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**Item ID Number** 05560  **Not Scanned**

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**Report/Article Title** IV. The Target Air Bases

**Journal/Book Title** Air Base Defense in the Republic of Vietnam, 1961-197

**Year** 1979

**Month/Day**

**Color**

**Number of Images** 0

**Description Notes** Also included are two maps. One shows provinces and major cities of South Vietnam, and the other is a 1974 National Academy of Sciences Computer Printout of all defoliation missions in South Vietnam, 1965-1971.

**AIR BASE DEFENSE  
IN THE  
REPUBLIC OF VIETNAM  
1961 - 1973**

**Roger P. Fox**

**OFFICE OF AIR FORCE HISTORY  
UNITED STATES AIR FORCE  
WASHINGTON, D.C., 1979**

on maximum alert with particular attention to the defense of headquarters complexes, logistical installations, airfields, population centers, and billets." 64

The enemy unleashed his main attack between 0300 and 0400 local time on 31 January with about 84,000 troops. In addition to Saigon they assaulted 36 of the 44 provincial capitals, 5 of the 6 autonomous cities, 64 of the 242 district capitals, and 50 hamlets.<sup>65</sup> Responding to USMACV alerting orders, the Seventh Air Force Commander directed all bases to adopt Security Condition Red (Option 1), a readiness posture in which all base defense forces were mobilized and deployed to repel an impending attack. Hence at both Bien Hoa and Tan Son Nhut, the VC/NVA forces found themselves opposed at once by U.S. defenders.<sup>66</sup> It was generally agreed that this fact alone accounted for the successful defense of the two bases.

#### Security check



#### Sabotage

Of the four threats posed by the VC/NVA to the local security of U.S. air bases, sabotage was the least significant. Despite unlimited opportunities for sabotage afforded by the thousands of Vietnamese civilians working on these installations, this classic weapon of insurgency warfare was a curiosity rather than a commonplace. Records reveal but one notable case of sabotage at an American base during the entire war. On 8 February 1967 at Bien Hoa, Soviet-made explosive devices, secretly planted, destroyed about 2,600 napalm bombs valued at \$342,000.<sup>67</sup> During 1968, a year of intense enemy activity, not a single instance of actual or attempted sabotage was reported at any Seventh Air Force base.<sup>68</sup> Why the VC/NVA all but ignored this simple and potentially highly rewarding tactic cannot be explained by available evidence.

The VC/NVA showed they could do serious damage to air bases, notably by standoff attacks and sapper raids. Much of their capability derived from a high degree of military expertise that reflected sound doctrine, meticulous planning and preparation, deeply instilled discipline, and an aptitude for fusing available manpower and weapons with proper tactics to produce a mission-effective force. Such ingenuity and skill helped surmount many of the inherent advantages of the defense and to retain a broad initiative to strike at ground-deployed U.S. air power at times and places of their choice. Accordingly, it is perplexing that the VC/NVA never sought to redress more vigorously the air power imbalance by fully exploiting their notable counter-air base capabilities to the extent permitted by the vulnerability of Allied defense measures.

#### IV. THE TARGET AIR BASES

The majority of bases do not have a positive approach or active planning program for the protection of their operational assets. . . . There are no criteria established for the construction of air bases in a combat environment. New construction and redesigning is [sic] based on peacetime criteria.

Seventh Air Force Base Defense Study Group, 1967.

Major targets for Viet Cong/North Vietnamese Army attacks embraced the 10 primary bases that supported USAF operations in Southeast Asia. Da Nang, Phu Cat, Tuy Hoa, Nha Trang, Cam Ranh Bay, and Phan Rang are located in the narrow coastal zone bordering the South China Sea. (See page 56.) Pleiku is situated in the Central Highlands less than 70 kilometers from Cambodia. Tan Son Nhut and Bien Hoa are in the environs of Saigon. Binh Thuy, the southernmost base, lies on the outskirts of Can Tho in the middle of the Mekong Delta.

#### The Geographic Impact

Geography had a vital bearing on all facets of the war. Its impact on local ground defense of these bases came chiefly from the conformation, topography, climate, and vegetation of the Republic of Vietnam.

A geopolitical principle holds that a compact country is much easier to defend than a large sprawling one. Clearly, the Republic of Vietnam fits the latter category. Slightly larger than

Florida, the country extends more than 1,300 kilometers from north to south, while its width from east to west varies from 50 to 200 kilometers. Saigon, usually considered an east coast city, lies less than 60 kilometers from the Cambodian frontier to the west.

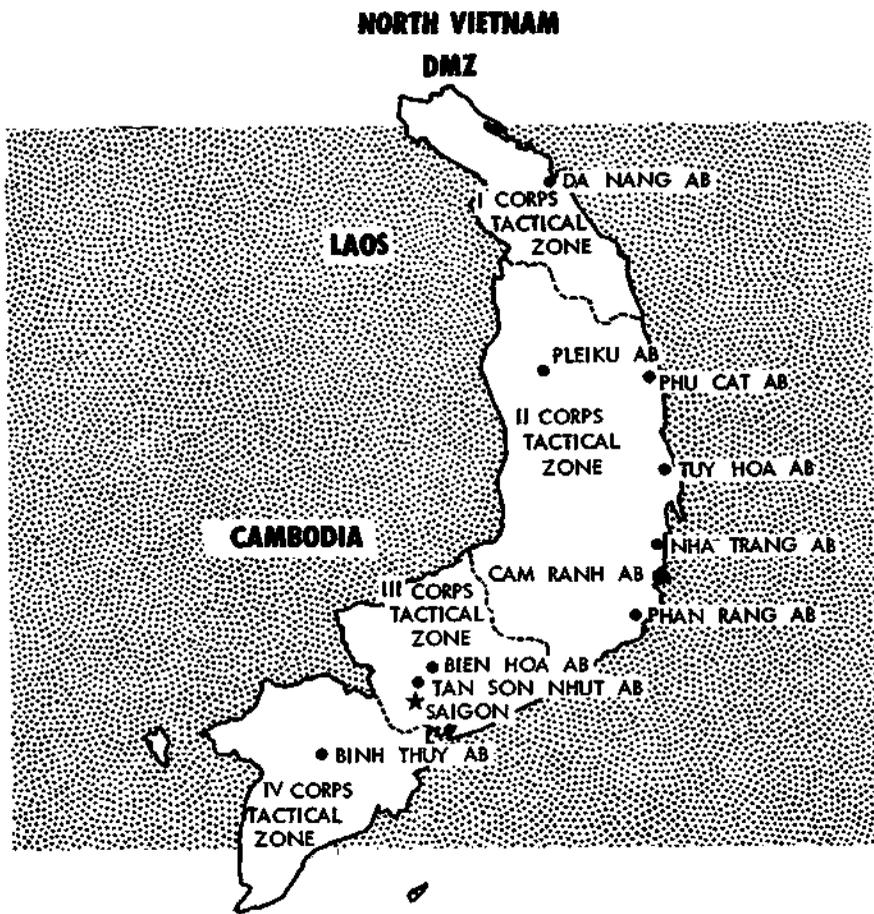
The Republic of Vietnam is a classic example of exposed territory. So lengthy are its boundaries in relation to its size, that points for infiltration by land and sea are almost unlimited—a circumstance fully exploited by the VC/NVA. The Ho Chi Minh Trail, stretching the whole length of the western boundary with branches extending into most interior areas, was their main route for infiltration of men and materiel throughout the war. Secondary but much more limited infiltration occurred along the 1,300-kilometer sea frontier. Hence, due in part to the physical conformation of RVN, logistic support for VC/NVA operations against USAF bases was available along well-established lines of communication reaching from North Vietnam to within tactical

striking distance of the target installations.

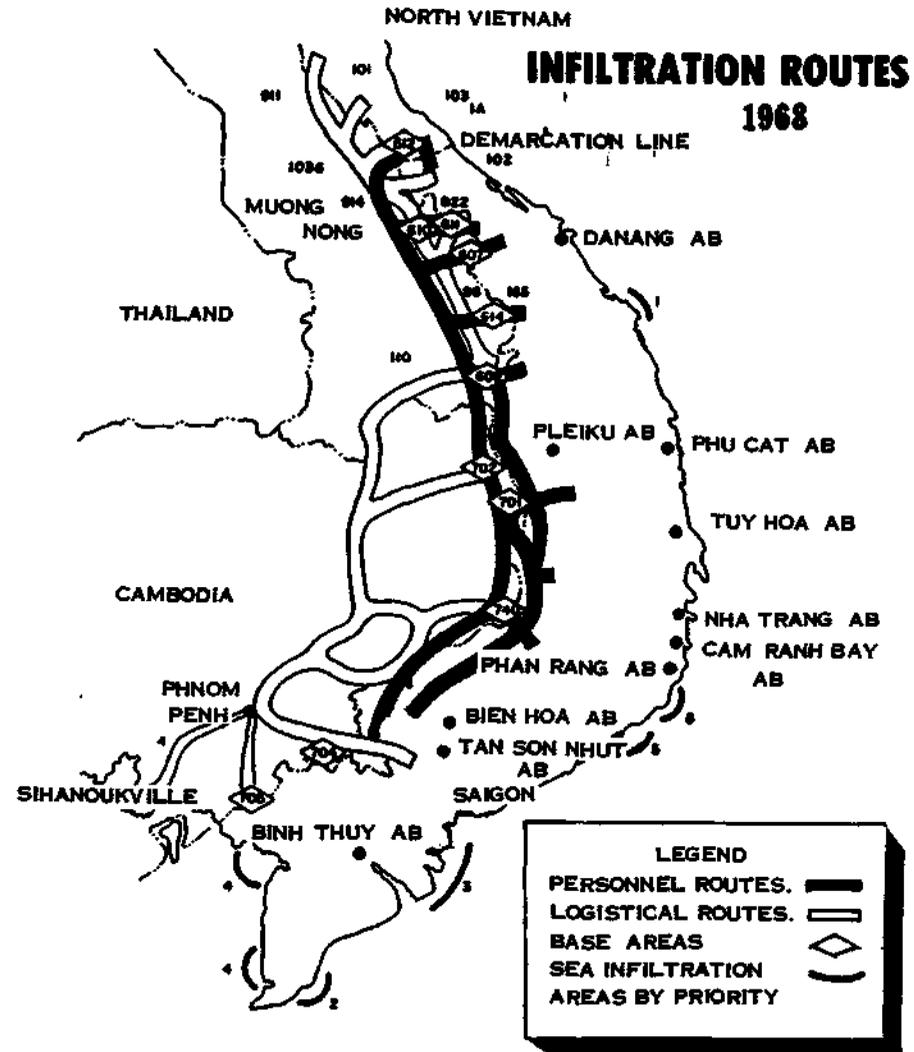
Topography also favored the insurgency forces. Nearly 60 percent of RVN consists of relatively high mountains and plateaus rising to 2,500 meters. These mountains, the Annamite Chain, extend southeastward

from China forming the border between RVN and Laos and, further south, between RVN and Cambodia. They terminate at a point in the Mekong Delta about 80 kilometers north of Saigon. Numerous spurs extending to the east insure broken and rugged terrain in close proximity to all USAF bases but Binh Thuy. Low-

**Primary USAF Operating Bases**



NOTE: CORPS TACTICAL ZONES WERE REDESIGNATED MILITARY REGIONS IN 1970.



lands with little or no relief comprise the remaining 40 percent of the country and are located chiefly in the Mekong Delta where the land is seldom more than 4 to 5 meters above sea level and is intersected by numerous waterways. Consequently, almost the whole countryside offered cover and concealment to the VC/NVA while presenting obstacles to observation, penetration, and movement by RVN and Allied ground forces. Each of the 10 USAF primary bases was accessible by land and/or water to insurgency forces.

Except in the mountains and plateaus of the Annamite Chain—for example the Pleiku AB area—high temperatures prevail throughout the year, the average annual range varying only from 77°F in the north to 81°F in the south. There high temperatures accompanied by high humidity create a climate that saps human energy and enormously increases maintenance requirements for all equipment. As in other countries with similar climates, the afternoon siesta is an institution observed, except for U.S. forces, by friend and foe alike. It appeared that by tacit agreement mutual hostilities were suspended during the early afternoon hours. Except for about six standoff attacks during the Tet and May offensives of 1968, air bases were rarely threatened during siesta.\*

Annual average rainfall is heavy in all regions of RVN and torrential in many. It is heaviest in the Da Nang-Hue area with 128 inches. At Saigon it amounts to 80 inches. For most of Southeast Asia the rainy season occurs in the summer (June-November), when an average of 10 typhoons off the South China Sea bring yet more rain. In the Da Nang

\* Siesta, it appeared, was the preferred time for launching a coup d'etat.

area the wettest period lasts from December through January. This heavy rainy season crippled Allied and VC/NVA operations alike and marked the yearly low point in attack on U.S. air bases.\*

Abundant rainfall joins the year-round high temperatures to give much of RVN a 12-month growing season that results in luxuriant vegetation. More than 80 percent of the country has a natural cover of rain forests, monsoon forests, and savanna lands, which provide extensive concealment for insurgents.

Around and within the U.S. air bases, plant life flourished in overwhelming and unwanted profusion. Several varieties of grasses and weeds created a critical problem for base defense. Especially widespread is tranh grass which reaches a height of 1 to 2 meters, easily tall enough to hide a man or even to imperil a helicopter landing. Yen-bach, another common weed and a serious countrywide pest, grows from 1.25 to 1.60 meters. Lau, cane of frequent occurrence grows in clumps 2 to 3 meters tall. Also widespread are the bamboos, the most common of which, mai pha, occurs throughout Southeast Asia to form dense, almost impenetrable brakes that ascend 12 to 16 meters in height. Obviously, the height and density of such vegetation afforded ideal concealment for ambush and infiltration.†<sup>1</sup>

\* John F. Fuller, historian of the Air Weather Service, gives a good account of the impact of weather on military operations in his monograph, *Weather and War* (Hist Ofc, MAC, December 1974).

† The botanical designations for these plants are: tranh grass (*Impertea cylindrica*), yen-bach (*Eupatorium odoratum*), lau (*Saccharum spontaneum*), and mai pha (*Bambusa arundinacea*).



Vietnamese fishing village engulfed by dense tropical vegetation

Effective vegetation control was made vastly more urgent and onerous by the year-long growing season and the exceptional growth rate. The latter was a truly incredible phenomenon and one on which information is surprisingly incomplete.<sup>2</sup> Security Police at Tan Son Nhut recorded that vegetation grew 1½ to 2½ inches per day during the rainy season,<sup>3</sup> an observation consistent with the findings of plant life specialists. A botanical study of one giant bamboo (*Dendrocalmus giganteus*) established that growth could occur as rapidly as 46 centimeters within 24 hours.<sup>4</sup>

Vegetation was probably least troublesome at Tuy Hoa where the entire eastern perimeter fronted directly on the South China Sea and where ground cover around the remainder of the circumference was the lighter variety common to savannas. The most extreme vegetation problem existed at Binh Thuy, the smallest USAF operating base. Situated in the center of the waterlogged Mekong Delta near Can Tho, it had an elevation of only .75 to 1.5 meters above mean sea

level. The base was ringed by exceptionally dense tropical vegetation 3-4 meters high. This growth engulfed the perimeter fences constructed on the outer face of the levee that enclosed the installation. Likewise concealed were navigable canals, used occasionally by the VC/NVA to float munitions and weapons to the base perimeter. In the interior of Binh Thuy the same vegetation flourished.

At other bases vegetation growth fell somewhere between the extremes represented by Tuy Hoa and Binh Thuy. At all bases, however, it was a permanent security threat that varied only in the urgency of its impact.\*

So on the whole, the geography of RVN greatly favored the VC/NVA either directly by facilitating their military operations or indirectly by restricting activities of Allied forces. In the case of air base defense, the tactical imbalance was perpetuated and

\* The combination of dank vegetation and abundant rainfall created a breeding ground for mosquitoes and other disease-bearing insects.

accentuated by other factors, notably decisions on location and layout of USAF operating bases.

#### Location and Layout of Air Bases

Among the most critical decisions affecting air base defense was the determination to make maximum use of existing airfields, however inadequate, in order to speed the introduction of USAF combat elements. The six bases in question were Da Nang, Pleiku, Nha Trang, Bien Hoa, Tan Son Nhut, and Binh Thuy. All dated from the French regime and all were located in or near population centers.

Tan Son Nhut with its southern and eastern perimeters abutting metropolitan Saigon and with numerous villages and hamlets situated to the north and west was literally engulfed in a sea of humanity. Da Nang AB joined and shared the name of the second largest city in RVN. At Nha Trang the perimeter fence bordered upon civilian dwellings and often served as a clothesline. Nor were conditions radically improved at Phu Cat, Tuy Hoa, Cam Ranh Bay, and Phan Rang—bases expressly built for the USAF. All four were close to settlements of varying size. In the spring of 1969 a study compared an old and a new base in this regard. It found that clearing a 1-mile security zone around Bien Hoa would displace

13,998 people, 2,478 homes, and 555 shops. A like strip circling Tuy Hoa would expel 16,180 persons and Dong Tac, a refugee village newly erected by the Agency for International Development (AID).<sup>5</sup>

Relocation of all people inhabiting air base approaches was probably the ideal technical solution to the defense problem. But politically it was out of the question, even though many of those concerned were squatters without legal title to the land they occupied. There was the unacceptable risk that those relocated would be alienated from the Government of Vietnam and converted to the VC/NVA cause. Such an outcome would have simply aggravated an already unsatisfactory situation.

As it was, problems of this nature faced the Air Force at Phu Cat, Tuy Hoa, and Phan Rang where construction had forced small landowners from their property. Many did not desire to sell in the first place, or feared that family graves might be disturbed or the land gods displeased. Some owners were underpaid or not paid at all. After waiting 2 years, former residents of Phu Cat petitioned the GVN to compensate them for their property. Such grievances created a receptive audience for VC/NVA propaganda and bred a distinct antipathy toward U.S. forces.<sup>6</sup>

Vietnamese so displaced posed fresh security problems. Former residents frequently desired to return to the base to worship at pagodas left standing, to care for graves, to harvest tree or garden crops, or to tend to other affairs. Security personnel had to accompany the returnees and to search for boobytraps after their departure. At one USAF base under VNAF control, the faithful regularly came on the base without clearance or escort to visit a pagoda located near unguarded VNAF napalm stocks and ordnance-loaded aircraft.<sup>7</sup> This episode will illustrate the exasperating and hazardous idiosyncrasies encountered in security operations at the six old airfields where VNAF had primary responsibility for base defense and exercised control over base access.

Concentrations of civilian dwellings adjacent to the 10 USAF operating bases afforded the enemy an abso-

lute tactical advantage since they provided cover and concealment to the threshold of the target base. These same conditions seriously restricted defense forces by prohibiting or limiting use of boobytraps, tripflares, sensors, freefire zones, and exclusion areas around base perimeters. Also totally or critically curtailed was the delivery of artillery, aircraft, or helicopter counterfire. Thus, like the Allied conduct of the overall war, base defense operations were profoundly influenced by the necessity to enlist the widespread active support of the population.

The USAF and VNAF buildup soon saturated the six older air bases to a point that invited enemy attack. Near the peak of the war, 76 percent of the total aircraft and 60 percent of all USAF aircraft operated from these more vulnerable airfields, whose target value was further heightened



Tan Son Nhut  
Air Base

#### Aircraft Assigned To Primary RVN Bases 3 January 1969

	RAAF	VNAF	USAF	USA	USN	USMC	Total
*Bien Hoa		75	220	220			515
*Binh Thuy		43	52				95
Cam Ranh Bay			117		22		139
*Da Nang		59	158	59	2	69	347
*Nha Trang		47	110	89			246
Phan Rang	8		141				149
Phu Cat			90				90
*Pleiku			48				48
*Tan Son Nhut		77	105	48			230
Tuy Hoa			97				97
<b>Total</b>	<b>8</b>	<b>301</b>	<b>1,138</b>	<b>416</b>	<b>24</b>	<b>69</b>	<b>1,956</b>

\* Older bases.

SOURCE: USAF Management Summary Southeast Asia, 3 Jan 69, p 39.

by large stores of munitions and aviation fuel. At many of them, conditions were further aggravated by the presence of major military headquarters and/or key political facilities. The ARVN II Corps was at Pleiku and the USMACV I Field Force Vietnam (FFV) at Nha Trang. Da Nang hosted the ARVN I Corps and the III Marine Amphibious Force.

But in this respect Tan Son Nhut was unique. It not only supported an aerial combat mission but housed the headquarters of the Vietnamese Air Force, Seventh Air Force, and United States Military Assistance Command, Vietnam.\* The base was also Saigon International Airport and in 1965 became the VNAF induction center. For much of the time, it served as the residence for the RVN premier or vice president. Location at the seat of government gave Tan Son Nhut a far-reaching political and psychological importance as a military target. Population saturation was noted as early as August 1965 in an Air Staff report which stated that the base was designed for 3,000 people but had 25,000.<sup>7</sup> An April 1968 estimate placed the permanent population at

\* USARV Headquarters was housed at Tan Son Nhut until it moved to Long Binh in July 1967. At that time, USMACV Headquarters relocated most of its activities from various points in Saigon to the newly built "Pentagon East," situated on Tan Son Nhut near the Saigon International Air Terminal.

25,000 but that the influx of daily workers and military members living off base raised this number to 55,000 during duty hours.<sup>8</sup>

Overcrowding seriously degraded security at the older bases. As congestion mounted, new combat-support facilities for the expanding aerial mission had to be sited solely on the basis of unoccupied real estate without regard to security factors. Dispersal to protect parked aircraft was impossible due to lack of space to enlarge or decentralize the ramps. At Tan Son Nhut, Da Nang, and Pleiku aviation fuel tanks and bladders were sited within 10-30 meters of the base perimeter. On every older base except Da Nang, munitions were stored in equally exposed locations.<sup>9</sup>

The USAF tenant status greatly complicated these troubles. As host, the VNAF insisted on exercising approval authority over all new construction. Thus a command change like that at Tan Son Nhut in early 1966 often necessitated renegotiation of many planning actions previously approved by the former commander. Agreements were also subject to cancellation for routine reasons. As one USAF base civil engineer plaintively observed, "Boy it's discouraging to get a project all set to go and then have the host say 'Sorry about that, you'll have to put it some place else.'" Usually no alternative site was offered or, if one were proposed, it was invariably in the rice paddies and required extensive fill before use.<sup>10</sup> The task of unsnarling

View of the crowded flight line at Tan Son Nhut



Vulnerable fuel storage bladders adjacent to the Pleiku Air Base perimeter

these tangles fell to the base engineer, one of the much-abused heroes of USAF deployment to RVN.

Because there were no USAF criteria for constructing air bases in a combat area, peacetime standards governed the design of Tuy Hoa, Cam Ranh Bay, Phan Rang, and Phu Cat.<sup>11</sup> Some of the more glaring drawbacks of this approach showed up in the siting and configuration of these bases.

Perhaps from a location standpoint, Phan Rang was the most vulnerable because it received its water and aviation fuel from offbase sources through pipelines exposed to enemy interdiction.\* In contrast, a peninsular site made Cam Ranh Bay the most defensible base in the Republic of Vietnam.

Critics, however, leveled their sharpest barbs at the internal layout of the four new installations. Security police officials, themselves partly to blame for the lack of proper planning guidance, pointed out that although the bases had "ample real estate to permit

the locations of critical resources consistent with optimum security/defense criteria . . . this was not done." As a consequence, they asserted, vital resources and facilities were without exception sited at vulnerable locations or were so positioned that excessive manpower were required for their protection.<sup>12</sup>

Munitions were stored in the northwest and aviation fuel in the southeast corner of Phan Rang, both within easy small-arms range from the base perimeter. At Cam Ranh Bay combat essential facilities were so scattered that additional multiple guardposts were created. The security police claimed that a little forethought in planning could have incorporated dispersal into the general scheme while grouping resources in a tighter-knit layout that would have reduced manpower, increased security, and simplified defense operations.<sup>13</sup>

The siting of noncritical facilities also impaired base defense. For example, at Tuy Hoa a raised railroad bed along the south and west perimeters afforded excellent cover and concealment to enemy forces approaching from the rice paddies in these areas. And base defense forces launching a

\* Of the older bases, Pleiku and Binh Thuy also relied on vulnerable off-base sources for water. [Final Report, 7th AF Base Def Study Gp, 17 Aug 67.]

counterattack were placed at a disadvantage, since the flat terrain from the track inward provided no cover against an enemy operating from the shelter of the embankment.<sup>14</sup> As these and other incongruities reveal, new bases were located and laid out with scant concern for security.

#### Active Defense Facilities, 1961-1972

After siting and layout, the most critical physical element in base defense operations was the status of security facilities—fences, barriers, lighting, sensors, minefields, towers, bunkers, and roads. But, from 1961 to 1965 USMACV viewed base defense as a primary responsibility of the overextended and hard-pressed RVNAF. Therefore the USAF did little more than post a few interior guards around parked aircraft and/or base billets, and file periodic reports on the unsatisfactory status of security safeguards.

As early as November 1961, the Farm Gate Commander at Bien Hoa informed CINCPACAF of security problems posed by uncontrolled vegetation and the need to lay "adequate concertina wire and mines throughout the perimeter."<sup>15</sup> During 1962 a USMACV survey rated Da Nang's perimeter fence as inadequate.<sup>16</sup> In

anticipation of VC/NVA reprisals for U.S. air raids on the DRV, USMACV and 2d Air Division in late 1964 jointly inspected the physical defenses at Tan Son Nhut.

This inspection revealed that the base perimeter fence—none too sturdy when new—was in an advance state of deterioration. There were improvised gates and numerous holes which permitted uncontrolled access by civilians and military dependents. Three-quarters of its length was overgrown by foliage so dense that a company-size unit could have infiltrated undetected. Minefields laid in 1957 along some sections were not chartered or maintained, and livestock grazed in allegedly mined areas. No perimeter lighting system existed, and from 40 to 50 percent of the 18-kilometer perimeter was neither under surveillance nor covered by fire, due to the distance between observation posts and bunkers.<sup>17</sup> As Tan Son Nhut was the most prestigious air base in RVN, its defenses were likely the best to be found.

USAF assumption of responsibility for base defense facilities dated from December 1965 when COMUSMACV directed 2d Air Division and all other Service components to initiate measures for the local defense of their RVN bases.<sup>18</sup>

Progress was halting and meager. After 18 months, a detailed survey by a Seventh Air Force Base Defense Study Group in the summer of 1967 reported widespread defects in physical security safeguards.<sup>19</sup> Of the 10 primary air bases, Da Nang alone boasted both permanent perimeter fencing and lighting systems installed by the USMC in early 1966. This double cyclone-type fence was the only one of its kind at RVN air bases.\* At Tan Son Nhut a new but

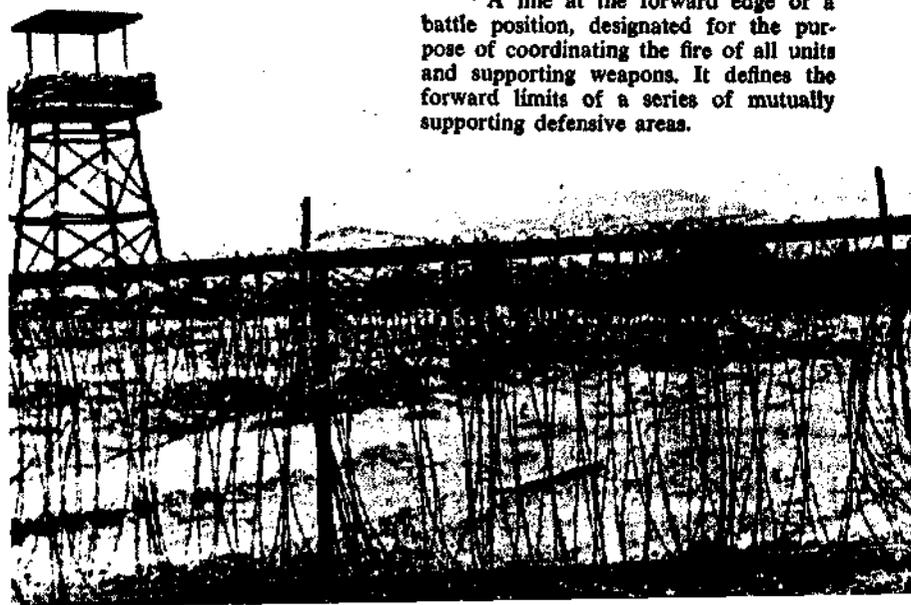
\* The French considered the best obstacle a vertical fence, 2 meters high, imbedded 40 centimeters into the ground to prevent tunneling, made of barbed wire with a maximum mesh of 20 cm, and equipped with a conventional double-apron fence at its base. [V. J. Croizat, trans, *A Translation from the French: Lessons of the War in Indochina* (RM-5271-PR, The RAND Corp, May 1967), 11 138-39.]

less durable perimeter barrier complex had been installed at the direction of COMUSMACV, after the 4 December 1966 sapper raid. It consisted of from one to three lines of triple-tier concertina wire, minefields, and permanent lighting.<sup>20</sup> Both Da Nang and Tan Son Nhut possessed good observation towers and fighting bunkers. Elsewhere the picture was bleak. Perimeter sighting was unsatisfactory at six bases; fencing was inadequate at 2; minefields were not utilized at 4; and bunkers were inadequate or unsafe at 5.

By February 1969 Phu Cat and Tuy Hoa were still "aggressively pursuing" fencing programs. Phu Cat had constructed a single line of triple-tier concertina wire along 16 kilometers of its main line of resistance (MLR),\* but its perimeter fence remained in the programming stage. Tuy Hoa's perimeter was 68 percent fenced, but the beach area was still unenclosed. Plans for a perimeter fence at Cam Ranh Bay were abandoned due to scope, configuration, and soil conditions, and an approved fencing project was confined to the MLR alone.<sup>21</sup> Perimeter

\* A line at the forward edge of a battle position, designated for the purpose of coordinating the fire of all units and supporting weapons. It defines the forward limits of a series of mutually supporting defensive areas.

Mine field on the perimeter of Phu Cat Air Base



Southern perimeter of Tan Son Nhut Air Base. In May 1968 the VC/NVA attacked the base through this area, abetted by the overgrowth on the fences and the close proximity of private dwellings





Base control tower and "big light" used in defense of Phu Cat Air Base

\$1,090, and a requirement of 100 for a single base was not unreasonable. But the initial outlay was only the beginning. Not designed for continuous 8- to 12-hour daily operation, these units required daily maintenance service, a task which at a large base employed two airmen full time. The NF-2s were also vulnerable to small-arms fire, and the loss of a single unit darkened that segment of the perimeter it serviced.<sup>22</sup>

lighting continued to lag at five bases. Thirty-two percent of Tuy Hoa's perimeter was unlighted. As with fencing, the lights programmed for Cam Ranh Bay were limited to the MLR. Procurement delayed Phan Rang's permanent lighting system, and the one planned for Bien Hoa in July 1969 was never installed.

A basic obstacle to adequate security lighting was a chronic shortage of electricity from sources both on and off base. In most cases, therefore, installation of a permanent perimeter lighting system included an organic power source. Field expedients were widely used as substitutes. These makeshifts ranged from mobile Fresnel units to jury-rigged flares that had been condemned for aerial use.

However, the most common interim answer was the NF-2 Light-All unit. One generator fed up to 10 floodlights spaced along 100 meters of perimeter. Each NF-2 unit cost

Hand-held slapflares\* and 81-mm mortar illumination rounds supplemented lighting at all bases and constituted the primary source at some. Air-dropped flares routinely enhanced these ground efforts. In April 1969, Seventh Air Force reported to PACAF a monthly cost of \$81,000 for slapflares and \$100,000 for mortar shells.†<sup>23</sup>

At best, none of these interim solutions, even coupled with sophisticated night observation devices, provided more than a bare minimum level of lighting. It was asserted that "the cost of aircraft destroyed by sappers at one base [Tuy Hoa] in July 1968 would have been sufficient to ade-

\* A slapflare looked like a paper towel cylinder with a cap on the bottom. The steps for igniting were to remove the cap, hold the flare in the left hand, and slap the bottom with the right hand.

† Cost data on the air-dropped flares was not available.



Sandbag bunker at Cam Ranh Bay Air Base

quately fence and light all our bases in RVN.\*<sup>24</sup>

Construction of fighting bunkers was equally troublesome. Experience and experimentation led to the use of a wide assortment of materials and designs. Initially bunkers of sandbags were nearly universal. But deterioration due to weather and hard usage normally necessitated replacement of the bags every 90 days and created a monumental work load. Waterproofing was not feasible and all timbers were vulnerable to rot and termites. Accordingly, the trend was to replace sandbags with more durable materials.

By 1968 each base had for the most part produced a bunker best adapted to local conditions. The French had found the ideal to be a facility of permanent construction and low silhouette. At Cam Ranh Bay, however, the shifting sands rendered this type undesirable. And at Binh Thuy, because of the high water table of the delta, bunkers had to be built above ground. Accordingly, building materials adapted to varying conditions and terrain, but most bunkers

\* This sapper raid on Tuy Hoa on 29 July 1968 resulted in 2 C-30s destroyed, and 5 C-130s, 1 C-47 and 1 F-100 damaged. Four USAF personnel were wounded. (7AF/IGS WEINTSUM, No. 68-13, 27 Jul-2 Aug 68, p 23)

were designed to withstand a direct hit by a B-40 rocket. Most but not all bunkers at the bases had some type of overhead protection. All enjoyed a standoff weaponry screen, usually cyclone or other heavy fencing. Placed 3-4 meters forward of the bunker, the screen predetonated rocket propelled grenades.<sup>25</sup>

In the spring of 1969, bunker construction was least advanced at Phu Cat and Cam Ranh Bay. At the former limited fire necessitated shifting bunkers from perimeter sites to the MLR, where in conjunction with the planned fencing and lighting, they would contribute to a sound defense complex. At Cam Ranh Bay bunker construction was deferred pending action on programmed MLR fencing and lighting.

After 4 years of massive USAF involvement, physical safeguards in 1969 were still judged inadequate by the Director of Security Police, Seventh Air Force. This was attributed to profound USAF disinterest as reflected by the lack of an active planning program and the absence of any criteria for air base construction in a combat area. General apathy and indifference were only intermittently dispelled by a near-disaster such as the 1968 Tet Offensive, or by a destructive sapper raid like that on Tuy Hoa

in July 1968. Contributing to the problem was the continuous turnover of commanders at all echelons. New commanders not exposed to enemy attack usually stressed more spectacular but less vital construction. Highly visible recreation facilities received top priority while defense works at obscure or remote locations were ignored. For example, at the time of the Tuy Hoa sapper raid the perimeter was only partially fenced and totally unlighted. Yet, a year before, the base had been equipped with air-conditioned recreation facilities that included a base exchange, open messes for officers and noncommissioned officers, a library, and a recreation center. The latter offered a poolroom, reading room, and complete snackbar. Under these conditions which prevailed at all bases, security police undertook the construction of security safeguards as a self-help project with a corresponding degrading of their primary security mission capability.<sup>26</sup>

By 1970 construction projects in support of base defense had been overtaken by events. Shortly after assuming office in January 1969, President Richard M. Nixon decided to Vietnamize the war and to begin the phased withdrawal of U.S. forces from RVN. His decision was swiftly reflected in such actions as the Nha Trang Project which, begun in 1969, aimed at early USAF relinquishment of that air base to VNAF.<sup>27</sup> Consistent with this policy, the Secretary of Defense refused Military Construction Program (MCP) funds for the perimeter fence at Phu Cat. Because concertina wire was an expendable item, he recommended that construction be accomplished with Operation and Maintenance (O&M) funds.<sup>28</sup> This policy was soon extended by USMACV to other security fence projects. Seventh Air Force instructed base commanders to draw fencing material

through base supply and install it by self-help.<sup>29</sup> At the same time security lighting requests were also deleted from the MCP with the recommendation that they be resubmitted in the O&M Program, "selecting the most critical area for accomplishment within the \$25,000.00 limitation."<sup>30</sup> Clearly, for all practical purposes, USAF construction of physical safeguards at RVN air bases was at an end.

#### Passive Defense Facilities, 1961-1972

Passive defense facilities directly complemented the physical security safeguards of active defense operations. Their purpose was to reduce the probability of and to minimize the damage from enemy action without taking the initiative. In RVN such facilities consisted chiefly of shelters, revetments, and hardened structures installed to protect USAF personnel and resources not engaged in a base defense mission.

From 1961 through 1965 the only USAF passive defense construction to speak of was the erection of aircraft revetments. The stimulus for this program came initially from the necessity to reduce explosive safety hazards arising from wingtip-to-wingtip parking a bomb-laden aircraft. On 16 May 1965 at Bien Hoa, an accidental explosion aboard a B-57 triggered a series of blasts that killed 28 and injured 77 people. The aircraft toll reached 10 B-57s, 2 A-2Hs, 1 A-1E, and 1 F-8U destroyed, plus 30 A-1Hs and 1 H-43 damaged. Also demolished were 12 pieces of aerospace ground equipment (AGE), 10 vehicles, and the JP-4 fuel dump. This one incident was more destructive than any single VC/NVA attack on any air base during the entire war.<sup>31</sup> It resulted in a USAF directed emergency program for revetment construction.



F-100 Super Sabres parked in aircraft revetments at Tan Son Nhut Air Base

For revetment construction the Air Force chose a prefabricated facility, developed by the Air Force Logistics Command (AFLC) and produced by the American Rolling Mill Company (ARMCO). It consisted of earth-filled corrugated steel bins 12 feet high and 5.5 feet wide. Built up on three sides of an aircraft hardstand, the bins afforded considerable protection against such dangers as near-miss blasts, secondary explosions, fragmentation effects, surface ordnance, and secondary damage and proliferation. Three 28-man Prime Beef\* teams were deployed to RVN to do the work, the first one arriving in August 1965. Aided by troop and

local-hire labor, they erected 12,040 linear feet of revetments at these bases by the end of the year.<sup>32</sup>

Tan Son Nhut	4,700
Bien Hoa	3,800
Da Nang	3,540

During 1966 through 1969, USAF interest in passive defense facilities continued to center chiefly on aircraft revetments which totalled 506 at all bases by 30 June 1967.<sup>33</sup> However, the Seventh Air Force Base Defense Study Group reported on 17 August the improper siting of many revetments. Explosives-laden aircraft stood face to face, their forward-firing weapons pointed toward maintenance facilities or other planes. The study group asserted that this arrangement severely curtailed protection against blast or fragment damage, and could not prevent an explosive chain reaction from aircraft to aircraft. Of the

\* Prime Beef (Base Engineer Emergency Forces) are worldwide base civil engineer forces. They are organized to provide trained military elements, used in direct combat support or emergency recovery from natural disaster.



**Damaged revetments at Bien Hoa Air Base following an attack in June 1969**

10 primary bases, Bien Hoa alone had positioned its revetments so that the bay opening of one faced the rear wall of another.<sup>84</sup> The corrective action recommended by the study group was rejected by Gen. William W. Momyer, Seventh Air Force Commander, because "we are too far committed to change now. Cost in time and manpower is prohibitive."<sup>85</sup>

Static aircraft protection embarked on a new phase in 1968 as the Air Force launched a crash shelter construction program. The switch from revetments to shelters stemmed from the VC/NVA spring offensive when standoff attacks had destroyed 25 (valued at \$94 million) and damaged 251 USAF aircraft. These strikes bared the weaknesses of revetments, mainly the absence of overhead cover. The adopted shelter design called for a double corrugated steel arch with a poured-in-place concrete cover 18 inches thick. An added free-standing backwall extended protection equal to the cover's and included an opening to let out jet exhaust. A small

number of the shelters were also fitted with a front closure device. Production of materials began in CONUS in mid-1968, and the first concrete cover was poured in RVN in October 1968. Civilian contractors such as Raymond-Morrison-Knudson and Brown-Root-James (RMK-BRJ) erected a few of these shelters. But USAF civil engineer Red Horse\* squadrons augmented by troop labor built the majority.<sup>86</sup> In contrast to revetments, siting of shelters received careful consideration. Wherever possible they were placed nose to tail with the front ends oriented away from the most likely direction of a ground attack.<sup>87</sup>

The capping of the last shelter at Tuy Hoa on 13 January 1970 completed the program. Seventh Air Force

\* Red Horse (Rapid Engineer Deployment, Heavy Operational Repair Squadrons, Engineering) are controlled by Headquarters USAF. They give the Air Force a highly mobile, self-sufficient, rapidly deployable civil engineer capability required in a potential theater of operations.

then owned about 1,000 revetments and 373 shelters for a total 1,373 protective structures. This number compared favorably with the 1,164 USAF aircraft permanently assigned at that time to RVN air bases.<sup>88</sup>

The protection afforded aircraft by hardened shelters confirmed the soundness of the program. Responding to a PACAF query, Seventh Air Force on 3 June 1969 cited two cases in which aircraft parked in shelters escaped destruction by direct rocket hits. On another occasion shelters saved several aircraft from damage or destruction when a nearby munitions storage area exploded. In spring 1970 a USN EC-121 crashed and burned at Da Nang, but adjacent hardened shelters saved three USAF F-4Ds from destruction and two others from major damage. The estimated dollar savings attributed to shelters in these incidents more than paid for the \$15.7 million program in RVN.<sup>89</sup>

Men, like aircraft, were for much of the war without safe shelter. Inspection by the 1967 Seventh Air Force Base Defense Study Group found personnel bunkers unroofed and in disrepair. They were often too dispersed to give real protection. Revetment construction to safeguard the lower floors of barracks was slow,

and no one had come up with a way to exit quickly from the unprotected upper floors. Quarters of key personnel were equally unsafe, and working areas were unsheltered.<sup>90</sup> Popular response to these exposed conditions were echoed in these earnest lines:

I arrived at Da Nang and my heart  
felt a pang  
As I viewed my new home for the  
year  
For the sheetmetal top, I was told  
would not stop  
The rockets intended for here.  
.....  
When the sirens go off, or the rocket  
tubes cough  
"Get under your bed!" reads Direc-  
tive  
But try (and I strive), I can't stop  
the drive  
To seek shelter a bit more protec-  
tive.<sup>91</sup>

The steps to a final solution of the barrack-revetment problem were drawn-out and wasteful. Initially revetments consisted of earth-filled sandbags, stacked to a height and thickness necessary for protection and stability. These bags as a rule deteriorated within 90 days and were replaced with new earth-filled ones. As local conditions stabilized and further replacement was required, plywood shells packed with earth took the place of the sandbags. These wood revetments also

**Brick revetments constructed about billets at Pleiku Air Base to protect against shell fragments. Such revetments were useless against direct hits**



rotted, and the substitute became brick or concrete materials that lasted for the useful life of the facility protected. By 1968 precast concrete slabs were adopted as the least expensive revetments for both personnel and equipment. A forklift operator and a welder were the only skilled labor required to erect them.<sup>42</sup>

Concrete slab revetments promised impressive savings. At Da Nang, for example, more than 40,000 linear feet of sandbag revetments shielded barracks and operational facilities. An estimate showed that replacement of sandbag revetments by concrete slabs around the barracks alone would save \$521,340 in 1 year.<sup>43</sup>

The delay in protecting essential facilities and services matched that in sheltering personnel. Again, in the absence of combat construction criteria, most bases made no plans for such protection. For example, in 1967 all bases were constructing centralized electric powerplants, but only Cam Ranh Bay had a protection plan for this facility. Even at that base, less than 25 percent of all mobile and alternate generators—those used chiefly for ground controlled approach (GCA) and other navigational aids—were protected. Disregarding the principle of dispersion, alternate generators were frequently located next to primary power sources.<sup>44</sup>

USAF munitions storage areas—priority enemy targets—were adequate at all bases except Pleiku and Binh Thuy. However, those of the VNAF were substandard at each base, save Bien Hoa. Large unprotected quantities of munitions cluttered every VNAF parking ramp, a serious hazard to USAF personnel and resources. Barring the bases of Tan Son Nhut, Phan Rang, and Cam Ranh Bay, munitions at aerial ports awaiting shipment had little or no protection.

Storage was either on or immediately adjacent to aircraft parking areas.<sup>45</sup>

Security of petroleum storage tanks—also priority enemy targets—needed upgrading. Other than at Tan Son Nhut, the protection of these storage tanks was after the fact. It relied on earthen dikes to contain escaping fuel and head off a holocaust. When rockets struck Da Nang on 27 April 1971 and Cam Ranh Bay on 25 May, the dikes let firemen limit the blaze to tanks taking direct hits.<sup>46</sup> On Tan Son Nhut the tanks belonged to commercial petroleum companies who encased them in costly masonry shells. The wisdom of this move was doubtful, due to the high silhouette of the tanks and the deep penetration of rocket propelled grenades. Fuel storage in rubber bladders became widespread in South Vietnam. Often set adjacent to aircraft hydrant fueling systems, the bladders posed a grave fire hazard.

No shielding from blast or fragmentation existed for most aircraft maintenance and civil engineering control centers, supply control systems using UNIVAC 1050 computers, and base command posts and communications centers.

Fire and crash vehicles crucial to damage control were normally parked in rows at one central open area on each base. Few bases had any plans to disperse this critical recovery equipment. None provided a hardened parking area.

Water sources, purification equipment, and storage points were unprotected at all bases. Pleiku, Phan Rang, and Binh Thuy depended on water from vulnerable offbase sources. Several bases put in fire hydrant systems, but only Bien Hoa had dispersed emergency water storage. Two water



Dikes constructed to protect petroleum supplies at Tuy Hoa Air Base

storage points at Cam Ranh Bay were situated in the fighter aircraft area, a choice target for enemy attack.<sup>47</sup>

The stimulus given passive defense by the 1968 Tet Offensive carried over into 1969. But this momentum focused almost exclusively on protection of aircraft with only limited attention to personnel and facilities. As the year wore on, the program began a gradual phaseout, owing to the decision to begin withdrawal of American forces and the cutback in funds for RVN operations.

With the completion of the last hardened aircraft shelter on 13 January 1970, significant USAF passive defense construction in RVN came to an end. Thereafter, general policy was to perform minimum maintenance on the minimum number of existing facilities needed to protect the diminishing USAF forces.

#### Vegetation Control

No element of the Vietnamese environment was more detrimental to base defense than the invincible ground cover described earlier. This rampant vegetation hid the enemy, shut off friendly observation and fields of fire, neutralized fencing and other

defense barriers, slowed security forces, and nullified detection by sentry dog teams. The need to control this jungle was evident and urgent—how to do it was the sticking point.

Clearing approaches to the base was the first order of business. This meant defoliating a zone around the outside circumference of the installation, an area outside the Air Force's accepted defense responsibility. Hence it became the task of the Allied ground commander whose TAOR was confined to the base. Actually internal and external security overlapped in this zone, creating a joint and at times unequal interest in common defensive measures. This diffusion of military responsibility and the necessity for political clearance vastly diminished the prospects of winning approval for any defoliation program.

Another critical area calling for the most complete defoliation was the air base perimeter. Here physical factors crippled or canceled out progress. From the outset the six old bases took security steps, and the four new bases followed. These safeguards embodied fencing, tactical wire, minefields, and tripflares set in divers numbers and mixes along the perimeter. The skill of the VC/NVA sapper in clearing manmade obstacles and in disarming

explosives devices dictated that this complex be kept free of concealing vegetation. Ignoring the French experience, the USAF discovered anew the problems associated with defoliation of the perimeter barrier system.<sup>48</sup>

Rarely if ever charted, the minefields of the perimeter barrier prohibited use of manual labor to cut and remove the vegetation. The mines, fencing, and wiring prevented mowing or scraping by mechanized equipment. Burning was unsatisfactory on several counts. Vegetation was highly fire resistant, particularly during the rainy season when growth was most rapid. It ignited slowly, even if sprayed with a flammable such as contaminated jet fuel. Because fire hardly ever consumed the vegetation, the residue went on obscuring the barrier system and offering cover to penetrators. Burning also detonated or destroyed mines and flares within the complex.

Next in importance was defoliation of the base interior. Here too, the ideal was to clear the ground cover that concealed penetrators and reduced surveillance by defense forces. For example, the defense vegetation ne-

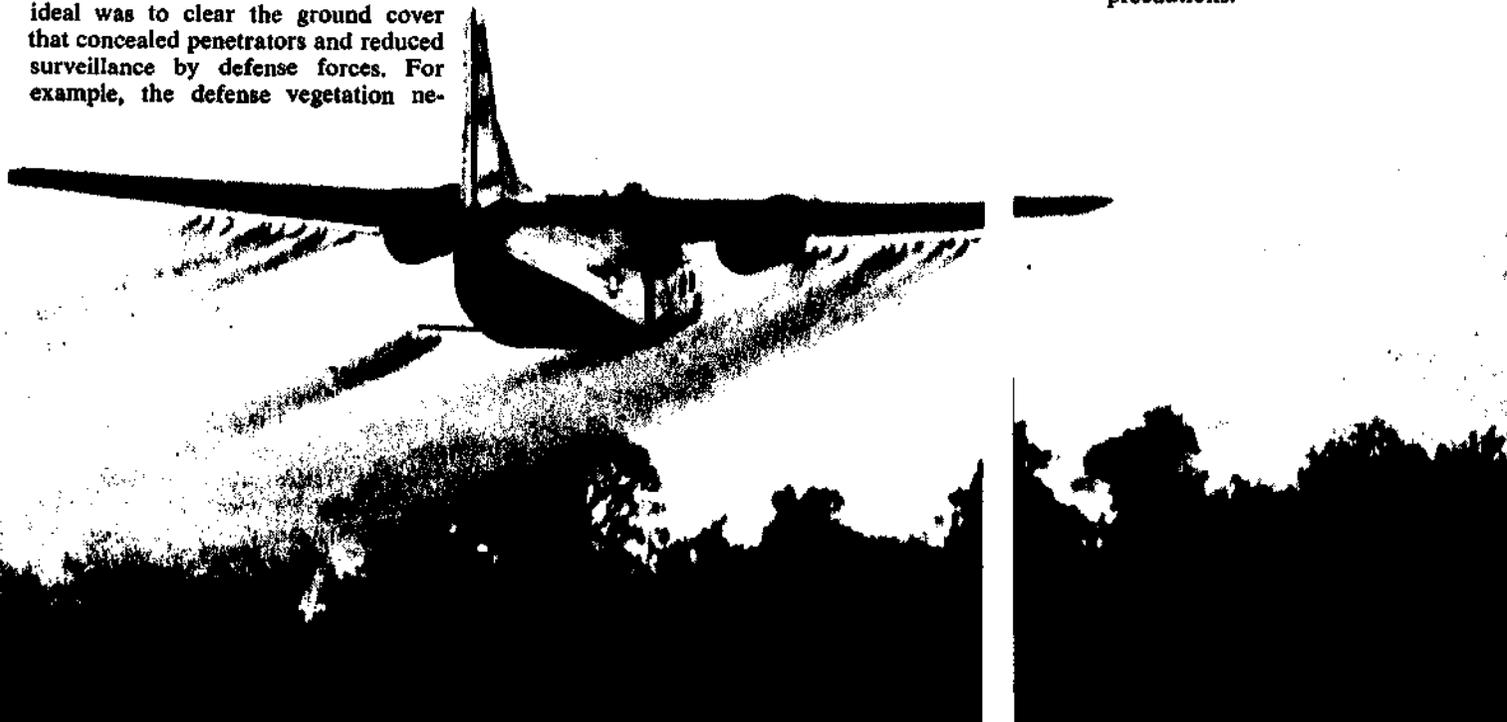
gated sentry dog detection—the base's most reliable alarm. And the exertion in plowing through this thicket sapped dog and handler. Because the interior was without the perimeter's hazards or obstructions, it seemed that the clearing methods mentioned earlier could be given full play. In practice this was not the case. Safety factors forbade burning in or near fuel and munitions storage areas. The immense labor entailed in clearing a sizable area in a reasonable time curtailed manual cutting. Cutting by hand nonetheless left the root system intact, and so was well-suited to Cam Ranh Bay's very unstable soil. Elsewhere, however, an undisturbed root system meant rapid regrowth of vegetation. Even though scraping served well in the base interior, the conventional USAF civil engineer squadron usually lacked the needed mechanized equipment. In light of these facts, the answer to vegetation control in the interior as on the perimeter appeared to be herbicides.

By the time the Air Force turned to herbicides for base vegetation control, they were in full-scale military use in support of other ground operations. The dispensing of defoliants centered on foliage along thoroughfares to deny the enemy ambush cover. Spraying also focused over VC/NVA camps and assembly areas, as well as over crops intended for feeding the foe. The acreage treated with agents from the 1,000-gallon tanks of USAF UC-123 (Ranch Hand) aircraft rose from 17,119 in 1962 to 608,106 in 1966.<sup>49</sup>

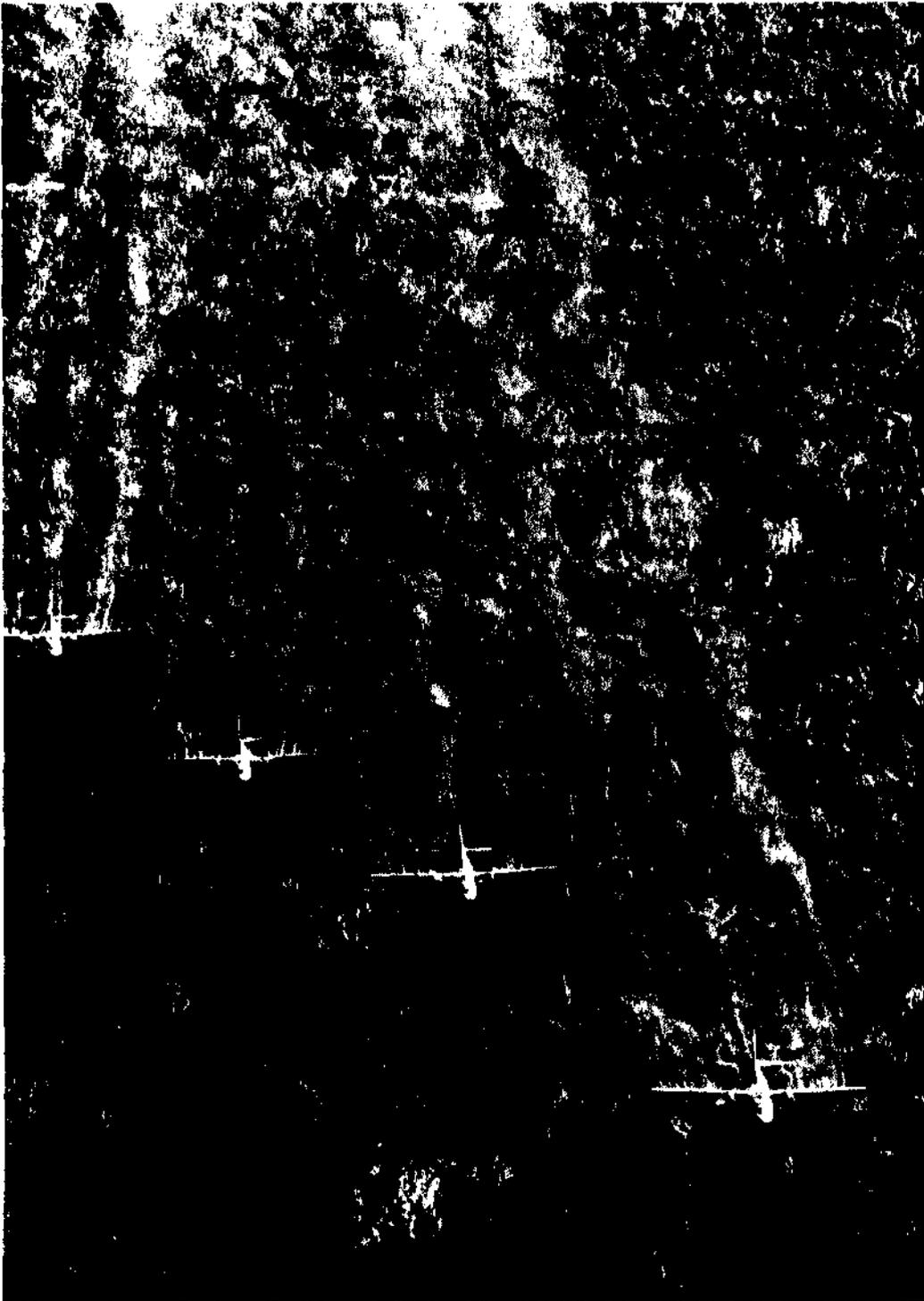
None of these herbicides was believed to endanger humans or animals. All had been widely used in the United States for more than 20 years on foods and other crops, rangeland, and forests. None persisted in the soil and periodic respraying was required to kill regrowth. All were liquids. Those dispensed in RVN were designated Orange, White, and Blue. Appendix 5 gives general data on their composition, application, effect, and safety precautions.

The use of these herbicides was a GVN program supported by the United States. The U.S. Ambassador and COMUSMACV acted jointly on GVN requests for herbicide operations on the basis of policy formed by State and Defense Departments and approved by the President.<sup>50</sup> Senior U.S. Army advisors at ARVN corps and division level were delegated authority to approve requests in which dispersal of the herbicides was limited to hand or ground-based power-spray methods.

A herbicidal defoliation request from a USAF air base was prepared and documented by the base civil engineer, using a set checklist. (See page 77.) It was then processed through U.S. military channels to the senior U.S. Army headquarters in the corps tactical zone. If approved there, it was sent on to the ARVN commanding general of the same CTZ for military approval and political clearance. It was at this point that delay most frequently occurred, due to opposition from the district and/or province chief. These officials were influenced by such things as superstition, concern for local crop damage, and possible propaganda value to the VC/NVA. Final action on requests for ground-delivered herbicides was taken at this level. If aerial delivery was desired, the request could only be approved at USMACV/JCS level.



A C-123 sprays defoliation chemicals over South Vietnamese jungles



Technical factors also entered into the dispensing of herbicides. Dry weather was essential, because rain quickly washed chemicals from the target vegetation to nearby crops and other desirable growth. Ideally, spraying was done between dawn and 1000, at ambient temperatures under 30° C (86° F), and in calm or very low wind conditions to minimize drift. Storage and mixing points had to be kept to a minimum, isolated from cultivated areas. Empty herbicide drums required close control to avoid accidental contamination.<sup>51</sup>

Approval and execution of herbicidal defoliation projects were time-

consuming and uncertain. In February 1968 Phan Rang requested defoliation of a 200-meter strip both inside and outside the perimeter, around the entire circumference of the base. The approving authority reduced the scope of the project to one-half the perimeter. In addition, problems in obtaining herbicide and other obstacles delayed completion of the project for 1 year.<sup>52</sup>

Excessive vegetation at Tan Son Nhut and Bien Hoa hindered the base defenders throughout the 1968 Tet attacks.<sup>53</sup> At Bien Hoa the approval process for aerial defoliation was termed "hopelessly complicated," one

#### Checklist for Defoliation Requests

1. Overlays or annotated photographs depicting the exact area.
2. Target list:
  - a. Area—province and district.
  - b. UTM coordinates.
  - c. Length and width.
  - d. Number of hectares.
  - e. Type of vegetation.
3. Justification:
  - a. Objectives and military worth.
  - b. Summary of incidents.
4. Psychological warfare annex (prepared by sector):
  - a. Leaflets.
  - b. Loudspeaker texts.
5. Civil affairs annex (prepared by sector):
  - a. No crops within 1 kilometer.
  - b. Contingency plan to provide food or money to families whose crops are accidentally damaged by the defoliation operation.
6. Certification by province chief:
  - a. Province chief approval.
  - b. Indemnification will be made by the Republic of Vietnam for accidental damage to crops.

SOURCE: Lib of Cong Rprt, 8 Aug 69, to the House Subcommittee on Science and Astronautics, 91st Cong, 1st sess, *A Technological Assessment of the Vietnam Defoliant Matter: A Case History*, p 19.

that might take two or more months. Plant growth meanwhile continued unabated. Even when authorized, a project was apt to be fettered with restrictions. Thus aerial delivery of Orange was denied at Bien Hoa, and only parts of its perimeter were approved for chemical defoliation. Accordingly, because Blue and White were not suited to local conditions, Orange had to be dispensed from a tank truck by a power spray that did not reach beyond the second fences. Local terrain made it impossible to go outside the third and fourth fence and spray inward.<sup>54</sup>

As noted earlier, Binh Thuy faced the most extreme defoliation problem. Here the one herbicide approved for use was Blue, which killed only those portions of plants with which it came in contact. With the root systems left intact, regrowth was rapid. In 1 month, 2,420 gallons of Blue valued at \$22,000 were sprayed over limited areas of the interior and a narrow zone around the perimeter of the 550-acre installation without making any significant inroads against the teeming vegetation.<sup>55</sup>

Herbicides for air base defense seldom if ever improved the horizontal view at installations by the desired 40 to 60 percent.<sup>56</sup> Defoliation needs of the 10 primary bases were specific, permanent, and known in advance. Still no ongoing long-term program to satisfy them was ever set up. Instead the job was done piecemeal, with each base handling defoliation requests. Despite administrative and technical controls, chemical agents remained the single sure way to control vegetation in places where other means could not—notably in the critical perimeter complexes. As the war drew to a close, however, curbs on the use of herbicides grew more and more rigid. The last herbicide mission by fixed-wing aircraft was flown on 7 January 1971.

On 1 May, a presidential directive ended all U.S. herbicide operations.<sup>57</sup> In the ensuing months, mines killed eight and injured seven Army personnel who were trying to clear vegetation by hand from wire entanglements and fields of fire.<sup>58</sup> With the Ambassador's full backing, COMUSMACV urged Washington to alter at once the ban on chemical herbicides because immediate defoliation was "essential to security of bases."<sup>59</sup>

On 18 August the President permitted the resumption of chemical defoliation until 1 December 1971. He authorized the use of Blue and White but not Orange. Approved herbicide operations were restricted to the perimeters of firebases and installations, with delivery limited to solely helicopter or ground-based spraying equipment, under the same regulations applied in the United States.<sup>60</sup> As the expiration date for this authority neared, COMUSMACV asked for an extension. On 26 November 1971 the President authorized continued use of herbicides and set no termination date. At the same time, he stipulated that U.S. defoliation assistance to the Government of Vietnam be confined to "base and installation perimeter operations and limited operations for important lines of communications." This policy prevailed until the last U.S. forces departed RVN in 1973.<sup>61</sup>

No defoliant method tried for air base defense purposes in South Vietnam proved to be at once efficient, economical, and politically acceptable. The practical value of herbicides was much impaired by technical, administrative, and political constraints. For chiefly technical reasons, the same could be said for techniques such as burning and scraping. For the United States—as it had for France—vegetation remained a major unresolved problem.

## V. USAF GROUND DEFENSE FORCES

The enormous mass of non-combatant personnel who look after the very few heroic pilots, who alone in ordinary circumstances do all the fighting, is an inherent difficulty in the organization of the air force. Here is the chance for this great mass to add a fighting quality to the necessary services they perform. Every airfield should be a stronghold of fighting air-groundmen, and not the abode of uniformed civilians in the prime of life protected by detachments of soldiers.

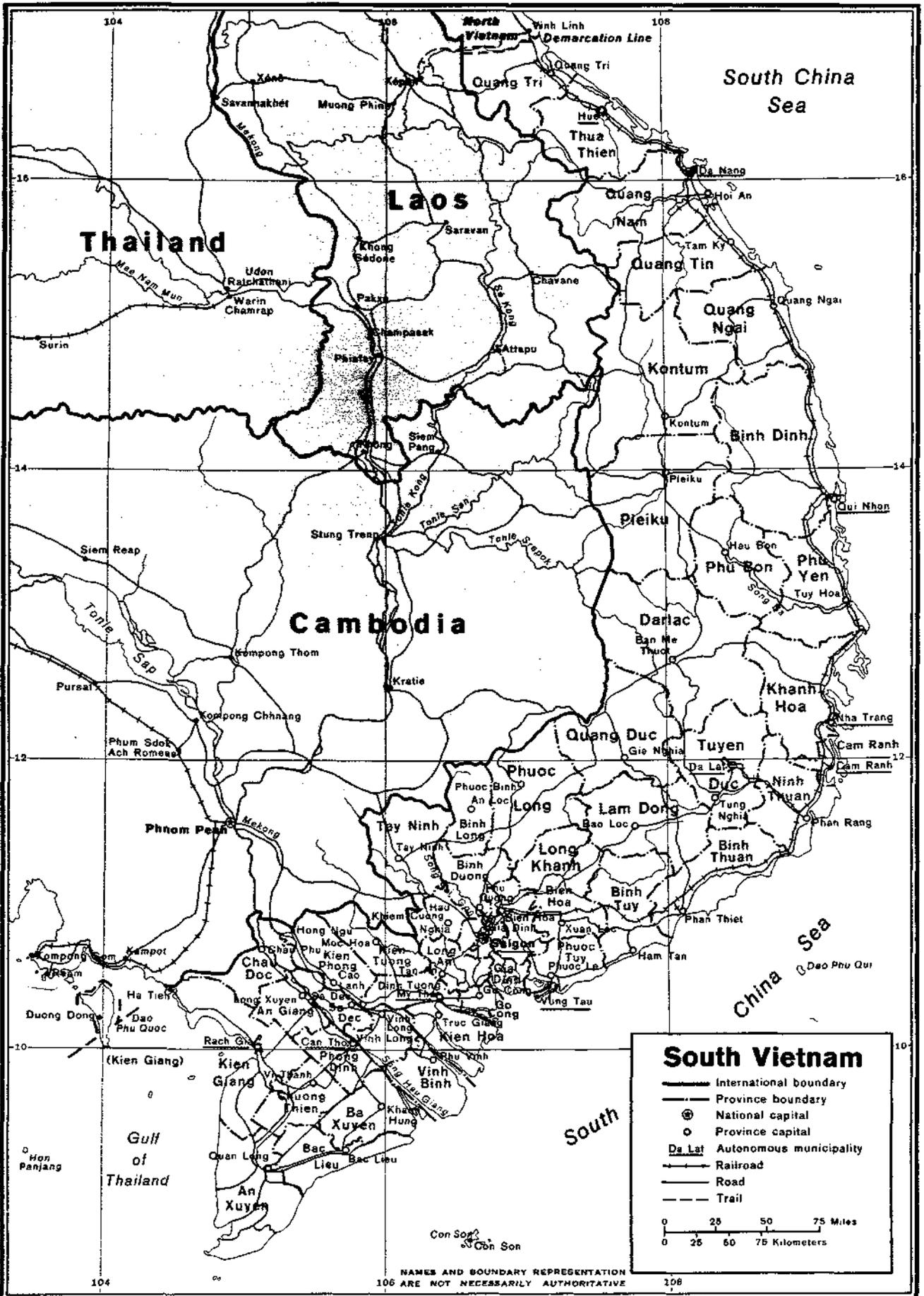
Sir Winston Churchill, 1941.

By late 1965 it became certain that U.S. ground combat forces would take part in offensive operations, and that the Air Force would be expected to protect its own installations. The USAF reaction to this unwelcome task was alien to the U.S. armed forces.<sup>1</sup> It was to ship the basic means of air base defense to South Vietnam—man by man and item by item. Then in the combat zone the Air Force assembled, organized, and trained these troops. More than 8 months passed before this process began to turn out forces that showed elementary skill in executing their unit mission.<sup>2</sup> Security police squadrons were formed in this manner at the 10 major bases in RVN. These units became the focal point of USAF ground defense during the entire war.

### Tactical versus Nontactical Organization

The governing USAF directives\* were silent on how to organize and employ security police in a hot war. Hence USAF ground defense forces in RVN were structured to cope with CONUS contingencies in a cold war. A security police squadron in RVN

\* Air Force Manual (AFM) 207-1, Doctrine, and Requirements for Security of Air Force Weapons Systems, 10 June 1964 (superseded by AFM 207-1, 10 Jun 68, and in turn by AFM 207-1, 10 Apr 70); AFM 205-3, Air Police Security Operations, 15 February 1963 (replaced by AFM 207-2, Handbook for Security Forces, 15 Jul 66, which was supplanted by AFM 207-2, 15 June 69).



Base 500876 5-72

1972  
Figure 1. Map of South Vietnam showing Provinces and Major Cities.

SOUTH VIETNAM  
DEFOLIATION MISSIONS

ALL MISSIONS

*delete*

Mission Tracks {  
Red = Crop  
Blue = Defoliant  
Green = Unknown

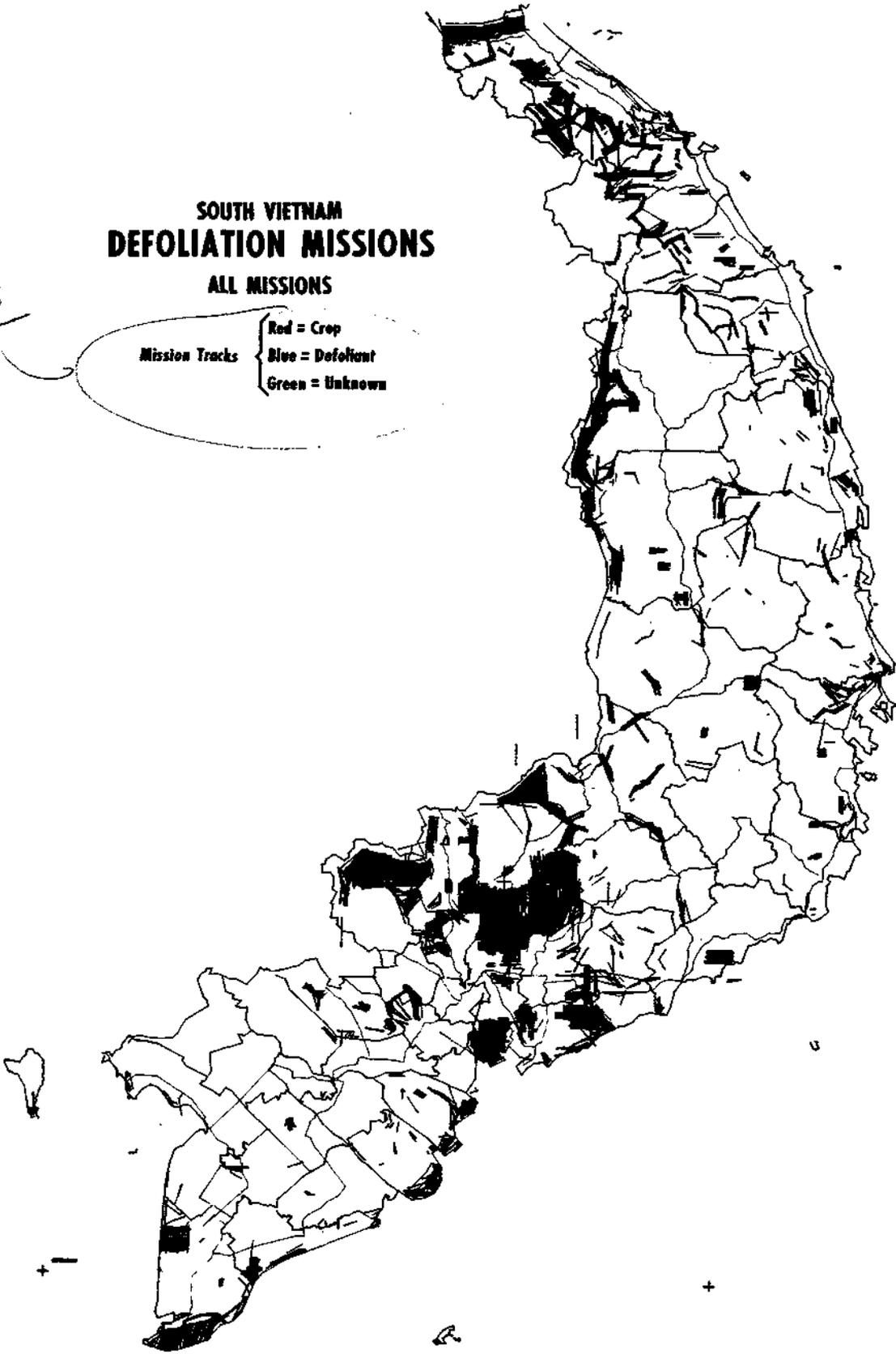


Figure 2. 1974 National Academy of Sciences Computer Printout  
of all Defoliation Missions in South Vietnam, 1965-1971