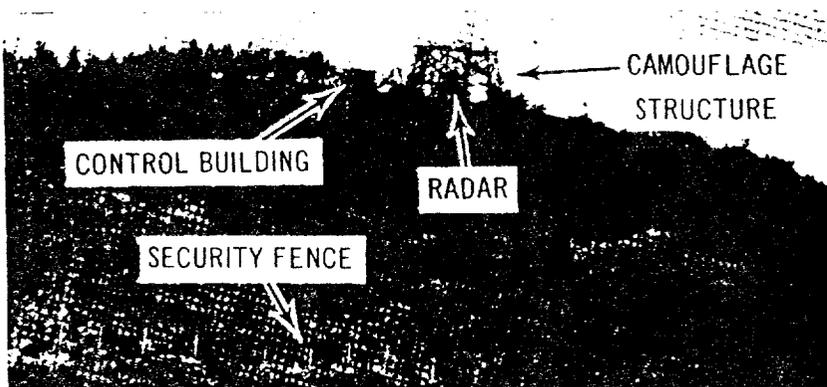


Figure 23. A low flying reconnaissance aircraft photographed this North Vietnamese surface search radar perched atop a rocky promontory. The horizontal shot of this installation with the clear sky as a background, helped to identify the antenna which is located inside an octagonal shaped wood structure. The camouflaged structure makes identification difficult from vertical photography. The unusual camera angle combined with the time of day has helped to provide information over and above that normally expected in the design characteristics of the system. This phenomenon has been labeled the "serendipity effect" by the Director, NPIC.

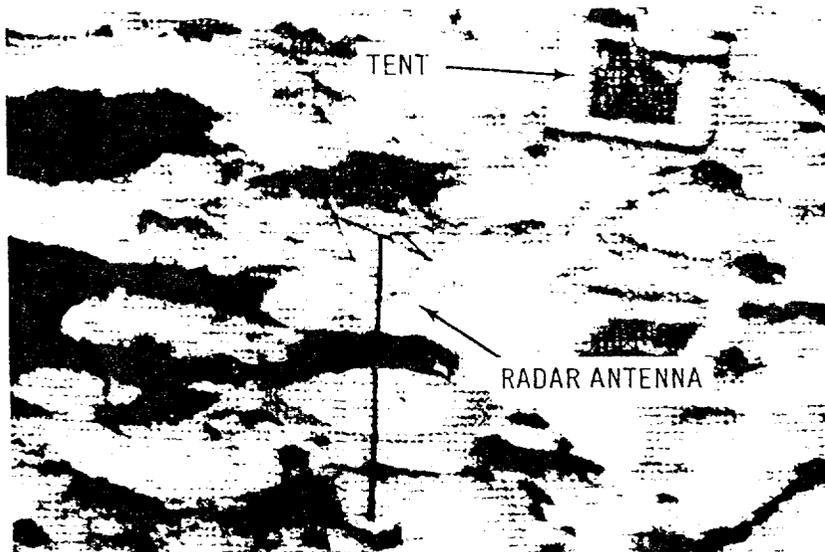


Figure 24. An open area can provide good camouflage if the radar equipment is basically simple and the tracks covered. The tent probably houses control equipment. Note how the background is undisturbed.



Figure 25. Deception discipline has been rigidly enforced at this Communist base camp in Cambodia. When viewed with the naked eye only five buildings are partially visible. However, analysis of stereoscopic photography reveals 16 additional buildings concealed by the tree canopy and camouflaged with natural vegetation. Note, the vehicle tracks are well concealed.



Figure 26. The buildings and service road in this Communist base camp located in Laos, are more visible when compared to those in Figure 24. Apparently deception discipline is not rigidly enforced.

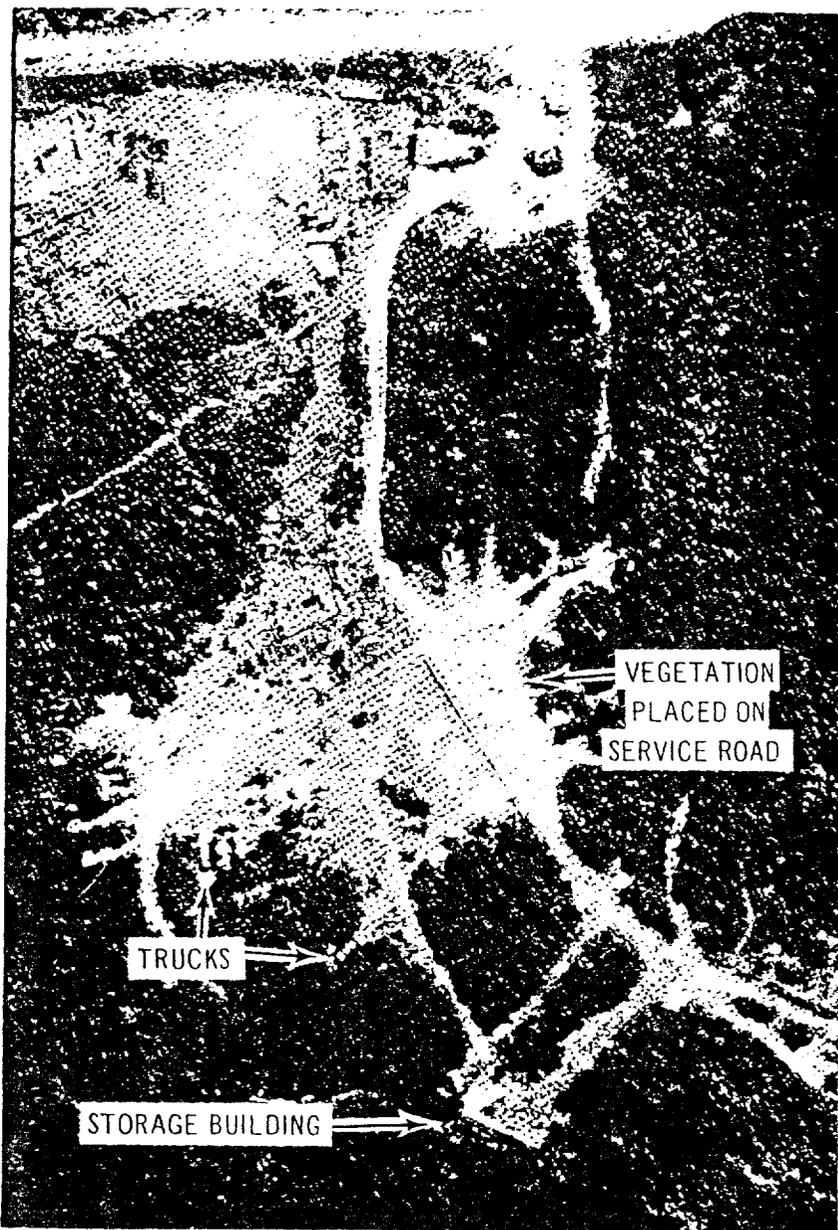


Figure 27. Vegetation emplanting on roads is supposed to present the appearance of disuse. However the heavy track activity at this facility in Laos is easy to discern because the regular spacing of emplanting vegetation has an artificial "salt and pepper effect" when viewed on overhead photography.

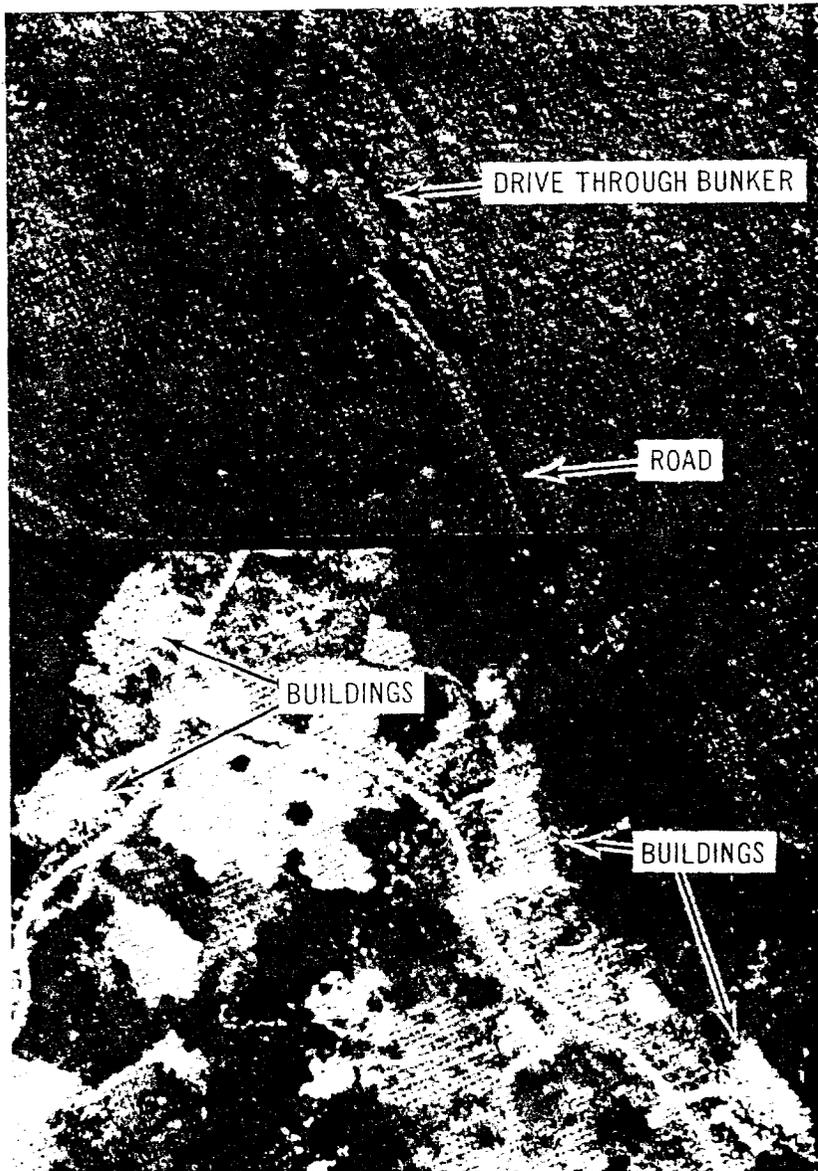


Figure 28. Upper photo illustrates how the proper application of natural foliage on access roads and military associated buildings is considered paramount. In the lower photo, camouflage disruption paint was artfully applied to the roofs on these ammo storage buildings. However, the deception specialist was remiss when he failed to conceal the access roads.

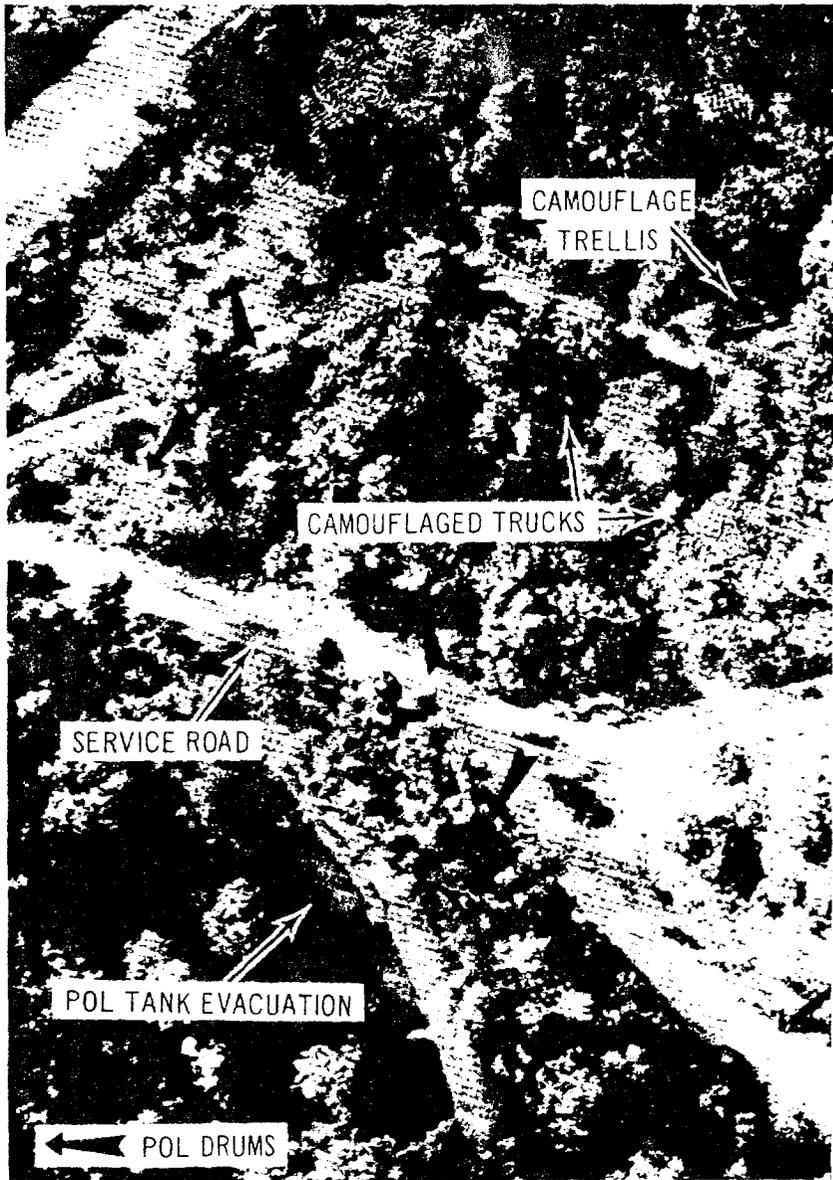


Figure 29. In this photo the track activity at a POL facility is easy to identify, but the POL supplies have been partially concealed and camouflaged with foliage and a camouflage trellis. Can you see the cargo trucks?

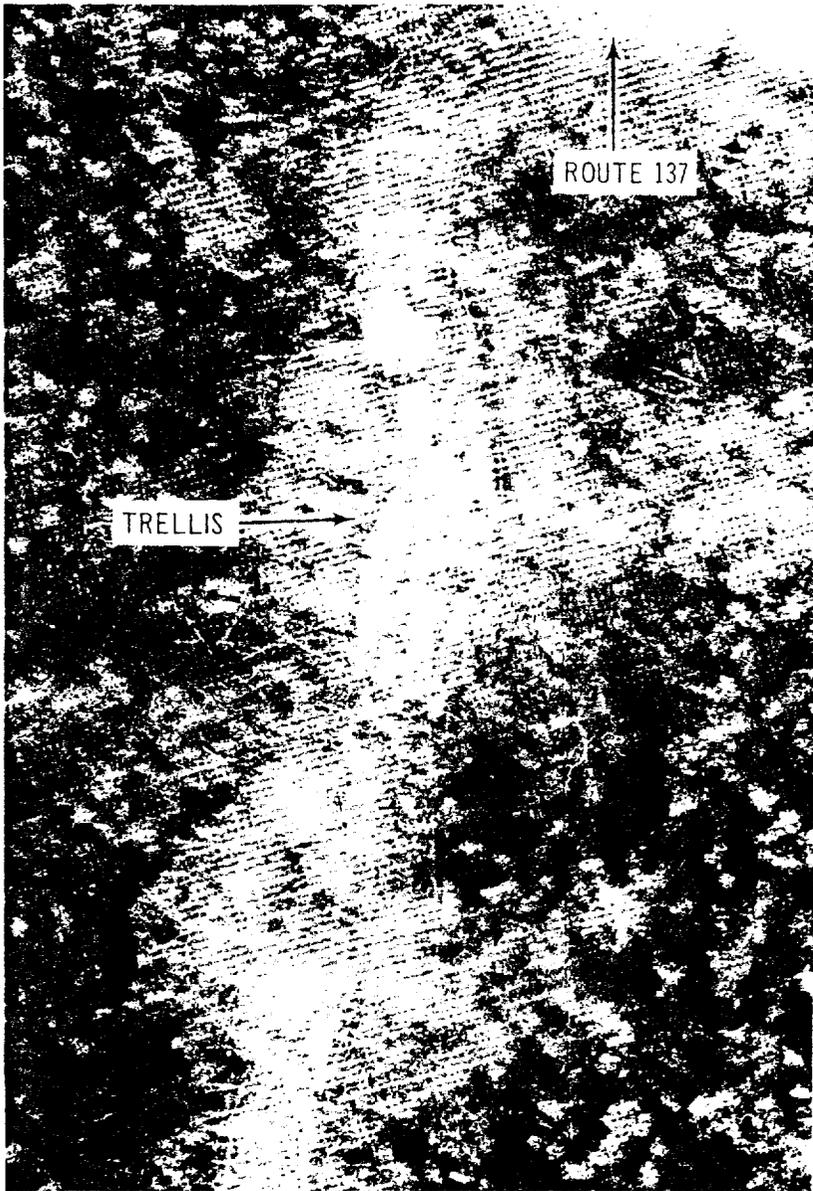


Figure 30. The arbor-type trellis observed in this photo has been used quite extensively by North Vietnamese to conceal new road construction and access roads that serve truck parks and military installations.

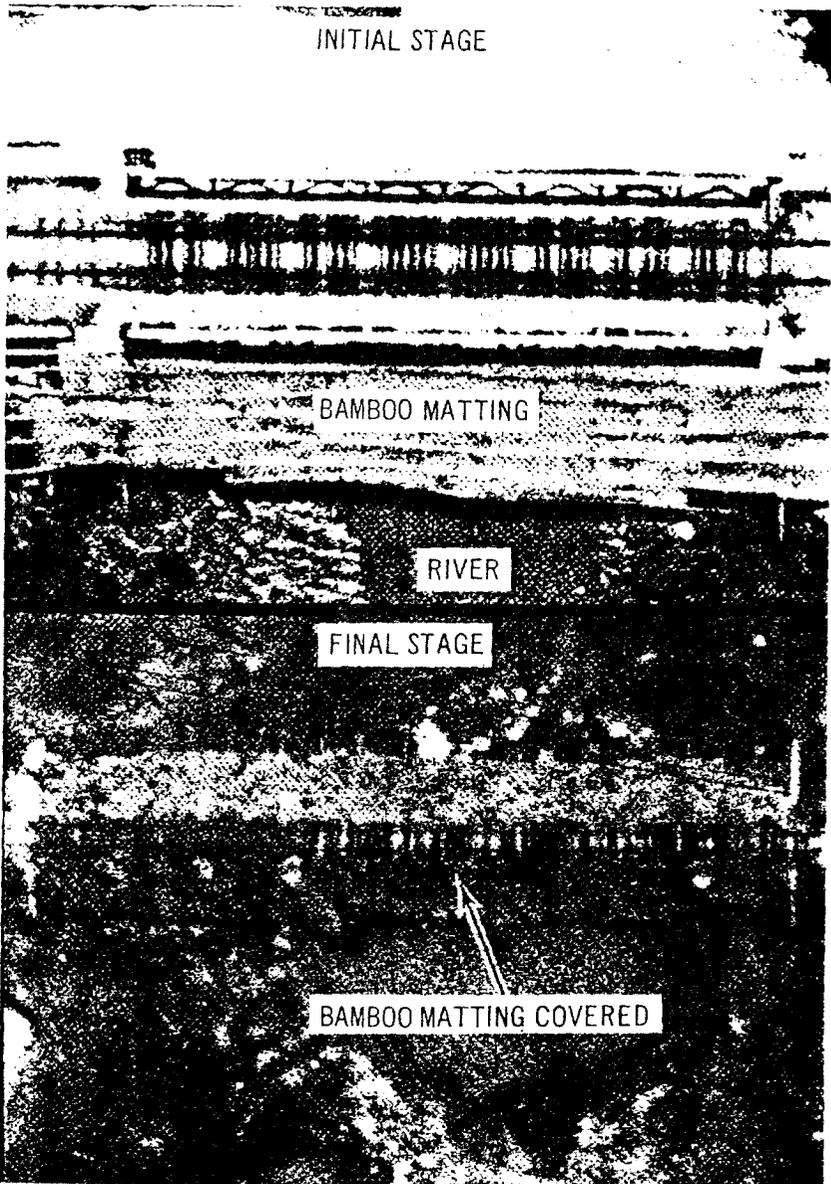


Figure 31. In the upper photo a bridge is observed in the early stage of being camouflaged. In the lower photo the bamboo matting placed on the abutments of a similar type bridge has been covered with vegetation to blend in with the adjacent road bed.

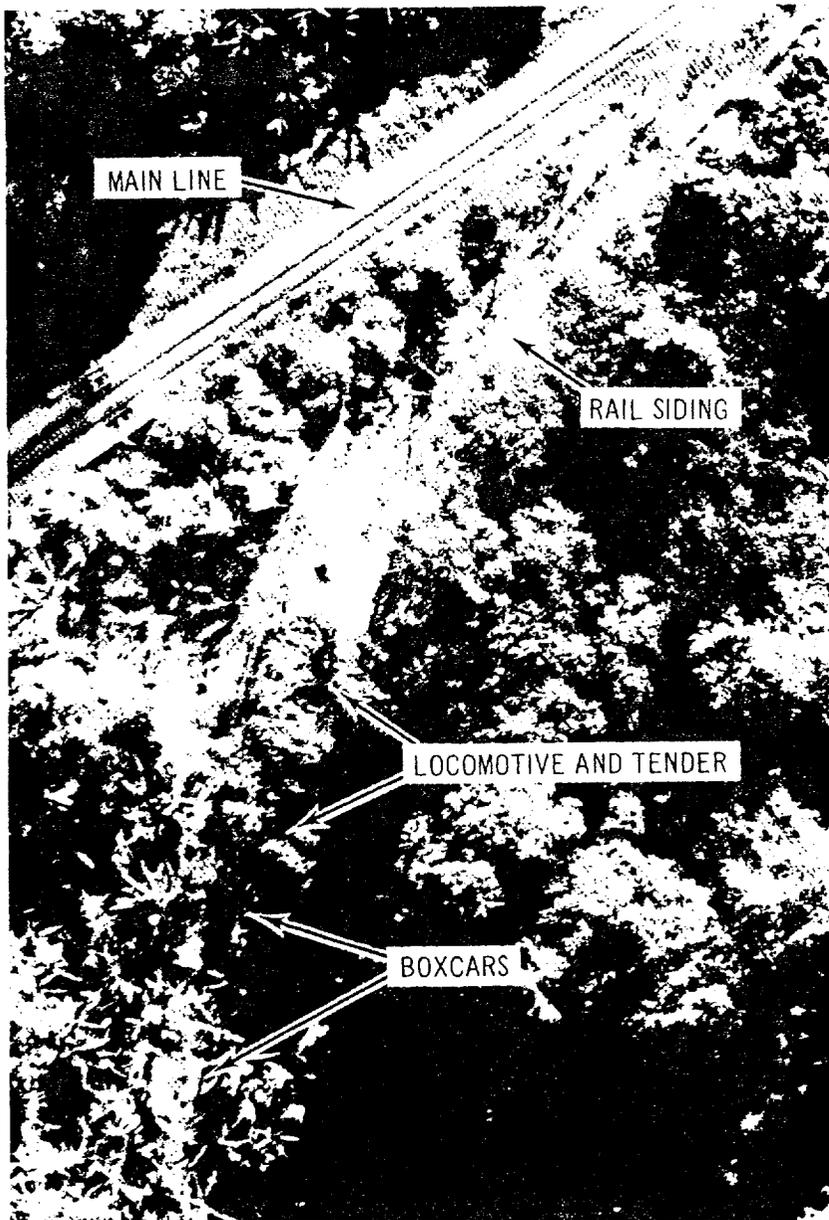


Figure 32. Emplanted vegetation, natural foliage, garnished netting, and tying tree tops together have been used to camouflage this locomotive and boxcars located on a small rail siding.

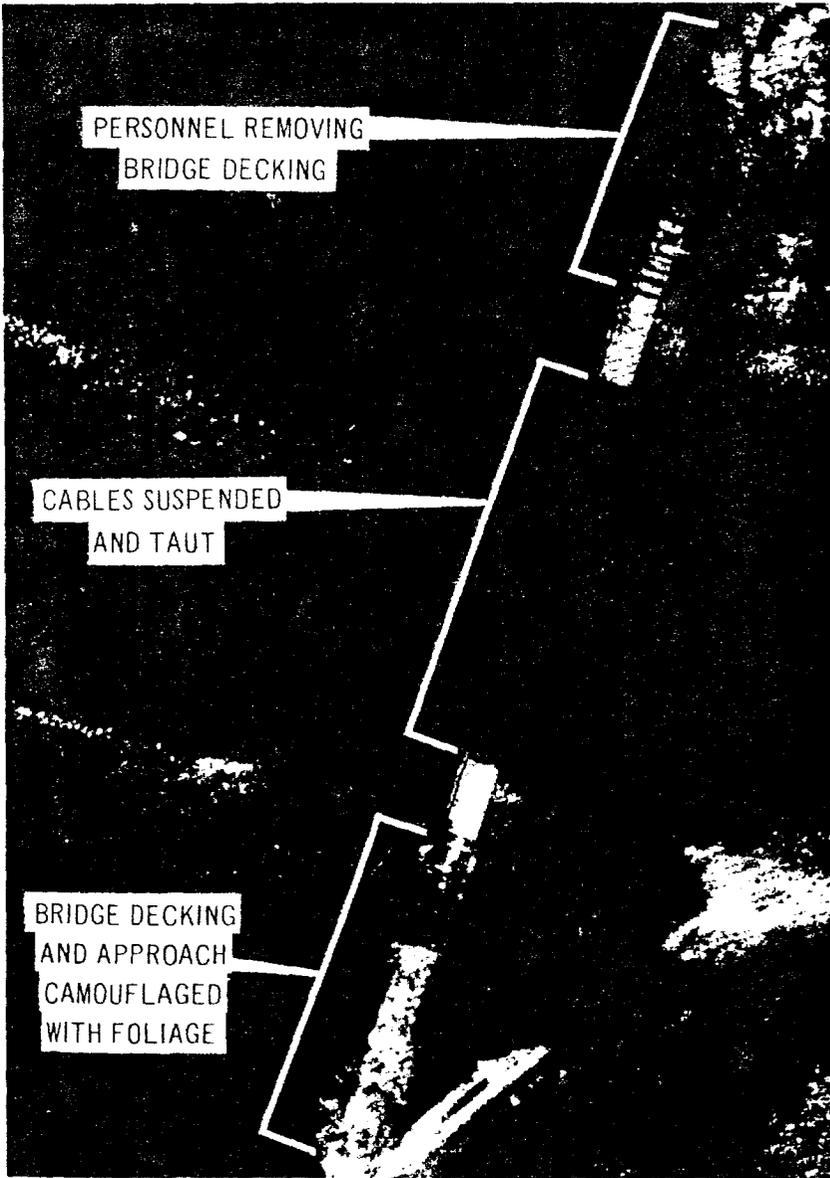


Figure 33. Close examination of this photo will reveal a fording point with adjacent cable bridge in the process of having the bridge decking removed by personnel. The cables suspended across the river are scarcely visible, giving the bridge an unserviceable appearance with the decking removed.

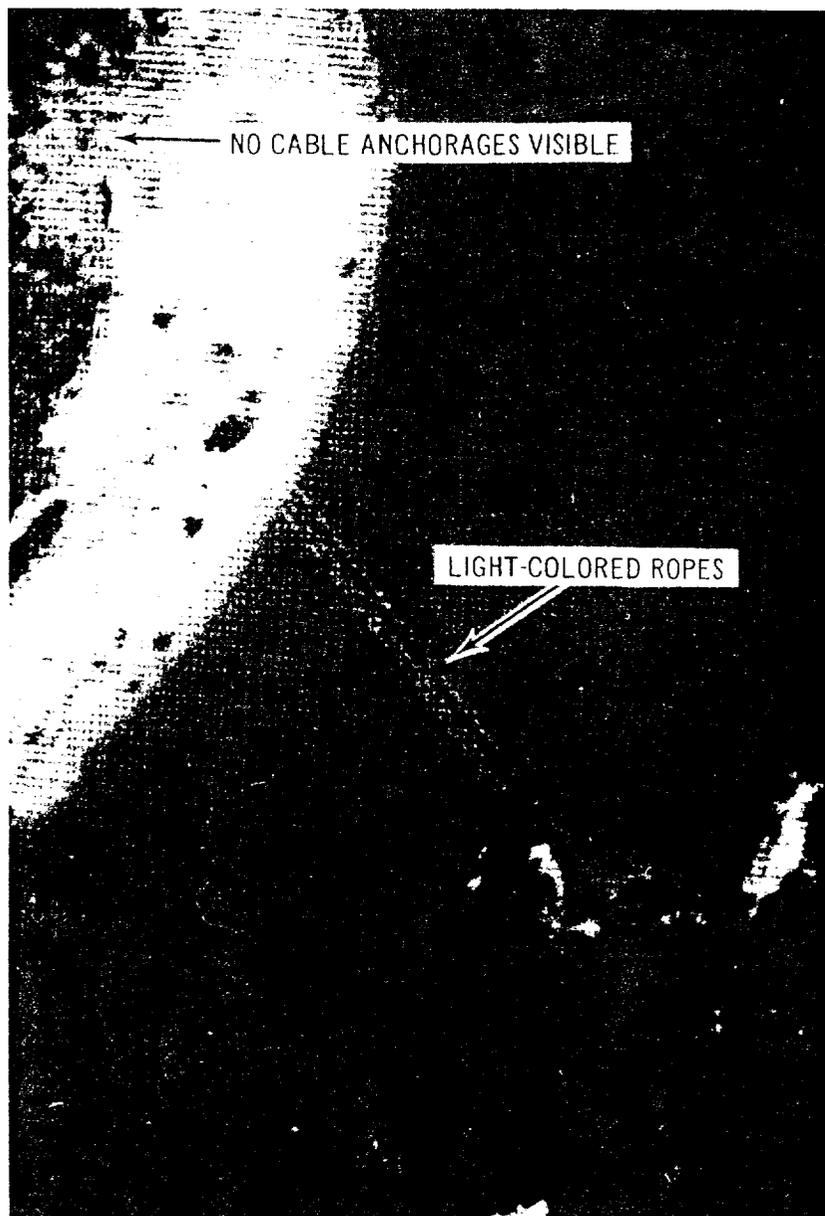


Figure 34. A dummy cable bridge is easy to identify due to the lack of cable anchorages and serviceable approach roads. Note the light colored ropes that have been strung across the river to simulate cables which is contrary to usual attempts to make cables difficult to see.

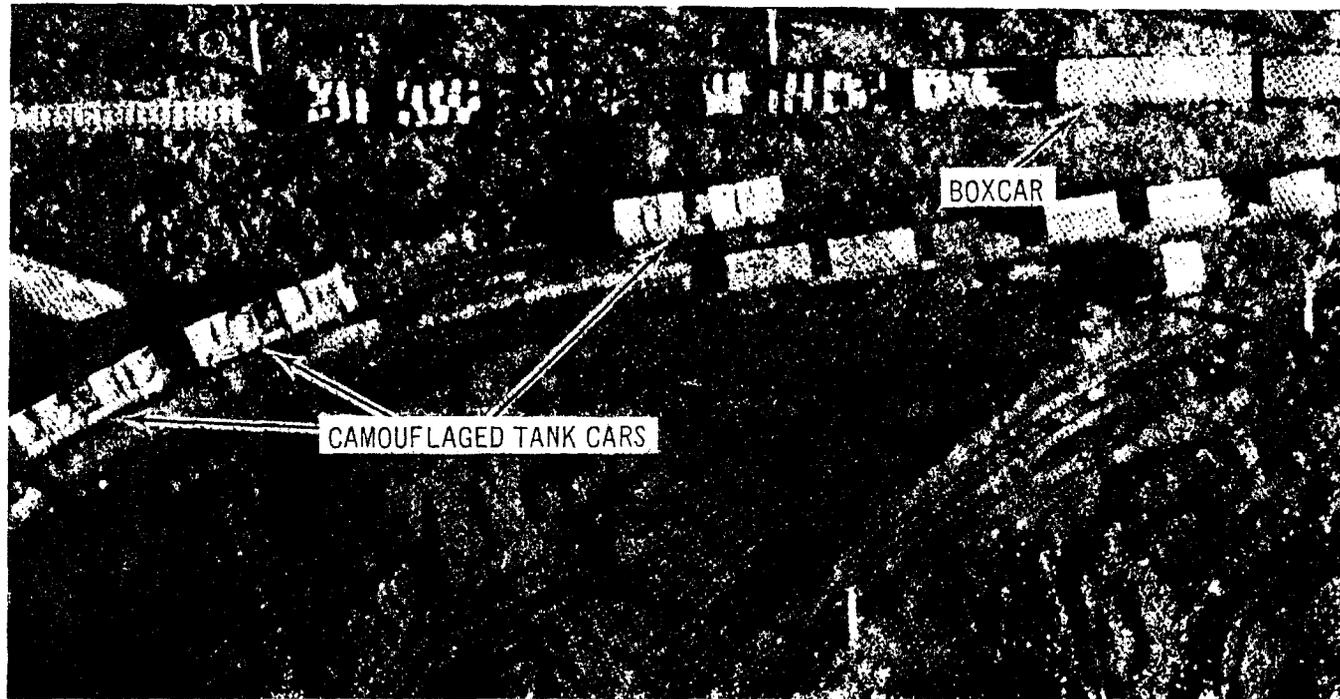


Figure 35. Because of the importance of POL supplies to their logistics activity, the North Vietnamese sought to protect transient POL whenever possible. Even wooden structures with canvas or wood covering was used to change the appearance of rail tank cars and make them appear as boxcars.

~~SECRET~~

Aerial Surveillance

~~SECRET~~



Figure 36. The North Vietnamese have deployed chemical smoke generators to create a smoke screen at important installations, probably in an attempt to foul television-equipped Walleye missiles, but also to obscure a large area against airstrikes.

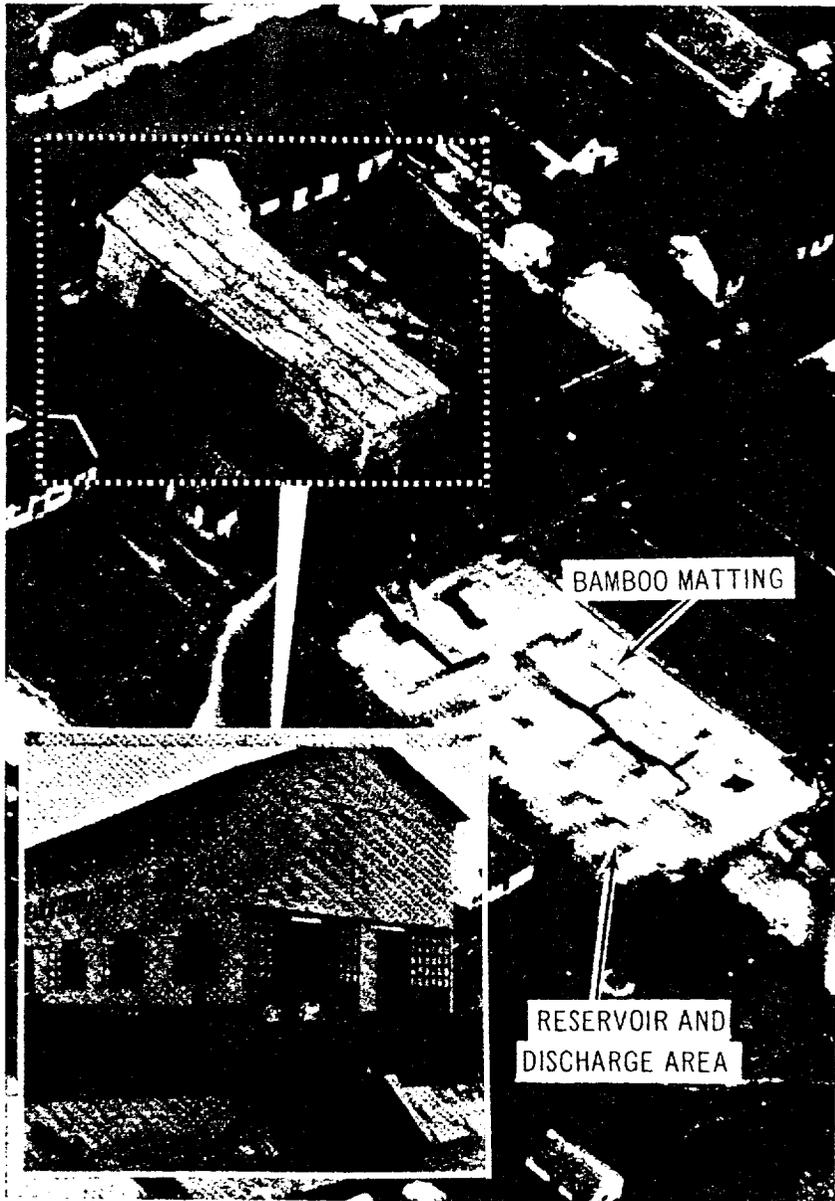


Figure 37. Irrigation pumping stations were among the first urban and industrial facilities to be camouflaged in North Vietnam. You will note in this photo, bamboo matting being placed over the entire pump house and the reservoir area. The inset photo of this facility was taken in 1952.