

COMMANDO HUNT V

HEADQUARTERS SEVENTH AIR FORCE

MAY 1971

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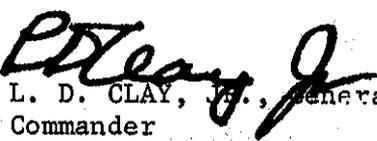


PREFACE

Commando Hunt V, the third large MACV air interdiction campaign against North Vietnamese dry-season efforts to resupply their forces in South Vietnam, Cambodia, and Laos through the southern Laos panhandle, began on 10 October 1970 and continued through 30 April 1971. It was an integral part of a United States air effort in Southeast Asia that also included support to Royal Lao forces throughout Laos, US and Vietnamese forces in South Vietnam, Cambodian and Vietnamese forces in Cambodia, and the Vietnamese ground-interdiction force in southern Laos. This report documents these diverse air operations with emphasis on the interdiction campaign.

The loss of their Cambodian logistics channel at the end of the previous dry season had multiplied the importance to the North Vietnamese of the southern Laos resupply drive. The continuing withdrawal of US combat power from Southeast Asia had increased the importance to the Free World Forces of countering it. To do so during Commando Hunt V required concentration against the enemy logistics system of US air resources which had decreased since the previous dry season.

The report describes how this application of air resources was accomplished while needs for air support elsewhere in Southeast Asia continued to be met. US Air Force tactical and strategic units in Vietnam and Thailand and US Navy and Marine air elements at sea and in Vietnam played important roles, as did the Vietnamese and Lao Air Forces. The report tells how the North Vietnamese used the various elements of their logistics system--the trucks, the roads, the storage areas and the defenses. And it tells how force was applied against these elements to achieve the results that made Commando Hunt V a success.


L. D. CLAY, Jr., General, USAF
Commander

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CHAPTER I

INTRODUCTION

Interdiction of the overland flow of supplies from North Vietnam to Viet Cong and North Vietnamese forces in South Vietnam and Cambodia was a primary mission for American airpower in Southeast Asia. Before the cessation of bombing of North Vietnam on 1 November 1968, the primary target for air interdiction was the supply system in North Vietnam. With the bombing halt, the emphasis shifted to the logistics channel the North Vietnamese maintained in southern Laos. These interdiction campaigns in southern Laos, the Steel Tiger area of operations, bore the name Commando Hunt with numerical designations that changed with the semiannual monsoonal shift. Commando Hunt V was the third north-east-monsoon, or dry-season, campaign and covered the period 10 October 1970 through 30 April 1971.

COMMANDO HUNTS I AND III

The first Commando Hunt, November 1968 through April 1969, saw the development of techniques to employ available airpower in around-the-clock interdiction of the total North Vietnamese logistics system in southern Laos. Refinements to force-control and targeting procedures evolved from a dynamic interaction between interdiction measures and logistics and defense actions. Improvement of equipment and tactics received equal attention and prompted the development of systems that reached maturity in Commando Hunt V.

In Commando Hunt I, the resupply activity of the North Vietnamese Army (NVA) ran at a high level from January through April of 1969. Against it US forces expended an average of 399 fighter-attack and two gunship sorties plus 22 B-52 sorties per day. These sorties destroyed or damaged 6000 trucks and produced 50,293 fires and secondary explosions. As a result, the NVA was able to transport through Laos to South Vietnam only about 8537 tons of the 45,119 tons of supplies estimated to have been brought into Laos from North Vietnam, a throughput-to-input ratio of approximately one to five.

The next dry-season interdiction campaign, Commando Hunt III, covered the period November 1969 through April 1970. The North Vietnamese started their resupply effort earlier than in the previous year. Road work and materiel shipments began before the end of the wet season and intensified after the rains slackened. Truck activity reached new heights in January and February of 1970 as did the efficacy of the truck-killing force. Fighter-attack aircraft flew an average of 288 strike sorties per day and gunships an average of 8 per day. Twenty-three B-52 sorties struck per day. Damaged or destroyed trucks numbered 10,032; fires and secondary explosions, 49,277. The estimated throughput-to-input ratio was about one to three: 18,979 tons into

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the Republic of Vietnam for 54,227 tons into Laos. A reduced air effort and an increased NVA logistics effort had resulted in a larger supply flow through Laos during Commando Hunt III than during Commando Hunt I.

This throughput did not meet the needs of the North Vietnamese, however, for they continued their resupply effort, albeit reduced, well into the wet season. The cumulative effects of rain and bombing brought this effort to a virtual halt in August.

The North Vietnamese resupply operation received a major setback as Commando Hunt III was ending when the Cambodians refused them further use of the port of Kompong Som. The successful Allied cross-border operations into Cambodia during May and June 1970 compounded their difficulties: they lost some 8679 tons of food and ammunition that had been available to support forces in the southern part of the RVN, and their sanctuaries in Cambodia were no longer secure. In addition, they became engaged in active operations against Cambodian forces which increased their needs for supplies from North Vietnam (NVN).

WET SEASON ACTIVITY - 1970

During the 1970 wet season the North Vietnamese departed from past practice in Steel Tiger and did not return their construction battalions to North Vietnam. They continued to build and improve the roads. West of Ban Bak there was construction on a new road that would bypass a system of interdiction points that had received many air strikes during Commando Hunt III. Improvement of the Bang Hiang River channel for free-floating supplies into Laos continued the development of the road-waterway-pipeline complex west of the Demilitarized Zone that stood at the head of the shortest, least-exposed supply route through Laos from North Vietnam to South Vietnam. Many NVA anti-aircraft positions remained active in Laos to protect the route structure and the truck movement that took place. NVA wet-season activity pre-saged an intensive resupply effort in the dry season.

Within North Vietnam also, preparations for the dry-season resupply effort went forward. There was continual improvement of roads, transshipment points, and bridges to speed truck movements to Laos. Replacement trucks were evident. For example, one truck park near Haiphong held over 1200 vehicles, while eight others in the Hanoi-Haiphong area contained 5000 more. The North Vietnamese also expanded POL storage capacity in their southern panhandle.

In contrast, the 1970 NVA and Viet Cong (VC) activity within RVN was lower than in previous years. The enemy's active-lull-active pattern of combat continued on a reduced scale, but there was a shift from battalion-sized attacks to smaller unit actions. Also, the rate of attacks by fire had decreased from 175 per month in the period June through August of 1969 to 150 per month a year later. This reduction was accompanied by a more dramatic drop in attack intensity, from 62

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to 41 rounds per incident. The supply shortages resulting from the Commando Hunt campaigns and the capture and destruction of stores in Cambodia and RVN appeared to have sapped the capability of the NVA and VC to mount large offensive actions within the Republic.

US tactical air activity throughout Southeast Asia during the southwest-monsoon period declined to an average of 417 sorties per day for the third quarter of 1970. The corresponding figure for the previous wet season had been 780 sorties per day. Poor weather was a contributing factor, and 7AF implemented a program to reduce sortie usage and conserve resources while good targets were scarce. In addition, the Joint Chiefs of Staff prescribed a lowered sortie level authorization for FY 1971: 14,000 US fighter-attack sorties per month for Southeast Asia, including 10,000 Air Force, 2700 Navy, 1300 Marine.

STRATEGIC ASSESSMENT FOR COMMANDO HUNT V

Seventh Air Force's assessment of the strategic situation to be faced during the 1970-71 northeast-monsoon season concluded that the North Vietnamese would mount an early major logistics effort to resupply their forces in RVN and Cambodia.

Across-the-beach resupply would not be able to meet their needs in either the Republic or Cambodia in the face of Allied naval patrols and the success of pacification. The Cambodian seaport was no longer available to them, nor were they expected to push significant amounts of supplies through the Demilitarized Zone (DMZ). The assessment concluded that in addition to its earlier role as the resupply route to NVA and VC forces in northern RVN, during Commando Hunt V the NVA line of communications in Steel Tiger would be the channel for resupply of NVA-VC forces in southern RVN and Cambodia as well. In a strategic sense it would be the critical point in the overall North Vietnamese campaign in Southeast Asia. Heavy preparations by the NVA in Laos and in NVN substantiated this conclusion.

The assessment noted the forecast by the American ambassador in Vientiane that a holding strategy would be pursued in northern Laos, the Barrel Roll area of operation, during the dry season. The Meo guerrillas and Royal Lao Army forces would not launch major offensive actions into or across the Plain of Jars (PDJ). Instead, they would concentrate on preventing NVA and Pathet Lao advances southwest of the PDJ and toward the capital cities of Luang Prabang and Vientiane. Air support of the Lao defenders would be necessary to preserve a viable Royal Lao government (RLG) that would continue to acquiesce to US air interdiction in southern Laos.

Whereas the North Vietnamese were projected to mount a bigger resupply drive than they had the previous year, the US air effort in Southeast Asia would be smaller than before. The authorized level of fighter-attack sorties for FY 1971, 14,000 per month, was 50 percent

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below the Commando Hunt III level. Moderate increases in the capabilities of the Vietnamese and Royal Lao Air Forces would offset this reduction somewhat. In addition, improvements to and doubling of the AC-130 force were expected to enhance the truck-killing program to a marked degree. Also, the B-57G force would add to the truck-killing capability.

COMMANDO HUNT V PLAN

Based upon his assessment of the strategic situation, the Commander, Seventh Air Force, promulgated Seventh Air Force Operation Plan 715, the campaign plan for Commando Hunt V. Since the campaign was an integral part of the overall MACV effort in Southeast Asia, the plan was a corollary to plans for air operations in RVN and Cambodia. Its objectives were:

- o to reduce the flow of personnel and materiel into the Republic of Vietnam and Cambodia to the lowest possible level, and
- o to make the enemy pay an increasingly greater cost for his efforts to dominate Southeast Asia.

The plan concentrated available airpower against the NVA's critical point, its resupply effort through Steel Tiger. The plan allocated 9800, 70 percent, of the 14,000 fighter-attack sorties per month to Steel Tiger interdiction. To the holding action in Barrel Roll, the plan allocated 900 fighter-attack sorties per month, and to operations in RVN and Cambodia, the remaining 3300. The proven capability of Southeast Asia tactical airpower to shift forces to handle contingencies made economy of force practical in Barrel Roll, RVN, and Cambodia. The plan also allocated the majority of the eventual 660 AC-130 and AC-119K gunship sorties to Steel Tiger interdiction with provisions for coverage of routes in Cambodia and for interdiction and troop support in Barrel Roll. The plan recognized the primacy to be given to support of ground forces engaged with the enemy. The Commander, US Military Assistance Command, Vietnam (COMUSMACV), approved the plan. It was then briefed to and endorsed by the Commander in Chief, Pacific, and the Joint Chiefs of Staff.

Just prior to the campaign, an addendum to the plan set forth a program for concentrated interdiction of the entry routes from NVN to Steel Tiger to preempt an expected early North Vietnamese logistics surge. COMUSMACV approved the addendum and stated that most of the 1000 Arc Light sorties per month would be available to the entry interdiction effort. Entry interdiction was the opening move in a Commando Hunt V campaign designed to take the initiative and maintain maximum pressure on the NVA logistics network in southern Laos.

The succeeding chapters treat Commando Hunt V in terms of its

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major features. First, the entry interdiction program is described and analyzed. Entry interdiction not only was the opening phase of the campaign, but also was an innovation in Steel Tiger interdiction efforts--the first sustained, concentrated saturation-bombing effort designed to delay and impede traffic flow. Chapter III describes the truck-killing program. New aircraft configurations specialized for the night-time truck-killing role had matured for full exploitation during Commando Hunt V. Their targets, management, and results are described. Chapter IV addresses the most significant difference between Commando Hunt V and its predecessors--the Lam Son 719 two-month incursion into Steel Tiger by a South Vietnamese corps. Chapter V treats the other facets of the campaign within Steel Tiger, the attacks against truck parks and storage areas, defenses, and lines of communication, and the air support furnished indigenous forces and guerrillas operating in Steel Tiger. Chapter VI presents brief resumes of the air efforts in Cambodia, RVN, and Barrel Roll to reflect the integral nature of the overall air war in Southeast Asia. Chapter VII treats the Steel Tiger air interdiction effort in total to summarize the accomplishments of the campaign.

Detailed data on allied and enemy resources and operations are left to the appendices. Appendices also treat the buildup of the gunship force, the introduction of the B-57G, weather factors during the campaign, aspects of materiel activities that underlay operational success, and data bases.

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CHAPTER II

ENTRY INTERDICTION

CONCEPT

The entry interdiction program was conceived as a concentrated and persistent application of road interdiction. Its objective was to impede the movement of enemy trucks and supplies from North Vietnam into the route structure in Laos by cutting all entry paths using the least number of interdiction areas.

The input routes interdicted were those leading into Laos through the Mu Gia and Ban Karai Passes, Ban Raving, and the western edge of the DMZ. The targets in Laos were established where these roads ran through constricted areas framed by extensive karst formations or difficult terrain that would make enemy bypass construction difficult and time consuming. Each of the original target boxes was about 1 by 2 km in size.

Entry interdiction started on 10 October 1970 and marked the beginning of the Commando Hunt V campaign. It seized the initiative prior to the enemy's logistics buildup, which was to begin on 14 October according to intelligence estimates. It delayed the enemy's logistics surge and gained time for the buildup and training of the AC-130 and B-57G truck-killing force.

RESOURCES

The strike forces employed were Arc Light B-52s and tactical air. COMUSMACV allocated 27 Arc Light sorties per day to entry interdiction. Arc Light was to be complemented by an average of 125 tactical air sorties per day. Arc Light strikes were to destroy the roads and tactical air was to prevent repair activity and maintain a presence to deter movement through the boxes. Each B-52 delivered forty-two 750-pound M-117 bombs and twenty-four 500-pound MK-82 bombs. At first, the bombs were fuzed for a 0.10 second delay to achieve maximum cratering. Most fighter and attack aircraft delivered MK-82 bombs. Gaps in coverage of two hours or longer were to be preceded by tactical air emplacement of time-delay munitions, principally MK-82 bombs fuzed for delays of up to five hours.

In addition to the Arc Light and tactical strike aircraft, certain types of support aircraft were necessary to the operation. Each day the B-52s required five support packages, each consisting of two Iron Hand F-105s and two EB-66s. The F-105s carried either Shrike or Standard ARM radar-homing missiles to provide protective

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reaction against surface-to-air missile (SAM) firings. The EB-66s provided an electronic countermeasures (ECM) capability to supplement that of the B-52s. Two F-4s provided flak suppression against 100 mm AAA. These F-4s, in addition to those flying escort missions for reconnaissance aircraft in Route Package I of North Vietnam, were directed to put their unexpended ordnance in the interdiction boxes. Their ordnance was expected to harass traffic and repair activity.

Combat air patrol (CAP) against a potential MiG threat was provided to the B-52s when necessary. The MiG CAP consisted of two F-4s and flew with Arc Light strikes in the Mu Gia area. Strikes in other areas required MiG CAP only when Intelligence estimated that there were MiGs at airfields within operating range of these areas.

PROCEDURES

Target Selection

The target boxes were designated as follows:

<u>Entry Corridor</u>	<u>Box</u>
Mu Gia	A
Ban Karai	B
Ban Raving	C
DMZ	D

Figure II-1 shows the general location of these boxes. To vary the approach directions for bomb runs, target boxes had alternative orientations. As the campaign progressed, additional boxes were developed to cut bypasses or specific route segments outside the original boxes. When the original target areas became ineffective for reducing traffic, new areas were selected. Alphanumeric designations identified the various box configurations, e.g., A-1, B-3, C-2.

Box A

Figure II-2 depicts the original Box A. The box cut Routes 23A and 1202 where they were constrained to pass between large karst formations bordering the Ngo River. The extensive karst in the area made the construction of bypasses difficult. While this target box blocked the main routes from Mu Gia Pass to the south, it was bypassable by taking Route 12E to the west and returning to Route 23A by way of Routes 128A and 1281. However, this bypass was about 65 km longer than the direct route down 23A or 1202. Also, trucks were more vulnerable to air attack on Route 12E, which was straight, flat, and exposed. Nevertheless, the enemy used this long bypass when it became difficult to keep the roads open through Box A. Because the box was within operating range of MiGs at Phuc Yen Airfield, all Arc

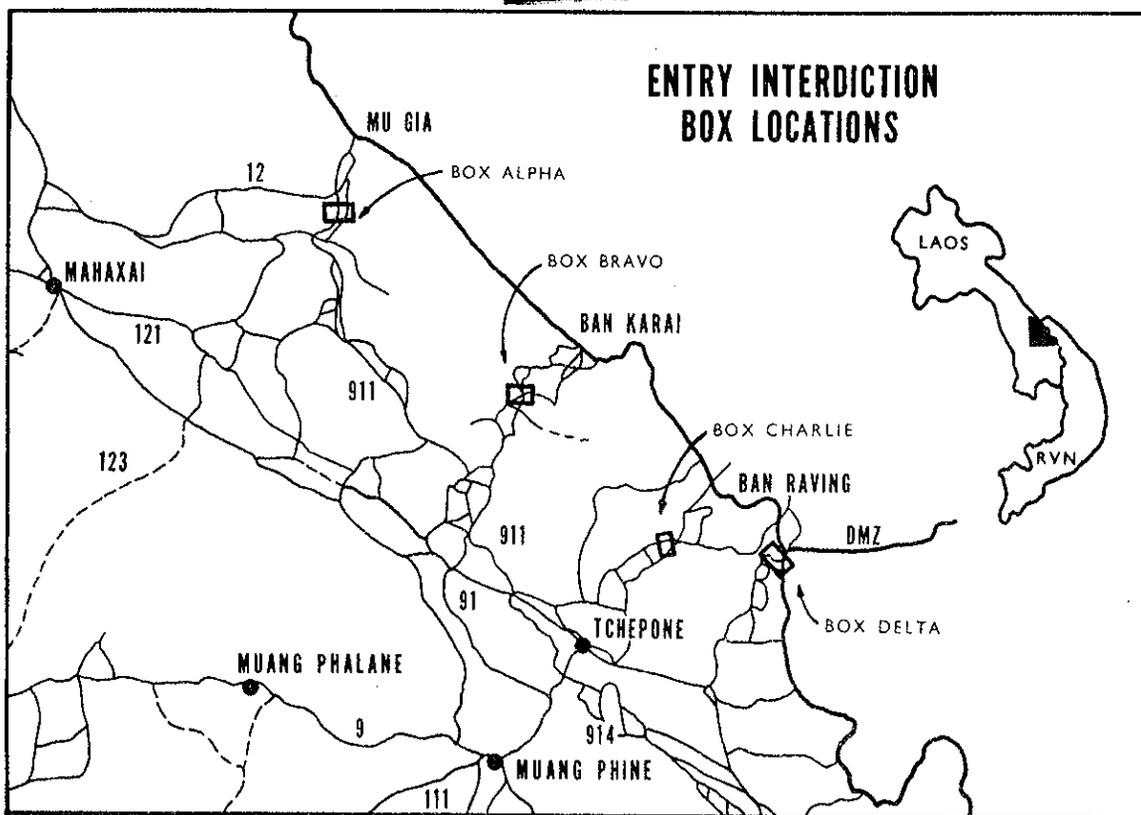


FIGURE II-1

Light strikes required MiG CAP support. The box was 9.5 NM from the NVN border and about 80 NM from the nearest known occupied SAM site as of 10 October.

Box B

Figure II-3 depicts the original Box B. The box cut Routes 912B and 9125B where they passed between two karst formations alongside the Chala River. The route structure southwest of Ban Karai Pass contained many bypasses built to counter previous interdiction campaigns. However, in October 1970 all motorable roads leading into the core route structure converged just north of the original Box B, and all southbound traffic had to cross the box on Route 912B or Route 9125B. About 4 NM south of the box the route structure fanned out into terrain which did not lend itself to road interdiction. This box was 8.5 NM from the NVN border and 105 NM from the nearest known occupied SAM site as of 10 October.

Box C

Box C, depicted in Figure II-4, cut Routes 92A and 1035A where

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LOCATION OF BOX A

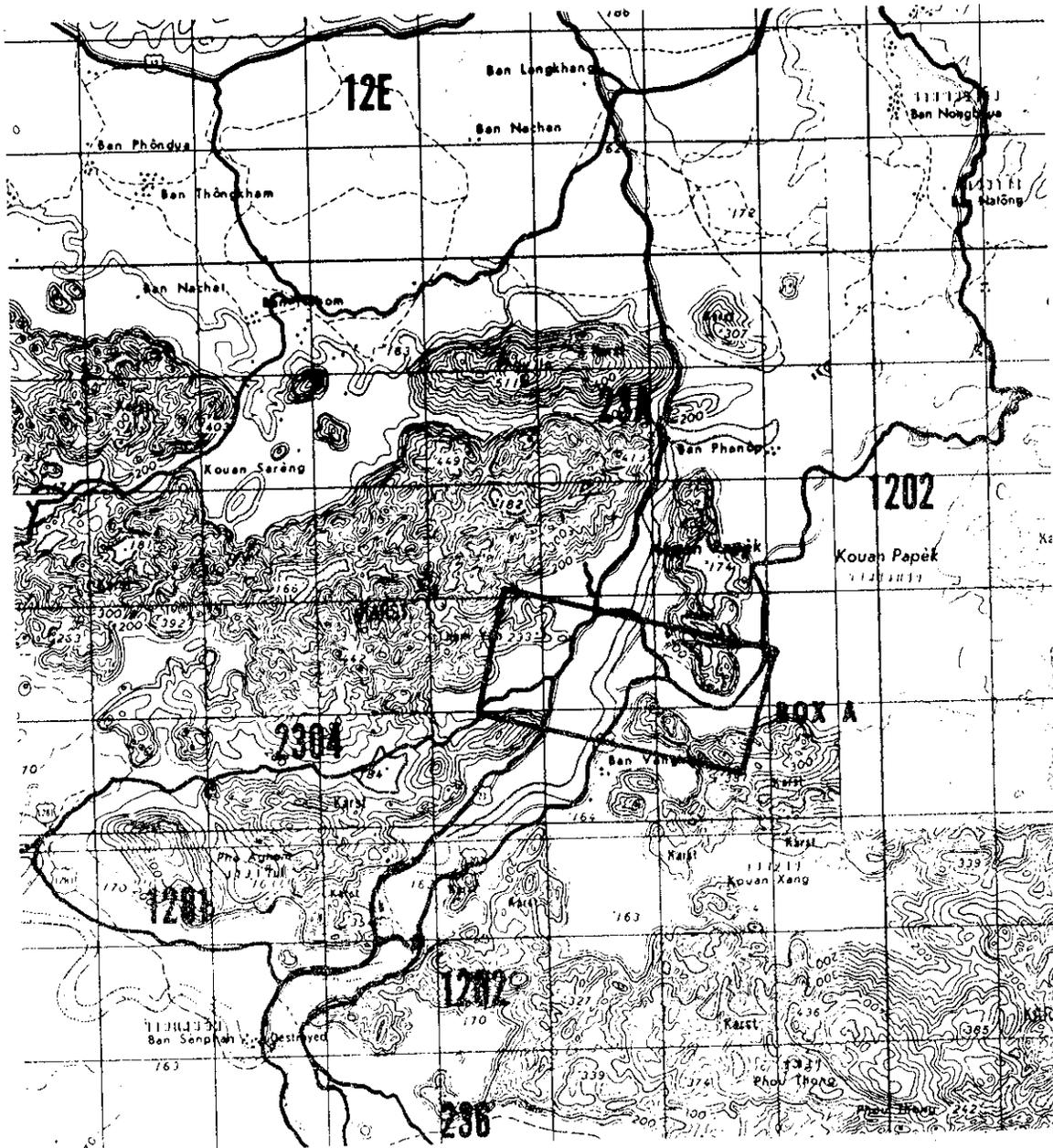


FIGURE II-2

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they passed between a large karst formation and the Banghiang River (Waterway 7J). The steep karst on the south side of the river formed a natural barrier to road construction. Traffic moving south from Ban Raving on Routes 1038 and 1039 was channeled through this constricted area before fanning out into the central route structure. Box C also covered Waterway 7J, which had been used earlier in the year for free-floating supplies to transshipment points north of Tchepone. Box C could be bypassed to the north and east by following Route 910 from NVN. However, a portion of this route was in trail status in October 1970, and it never received heavy use of inputting supplies into Laos.

This box was 10 NM from the NVN border and 130 NM from the nearest known occupied SAM site as of 10 October.

Box D

Figure II-5 depicts the original Box D, which cut Route 1032B where it made a steep descent from the north, crossed Waterway 7J, and made a steep ascent to the south along the Laos-RVN border. It also cut Route 92A, an alternative route leading toward Tchepone, and it covered Waterway 7J at a launching area for free-floating supplies. Route 1032B was the only road leading south from the western edge of the DMZ to Routes 9, 925, and 926, the northernmost throughput routes to RVN. This box was on the Laos border just south of the Demarcation Line in the DMZ and 135 NM from the nearest known occupied SAM site as of 10 October.

Sortie Scheduling

Arc Light strikes for entry interdiction were scheduled to occur at random times, and the axes of approach were varied. Tactical air strikes were scheduled around Arc Light strike times. The intent was to cover target boxes during hours of darkness, in particular between 1700 and 2300G (Laos Time), when most of the truck activity took place. Arc Light strikes were made by cells of three B-52s to insure cutting the road on each strike and to provide adequate mutual ECM support over the target. Tactical air strikes were scheduled in flights of two aircraft each. A typical 24-hour schedule of strikes against Box B is shown in Table II-1.

The number of sorties scheduled against each box depended on the condition of the roads, the ease of interdictability, and the number of roads or bypasses to be cut. At first, an equal weight of effort was applied to each of the four boxes. As the situation changed and experience was gained, the weights of effort were adjusted for maximum effectiveness. In general, 27 sorties per day was the maximum Arc Light allocation. This figure varied at times, decreasing when there were higher priority requirements elsewhere and increasing to

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LOCATION OF BOX D

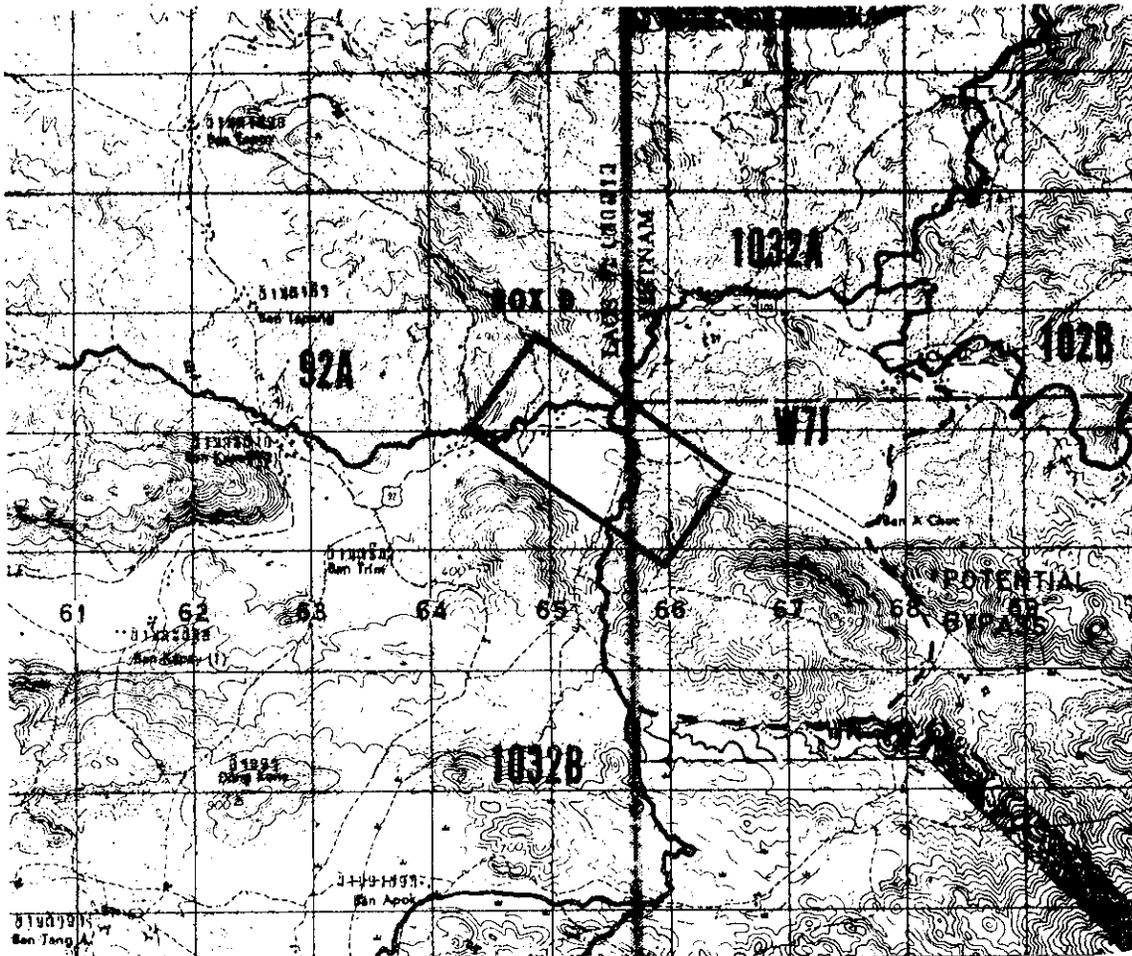


FIGURE II-5

30 or 33 when a surge was carried out against the entry interdiction boxes. The number of tactical air sorties available for entry interdiction depended on relative mission priorities and the number of aircraft carriers on station. The weekly sortie data for Arc Light and tactical air are shown in Table II-2.

ENEMY ALTERNATIVES

At the outset of entry interdiction four basic options to counter the program appeared to be open to the NVA:

1. try to stop or reduce entry interdiction by military means;

TYPICAL 24-HOUR SORTIE SCHEDULE FOR ENTRY INTERDICTION BOX B

LAOS TIME

DAY STRIKES			NIGHT STRIKES		
<u>TIME PERIOD</u>	<u>AIRCRAFT</u>	<u>TIME OVER TARGET</u>	<u>TIME PERIOD</u>	<u>AIRCRAFT</u>	<u>TIME OVER TARGET</u>
0501-0600			1701-1800	2A-7	1730
0601-0700			1801-1900	2F-4	1815
0701-0800	2F-4 2F-4	0725 0740	1901-2000	3B-52	1910
0801-0900	2F-4	0800	2001-2100	2F-4	2030
0901-1000	3B-52	0915	2101-2200	2F-4	2150
1001-1100	2F-4	1015	2201-2300	2F-4	2215
1101-1200			2301-0000	3B-52	2350
1201-1300			0001-0100	2F-4	0035
1301-1400			0101-0200		
1401-1500	3B-52	1455	0201-0300	2F-4	0205
1501-1600	2A-6	1520	0301-0400	2F-4	0335
1601-1700			0401-0500	2F-4	0430

TABLE II-1

2. try to go through the interdiction boxes;
3. try to go around by constructing bypasses; or
4. develop new input corridors.

Within each of these basic options there were several separate suboptions that could be used one at a time or in combinations.

ENTRY INTERDICTION SORTIES FLOW

PERIOD ENDING	BOX A		BOX B		BOX C		BOX D	
	ARC LIGHT	TAC AIR	ARC LIGHT	TAC AIR	ARC LIGHT	TAC AIR	ARC LIGHT	TAC AIR
13 OCT	26	126	29	129	29	117	27	81
20 OCT	37	214	65	230	27	135	37	153
27 OCT	32	194	76	243	24	113	34	108
3 NOV	36	214	77	242	30	153	28	84
10 NOV	46	237	92	255	21	211	21	140
17 NOV	48	248	87	347	15	144	21	117
24 NOV	48	186	70	217	16	122	15	78
1 DEC	52	282	90	348	25	257	17	120
8 DEC	50	284	92	344	39	280	15	87
15 DEC	49	283	85	406	39	246	18	143
22 DEC	52	158	82	319	38	198	24	144
29 DEC	18	217	92	152	15	254	50	106
5 JAN	62	221	18	158	47	222	28	104
12 JAN	73	154	0	190	63	138	22	101
19 JAN	71	160	63	223	39	160	30	142
26 JAN	0	252	76	114	15	137	61	88
2 FEB	0	201	84	220	36	206	41	79
6 FEB	0	125	42	48	20	108	29	43

TABLE II-2

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Stop or Reduce Interdiction

To stop or reduce the saturation bombing the North Vietnamese could have moved surface-to-air missiles to areas within range of the interdiction boxes. They would deploy the SAM batteries under cover of darkness or weather and move them often. Firings would be made at the B-52s. Another option was to introduce 100 mm antiaircraft artillery (AAA) either in the target area or along the approach and departure paths. Also, the enemy could have introduced AAA fire-control radar. A fourth option open to the enemy was to use fighters to force the B-52s away from the entry interdiction boxes. North Vietnamese MiGs had shown little inclination to cross the Laotian border in the past, however. Table II-3 summarized these options and shows their estimated likelihood and actual employment.

<u>OPTION</u>	<u>PROBABLE</u>	<u>HIGHLY POSSIBLE</u>	<u>POSSIBLE</u>	<u>UNLIKELY</u>	<u>USED</u>
	(BOX)	(BOX)	(BOX)	(BOX)	(BOX)
USE SAMS	A, B, D		C		B, C, D
USE 100 MM AAA	B	A, D	C		B
USE RADAR WITH AAA		D		A, B, C	
USE FIGHTERS			A, B	C, D	A

TABLE II-3

Push Through Interdiction Boxes

The North Vietnamese had the alternative of trying to force supplies through the boxes while either ignoring the saturation bombing or taking advantage of any reductions in its intensity.

It was considered probable that the enemy would porter supplies through or around the interdiction boxes depending upon the terrain. For portering through a box, the activity was most apt to start soon after an Arc Light attack. During the course of the entry interdiction program, portering was believed to have been employed in all

[REDACTED]

four areas. It was evident from a light level of truck activity detected north and south of a box while photography showed no signs of vehicle tracks through or around the box. At times photography showed foot trails and stacks of supplies in the areas where portering was suspected. Attacks against these areas at night often produced scattered secondary explosions and fires.

In addition to portering, it was considered possible that the enemy might use helicopters to move heavy material that porters could not handle. It was estimated that, if used, the helicopters would operate from inside North Vietnam and fly numerous shuttles at night. Use of this option was not detected during Commando Hunt V.

It was also considered probable that the enemy would use waterways to float supplies through the interdiction boxes. Waterway 7 had been used for free-floating supplies near the end of Commando Hunt III and during the wet season. The Ngo River flowing through Box A could be used in a similar way during high-water periods, but the Chala River flowing through Box B was not deep enough. The North Vietnamese did not use waterways in the entry interdiction areas. One reason may have been that the saturation bombing had destroyed the banks of the waterways to the point where free floatation was no longer possible.

Another enemy option was to construct a road through an interdiction box and run several trucks through between strikes. As the soil dried out and became pulverized from repeated bombing, it became easier to construct roads through the boxes. This option seemed to have been used often.

Build Bypasses

Although the bypass along Route 12E was 65 km longer than the route through Box A, it was used when roads through the box were interdicted. Another bypass could have been constructed from Route 12E south to Route 1281 across the karst ridge about 5 km west of Box A (Figure II-6). It was never built.

The most probable starting point for construction of a bypass around Box B appeared to be at the east end of Rat Fink Valley. The bypass would run south to Route 915 and west to Route 912A through rolling terrain and triple-canopy foliage (Figure II-7). This eastern bypass was built in early December, and designated Route 9127. In mid-November a western bypass (later designated Route 9125B) around Box B had been developed from a portering trail between points on Route 9125. It traversed rugged terrain and appeared to be seldom used after the eastern bypass was opened.

The most feasible routes for bypassing Box C ran around the

POTENTIAL BYPASS AROUND BOX A

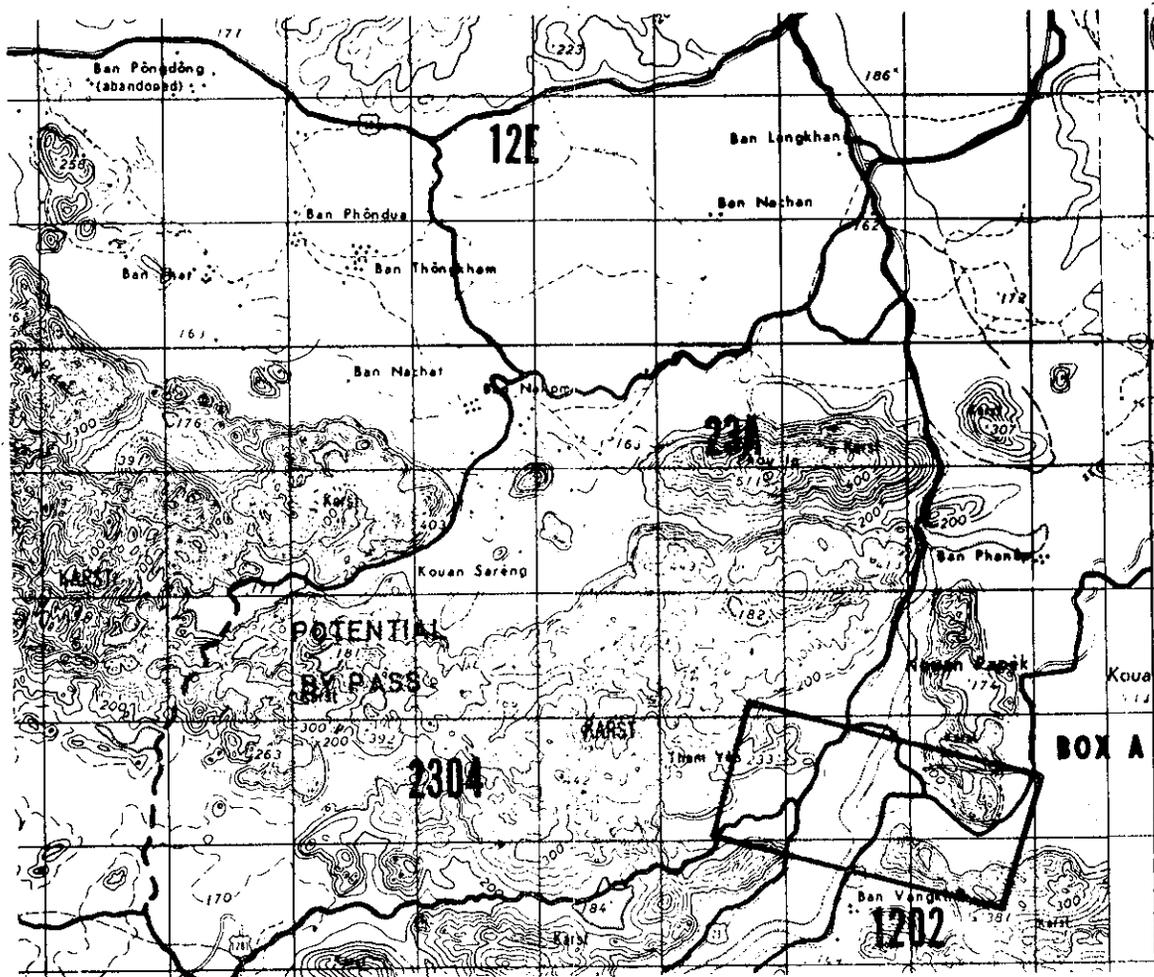


FIGURE II-6

northwest end of the box and are shown in Figure II-8. The NVA used the more southern of these bypasses during Commando Hunt V.

In the DMZ area the best bypass appeared to loop around the karst hill to the southeast of Box D to join Route 1032B about 1 km farther south (Figure II-9). In January, the enemy added a western bypass that ran south from Route 92A and split into two branches to intersect Route 1032B about 1.5 km and 2 km south of the box.

Develop New Input Corridors

The use of Nape Pass as an alternate input route would have required extensive road repair and would have exposed enemy supplies,

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POTENTIAL BYPASS AROUND BOX B

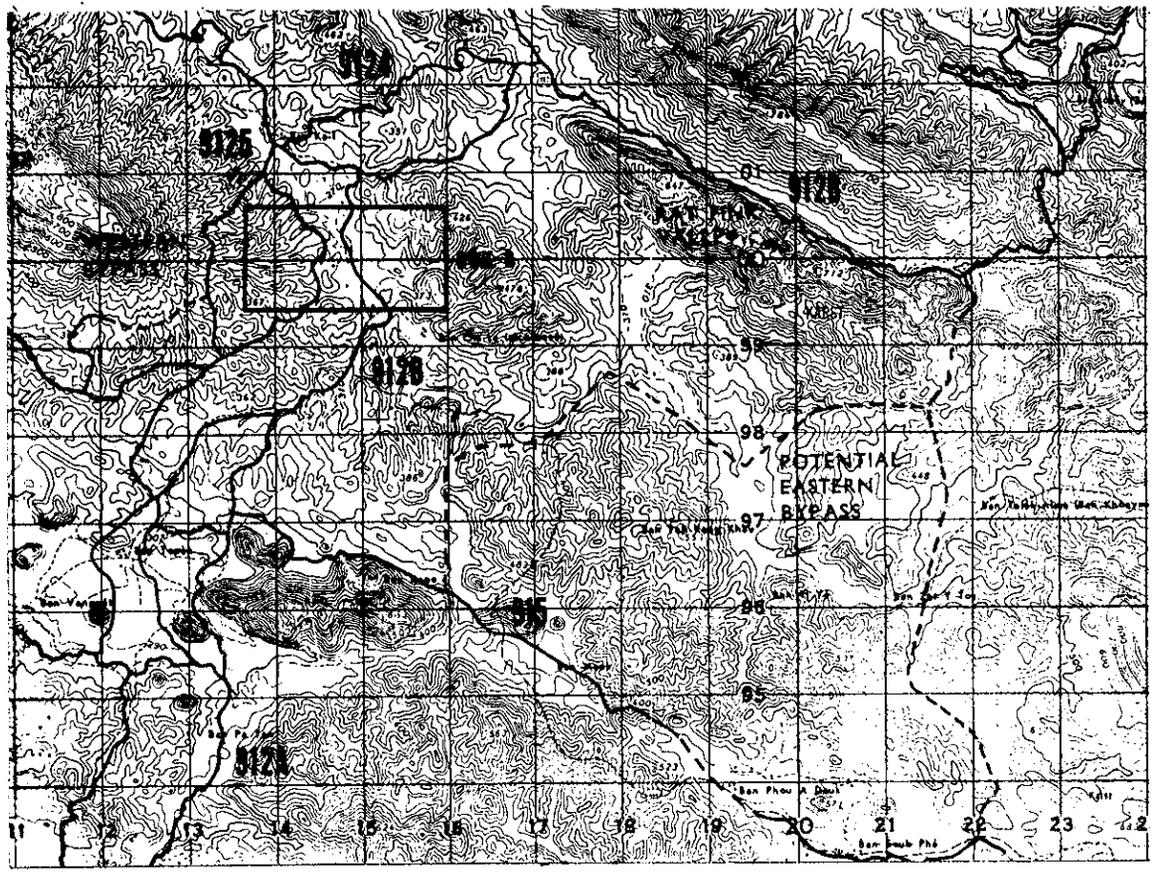


FIGURE II-7

men, and equipment to air strikes for a longer distance than existing routes. No evidence developed to suggest that Nape Pass was used during Commando Hunt V as an input corridor.

The use of Route 910 seemed probable if pressure was maintained on the interdiction boxes (Figure II-10). It had been motorable during Commando Hunt III but had reverted to trail status by October 1970. Traffic was detected on Route 910 near the end of December 1970 when the entry interdiction program had been in effect for over 75 days. However, it never developed into a major input corridor. Monthly sensor-detected southbound truck movements on Route 910 were:

<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>
0	40	28	32	9	7



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POTENTIAL BYPASS AROUND BOX C

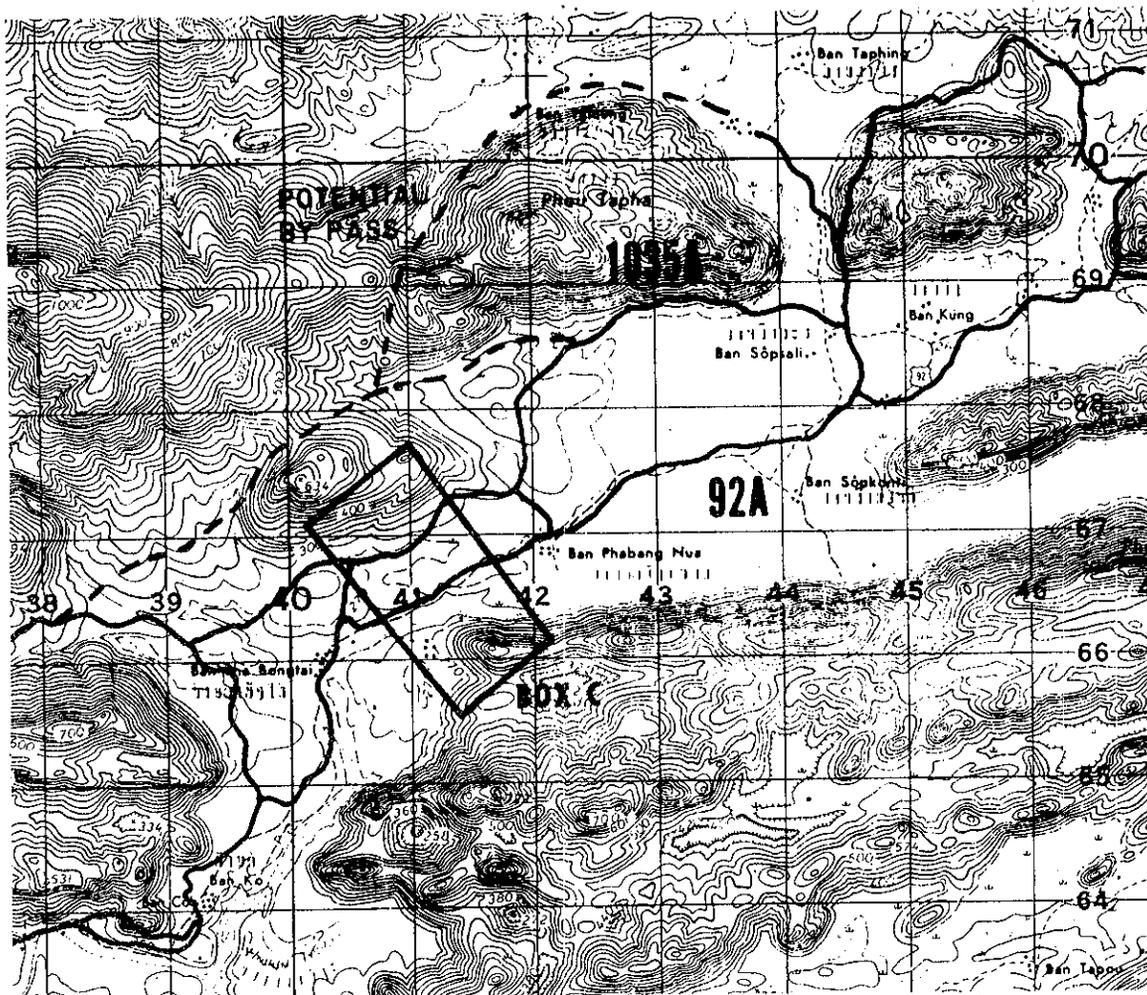


FIGURE II-8

IMPLEMENTATION

Entry interdiction began with an Arc Light strike on Box A at 0045G on 10 October. Enemy truck activity was still at a low level, 49 trucks having been detected as input to Steel Tiger during the first week of October. By 13 October forward air controllers (FACs) reported the roads closed in all boxes except B.

On 11 October a warning advisory was issued for two 100 mm anti-aircraft guns just south of Box B. B-52s striking Box B reported the first 100 mm firing at 2015G on 17 October. Arc Light strikes against this box were suspended while the situation was analyzed. By midday on 18 October it was concluded that 100 mm firings were not a serious threat to the B-52s, and the strikes were resumed.

~~SECRET~~
POTENTIAL BYPASS AROUND BOX D

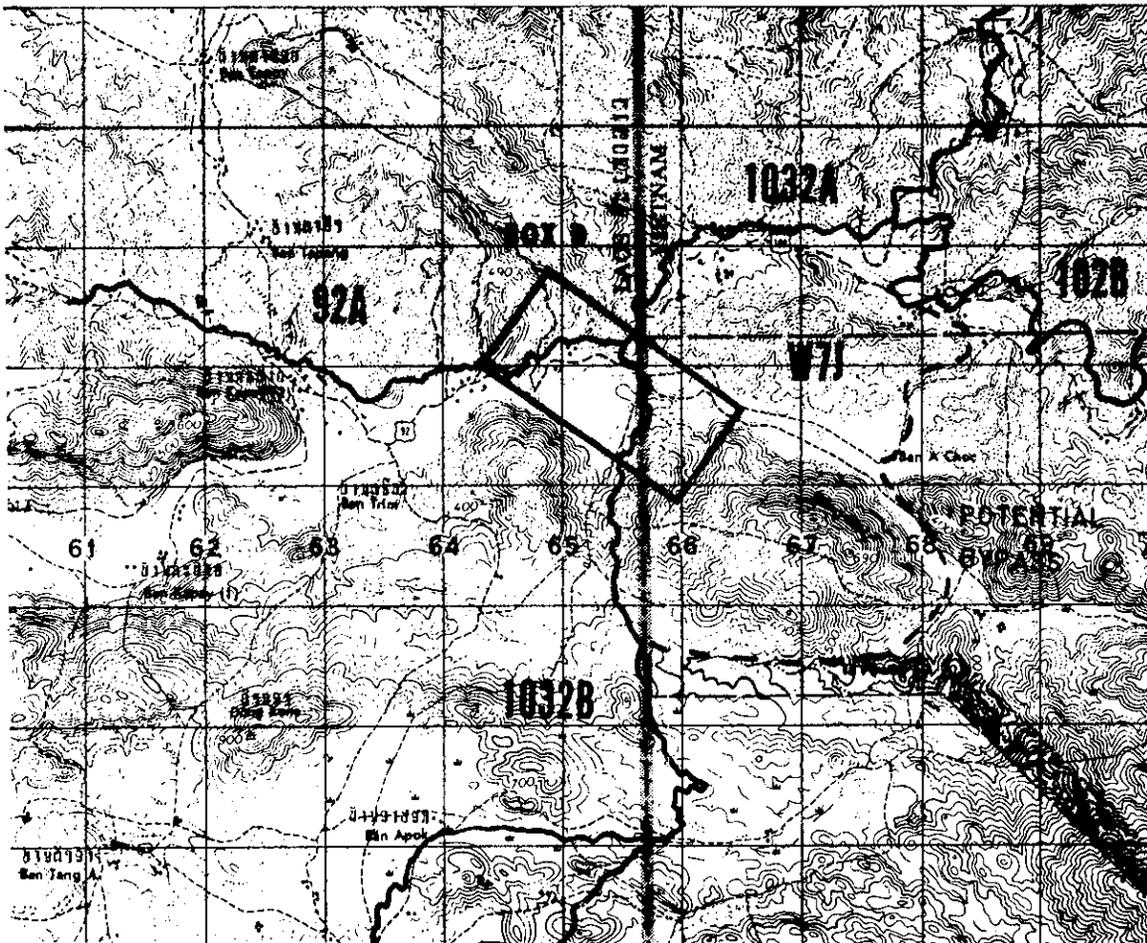


FIGURE II-9

By 19 October it was apparent that Ban Karai would be the most difficult entry corridor to interdict. The terrain in Box B was flatter and wider than that in the other boxes. Ban Karai was also the most used of the four input corridors and one which the enemy seemed determined to keep open. Thus, it became necessary to allocate a greater weight of effort to Box B than to any of the other boxes.

From 25 October to 2 November, truck activity throughout Steel Tiger declined as typhoons brought heavy rains on 25 and 28 October. The estimated amounts of rainfall in the entry interdiction areas were:

POTENTIAL INPUT CORRIDOR ON ROUTE 910

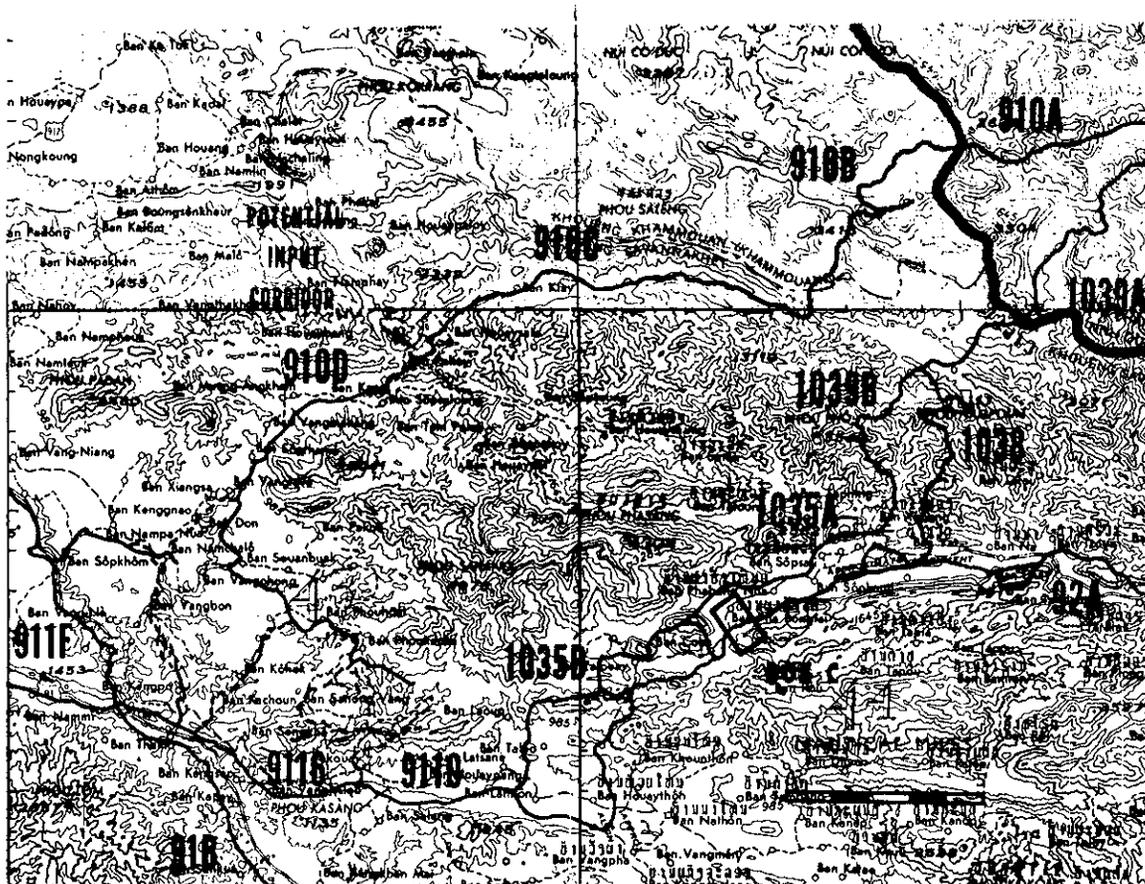


FIGURE II-10

INCHES OF RAINFALL

<u>AREA</u>	<u>25 OCT</u>	<u>28 OCT</u>	<u>TOTAL RAINFALL</u>
MU GIA	3	4	7
BAN KARAI	6	5	11
BAN RAVING-DMZ	6-8	10	16-18

Of the 49 southbound trucks estimated to have moved through the interdiction boxes from 10 October to 2 November, only 9 were detected after 25 October.

As the roads in the entry corridors dried out, enemy activity there increased. Since the roads in all four interdiction boxes

[REDACTED]

were obliterated, Arc Light bombing patterns were sometimes lengthened to 1 by 5 km to increase the area of destruction. Early in November, fires and secondary explosions were observed at the northern ends of these long boxes, suggesting that supplies were being stacked outside the original box areas. The absence of vehicle tracks through the boxes led to the estimate that portering was taking place.

On 3 November, FACs reported apparent portering over the karst formation at the western edge of Box B and identified the portering trail as a potential bypass around the box for truck traffic. Photography of 3 November confirmed that the western bypass was being built. On 6 November, long Arc Light boxes were oriented to cover the bypass. In addition, tactical air struck two points on the new road.

After 17 days with no detected traffic through Box B, sensors counted 21 southbound trucks below the box on the night of 8 November. A FAC reported on 9 November that the western bypass around Box B showed signs of recent vehicular traffic. A new Arc Light target box was developed to improve interdiction of the bypass, and photography of 12 November showed the bypass to be cut. The photography also showed nine destroyed trucks on the bypass.

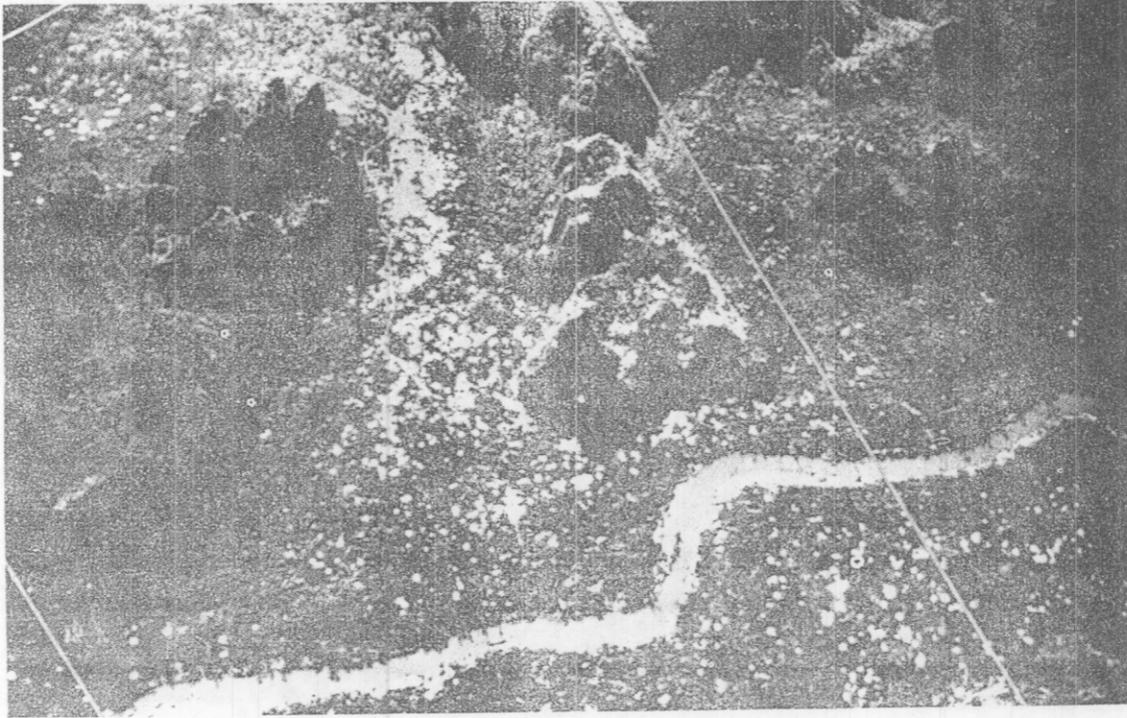
The conditions of the entry interdiction boxes at various stages of the program are shown in Figures II-11 through II-16. By mid-November it appeared that maximum destruction had been achieved in the original boxes. Photography of Boxes A and B at this time showed the beginning of road reconstruction through the dried and pulverized soil. These single-lane roads could be made motorable by a skilled bulldozer operator in a short time.

Truck activity in all input areas except the DMZ started to rise around 17 November, and on 19 November, an input surge began which lasted 10 days. The start of this surge coincided with a reduction of entry interdiction tactical air sorties in connection with protective reaction strikes into North Vietnam. The use of much of the available Iron Hand support for these NVN strikes led to the diversion of Arc Light strikes from the interdiction boxes to other areas. On 21 November, the total entry interdiction effort was 6 Arc Light and 15 tactical air sorties. After this low point, the effort increased to an average of 27 Arc Light and 146 tactical air sorties per day through mid-December.

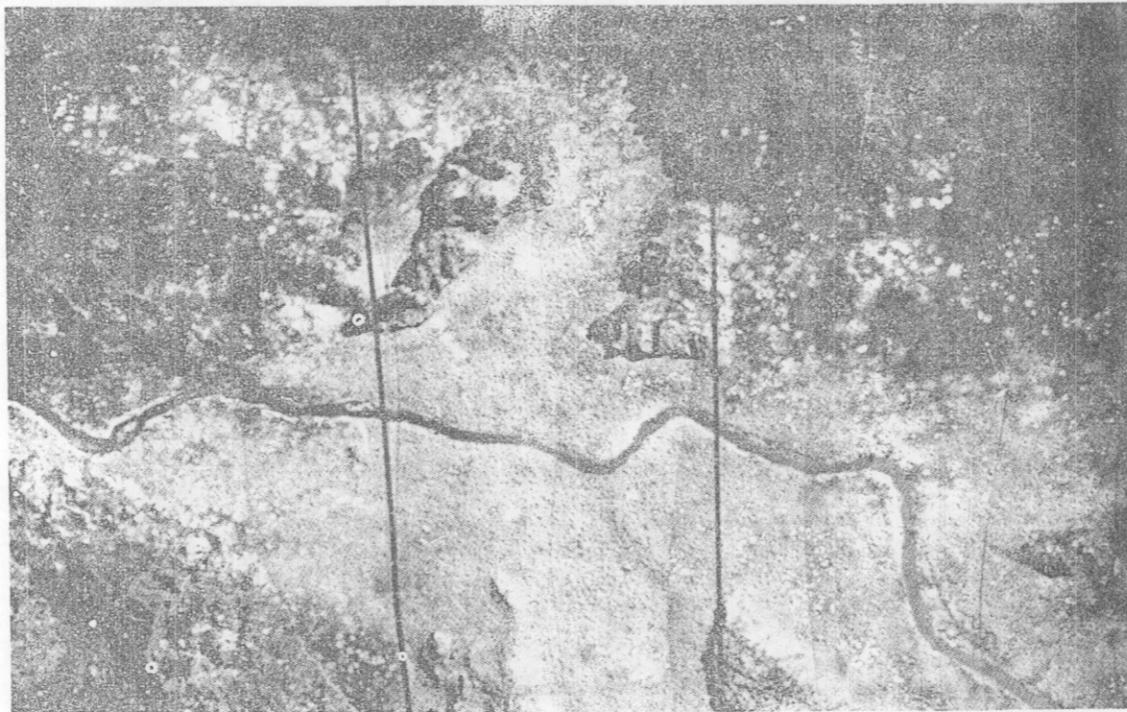
The enemy's demonstrated capability to push roads through Boxes A, B, and C by late November showed that the boxes were losing some of their effectiveness. To rectify the situation, new interdiction boxes were developed. In the Mu Gia area Box A was moved to a point about 2 km southwest of the original box (Figure II-17). The enemy showed no signs of reconstructing Routes 23A and 2304 but concentrated

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BOX A ON 8 OCTOBER



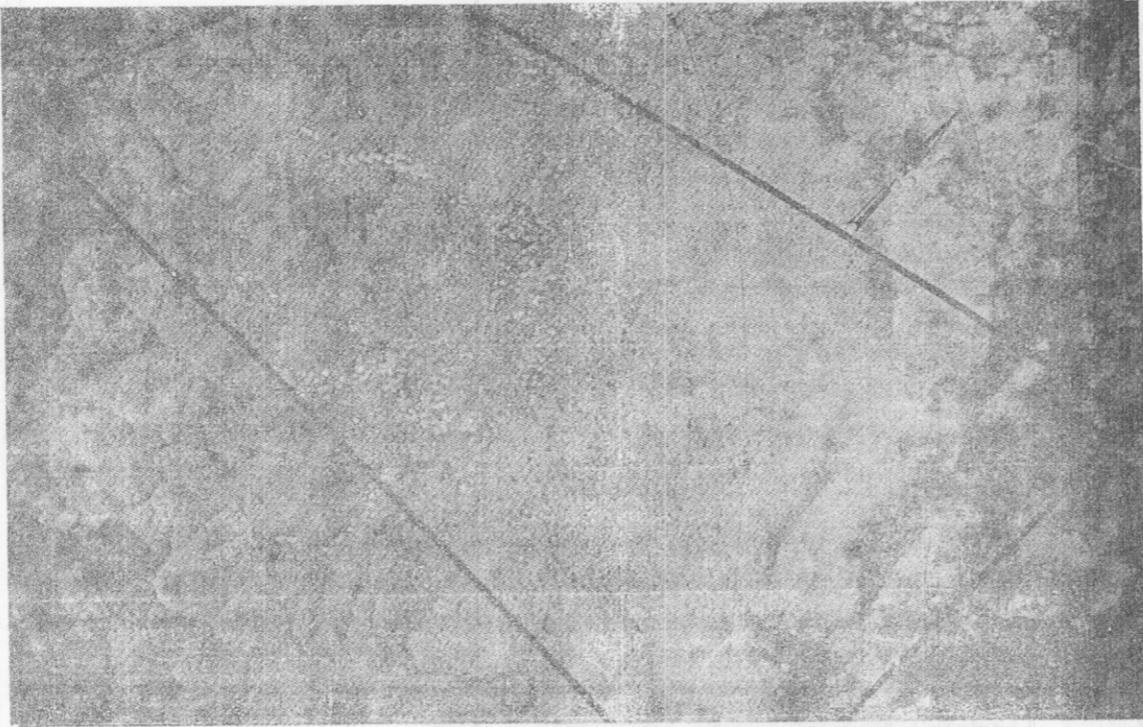
BOX A ON 12 NOVEMBER



FIGURES II-11/II-12

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[REDACTED]
BOX B ON 5 NOVEMBER

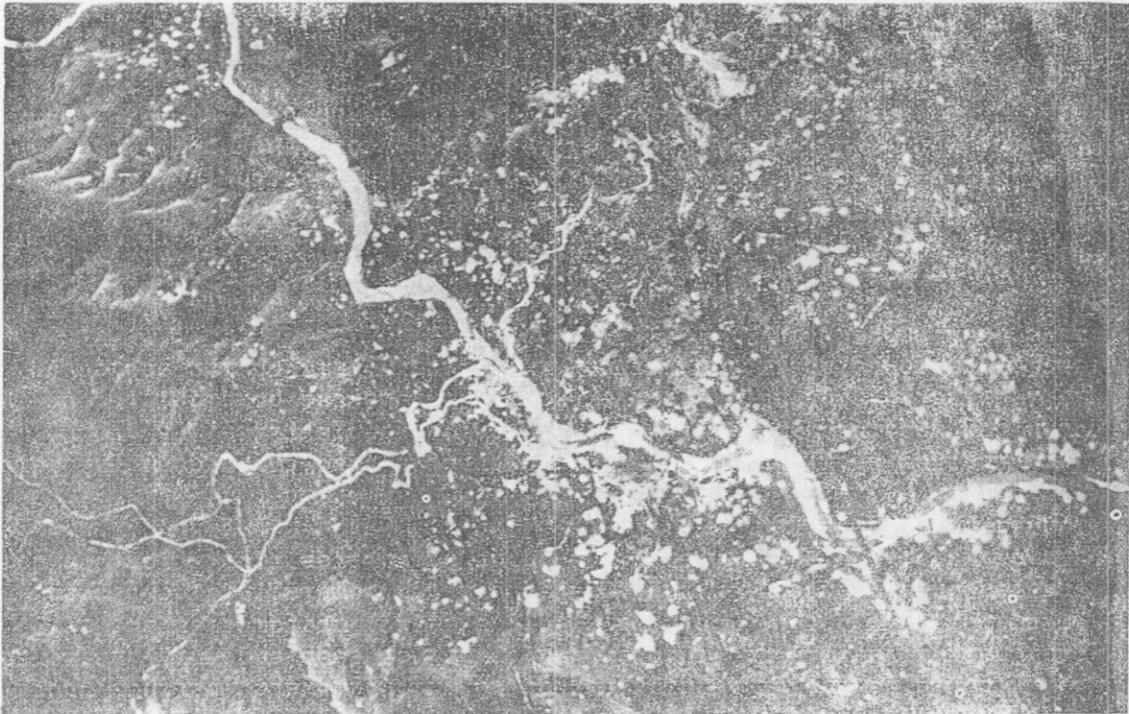


BOX C ON 24 OCTOBER



FIGURES II-13/II-14

[REDACTED]
BOX D ON 8 OCTOBER



BOX D ON 13 NOVEMBER



FIGURES 11-15/11-16

[REDACTED]

LOCATION OF NEW BOX A

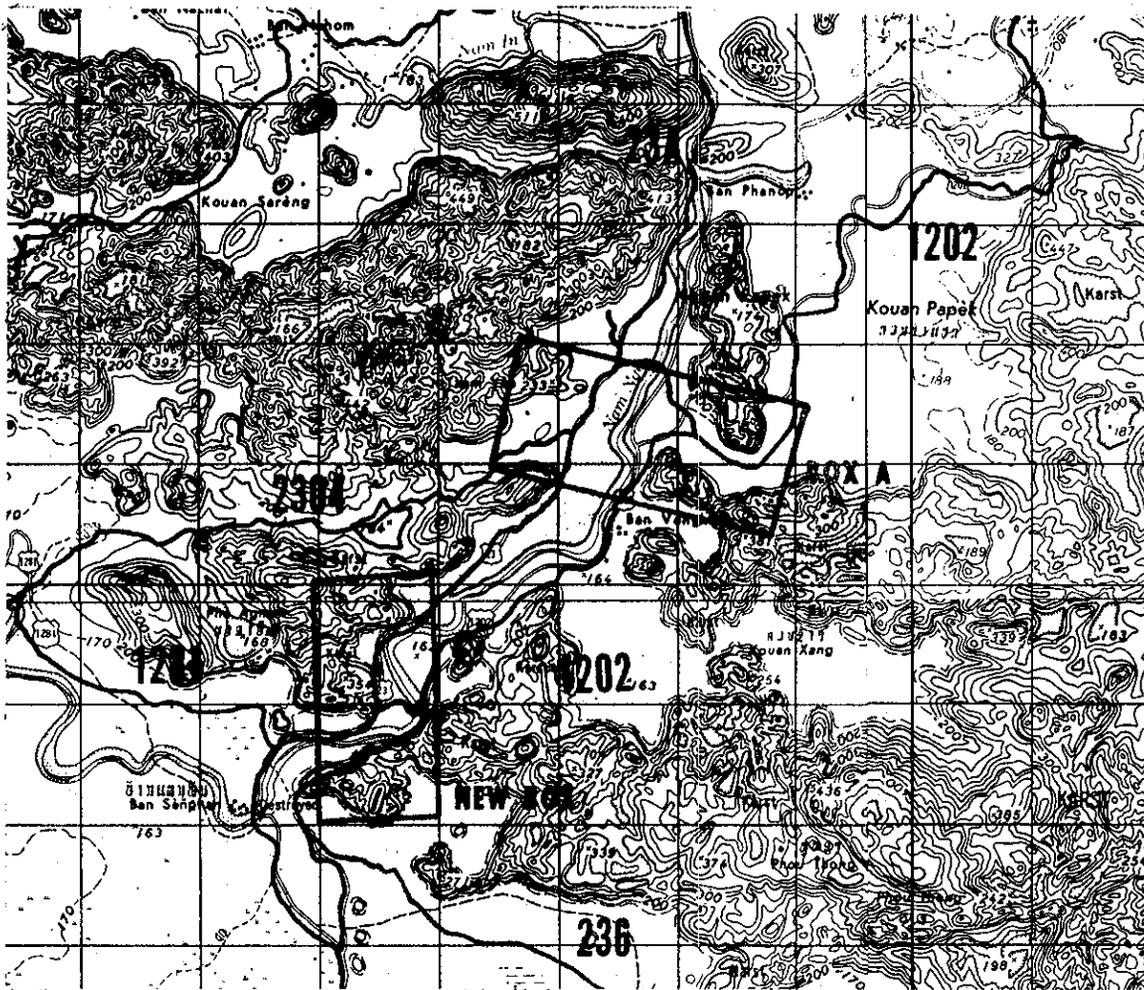


FIGURE II-17

on keeping Route 1202 open. The new box cut that route where it squeezed between a karst cliff and the Ngo River. Strikes against it began on 25 November, and by 27 November had caused large karst slides and closed Route 1202.

For Boxes B and C, the only good alternate interdiction boxes were closer to the North Vietnamese border and the SAM threat. On 30 November, the entry interdiction program experienced its first Arc Light divert due to indications of a SAM firing. An Arc Light enroute to strike Box C was diverted after one of the Iron Hand aircraft fired a Shrike missile at a Fan Song radar signal from southern North Vietnam. Movement of Box B was deferred pending further assessment of enemy intentions. In the meantime, a concentrated effort of 27 Arc Light sorties hit Box B on 2 December. Some

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strikes against Box C were shifted about 3 km northeast to cut the approach to the bypass on the north side of the box.

On 4 December, another enemy surge took place, with most traffic going through or around Box B. Of the 37 southbound trucks detected south of the boxes, 32 had gone through or around Box B. On 5 December, 44 southbound trucks were detected by sensors as having gone through or around Box B. FAC reports and photography of 4 and 5 December indicated that no traffic had traversed the box, nor had sensors on the western bypass shown any activations since 2 December. All evidence suggested that traffic was using an eastern bypass around Box B which FACs had reported under construction in late November. The precise trace of the bypass was unknown at the time, but it was known to begin at the east end of Rat Fink Valley, a good interdiction point. Tactical air sorties hit the east end of Rat Fink Valley on 6 December, and Arc Light strikes in the same location began on 9 December. Throughout early December, low ceilings covered the general area extending from the original Box B to Ban Karai Pass and made it impossible to get photographic or visual coverage of the eastern bypass.

Good weather on 11 and 12 December allowed visual and photographic coverage of all entry interdiction boxes. Coincident with these dates, an upsurge of traffic was detected as having come through or around Box D (Figure II-18), and a new target box was established on 14 December to cut it. For the following week an average of one Arc Light strike (3 sorties) per day hit Box D, with the strikes alternating between the eastern bypass and the original box. This level of effort had little effect on input traffic. A concentrated effort of 15 Arc Light sorties on 26 December reduced sensor-detected traffic in this area to near zero.

On 1 January, SAMs were fired at an Arc Light cell striking Box B. From 2 January to 14 January, Arc Light struck an interim Box B located to the southwest beyond the SAM-threat line. It covered the main routes leading south from Ban Karai but was in terrain which made bypassing quite easy. Tactical air continued to strike the original box and the east end of Rat Fink Valley. Photography of 13 January showed a new road across the southeastern corner of Box D. A western bypass around the box was also under construction and a new interdiction box was developed to cut it (Figure II-18). With three potential routes through the box, it was necessary to strike the area with three Arc Light cells daily to keep the roads closed.

The proliferation of bypasses and the declining effectiveness of the original box areas prompted a reassessment of entry interdiction in mid-January. In the Mu Gia area another good interdiction box remained which would cut Routes 23A and 2302 about 12 km south of the southern box. In both the Ban Karai and Ban Raving areas, it would

LOCATION OF NEW D BOXES

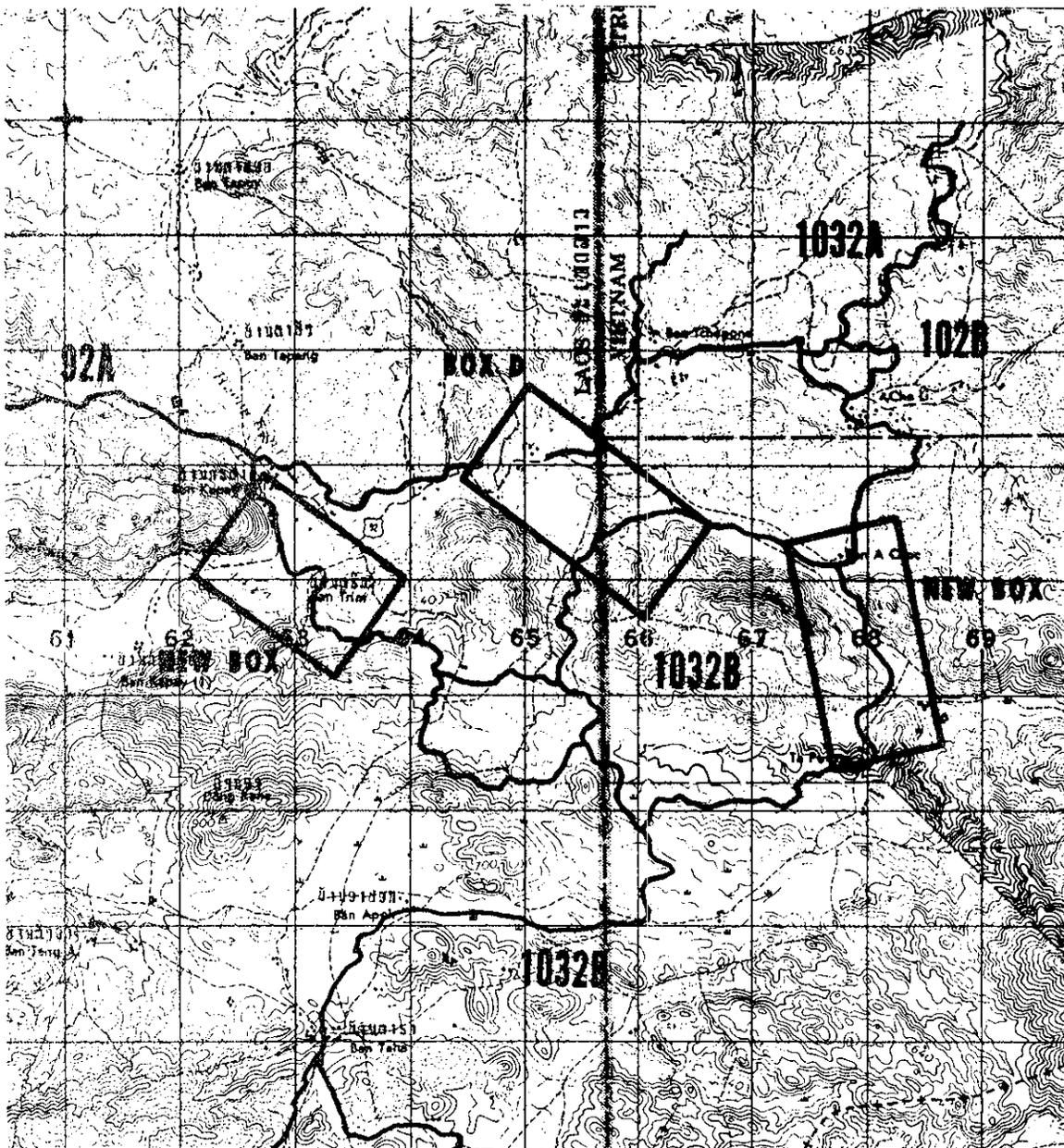


FIGURE II-18

be necessary to strike two interdiction boxes located between the original boxes and the North Vietnamese border. However, there had been no SAM firings since 1 January. Arc Light strikes against the new Box A began on 16 January. On the same day, Arc Light strikes resumed on the interdiction box at the east end of Rat Fink Valley.

[REDACTED]

Strikes in the original Box B continued, but on 20 January, were shifted 5 km northward to a new interdiction box to cut Routes 9120 and 9125A (Figure II-19).

LOCATION OF NEW B BOXES

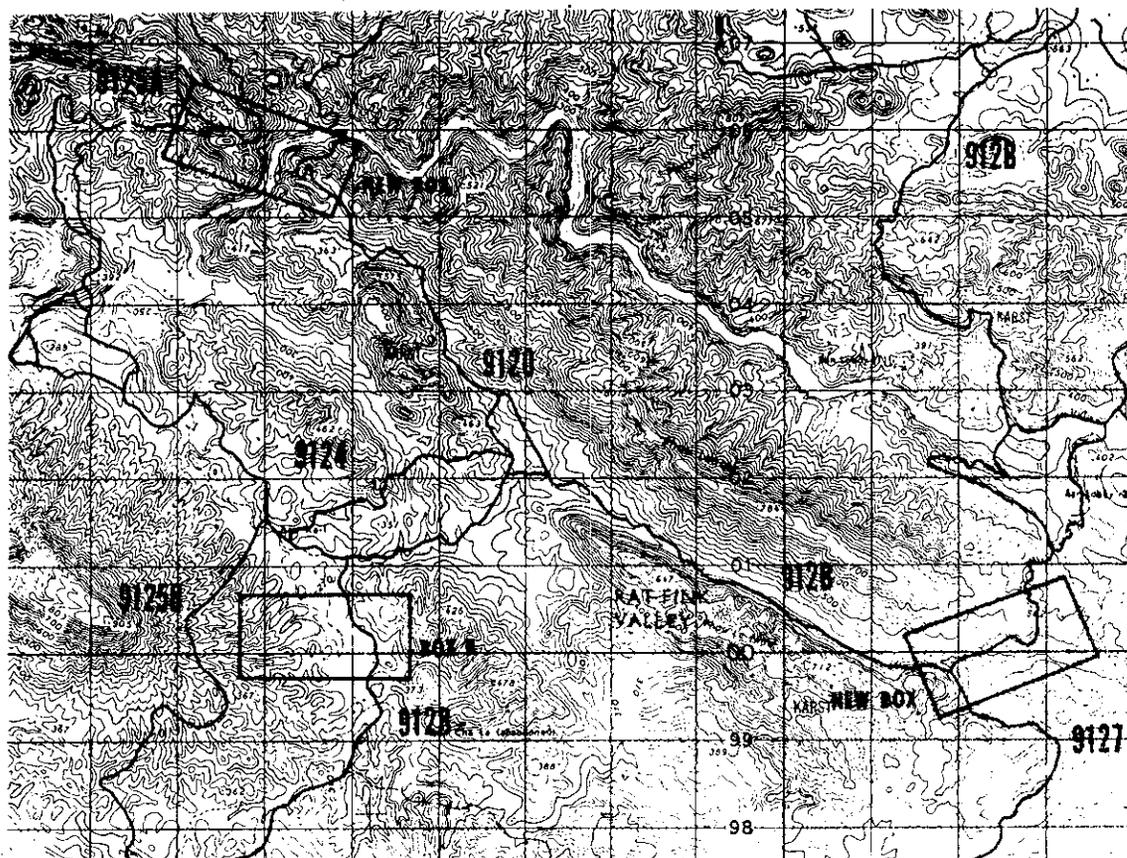


FIGURE II-19

Arc Light strikes in the Mu Gia area were discontinued after 19 January to concentrate the effort on the other three entry areas. Tactical air continued to interdict near Mu Gia, cutting roads and emplacing delay munitions during the day and striking trucks at night. The reasons for selecting Mu Gia as the entry area in which to discontinue Arc Light strikes were:

1. it had better weather than the other entry areas, thus providing a better environment for tactical air operations; and
2. it was farthest from the exit areas and would require the longest exposure of traffic to air attacks.

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On 26 January, Arc Light strikes ceased in the original Box C area. They resumed on 28 January about 8 km to the northeast to cut Routes 1038 and 1039B (Figure II-20).

LOCATION OF NEW C BOXES

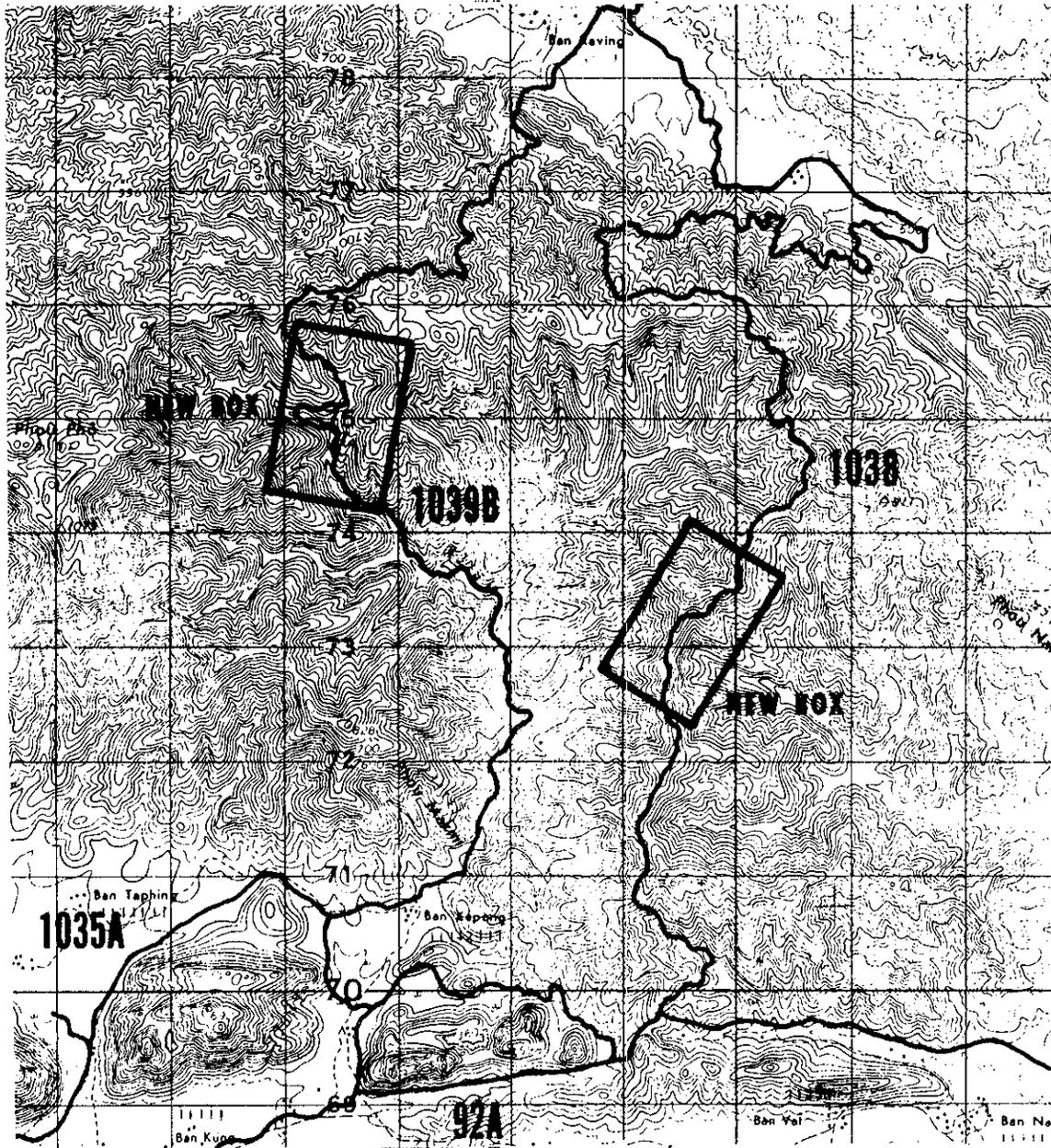


FIGURE II-20

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[REDACTED]

The entry interdiction effort was phased down in early February as strike resources were shifted to support Operation Lam Son 719. The last day on which Arc Light strikes were directed against Boxes B, C, and D was 6 February. Thereafter, the boxes were interdicted singly or in pairs on a less consistent basis. An average of 11 Arc Light sorties per day struck the Ban Karai boxes from 10 through 16 February. An average of 8 per day struck the Box D area from 10 through 16 March with excellent results in reducing input traffic. Arc Light strikes in both Box C and D areas resumed on 7 April.

PROBLEMS

Weather

One of the chief problems associated with entry interdiction operations was weather. During the northeast monsoon, spillover of clouds along the ridgeline and through the passes often produced low ceilings that extended several miles into Laos. Table II-4 shows how

PERCENT OF DAYS WITH SUCCESSFUL RECONNAISSANCE		
10 OCT - 26 JAN		
<u>BOX</u>	<u>VISUAL</u>	<u>PHOTOGRAPHIC</u>
A	83%	62%
B	68	36
C	43	35
D	24	26

TABLE II-4

weather hampered visual and photographic reconnaissance. Lack of reconnaissance made it difficult to ascertain the condition of an interdiction box, adjust bombing patterns if necessary, and determine enemy reactions. Often, sensor detections provided the only feedback on effectiveness of entry interdiction in a given area.

It had been hoped at the start of entry interdiction that constant surveillance over the box areas would deter repair activity.

[REDACTED]

The fact that some of the interdiction boxes could not be seen from the air for days at a time made the constant surveillance concept unworkable in most cases.

SAM Threat

The SAM threat did not affect tactical air operations against the entry interdiction boxes, but some Arc Light diversions resulted from Fan Song radar signals and actual SAM firings. Although the ECM capability of 3 B-52s and 2 EB-66s gave high assurance that the SAM guidance signals would be jammed, the adverse consequence of losing a B-52 induced caution in their use.

AAA Threat

Tactical air strikes against the entry interdiction boxes were not affected to a great extent by AAA firings even though the enemy knew that attacks were being made on a regular basis against the same target. In mid-October, occasional 100 mm firings around Box B had some effect on B-52 tactics. One Arc Light strike against Box B was diverted because of the 100 mm threat, and for several weeks no strikes were scheduled around the time of sunset to avoid illuminating the high-flying aircraft as they passed over the target areas. When it became evident that the 100 mm firings represented harassment at most, Arc Light strikes were scheduled again on a normal basis.

Sensors

In theory, sensor strings located adjacent to an interdiction box on each route leading to and from the box would have measured all traffic through the box area. In practice, terrain and vegetation often dictated the location of sensor strings. Traffic measurement was further complicated by the existence of storage areas between sensor strings. These storage areas were often the terminals for truck shuttles, and their presence tended to disrupt the pattern of sensor-detected truck movements.

The experience in the Mu Gia area illustrated problems in the use of sensors. Sensors were located on Route 1201 about 8 km north of Box A and in a band across Routes 2304, 23A and 236, about 5 km south of the box area (Figure II-21). Southbound trucks usually passed through the sensor string on Route 1201 and seemed to end their shuttles in cave storage areas north of the interdiction box. Shuttles southbound from the caves were not detected until they had passed through the interdiction box. This pattern of movement made it difficult to correlate traffic north and south of the box and so assess the number of movers going through or around it. The sensors south of the box were relied on for the most part to determine how much southbound traffic had come through or around the box. However,

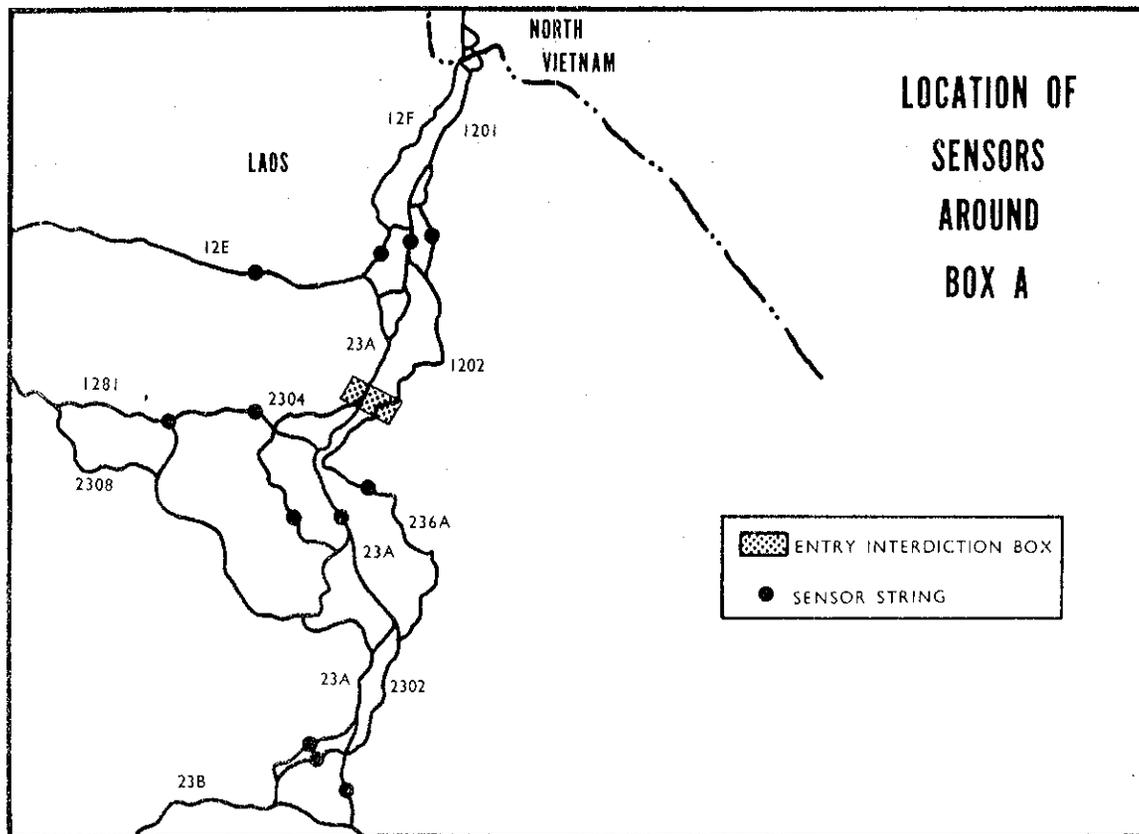


FIGURE II-21

these strings became ineffective from time to time, and sensors on Routes 2309, 23B, and 911A had to be used. The latter strings gave correlations with detections north of Box A because another large storage complex lay between them and the box.

EFFECTIVENESS OF ENTRY INTERDICTION

The most direct assessment of the effectiveness of entry interdiction would be to compare the number of enemy trucks detected moving south through or around the boxes with the number the enemy intended to push through. Without firm quantitative estimates of the enemy's intent it was not possible to make such an assessment. However, analysis of all events associated with entry interdiction showed that it had a definite detrimental impact on enemy activity, particularly during the early part of the campaign.

A less direct assessment compared observed patterns of enemy traffic movement. During both Commando Hunt III and Commando Hunt V sensor-detected southbound truck movements in Steel Tiger varied in

[REDACTED]

a cyclical manner that followed the phases of the moon. Periods of peak activity occurred during periods of high moon illumination. Southbound truck movements in the entry areas to the Laotian route structure from North Vietnam showed the same trend. However, truck movements southbound through or around the entry interdiction boxes followed this trend only in the absence of saturation bombing. The sustained entry interdiction effort caused movement through the interdiction areas to vary according to the weight of air effort applied and the point of application.

Figures II-22 through II-25 show trends of southbound movers through the box areas and bombs delivered against the boxes. All the graphs show that, in general, an inverse relationship existed between the number of bombs delivered and southbound movers through the boxes. For Box A and C, regression analysis showed that a decrease in movers through an interdiction box was correlated at the 98 percent confidence level with an increase in bombs delivered.

For Boxes B and D the situation was more complicated. By mid-January each had two active bypasses as well as a motorable route through the original box, making it necessary to strike more than one target to close all routes. A rise in traffic always accompanied the opening of a bypass, and this rise was independent of air activity until air strikes were directed against the new route. As a result, correlation between bombs delivered and movers through the interdiction area had to be done on a route-by-route basis. Figures II-23 and II-25 show that whenever a bypass was discovered and struck with enough ordnance, traffic through the area declined.

A major benefit of entry interdiction in Commando Hunt V was the time gained for buildup of the truck-killing force. This time was needed at the start of the campaign when the B-57Gs and AC-130 gunships were not up to full strength or effectiveness. By mid-December, when most of the truck-killing force was operational, it was estimated that cumulative input of enemy supplies was about 64 percent of what it had been at the same time in the previous year. If the enemy intended to follow the previous year's schedule, then he was about two and a half weeks behind. If he intended to start a logistics surge in mid-October, as intelligence reports indicated, then he was four and a half weeks behind.

An unanticipated benefit of entry interdiction in Boxes C and D was to render Waterway 7 unusable for the free-floating transportation of supplies. At the start of Commando Hunt V, the waterway was considered a potential input route as it had been during the wet season. However, severe cratering and erosion of its banks in Boxes C and D made it difficult for floating supplies to traverse those areas (Figure II-26).

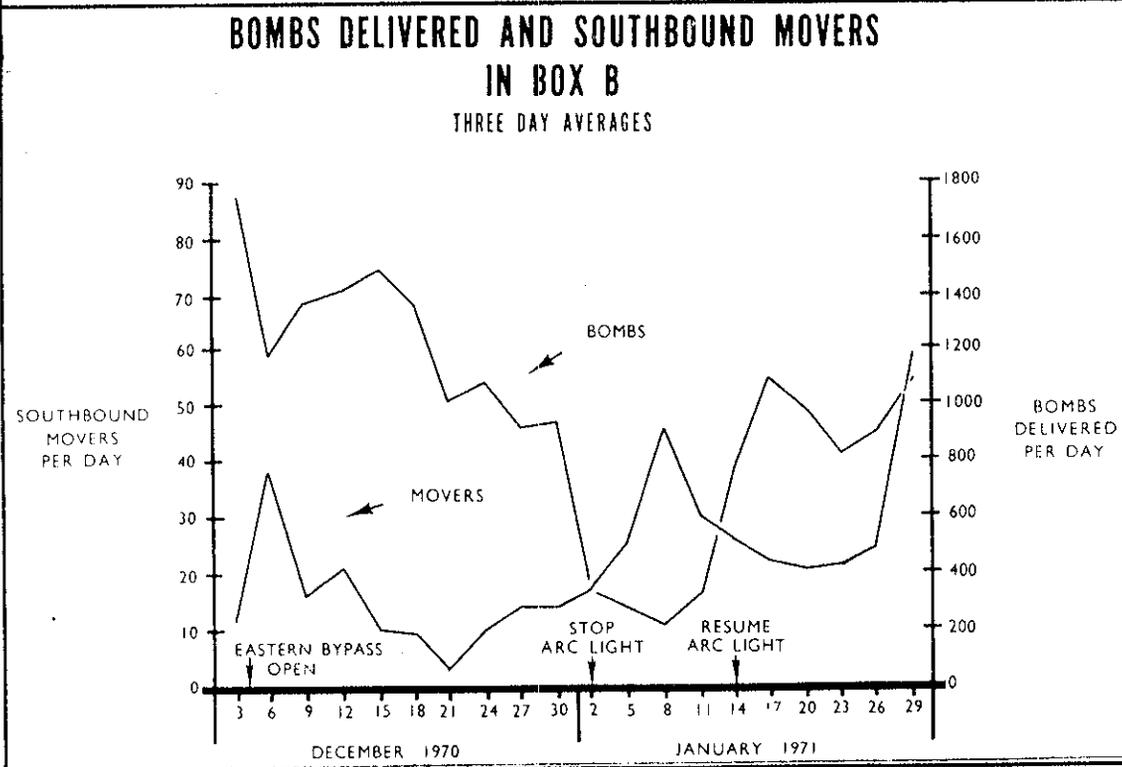
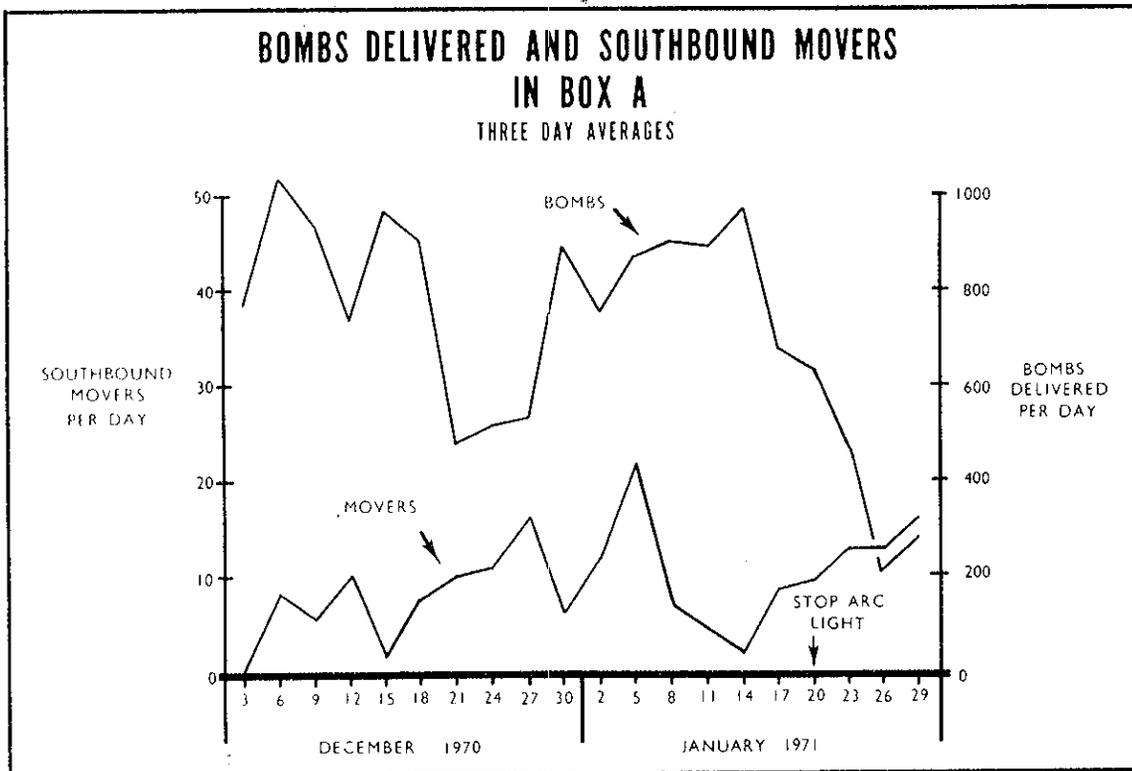
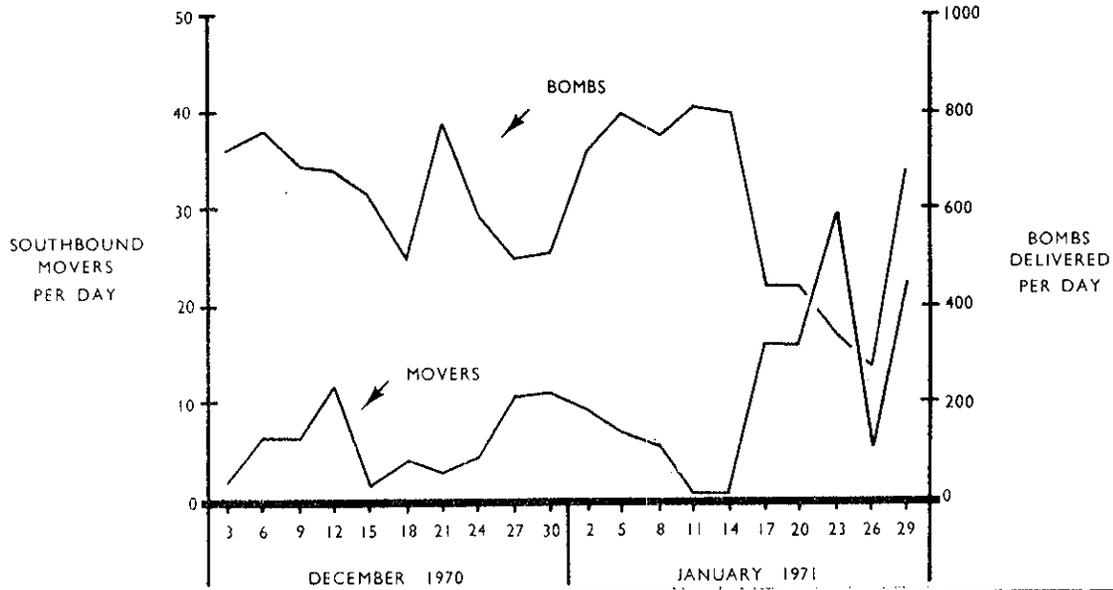


FIGURE II-22/II-23

BOMBS DELIVERED AND SOUTHBOUND MOVERS IN BOX C

THREE DAY AVERAGES



BOMBS DELIVERED AND SOUTHBOUND MOVERS IN BOX D

THREE DAY AVERAGES

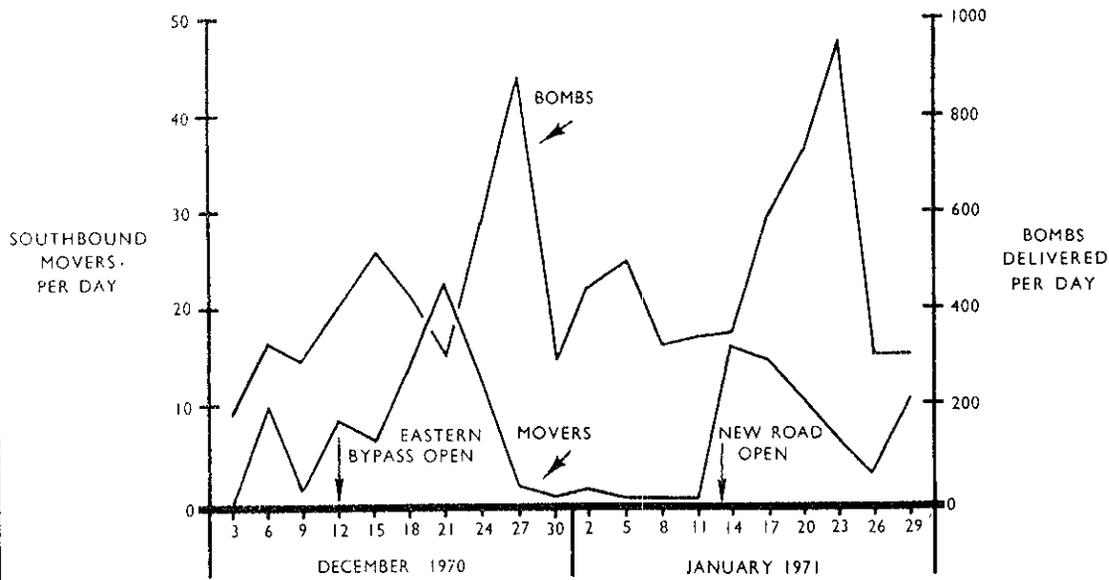


FIGURE II-24/II-25

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WATERWAY 7 IN BOX C - 15 DECEMBER

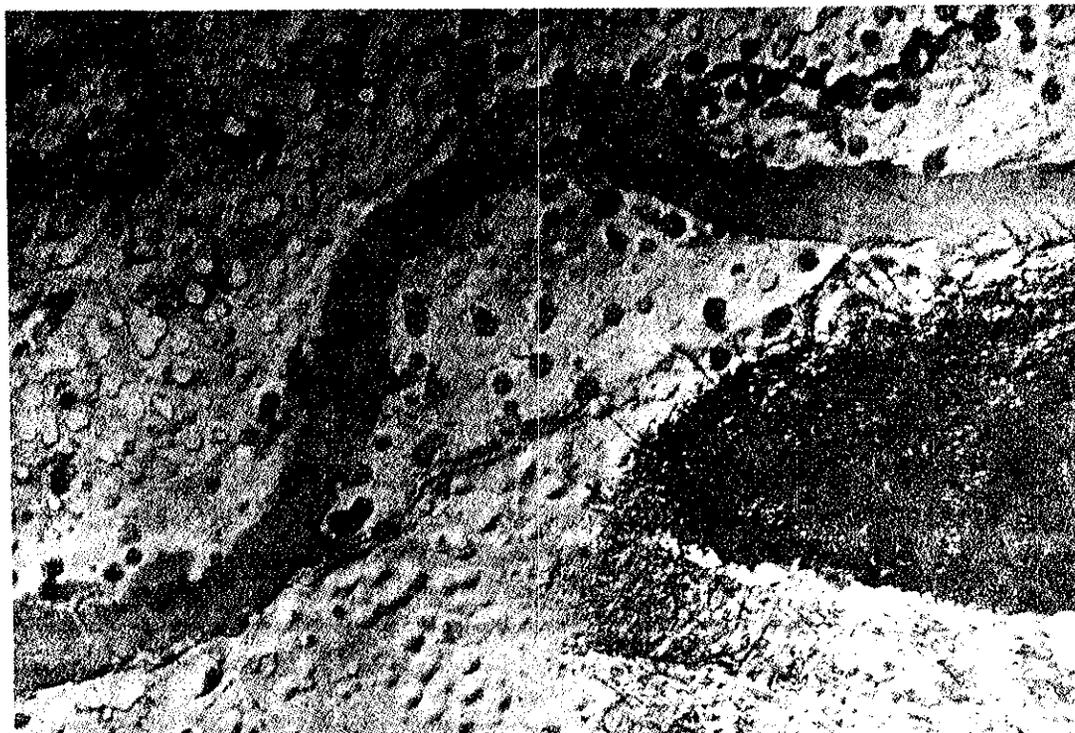


FIGURE II-26

Besides assessing the measurable aspects of entry interdiction, nonquantifiable aspects must be taken into account. As noted before, the data were imperfect and incomplete. Yet when following entry interdiction on a day-to-day basis in context with all other Commando Hunt activities, it was apparent that concentrated applications of force led to decreased enemy traffic and below-threshold applications led to increased traffic. The great effort which the enemy expended to build bypasses, porter supplies, and marshal SAMs and AAA was evidence of the detrimental impact which entry interdiction had upon his logistics plan. Traffic through the box areas did not show a sustained surge until mid-December when most of the bypasses were complete, and road repair was facilitated by the dry, pulverized soil.

In summary, by upsetting the enemy's timetable for the 1970-71 dry season, forcing him to expend considerable extra effort on bypass construction, and gaining time for buildup of the B-57G and AC-130 force, entry interdiction made a major contribution to the success of Commando Hunt V.

CHAPTER III

THE EFFORT AGAINST TRUCKS

The effort against trucks operated within the framework of two objectives: to minimize supply flow into RVN and Cambodia, and to increase enemy costs in conducting his logistics campaign. The truck effort in Commando Hunt V built upon the experiences of Commando Hunts I and III. It operated in conjunction with entry interdiction as enemy vehicular activity gained momentum and systems for killing trucks became available and matured to full effectiveness. Strikes against trucks built to a high level in mid-December and remained there through April.

RESOURCES

The specialized systems for attacking trucks at night were the AC-130 and AC-119K gunships, and B-57Gs. Because the AC-130s and AC-119Ks lacked flak-suppression capability, they required fighter escorts when operating in high-threat areas. All fighter and attack aircraft attacked trucks to varying degrees; they were the only systems used to strike during daylight.

AC-130

The AC-130 gunship force for this campaign was larger than in Commando Hunt III, and all aircraft had 40 mm guns and improved sensor systems. The Surprise Package aircraft, introduced during Commando Hunt III, flew the first AC-130 combat mission on 25 October. Five Update AC-130s flew their first missions between 2 November and 27 December. They differed from the Surprise Package in having night observation devices instead of the low-light-level television (LLTV) and lacked its digital fire-control and inertial-navigation systems. Six new Pave Pronto aircraft that had LLLTV flew their first combat missions between 22 November and 22 January. Two other Pave Pronto aircraft, released from training roles, began combat on 25 and 26 March.

Until 15 February, the AC-130s operating in Steel Tiger were restricted from working in Visual Reconnaissance (VR) Sectors 4, 6, and 9 (Figure III-1) due to the intense AAA threat in those areas. After 15 February all but the northern half of Sector 4 and the north-eastern two-thirds of Sector 6 were open to the AC-130.

AC-119K

The opening of the campaign found 16 AC-119Ks in SEA. The AC-119K mounted 20 mm guns and had a forward-looking-infrared (FLIR)

VISUAL RECONNAISSANCE SECTORS STEEL TIGER

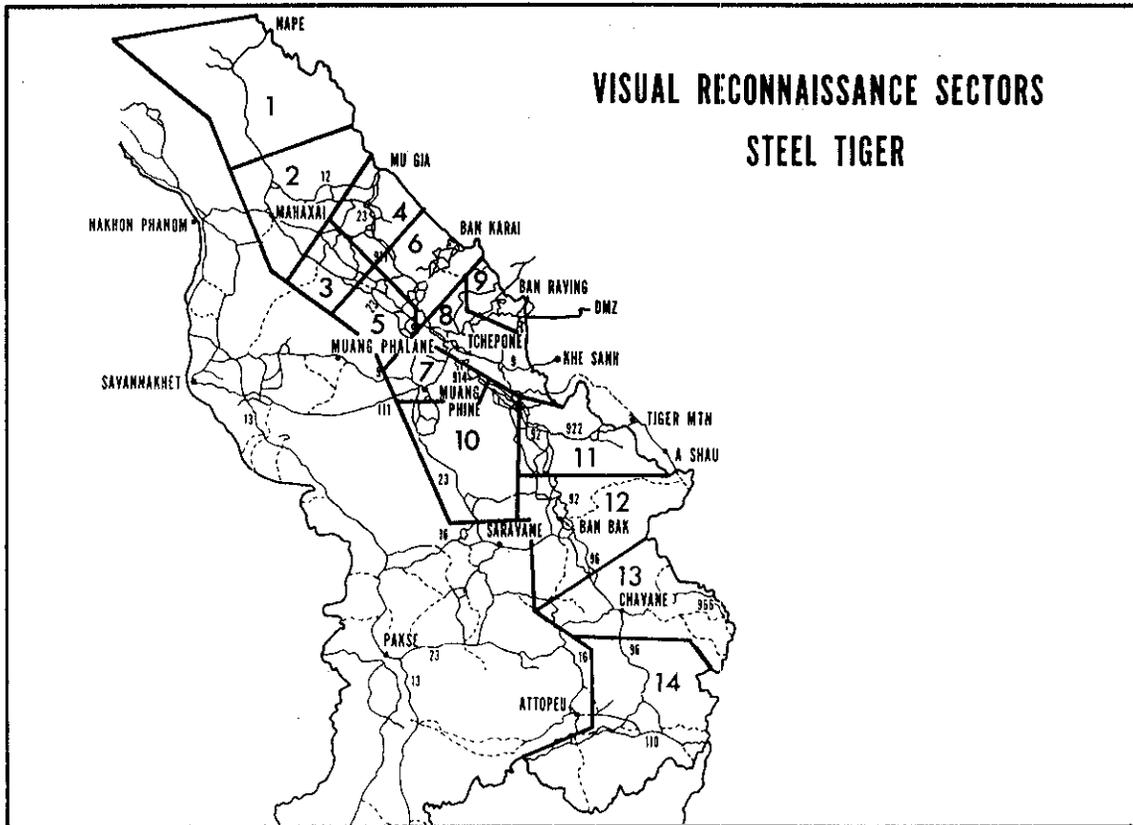


FIGURE III-1

sensor and a night observation sight. In the early part of the campaign, AC-119Ks were restricted from flying in any high-threat area in Steel Tiger. From February on, the restricted areas were VR Sectors 4, 6, and 9 at anytime, and VR Sector 8 during periods of more than 50 percent moon illumination.

B-57G

The first B-57G combat mission took place on 18 October 1970. The eleven B-57Gs available for use in Steel Tiger delivered M-36E1 and laser-guided MK-82 bombs. They had LLLTV and FLIR.

IMPLEMENTATION

Truck Activity

Despite the fact that some 2800 trucks were estimated to be in Steel Tiger at the outset of the Commando Hunt V campaign, truck

activity did not begin to rise from wet-season levels until mid-November, reaching its first peak in mid-December (Figure III-2).

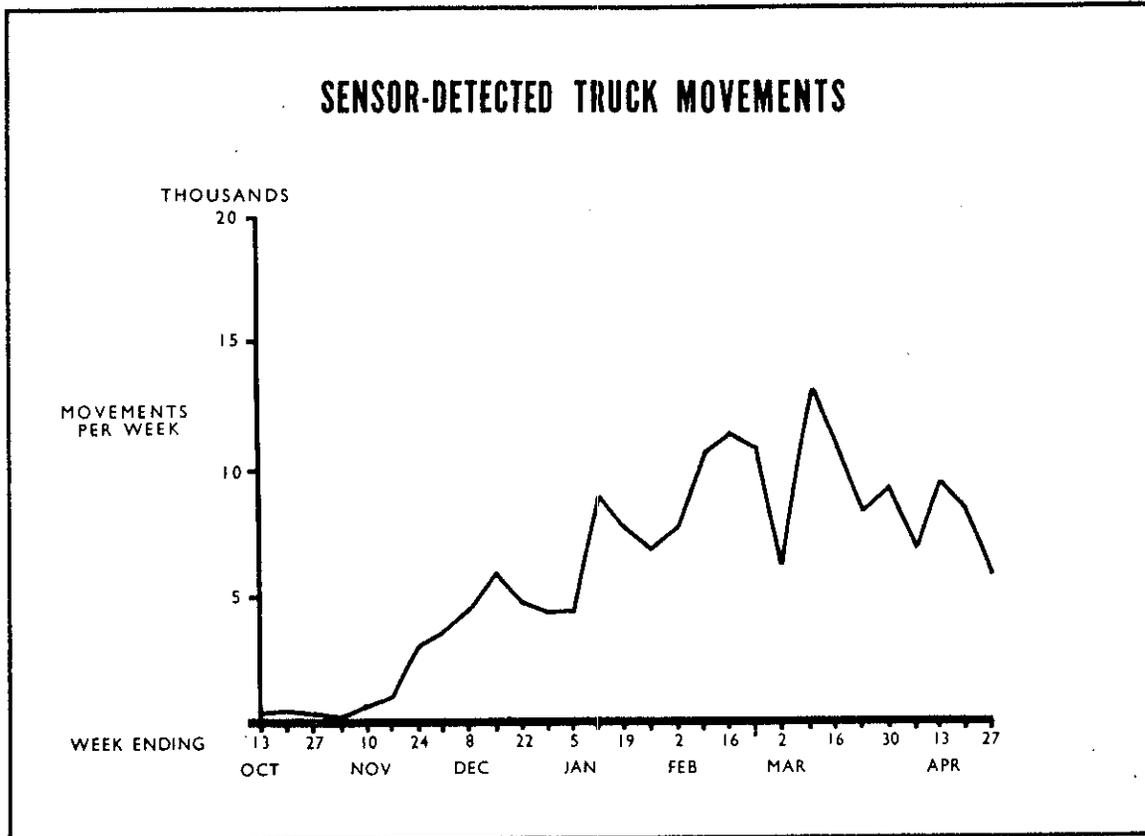


FIGURE III-2

Activity then ascended in steps to a season high in mid-March during the Lam Son 719 operation. Beyond that point activity dropped off, returning to the January level by the end of the campaign. In Commando Hunt III, truck activity had started about three weeks earlier. The delayed start in Commando Hunt V was attributed to entry interdiction, aided by heavy rains in late October.

Igloo White sensor-detected truck movements, while not precise indicators of the absolute level of truck activity and hence of the number of potential targets, were the best available measure and were adequate for planning. Figure III-3 shows the change in sensor-field strength over the course of the campaign. While changes in the size of the sensor field affected average trends in sensor detections, the field strength did not change at as great a rate as did the level of sensor-detected truck movements; hence the general increase and later

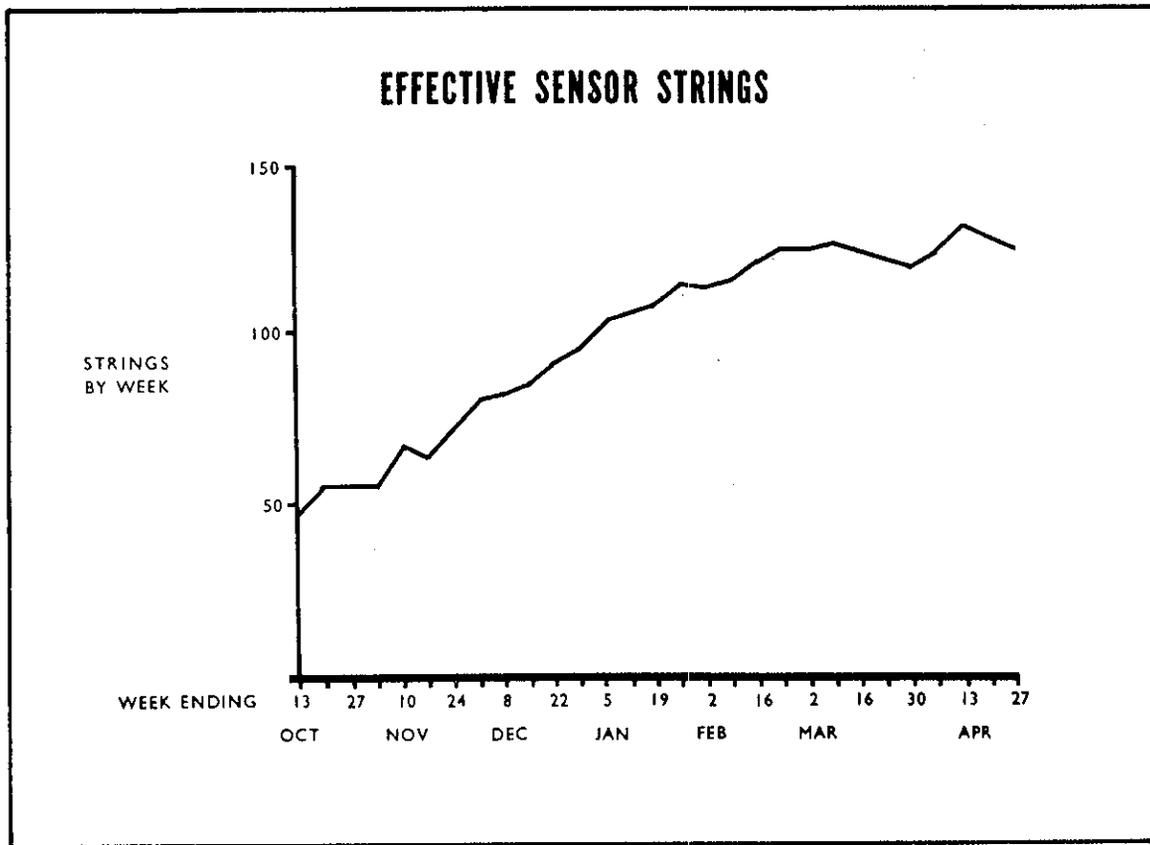


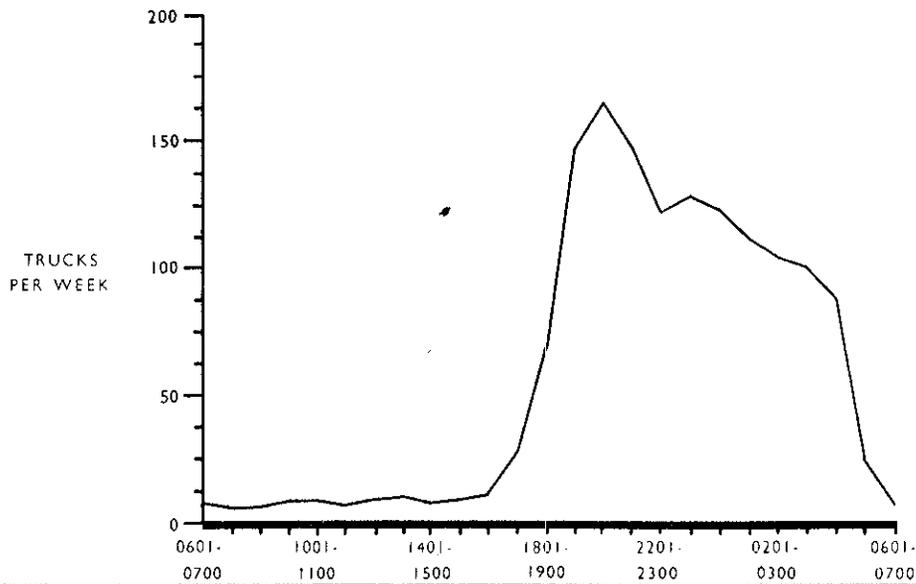
FIGURE III-3

decrease in sensor-detected truck movements reflected real changes in truck activity. Also, while sensors were not monitored during the day in general, daytime monitoring in previous dry-season campaigns had indicated that truck movement was very slight in the daytime, and selective monitoring during Commando Hunt V gave the same result. In addition, visual observations in all dry-season campaigns were always much lower in the daytime than at night, despite heavy daytime presence of FACs and strike aircraft. Figure III-4 shows the Commando Hunt V experience. At night, the trend and major perturbations in sensor-detected truck movements were correlated with those of total truck observations, as Figure III-5 shows.

The enemy's logistics system in Laos was primed for high-level activity by the end of the first surge in truck activity in December. Figure III-6 shows that at about that time the percentage of sensor-detected truck movements that were southbound fell to a constant level of about 55 percent. This same steady-state level was experienced in previous dry-season campaigns.

TRUCKS OBSERVED BY HOUR OF THE DAY

(LAOS TIME)



TRUCKS OBSERVED VS SENSOR-DETECTED TRUCK MOVEMENTS

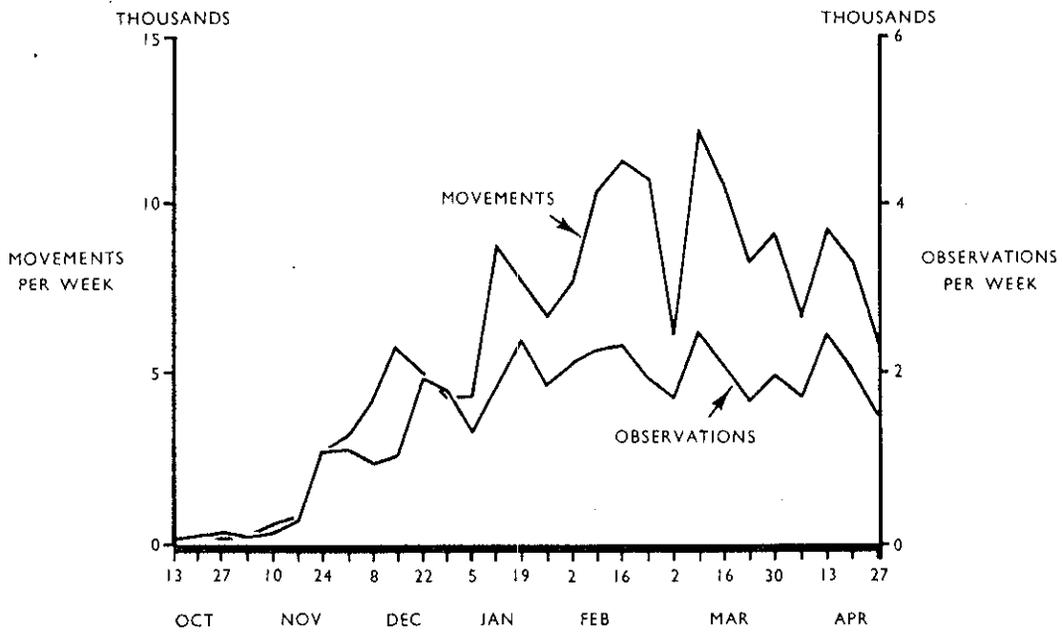


FIGURE III-4/III-5

PERCENT TRUCKS SOUTHBOUND

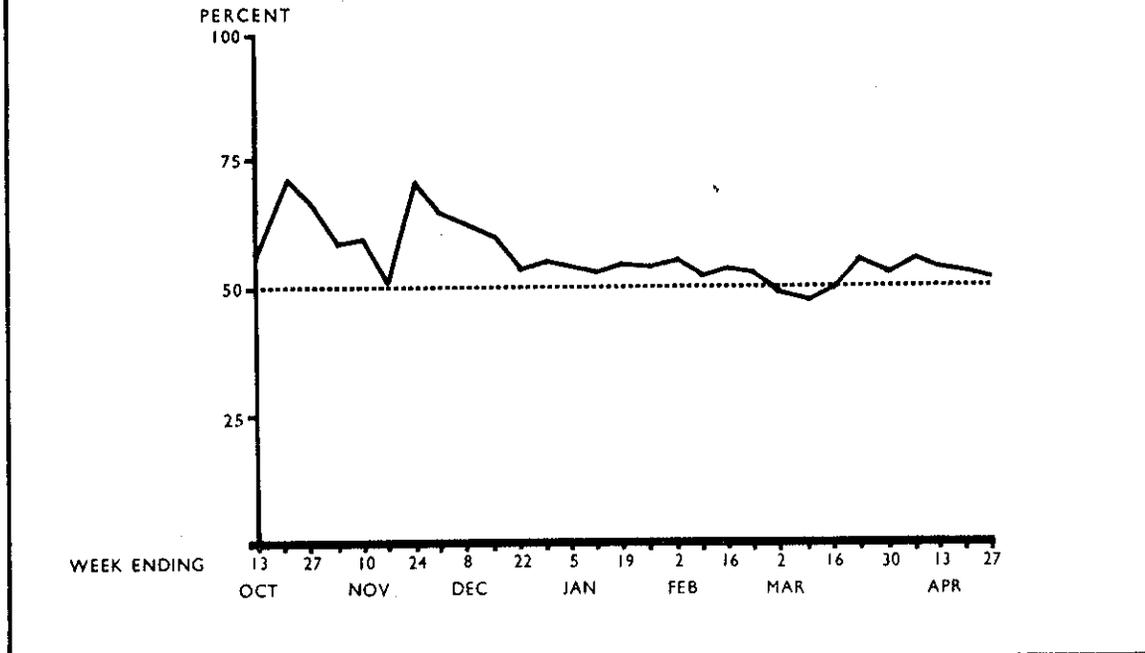


FIGURE III-6

Operational planners at 7AF viewed truck targets in a geographic and temporal context, by VR sector and hour of the night. The VR sectors delineated areas of FAC responsibility and of gunship and B-57G operations. Strike planning involved the allocation of aircraft and ordnance to VR sectors and times on station so as to maximize expected trucks destroyed or damaged. Trends and projections of sensor-detected truck movements affected this scheduling. Figure III-7 shows the variations in sensor-detected truck movements that occurred in the VR sectors over the campaign.

VR Sector 4, encompassing the Mu Gia Pass entry area, did not show high activity until late in the campaign (Figure III-7). Sector 6, which included the Ban Karai Pass, was the first to show high activity, peaking by the week of 18 through 24 November, earlier than the first system-wide peak. The activity in Sector 9, which included the Ban Raving and DMZ entry areas as well as the little-used Route 925 exit gate, followed a pattern similar to that in Sector 4. Activity in Sectors 7, 8, 10, and 11 peaked for the first time about three weeks after the first peak in Sector 6. Activity in Sectors 12, 13,

SENSOR-DETECTED TRUCK MOVEMENTS AND PERCENT SOUTHBOUND BY VR SECTOR

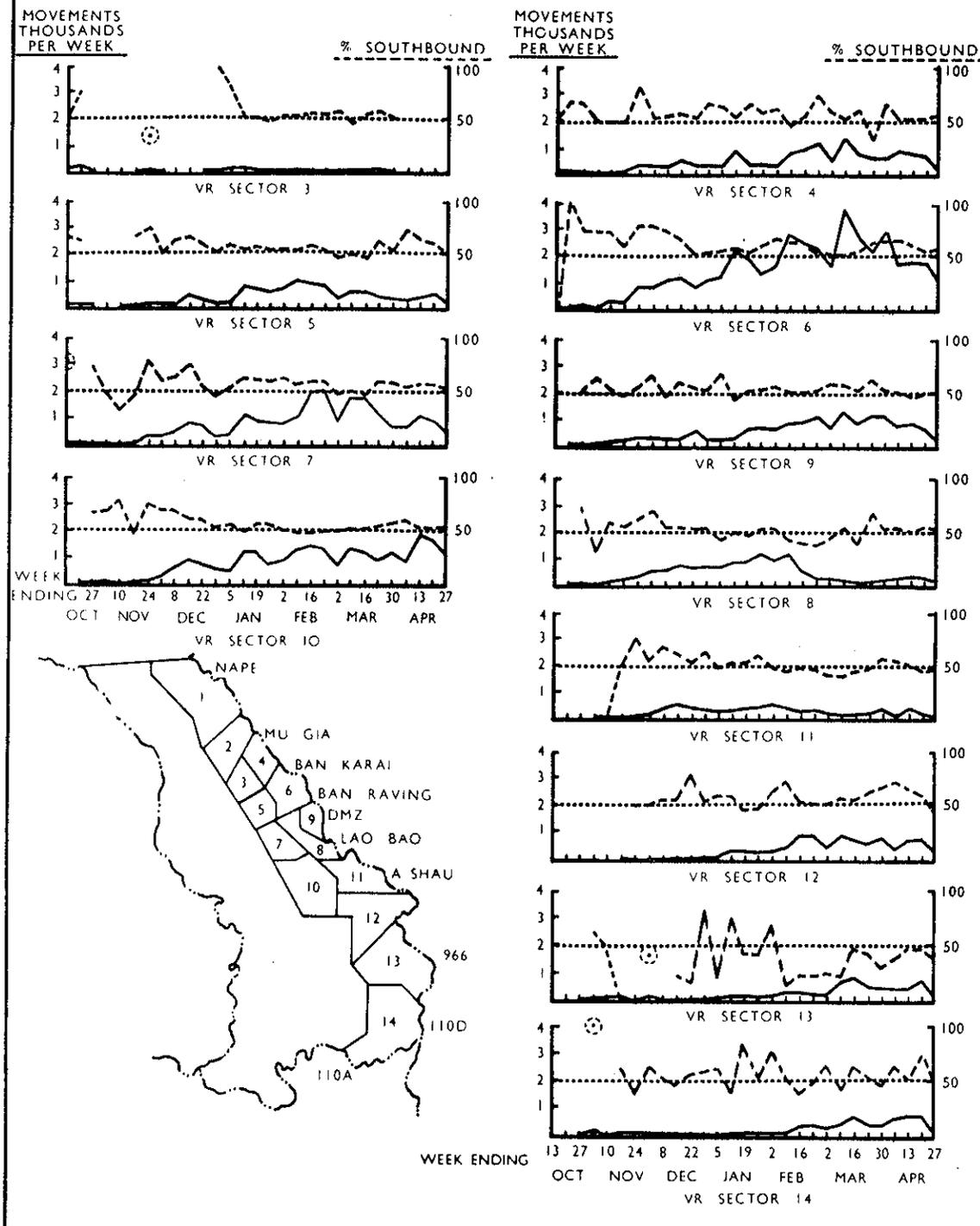


FIGURE III-7

[REDACTED]

and 14 picked up in turn but without the prominent peaking evident in the sectors to the north.

Sector 4, Mu Gia, and Sector 6, Ban Karai, showed a southbound bias that was almost always higher than the system-wide steady-state level of 55 percent. The bias in Sector 9, Ban Raving and the DMZ, seldom rose above the 55 percent level. A southbound wave moved through VR Sectors 7, 8, and 10 as activity built toward the mid-December pace. This wave then rippled south through VR Sectors 12, 13, and 14 as the season progressed.

The locale of heavy southbound bias was of interest to the operational planners because of the expectation that southbound trucks carried cargo.

Sectors 7, 8, 9, 10, and 11 contained the area of operations for Lam Son 719, the South Vietnamese incursion into Laos during February and March. Activity in Sector 8 dropped to near zero as Lam Son 719 got underway. Sector 9 picked up in activity as supplies moved to the enemy forces in the area. West of Lam Son 719 in Sector 7, activity surged to compensate for the stoppage of traffic within the Lam Son 719 area. South of Lam Son 719, in Sectors 11, 12, and 13, traffic moved northward to help supply the enemy's countermoves.

Figure III-8 shows the pattern of sensor-detected truck movements by time of night. Truck activity peaked during the 1801-2000 time period throughout the campaign. Enemy activity in all time periods rose until mid-March. From 1801 through 2400 the average percent southbound remained above 50 percent throughout the campaign. The bias became northbound for the remaining hours of the night from mid-November through December and remained northbound throughout the campaign. Schedulers considered these trends in assigning times on station for the truck-killing systems.

The correlation of truck activity with moon illumination in previous dry-season campaigns was also evident in Commando Hunt V (Figure III-9). The pattern changed somewhat during the Lam Son 719 operation in that the truck activity peaked before the full moon.

Level of Effort Against Trucks

The number of sorties striking trucks rose beginning with the week of 28 October through 3 November (Figure III-10). The first major surge in sorties striking trucks started in mid-December, corresponding to the first peak in enemy truck activity. The upward trend reversed after the week of 20 through 26 January as fighter-attack sorties striking trucks declined after the AC-130 force reached full strength.

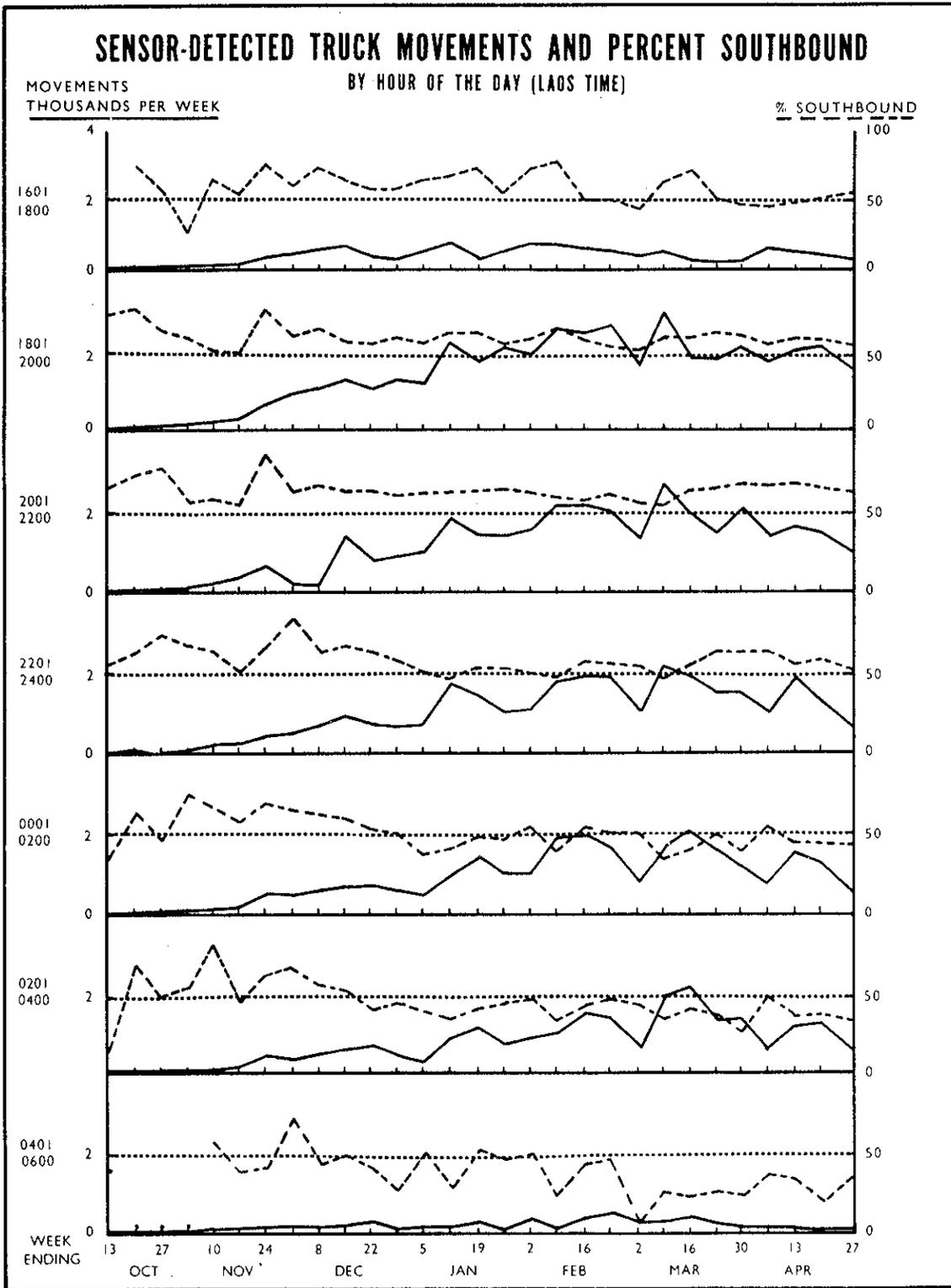
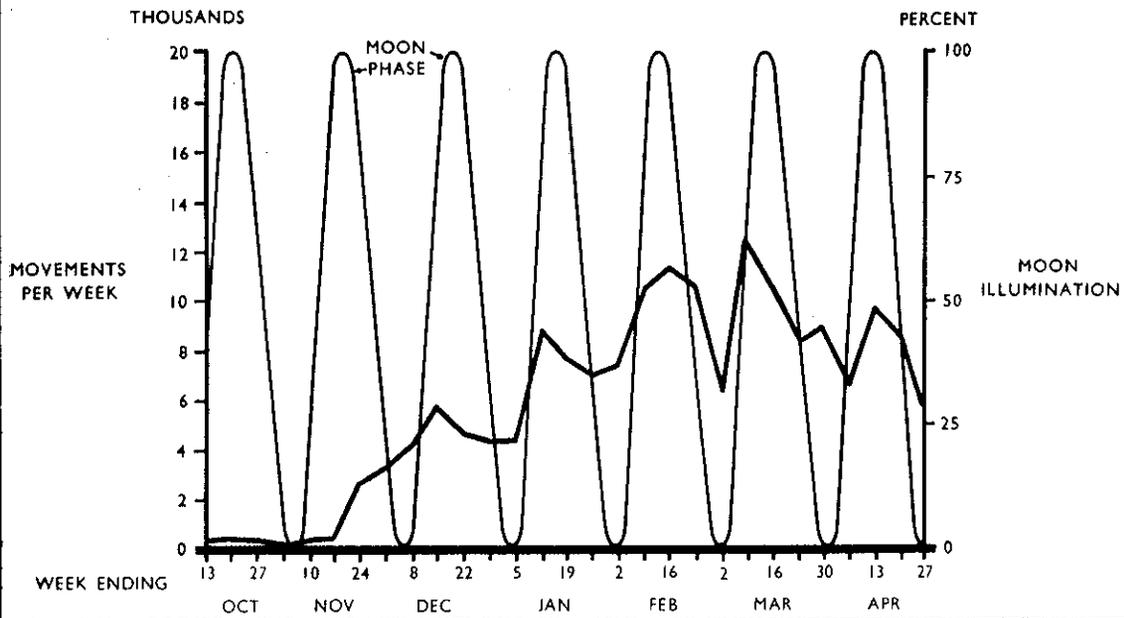


FIGURE III-8

MOON ILLUMINATION VS SENSOR-DETECTED TRUCK MOVEMENTS



TOTAL SORTIES AND SORTIES STRIKING TRUCKS

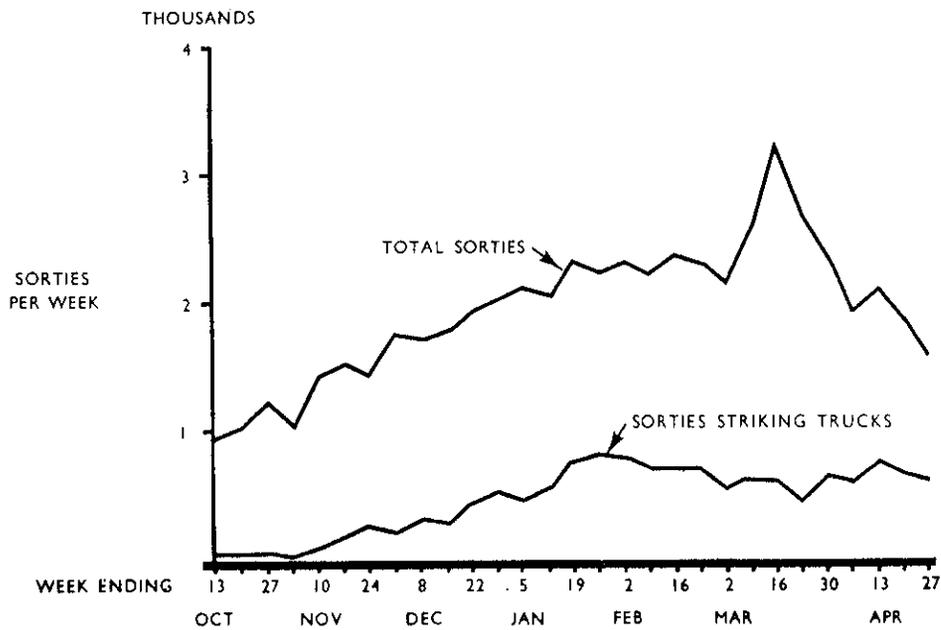


FIGURE III-9/III-10

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Sorties of the specialized truck-killing systems depict the effort against trucks best. Figure III-11 shows the AC-130 buildup

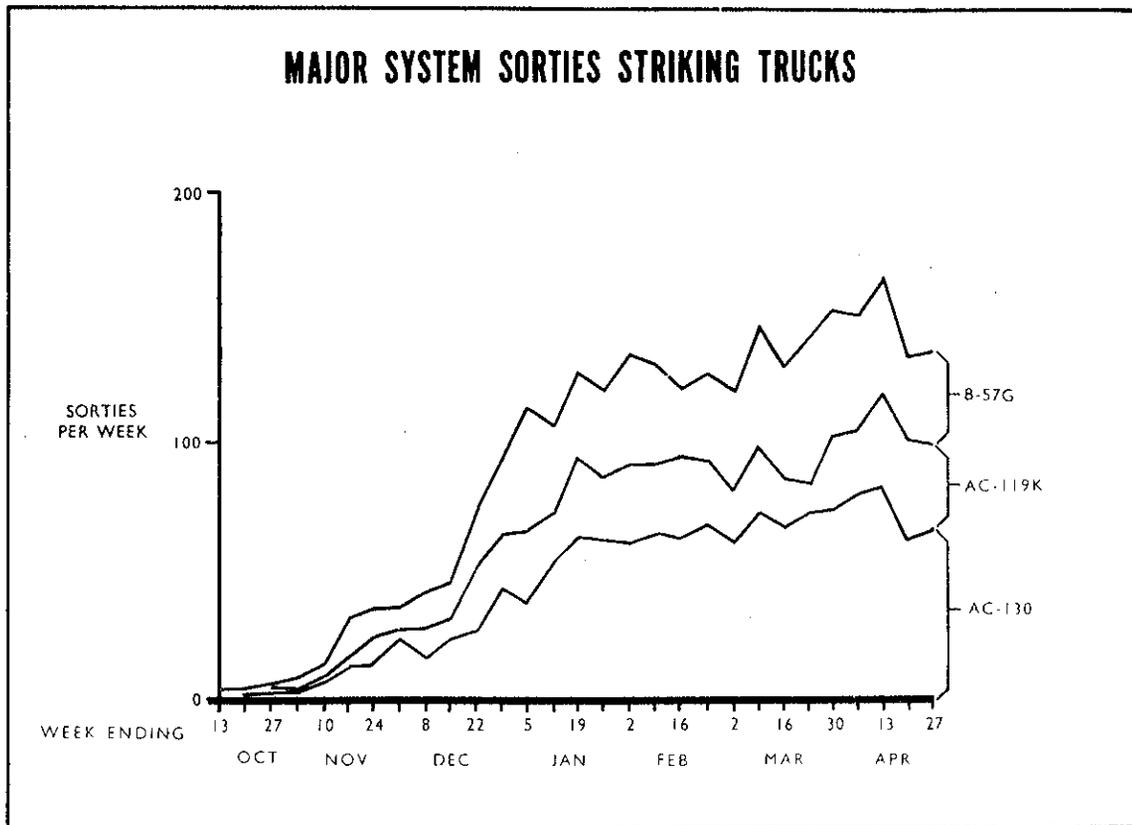


FIGURE III-11

and the general increase in specialized-system effort that reacted with increased truck activity to produce high damage rates. Sorties striking trucks peaked for the AC-130s on the week ending 13 April, the first moon-phase and truck-activity peak to occur after the introduction of two Pave Pronto aircraft in late March (Figure III-8).

FORCE EFFECTIVENESS

Commando Hunt V trends in trucks observed, trucks struck, and trucks destroyed or damaged in Steel Tiger are shown in Figure III-12. The trend in trucks observed followed the trend of sensor-detected truck movements. The trend in trucks struck and destroyed or damaged peaked later, during the week ending 13 April.

Figure III-13 shows that between 46 and 75 percent of the trucks

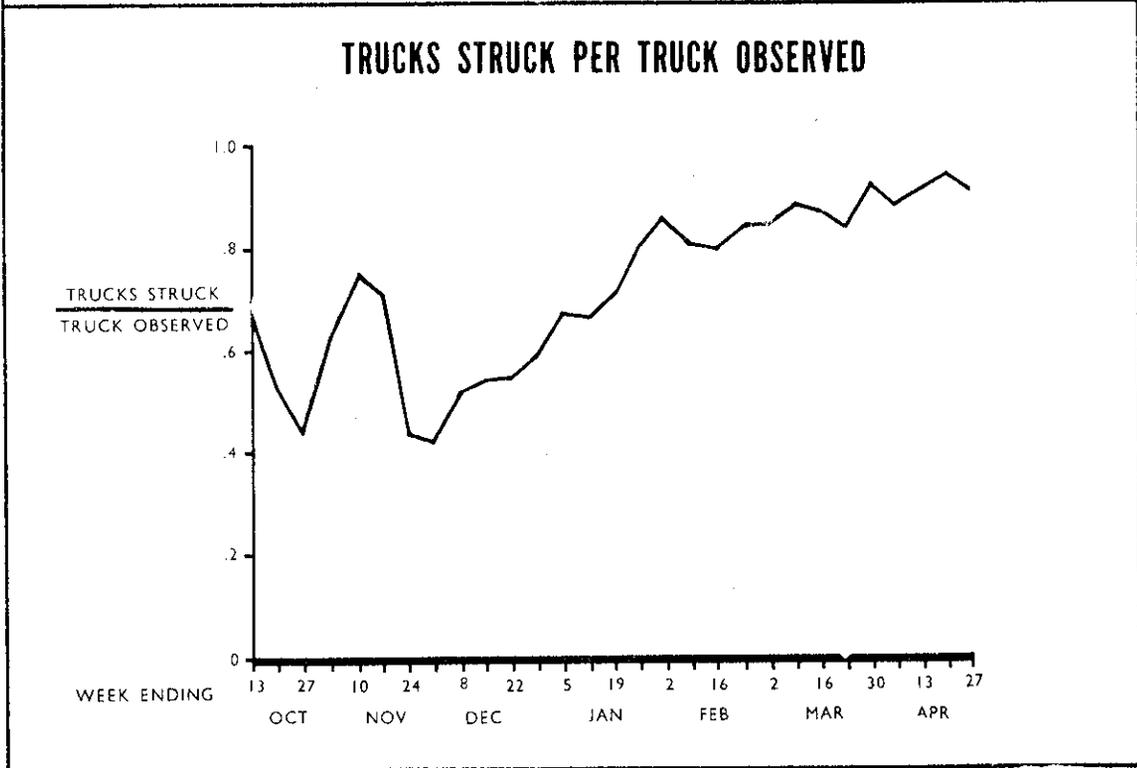
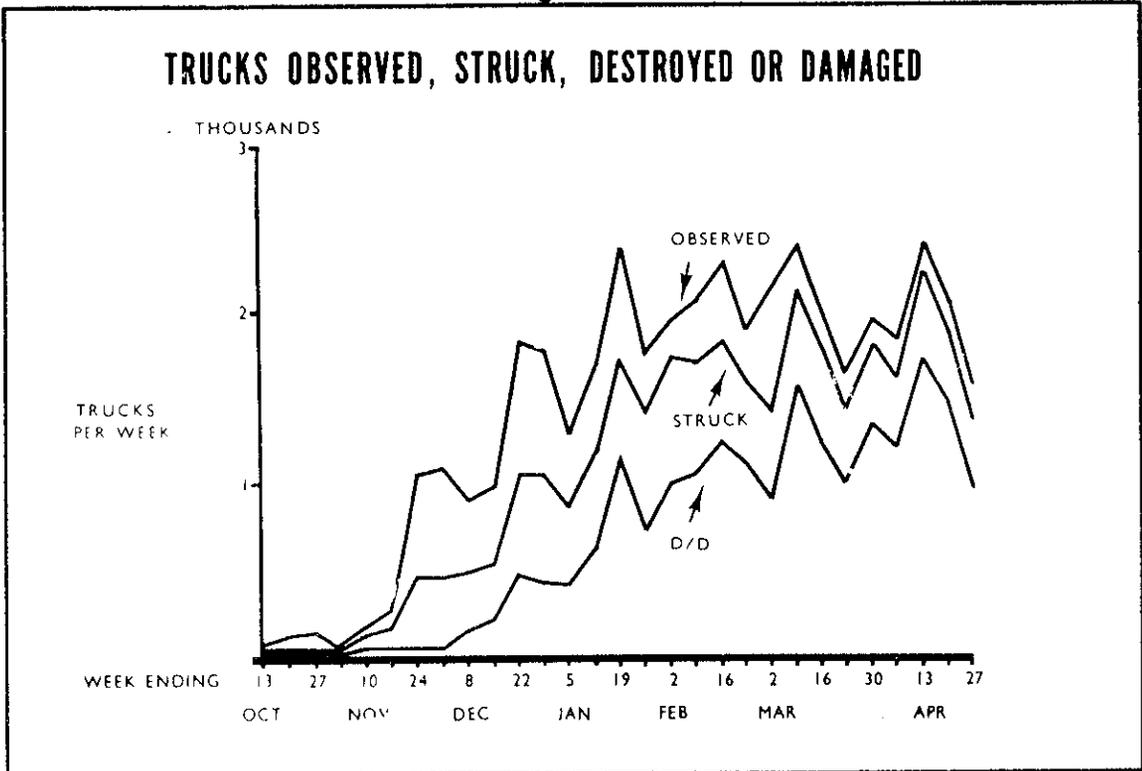


FIGURE III-12/III-13

that were observed during the first six weeks of the campaign were struck, when the level of truck observations was low. When the first large increase in truck observations occurred, the percentage of observed trucks that were struck dropped to 43, and did not rise above 60 for the next six weeks. During this period, entry interdiction was using many fighter and attack sorties, and the gunship and B-57G forces were not up to full strength, accounting, along with bad weather, for most of the trucks that were not struck (Figure III-14). As emphasis on entry interdiction declined and as the number

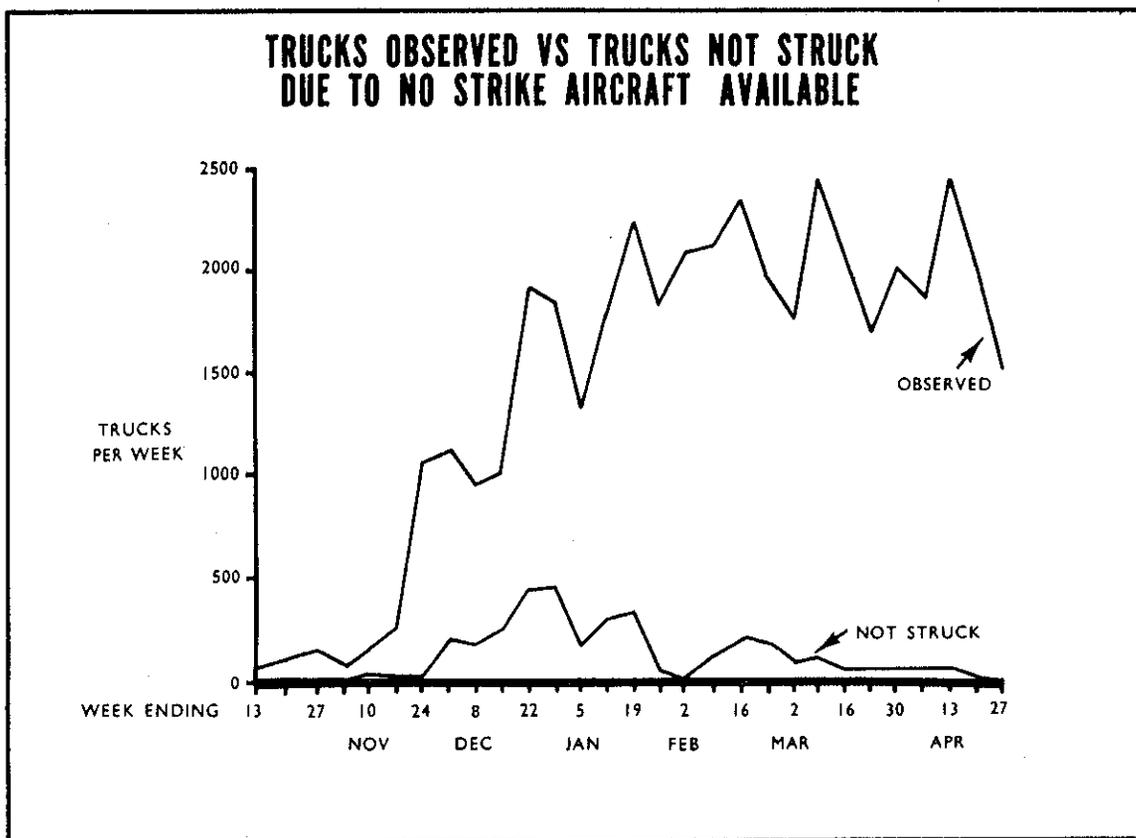


FIGURE III-14

of gunships and B-57Gs built up, the number of trucks not struck because no strike aircraft were available declined, and the percentage of trucks observed that were struck rose to 93 by the week of 14 through 20 April.

Figure III-15 shows that of the trucks that were struck, the percent destroyed or damaged, low in any case during the first 6 weeks of the campaign, dropped to an average of 14 percent during the two week

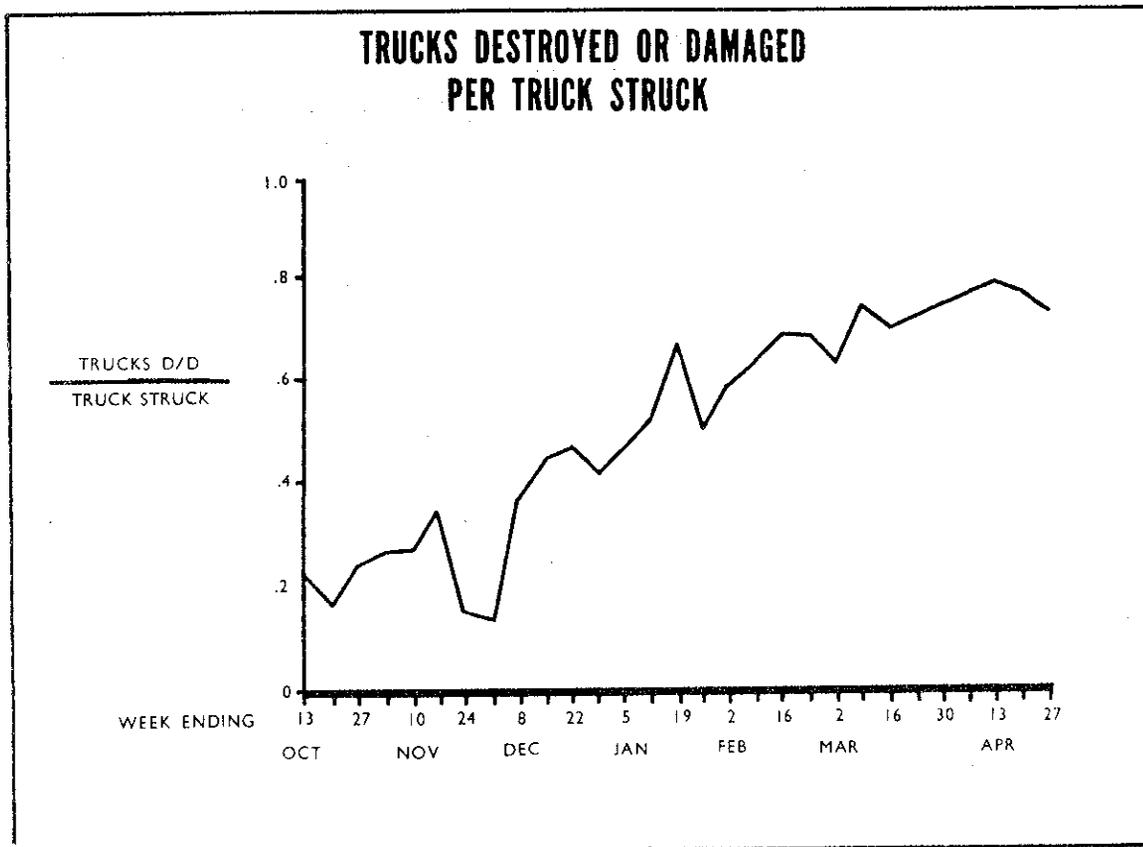


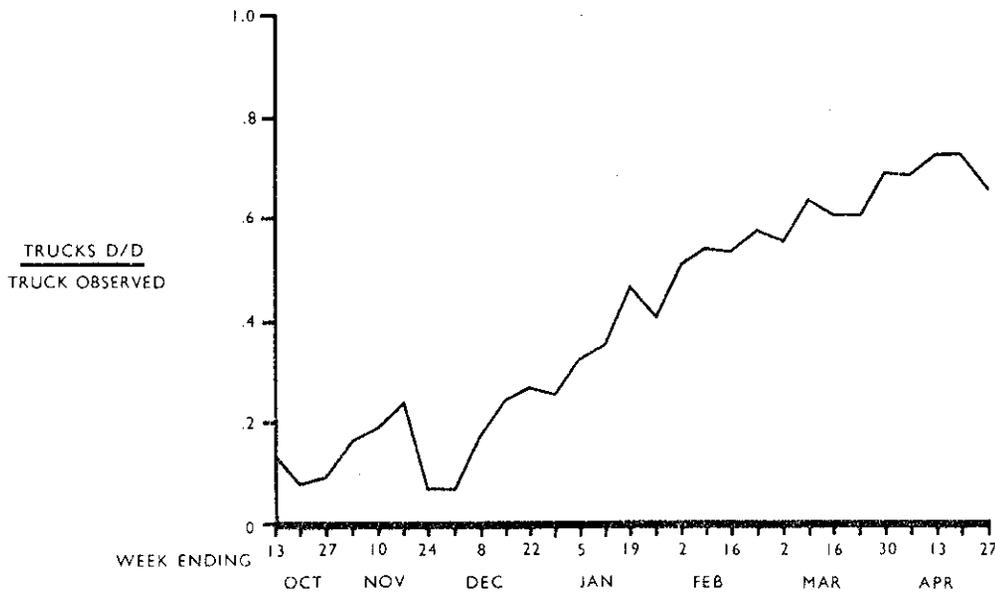
FIGURE III-15

period from 18 November through 1 December. During this period, technical problems hindered the performance of the AC-130s, which were striking numerous trucks. These problems were solved, and force performance rose as AC-130, AC-119K, and B-57G crews grew more proficient. As a result, the percentage of trucks struck that were destroyed or damaged rose to 36 in the week 2 through 8 December and eventually to 79 by the week 7 through 13 April.

Figure III-16 shows that the percentage of observed trucks that were destroyed or damaged, the product of the factors just discussed and a useful measure of force performance, rose from a low of 6 during the two-week period 18 November through 1 December to a high of 72 by the week of 7 through 13 April.

The trend in trucks destroyed or damaged by the major truck-killing systems paralleled the total destroyed or damaged trend, as Figure III-17 shows. The major difference was a slower start and then a more rapid increase in trucks destroyed or damaged as the major

**TRUCKS DESTROYED OR DAMAGED
PER TRUCK OBSERVED**



**TRUCKS DESTROYED OR DAMAGED
BY MAJOR SYSTEMS**

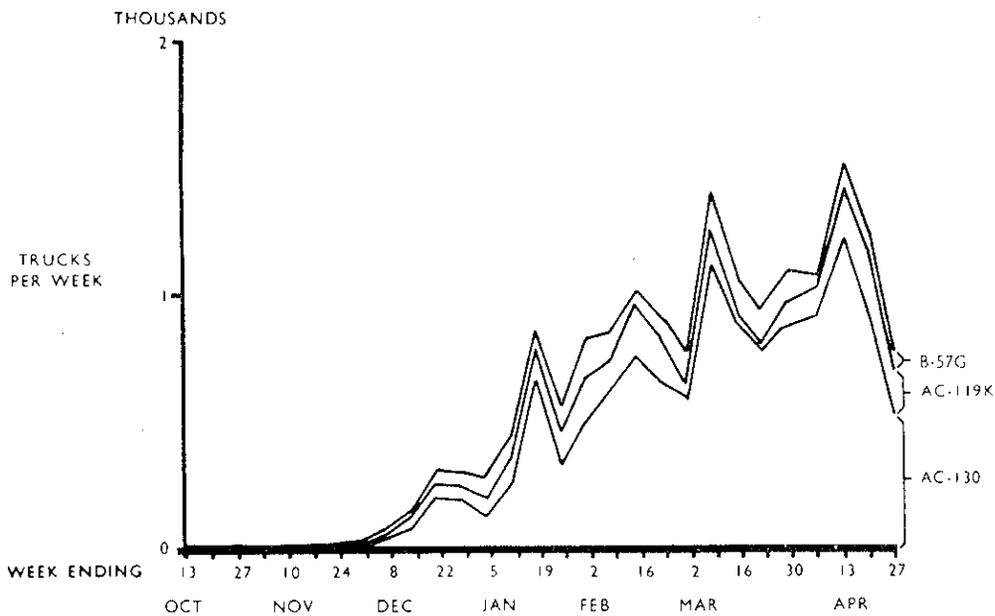


FIGURE III-16/III-17

systems gained full strength and effectiveness. Table III-1 sum-

FORCE PERFORMANCE AGAINST TRUCKS								
	10-31							
	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
TOTAL SORTIES FLOWN	3255	6503	8328	9744	9148	11872	8072	56922
SORTIES STRIKING TRUCKS	162	715	1755	2970	2898	2726	2928	14154
% SORTIES STRIKING TRUCKS	5	11	21	30	32	23	36	25
TRUCKS STRUCK	154	1229	3413	6133	6749	7765	7471	32910
TRUCKS D OR D	31	230	1469	3475	4383	5639	5699	20926
D OR D/SORTIE STRK TRKS	.19	.32	.84	1.17	1.50	2.07	1.95	1.48
D OR D/TRUCK STRUCK	.20	.19	.43	.57	.65	.73	.76	.64

TABLE III-1

marizes overall force performance against trucks. These data include sorties reporting results not observable (RNO).

Difficulty of Measuring Total Loss to Enemy

Initial Assessment. Not all 20,926 trucks reported as destroyed or damaged were as well-documented as the destroyed truck near Ban Bak in Figure III-18. The capability to assess strike results by aircraft on the scene depended on a variety of factors. FACs were in a better position to observe strike results than jet strike aircraft crews flying higher and faster. Weather, darkness, smoke, and foliage also

~~SECRET~~

DESTROYED TRUCK NEAR BAN BAK



FIGURE III-18

affected visibility. The gunship crews were assisted by electronic observation devices, but not all gunships were equipped with the same range of capabilities. Observation was also affected in many cases by the need to evade AAA firing. During Commando Hunt V, results were not observable on 23 percent of the strikes against trucks.

The criteria for assessing strike results depended on the weapon system and observation techniques involved. These criteria had to be uncomplicated and compatible with the degree of observable detail. The criteria used for a destroyed truck for aircraft attacking with bombs, which included B-57G as well as fighter-attack aircraft, were that the truck be:

1. no longer visible after a direct bomb hit,
2. observed to be burning with flames visible,

- ~~XXXXXXXXXX~~
3. observed to be a mass of twisted metal after a strike, or
 4. rendered unusable and irreparable after a strike.

For a damaged truck, the criteria were that the truck:

1. have parts missing, such as hood, fenders, wheels, or portions of the undercarriage,
2. be stopped and obviously unable to continue after the strike, or
3. be overturned with no fire or explosion.

There were two sets of criteria for the gunships because of differences in armament. The AC-130s were armed with both 40 mm and 20 mm guns, and their rules for assessing strike results were that, for a destroyed truck, the truck had been observed by gunship sensors to have:

1. received a direct impact of a 40 mm projectile, or
2. exploded or burned after projectile impact.

For a damaged truck, the criteria was that the truck was observed by gunship sensors to have:

1. been missed, one mil low, by a 40 mm projectile, with no fire or explosion, or
2. stopped and not moved again after a 20 mm projectile impact with no fire or explosion.

The AC-119Ks were armed with 20 mm and miniguns, and their criteria for assessing strike results were that, for a destroyed truck, the truck had been observed to have exploded or burned after projectile impact.

For a damaged truck, the truck had to have been observed to have stopped and not moved again after a projectile impact with no fire or explosion.

Experience gained during the campaign suggested that the effect of a single direct hit or near miss by a 40 mm projectile was not as great as originally believed. However, for consistency in evaluating force employment, the criteria for AC-130s were not changed during Commando Hunt V. On 1 May, a test of changed AC-130 criteria began. These criteria categorized a truck as damaged by the direct impact of a 40 mm projectile if no fire or explosion ensued and dropped the one-mil-low criterion. Table III-2 shows a comparison of Commando

**EFFECT OF APPLYING CHANGED CRITERIA TO AC-130 STRIKE RESULTS
IN STEEL TIGER**

	COMMANDO HUNT V			CHANGED CRITERIA		
	<u>AC-130</u>	<u>OTHER</u>	<u>TOTAL</u>	<u>AC-130</u>	<u>OTHER</u>	<u>TOTAL</u>
DESTROYED	10112	6114	16226	4895	6114	11009
DAMAGED	2629	2071	4700	6137	2071	8208
TOTAL	12741	8185	20926	11032	8185	19217

TABLE III-2

Hunt V observed strike results with an estimation of revised results based on these changed criteria for AC-130s. This estimate only indicates the effect of applying after-the-fact criteria to existing data. It does not indicate what Commando Hunt V results would have been had the changed criteria been used throughout the campaign. The effects of changes in tactics that would have been induced were not assessable.

The estimate was made by:

1. subtracting the number of damaged trucks associated with one-mil-low impacts of 40 mm projectiles, and
2. changing from destroyed to damaged the description of those trucks which sustained direct hits by 40 mm projectiles without associated explosions or fires.

Some 1709, about 65 percent, of the reported damaged trucks were attributed to one-mil-low impacts. The number of destroyed trucks which had secondary explosions or fires was estimated by assuming that the frequency of secondaries associated with single truck kills was representative of overall strike results.

Duplicate Strikes and Derelicts. The strike results reported by aircrews reflected some duplicate attacks against the same target. Every effort was made to eliminate such counts from the data base.

~~XXXXXXXXXX~~

There were also some strikes that correlated with positions of known derelicts. The accuracy of reported strike location often did not allow conclusive confirmation of a derelict strike, however. When appropriate, these results were discounted, but there was no way to estimate the number of actual derelict strikes which remained in the data base. Data for the campaign showed that 66 percent of trucks reported destroyed by aircraft other than gunships were moving when initially attacked and therefore could not have been derelicts. The AC-130s struck moving targets 72 percent of the time. In addition, 60 percent of initial detections made by the AC-130s were by the Black Crow ignition detector. In the event that a truck was stopped and its engine turned off, the heat pattern from the engine, drive shaft, and exhaust pipe of the recently operated truck contrasted with the cold cargo bed to give a distinctive signature on the infrared sensor carried by all AC-130s and AC-119Ks. This signature distinguished operable trucks from derelicts and decoys. A regression analysis of campaign data showed that the trend of trucks reported as destroyed or damaged had a strong positive correlation with the trend of sensor-detected truck movements at greater than the 99.9 percent confidence level.

Photographic Confirmation. A number of factors limited the usefulness of photography for confirming strike results. In many cases the strike crews were not sure of the exact location of their strikes. The gunships, due to the nature of their orbiting attack pattern, had difficulty determining the target location relative to aircraft location. Also, the gunships did not report the position of each truck in a strike against multiple trucks. Photo reconnaissance generally covered strips along selected route segments and not the entire area of a reported strike. The extent to which truck kills were photo-confirmed was a function of the frequency of reconnaissance coverage as well as of the amount of foliage along the road. Also, time lags between the strike and photography allowed the enemy to remove or camouflage damaged trucks. These factors combined to make correlation between photography and specific strikes difficult at best. Photographic confirmation did not provide a statistical base which was strong enough to draw any inferences about the total number of destroyed or damaged trucks.

Significance of Strike Results

Attempts to quantify the impact of truck losses upon the enemy were hampered by a lack of definitive information on the enemy's capability and intent. As truck losses mounted in February and March, there was no discernible effect on the detected level of truck activity. However, some indicators suggested that there had been more slack in the enemy logistics system at the start of Commando Hunt V than was generally assumed. For example, analysis of sensor-detected truck movements showed that the average truck speed increased; a sample of strings that showed consistent high activity throughout the campaign

indicated that the increase might have been as much as from 8 kph to 20 kph (Figure III-19). This increase alone could have more than

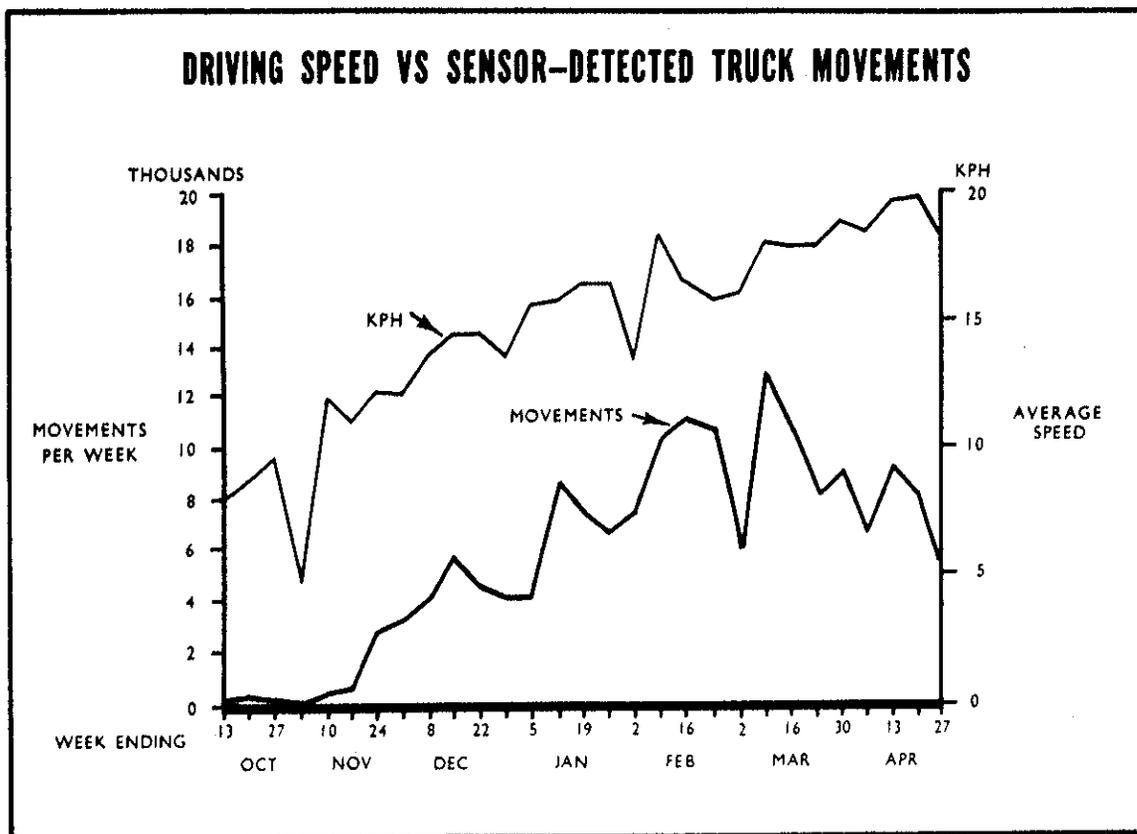


FIGURE III-19

doubled the productivity (measured in ton-kilometers per day) of the truck fleet, or conversely, maintained the same productivity with about half as many trucks.

The primary measure of effectiveness for the interdiction campaign was the amount of supplies which exited Steel Tiger into Cambodia and the RVN. The number of trucks destroyed or damaged was a measure of the accomplishment of the secondary objective, that of increasing the enemy's cost of moving supplies. Its most constructive use was in determining the relative effectiveness of weapon systems in the dynamic allocation of air resources during the campaign. For this purpose, the combined figure of destroyed or damaged trucks, reported on the basis of consistent criteria, was an adequate index.



Aircraft Effectiveness

Performance data for individual aircraft systems are shown in Table III-3. The AC-130s, the AC-119Ks, and the B-57Gs were the only systems flying in Steel Tiger that struck trucks on more than one-half of their sorties. The AC-119Ks struck trucks the least of these systems; they were often diverted to support troops in contact during Commando Hunt V. Among the special systems, the AC-130s did better in terms of trucks destroyed or damaged than the AC-119ks, which in turn did better than the B-57Gs.

Of the fighter-attack aircraft, the A-6 performed the best in terms of trucks destroyed or damaged per sortie. While F-4s struck trucks with only 25 percent of their sorties, they totalled more sorties striking trucks than any other aircraft. As a consequence F-4s destroyed or damaged the second highest number of trucks of any aircraft type. Over the campaign the average trend of trucks destroyed or damaged per sortie rose in almost a straight line from an average level .1 to more than 2.0 (Figure III-20). Of the specialized systems, the AC-130 per-sortie performance rose the fastest. It dropped somewhat with the reduction in truck activity at the end of the campaign. The AC-119K performance had a temporary dip during the Lam Son 719 period. AC-119K weapons may have lost accurate boresight when supporting troops in contact. In addition, some AC-119K strikes against trucks were broken off to support troops. The B-57G performance was limited by its ordnance load and one-hour time on station. The jet fighters appeared to have been performing at their system limit from the first.

The three major systems followed about the same trend of trucks destroyed or damaged per hour on station through mid-January (Figure III-21). At that point, the three systems diverged, with the AC-130s moving ahead of and the AC-119Ks dropping below the performance of the B-57G for a time.

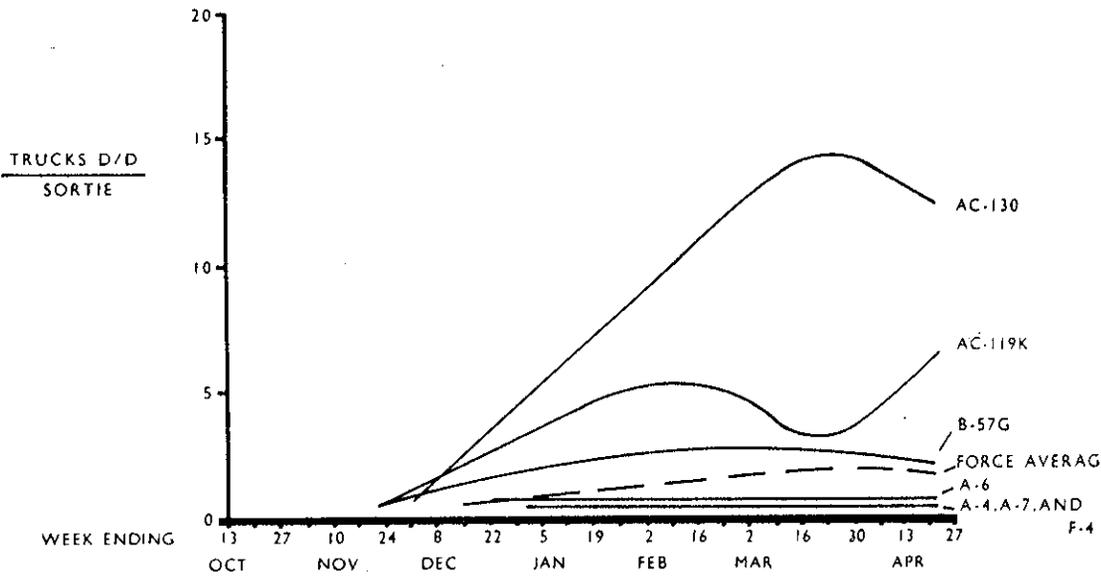
Average force performance in terms of trucks destroyed or damaged per truck struck increased over the season (Figure III-22). Rising trends were the rule for the individual aircraft system also. The temporary dip in the AC-119K curve was during Lam Son 719. Jet fighters not only produced a significant proportion of the total trucks destroyed or damaged in Commando Hunt V but also maintained presence over the route structure in the daytime, deterring movement and striking trucks when they moved. Table III-4 shows that the number of day fighter sorties outnumbered those flown at night, but that day sorties striking trucks were outnumbered by those striking at night. As the gunships took over the night role, night fighter strikes on trucks decreased beginning the week of 27 January through 2 February with a major dip during the Lam Son 719 period. Daytime sorties

AIRCRAFT PERFORMANCE AGAINST TRUCKS

<u>FIGHTERS</u>	<u>A-1</u>	<u>A-4</u>	<u>A-6</u>	<u>A-7</u>	<u>F-4</u>	<u>F-100</u>
TOTAL SORTIES FLOWN	674	7551	3590	9581	27305	4635
SORTIES STRIKING TRUCKS	24	1389	1052	2070	6708	200
% STRIKING TRUCKS	4	18	29	22	25	4
TRUCKS STRUCK	22	1413	1739	2476	9317	293
TRUCKS D OR D	7	396	518	703	2136	87
D OR D/SORTIE STRK TRKS	.29	.29	.49	.34	.32	.44
D OR D/TRK STRUCK	.32	.28	.30	.28	.23	.30
<u>SPECIAL SYSTEMS</u>		<u>B-57G</u>		<u>AC-119K</u>		<u>AC-130</u>
TOTAL SORTIES FLOWN		1202		929		1437
SORTIES STRIKING TRUCKS		840		558		1311
% STRIKING TRUCKS		70		60		91
TRUCKS STRUCK		2824		3128		14992
TRUCKS D OR D		1931		2400		12741
D OR D SORTIE STRK TRKS		2.30		4.30		9.72
D OR D HOUR ON STATION		2.30		2.15		3.24
D OR D TRK STRUCK		.68		.77		.85

TABLE III-3

TRUCKS DESTROYED OR DAMAGED PER SORTIE BY AIRCRAFT TYPE



TRUCKS DESTROYED OR DAMAGED PER HOUR ON STATION BY AIRCRAFT TYPE

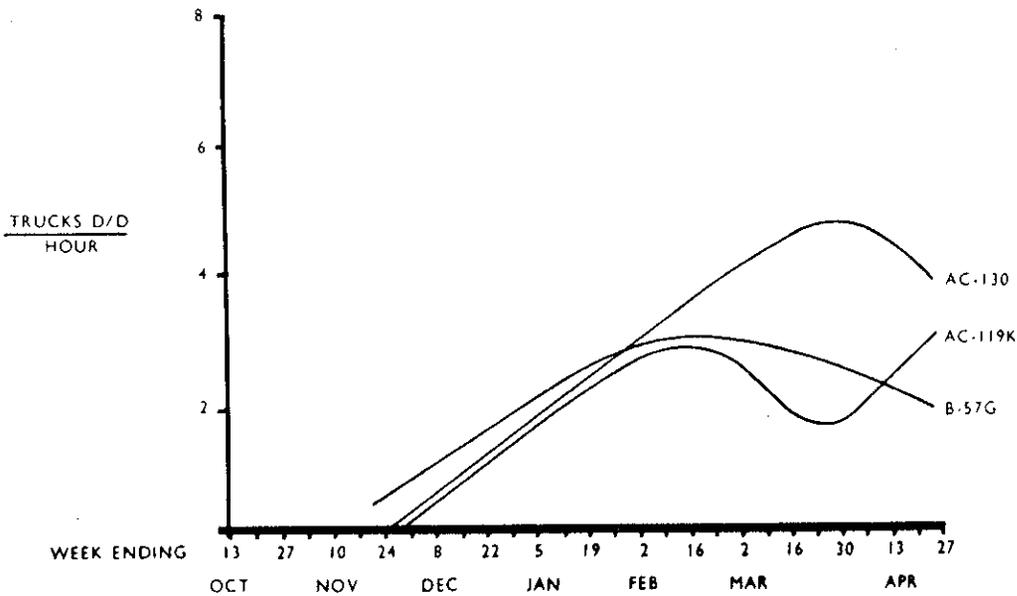
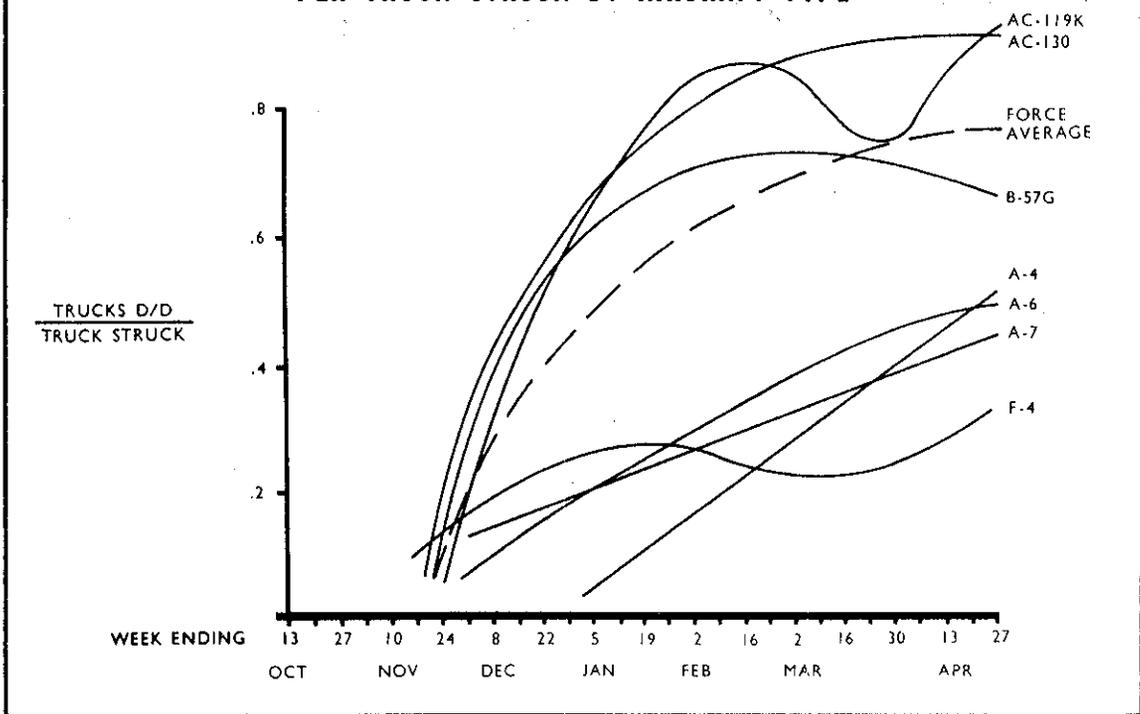


FIGURE III-20/III-21

TRUCKS DESTROYED OR DAMAGED PER TRUCK STRUCK BY AIRCRAFT TYPE



PERFORMANCE OF FIGHTER AIRCRAFT

	<u>DAY</u>	<u>NIGHT</u>
TOTAL SORTIES FLOWN	33450	19886
SORTIES STRIKING TRUCKS	3823	7260
PERCENT STRIKING TRUCKS	11	38
TRUCKS STRUCK	2699	9407
TRUCKS D OR D	1321	2533
D OR D/SORTIE STRIKING TRUCKS	.35	.39
D OR D/TRUCK STRUCK	.49	.27

FIGURE III-22/TABLE III-4

striking trucks continued to increase (Figure III-23).

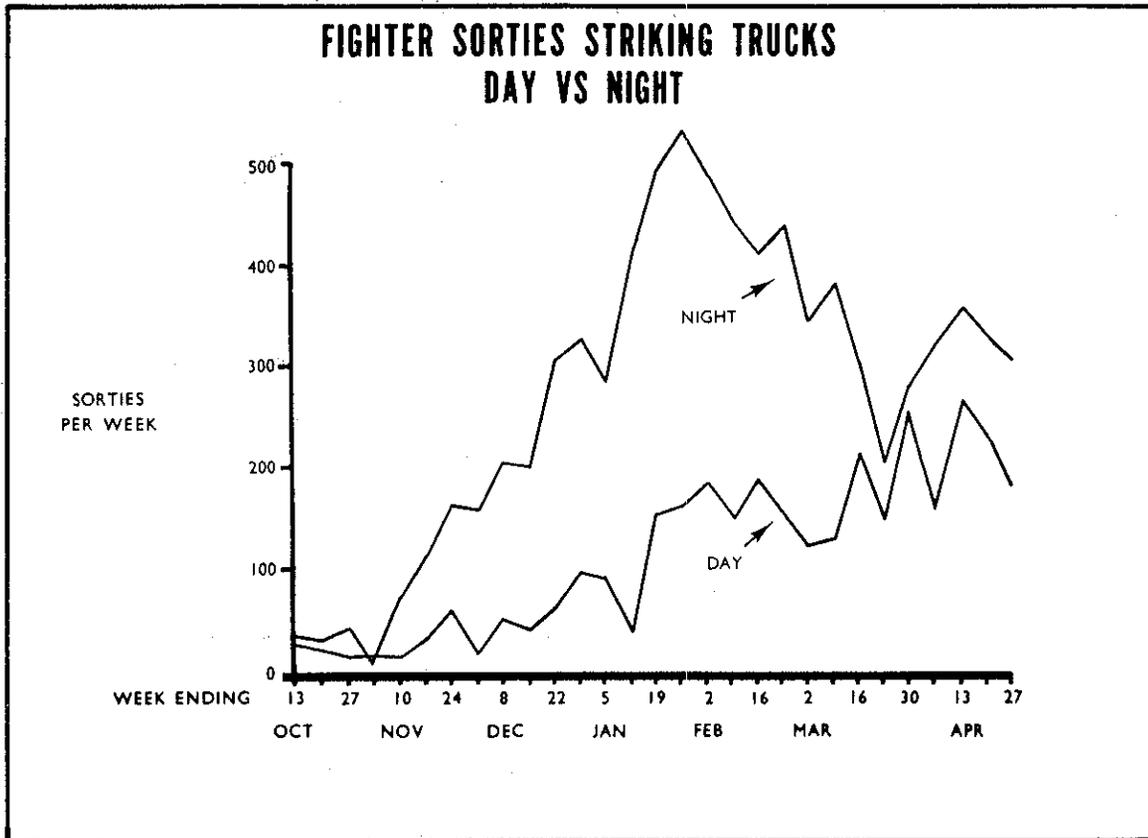


FIGURE III-23

EVALUATION

Despite the significant increase in the enemy's average driving speed over the campaign, sensor-detected truck movements began to drop off beginning in mid-March (Figure III-19). It appears that the number of trucks available to run per night may have dropped at the end of the campaign. If so, this must have been in large part the result of the interdiction effort. In all, twice as many trucks were reported as damaged or destroyed in Commando Hunt V as in Commando Hunt III.

Thus the effort to develop and deploy effective truck-killing systems, based on the experience of previous dry-season campaigns, paid off in Commando Hunt V. The AC-130s performed by far the best of the three major systems, according to any measure. They accounted for 61 percent of the total trucks reported as destroyed or damaged. The B-57Gs performed as well as the AC-119Ks when average time on

[REDACTED]

station was factored out. All three systems contributed greatly to the fact that the enemy's logistics operations in Laos were more costly to him than in any previous dry-season campaign. In addition, through degradation of the enemy's logistics system, the truck-killers were a considerable factor in the low throughput experienced during Commando Hunt V.

CHAPTER IV

LAM SON 719

Air interdiction in Steel Tiger was supplemented during Commando Hunt V by ground interdiction supported by air resources. Lam Son 719, the South Vietnamese incursion into Laos during February and March, was the most significant of these ground operations. A three-division South Vietnamese force was to interdict the major north-south route structure in the Tchepone area and destroy as many enemy supplies as possible.

FORCES

US

US airpower made feasible the RVN Armed Forces (RVNAF) operation in an area of heavy enemy force concentration. Tactical and strategic air strike forces and tactical airlift played key roles in Lam Son 719. Strike-force emphasis shifted from interdiction to support of ground forces. Tactical airlift deployed forces, resupplied rear support elements, and delivered 15,000-lb. Commando Vault bombs for helicopter landing zone construction.

The US Army XXIV Corps, though not operating on the ground in Laos, provided supporting fires and helicopter support to the RVNAF.

RVNAF

The RVN I Corps main forces in Lam Son 719 were the 1st Armored Brigade, the 1st Airborne Division, the 1st Infantry Division, the 1st Ranger Group, and the Marine Division. The maximum number of RVNAF troops in Laos at any one time was about 17,000.

The Vietnamese Air Force (VNAF) participated in helicopter support operations, and flew A-37 strike sorties in support of ground forces during March.

NVA

In the early weeks of the operation, the NVA force numbered around 15,000 and included elements of four infantry divisions. Additional rear-service forces with an estimated 12,000 troops including antiaircraft, transportation, and engineer elements were in the area.

During the first two weeks in March, five additional infantry

[REDACTED]

regiments were committed in the Lam Son 719 area of operation (AO). The estimated reinforced enemy strength in Laos was 35,000 troops.

PLANNING

The Lam Son 719 operation was to proceed in four phases:

1. reopen supply routes and fire support bases in South Vietnam to ensure support for the operation in Laos;
2. move RVNAF units along Route 9 to seize Tchepone; block north-south routes crossing Route 9, and seize or destroy supplies;
3. secure rear lines and move southwest through base areas to destroy supplies and block Route 914; and
4. withdraw from Laos prior to the onset of the wet season, leaving harassing forces behind.

Tactical Air

Since Lam Son 719 was to be a major joint operation separate from routine operations in Military Region 1 (MR 1), the established MR 1 portion of the tactical air control system was not disturbed. The RVNAF AO in Laos was in essence a new corps area, and a separate direct air support center (Victor DASC) to service it was established at XXIV Corps Headquarters at Quang Tri. During Phase 1, requests for both preplanned and immediate support within RVN were processed through I DASC using normal procedures. Division tactical operations centers (DTOCs) were to be at Khe Sanh, and English-speaking Vietnamese observers were to ride in FAC aircraft to facilitate communication with ground commanders in Laos.

Figure IV-1 depicts the tactical air control net that supported the three RVNAF divisions in Laos.

The Lam Son 719 operation in Laos began with two FACs, each of whom was assigned a flight of two fighters every thirty minutes. As the RVNAF AO enlarged and the action became more intense, the number of FACs was raised to six, with each FAC being assigned a section of the operational area. A seventh FAC was airborne for helicopter escort. The increased demands for tactical air were met by reducing the time interval between flights of fighters to ten minutes.

Arc Light

Initial planning for support of Lam Son 719 was accomplished at 7AF. This support consisted of strikes to block the major LOCs into the Lam Son 719 AO.

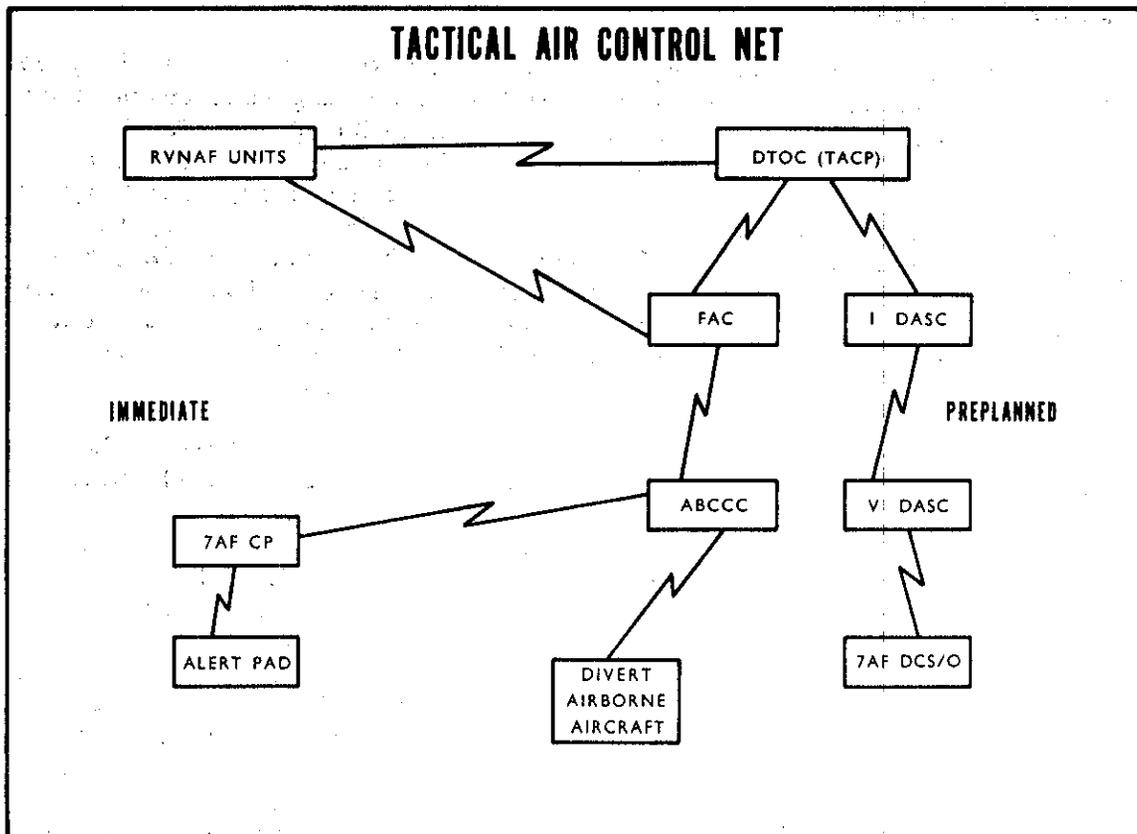


FIGURE IV-1

From 8 February on, the B-52 targeting was accomplished at Quang Tri. A 7AF liaison officer familiarized the XXIV Corps staff with B-52 operating and targeting procedures. After the RVNAF entered Laos, Lieutenant General Lam, Commander of the RVNAF forces, selected almost all B-52 targets himself.

To increase responsiveness, a procedure was developed to allow target changes as close as three hours to time over target (TOT). Arc Light cells had fixed takeoff and target times with intermediate control points outside the Lam Son 719 area. When a target change was made enroute a computed time to depart the control point was furnished to the crew along with a new initial point for the bomb run.

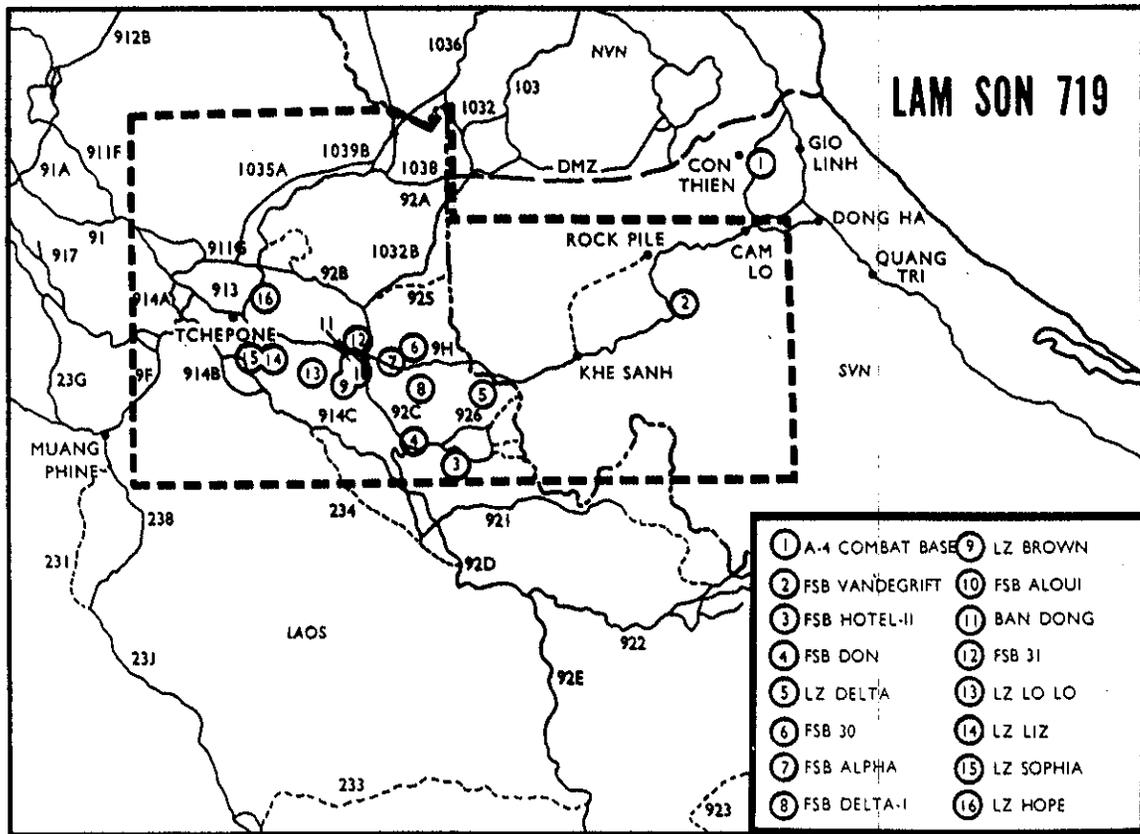
Beginning 24 February, the B-52 sortie rate was increased to 40 per day. An additional increase to Arc Light striking power began on 6 March when three B-52s were configured to carry 108 bombs per sortie rather than the customary 66. An additional aircraft per day was so configured until 10 April when all sorties were carrying 108 bombs.

GROUND OPERATIONS

Operation Lam Son 719 began on 30 January when the US 1st Brigade, 5th Infantry Division (Mechanized), with attached engineer units, moved down Route QL9 to open the road from Dong Ha to Khe Sanh. The US forces reached Khe Sanh on 31 January and the engineers began immediately to restore the Khe Sanh runway and to emplace heavy artillery in the area in preparation for its use as the forward combat support base. A task force securing Route QL9 pushed on to the Laotian border, reaching it on 3 February. Armor and infantry task forces then made sweeps north of Route QL9 and south of Khe Sanh towards the Laotian salient. The RVNAF began to assemble in the Khe Sanh area, assisting in the security sweeps and preparing for the move into Laos.

The Army of Vietnam (ARVN) 1st Armored Task Force crossed the border into Laos on the morning of 8 February. Simultaneously with its movement on Route 9, five battalions of rangers and infantry made helicopter combat assaults into positions north and south of Route 9. The armored task force traveled 10 km the first day and 5 km the second day. Route 9 was in poor condition with numerous washouts and the dense underbrush along its sides hindered the progress of the two airborne infantry battalions screening for the armored column. Low cloud ceilings, poor visibility, and rain delayed the heliborne insertion of additional battalions until 10 February and hampered the road improvement efforts of the ARVN engineers. The weather cleared on 10 February and the drive to Ban Dong at the intersection of Routes 9 and 92 continued. By 12 February, the ARVN forces had the positions they were to hold more or less statically until 3 March (Figure IV-2). Two ranger battalions occupied positions along Route 925 to screen the northern flank. Battalions of the 1st Airborne Division established fire support bases along the ridge north of Route 9, while units of the 1st Infantry Division operated on the escarpment south of the highway. The armored task force conducted operations along Route 9 and 92. By 16 February, the South Vietnamese forces in Laos totaled more than 10,000 men. Fixed fire support bases were constructed on high ground overlooking Route 9 (Figure IV-3).

In the first four days, enemy resistance to the ARVN movements was light. As the South Vietnamese consolidated their positions, the communist troops encircled them with infantry, artillery, mortars and rockets. Attacks by fire followed by infantry probes harassed the ARVN while they conducted searching sweeps for the enemy's supply caches and fortifications. Though enemy positions were struck heavily by air-delivered ordnance, the intensity of the enemy attacks increased. With coordinated tank and infantry attacks under the cover of heavy mortar and rocket fire, the enemy overran a ranger battalion on 18 February and an airborne fire support base on 25 February. The whole northern flank and the western-most positions on the southern flank were engaged in heavy fighting with the enemy until 27 February, when



RVNAF FIRE SUPPORT BASE IN LAOS

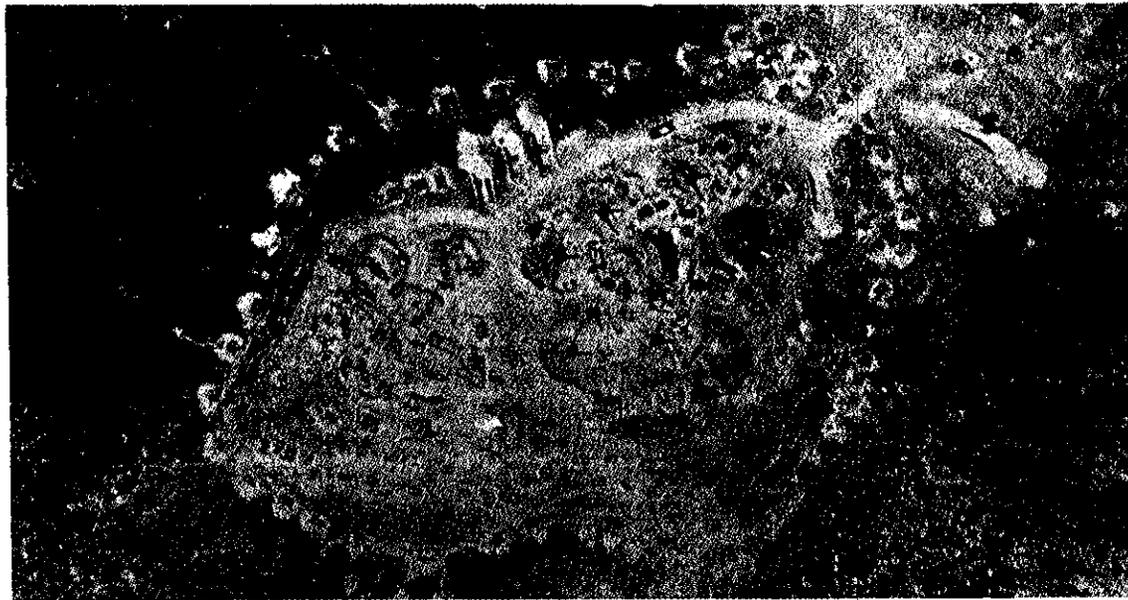


FIGURE IV-2/IV-3

[REDACTED]

a lull occurred during which each side replenished and reinforced. The NVA added five infantry regiments and redeployed the units of its tank and artillery regiments, bringing the communist strength to 35,000. The South Vietnamese increased its invasion force with two marine brigades, an infantry regiment, and two armored units to a peak strength of 17,000 troops in Laos.

On 3 March, the South Vietnamese began a series of heliborne "leap-frog" maneuvers to Tchepone by the 1st Infantry Division with a one battalion combat assault into Landing Zone (LZ) Lo Lo. This was followed on 4 March with a one battalion helicopter assault at LZ Liz. Two battalions were lifted to LZ Sophia on 5 March, and on 6 March two battalions assaulted LZ Hope, north of Tchepone. These two battalions operated in the Tchepone area for four days and returned to the escarpment near Sophia on 10 March.

The 1st Infantry Division began an orderly redeployment to the east, conducting harassing probes against Route 914 as they moved. The enemy began an offensive on 14 March. Attacks were launched against all the South Vietnamese positions and by 19 March all units were in heavy contact. The battalions of the 1st Infantry were engaged in desperate fighting as were the airborne units holding on the north to cover the withdrawal of the armored task force along Route 9. After the 1st Infantry was extracted, the Vietnamese marines received the brunt of the enemy attacks from the south. As the armored column moved east, it was ambushed several times and nearly overtaken by NVA tanks on 22 March. Tactical air strikes broke up the attack and covered the task force until it crossed back into RVN on 24 March. The airborne and marine battalions were extracted by helicopter and all South Vietnamese units were out of Laos by nightfall on 24 March.

Reconnaissance and harassing units were reinserted into Laos on 25 and 31 March and 6 April for short periods of time. Operation Lam Son 719 was terminated on 8 April. Table IV-1 shows the results of the campaign. All data are as reported by RVNAF units except for US casualties. An unknown amount of RVNAF equipment was abandoned in Laos.

AIR SUPPORT

Prior to Lam Son 719, about 10 percent of the strike sorties flown in Steel Tiger were for support of ground forces. These sorties supported Lao guerrilla operations against the western portion of the Ho Chi Minh trail. To support the multi-division Lam Son 719 operation there was a major shift in tactical air effort from interdiction to support of ground forces. Figure IV-4 shows the shift in Steel Tiger sorties. Both categories shown include Lam Son 719 sorties.

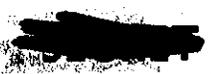
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OPERATIONAL RESULTS 17011 17372

<u>CASUALTIES</u>	<u>KIA</u>	<u>WIA</u>	<u>MIA</u>
FRIENDLY			
US	176	1042	42
RVNAF	1531	5424	651
ENEMY	13642 (4364 KBA)	0	54 (DETAINED)

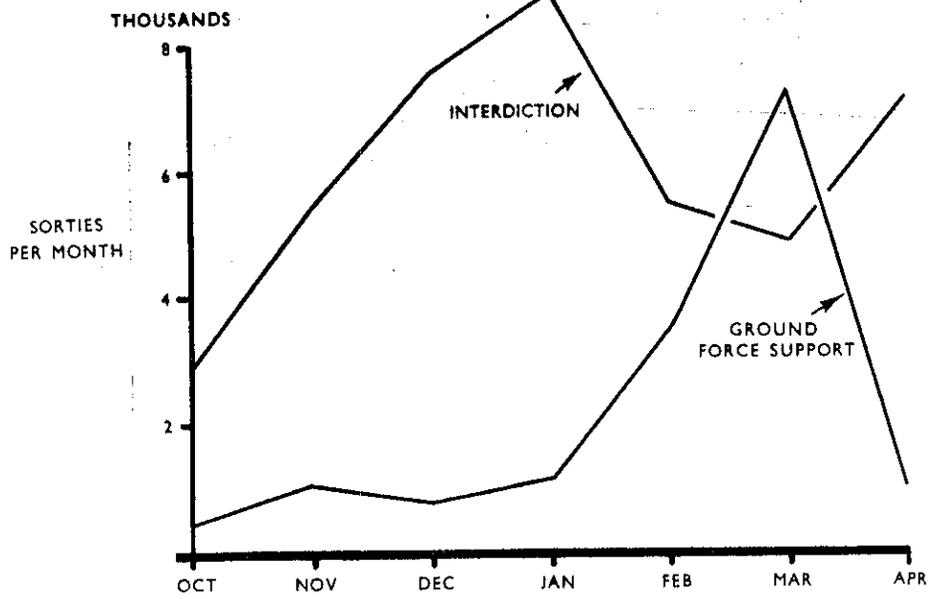
<u>ENEMY EQUIPMENT</u>	<u>CAPTURED OR DESTROYED</u>
VEHICLES	528
WEAPONS	7001
AMMUNITION	20000 TONS
SMALL ARMS	480566 ROUNDS
FOOD	1282 TONS
POL	217710 GALS
STRUCTURES	1270
BUNKERS	1328

TABLE IV-1

In addition to this major shift in emphasis, there was a significant increase in sortie rate during March to provide continuous air support to the operation, as Figure IV-5 shows. During peak periods, the fighter force surged to a rate of 1.5 sorties per day per possessed aircraft; some units achieved a 2.0 rate. The Navy had three carriers on station for seven days during March which increased the number of sorties available for Lam Son 719 support. The high of 337 tactical air sorties to Lam Son 719 occurred on 10 March. The regional breakout of Figure IV-5 shows that the additional Lam Son 719 support was provided without drawing down air support in RVN, Cambodia, or Barrel Roll.



STEEL TIGER STRIKE SORTIES



US STRIKE SORTIES IN SEA

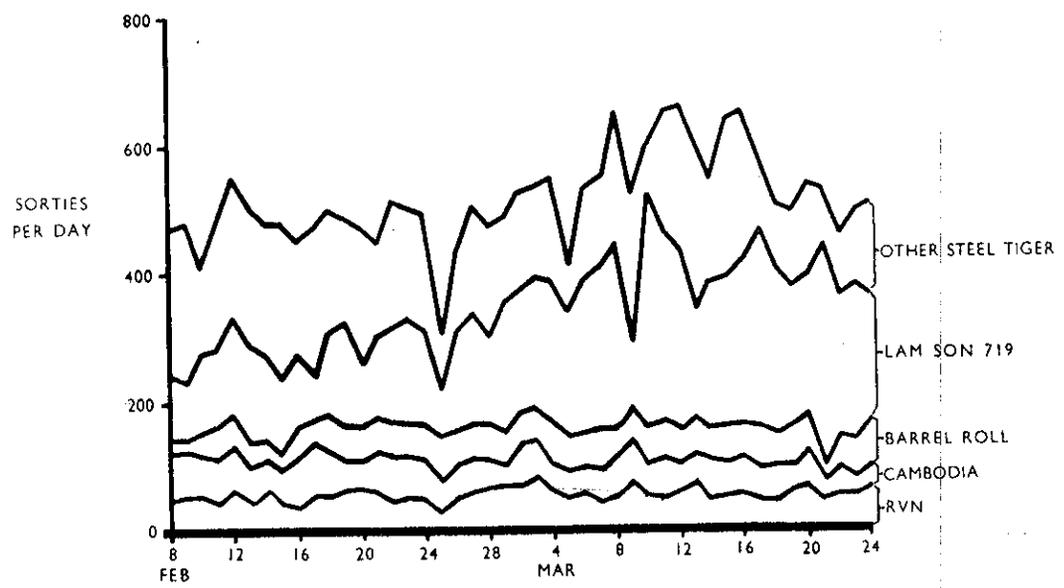


FIGURE IV-4/IV-5



Figure IV-6 shows the Lam Son 719 sorties. In all, 8512 tactical

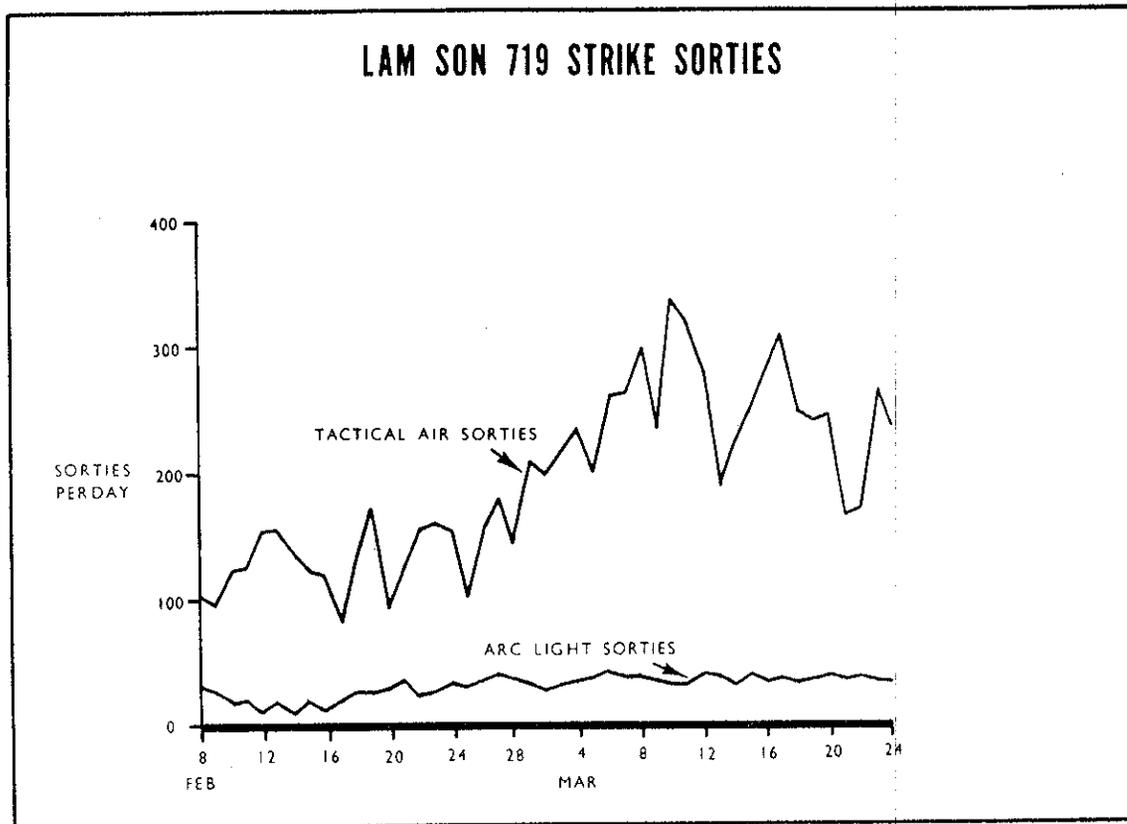


FIGURE IV-6

air sorties, 1358 Arc Light sorties and 2809 tactical airlift sorties flew in support of Lam Son 719. One hundred and forty-seven VNAF A-37 sorties are included in the tactical air total. Hammer FACs flew a total of 1291 sorties during the period 8 February through 24 March, averaging 29 sorties per day. Table IV-2 shows the distribution of tactical air sorties by type target.

EFFECTIVENESS

The RVNAF reported over 13,000 NVA troops killed during the operation. RVNAF follow-up ground sweeps confirmed 4364 killed by air (KBA). These ground sweeps were not conducted in many of the areas where air strikes were made against known enemy positions. Therefore, the actual KBA and wounded by air (WBA) figures could have been much higher than reported. Ground sweeps also confirmed air destruction of 61 tanks and damage to 13 others. Table IV-3 summarizes the results of air strikes as reported from RVNAF sweeps.

TACTICAL AIR SORTIES IN LAM SON 719

8 FEB-24 MAR

<u>TARGET</u>	<u>SORTIES</u>	<u>PERCENT</u>
PERSONNEL	3593	42.2
TRUCKS	974	11.4
TANKS	180	2.1
DEFENSES	1284	15.1
LOC INTERDICTION	1111	13.1
STORAGE	538	6.3
FORTIFICATIONS	186	2.2
OTHER	646	7.6
TOTAL	8512	100.0

TABLE IV-2

AIR STRIKE RESULTS REPORTED BY RVNAF GROUND UNITS

LAM SON 719

	<u>DESTROYED</u>	<u>DAMAGED</u>
PERSONNEL (KBA, WBA)	4364	0
TRUCKS	134	10
TANKS	61	13
AAA	60	0
ENEMY POSITIONS	1009	0

TABLE IV-3

Table IV-4 shows strike results reported by tactical aircrews

TACTICAL AIR RESULTS REPORTED BY AIRCREWS AND FACs		
LAM SON 719		
<u>TARGET</u>	<u>DESTROYED</u>	<u>DAMAGED</u>
PERSONNEL (KBA, WBA)	2307	0
TRUCKS	1539	485
TANKS	74	24
OTHER VEHICLES	22	8
DEFENSES	225	48
LOCS (CUTS & SLIDES)	N/A	316
FORTIFICATIONS, STRUCTURES	374	57

TABLE IV-4

and FACs in the Lam Son 719 area during the period 8 February through 24 March. On 24 March, tactical air struck abandoned friendly tanks, destroying 14 and damaging 9. These tanks are not included in the table. The air strikes also produced 2049 fires and 9291 secondary explosions. Aircrews reported observable results on only 30 percent of the sorties flown in Lam Son 719.

Table IV-5 shows damage attributed to Arc Light strikes by RVNAF reports. RVNAF sweeps covered 40 of the 617 targets that the B-52s struck in the Lam Son 719 AO. The large number of tactical air and Arc Light strikes made assignment of damage to a particular type of aircraft dubious. For example, six B-52 targets swept by RVNAF ground forces, who reported large numbers of KBA, were also struck by tactical air before and after the Arc Light strikes.

Attacks Against Vehicles

Trucks were prime tactical air targets in the Lam Son 719 AO. The enemy used trucks to move supplies out of the path of the RVNAF advance and to support his battlefield forces. With Route 92 cut by

██████████

ARC LIGHT RESULTS REPORTED BY RVNAF GROUND UNITS

LAM SON 719

<u>TARGET</u>	<u>DESTROYED</u>
PERSONNEL (KBA)	2674
TRUCKS	77
TANKS	6
TRACKED VEHICLES	8
AAA	14
WEAPONS (INDIVIDUAL/CREW SERVED)	1769
AMMUNITION (ROUNDS)	21645
POL (GALLONS)	100000
RICE (TONS)	1197
ENEMY POSITIONS	1009

TABLE IV-5

the RVNAF, enemy logistics traffic shifted westward to Route 914. Traffic more than doubled on this route during Lam Son 719. Twenty-six percent of the trucks destroyed or damaged in the Lam Son 719 A0 (Table IV-6) were struck on Route 914.

During Lam Son 719, tactical air made 241 attacks against enemy tanks; crews or FACs reported 74 destroyed and 24 damaged. Ground forces confirmed 61 tanks destroyed. Most of the tanks attacked were believed to have been PT-76 light amphibious tanks; however, four T-54 medium tanks were photo-confirmed as destroyed. The quick-reaction force used 12 laser-guided bombs in 8 attacks to destroy 7 tanks. One flight of F-4s reported two direct hits on two tanks with MK-84

██████████

TRUCKS DESTROYED OR DAMAGED

LAM SON 719

<u>AIRCRAFT</u>	<u>SORTIES</u>	<u>DESTROYED OR DAMAGED</u>
AC-130	136	1630
AC-119	14	40
B-57G	12	18
FIGHTERS	812	336
TOTAL	974	2024

TABLE IV-6

LGBs. Figures IV-7 and IV-8 show these destroyed tanks.

Landing Zone Preparation

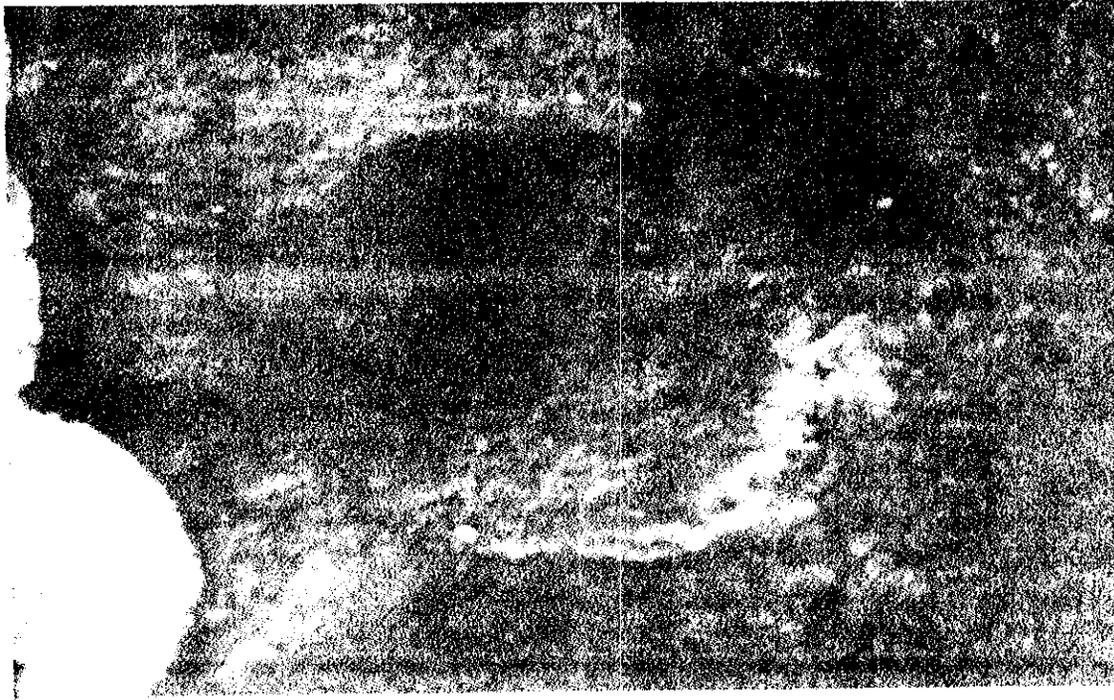
Initial airmobile assaults met little resistance. As the operation progressed toward Tchepone, enemy opposition intensified and airmobile assaults required extensive air preparation of helicopter landing zones (LZs). Preparation for the 6 March assault on LZ Hope near Tchepone was supported by 25 Arc Light, 1 Commando Vault, and 74 fighter sorties.

In the Commando Vault mission the C-130 dropped a 15,000-pound BLU-82 bomb to carve a helicopter landing area out of the jungle. From 8 February through 24 March, 141 Arc Light, 457 fighter, and 4 Commando Vault sorties supported major combat assaults and extractions.

Attacks Against Defenses

Of the one hundred fifty-five 23 mm, 37 mm and 57 mm antiaircraft guns estimated to have been in the AO when Lam Son 719 began, 60 percent were 37 mm. The mobility of the automatic weapons precluded estimation of their numbers. A total of 1284 sorties, 15 percent of the tactical air effort in Lam Son 719, struck enemy defenses. Forty-nine percent of these sorties were against automatic weapons and mortars, the major threat to helicopters engaged in inserting and extracting troops. Table VI-7 lists results from attacks against defenses.

[REDACTED]
DESTROYED TANK - LAM SON 719



DESTROYED TANK - LAM SON 719



FIGURE IV-7/IV-8

ENEMY DEFENSES BDA IN LAM SON 719

8 FEB-24 MAR

	<u>DESTROYED</u>	<u>DAMAGED</u>	<u>SILENCED</u>
AAA GUNS	21	8	12
AA POSITIONS	88	10	30
AUTO WEAPONS	54	9	10
MORTARS	33	1	6
ARTILLERY PIECES	19	16	3

TABLE IV-7

There were 42 US fixed-wing aircraft hit and seven lost during Lam Son 719. The hit rate of 3.4 per 1000 sorties and loss rate of .58 per 1000 sorties were about twice the rates for Steel Tiger during Commando Hunt V.

Sam Threat

The deployment of SAM sites near the DMZ and near Tchepone represented a serious threat to Arc Light and tactical strike aircraft operating in the Lam Son 719 area. Intensive reconnaissance searches were conducted for SAM deployments in Laos; two sites discovered were destroyed by tactical air.

LOC Interdiction

Tactical air sorties against IDPs averaged 25 per day in the Lam Son 719 area; seventy-one percent were against the routes leading to the battlefield from Ban Raving and the DMZ. Arc Light was also used in this role. Figure IV-9 shows the marked decline in southbound sensor-detected truck movements on Route 1032B during the period 9 through 16 March when an average of 7 Arc Light sorties per day struck the roads in entry interdiction Box D.

Storage Areas

Although only 6.3 percent of the sorties in Lam Son 719 struck area targets, there were some spectacular results. On 14 February, ARVN rangers near Route 925 estimated that tactical air strikes north

**BOX D INTERDICTION
LAM SON 719**

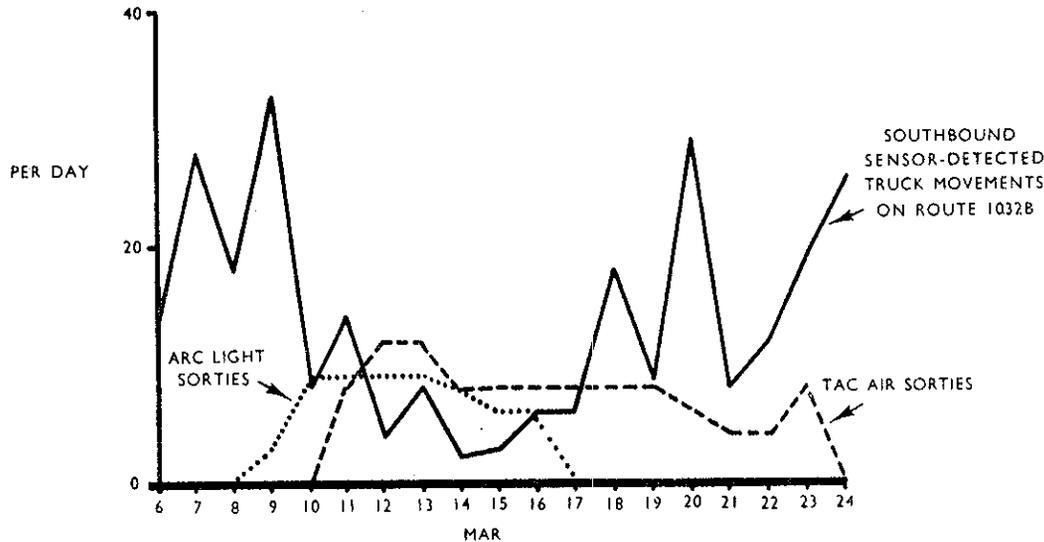


FIGURE IV-9

of their position destroyed 304 tons of ammunition. On 8 March, a FAC reported 1764 secondary explosions from attacks by 16 fighters against an ammunition cache. Other productive strikes during Lam Son 719 are discussed in Chapter V. From 8 February through 24 March, 39 percent of all secondary explosions reported in Steel Tiger were from the Lam Son 719 Area.

RECONNAISSANCE SUPPORT

From 3 February through 24 March, tactical reconnaissance units flew 431 successful sorties covering a total of 1982 objectives in the Lam Son 719 AO. An average of 60 objectives were scheduled per day, and an average of 40 received successful coverage each day.

TACTICAL AIR LIFT SUPPORT

Tactical airlift support for Lam Son 719 began on 26 January with the deployment of forces into RVN MR 1 and continued until 6 April. Table IV-8 summarizes the airlift effort in support of Lam Son 719. In addition, airlift C-130s delivered 28 BLU-82s in support of the VNAF in Laos.

834TH AIR DIVISION AIRLIFT SUPPORT
LAM SON 719

<u>DATE</u>	<u>MISSION</u>	<u>SORTIES</u>	<u>PAX</u>	<u>CARGO (TONS)</u>
26 JAN-6 FEB	DEPLOY US SUPPORT FORCES	338	2045	2633.8
30 JAN-6 FEB	DEPLOY CONTINGENCY FORCES	247	9254	1711.5
5 FEB-3 APR	RESUPPLY AND REINFORCEMENT	2083	15545	20513.7
28 MAR-6 APR	REDEPLOYMENT	141	4638	1261.7
TOTAL		2809	31482	26120.7

TABLE IV-8

IMPACTS OF LAM SON 719

The pattern of logistics movement during Lam Son 719 conveyed the enemy's intent to continue using the central route structure. Figure IV-10 shows the total sensor-detected truck movements for selected route segments and illustrates this intent. During January, traffic input on Route 1032B proceeded onto Route 92B, merging with traffic from 914B onto Routes 99A and 92C. When the RVNAF cut Route 92B during Lam Son 719, through traffic shifted to Route 914B. The traffic on Route 1032B increased but was used for direct support of local tactical units, since it could not proceed further south. Input through Ban Raving was reflected in the traffic on 1035B. Part of the increase in traffic on this route during February and March was for support of local tactical units, but most of it skirted the Lam Son 719 AO to merge with traffic from Route 917 onto Route 914B. The fact that the heavy traffic on Route 914B was not reflected farther south showed that it came from extensive local shuttling of troops and supplies in addition to the traffic from Routes 917 and 1035B. On Routes 99A and 92C, south of the Lam Son 719 AO, traffic decreased somewhat from the level in January. In April, the enemy resumed use of Route 92.

Lam Son 719 disrupted the enemy's traffic pattern, but the restriction of his logistics flow did not equal expectations held prior to the

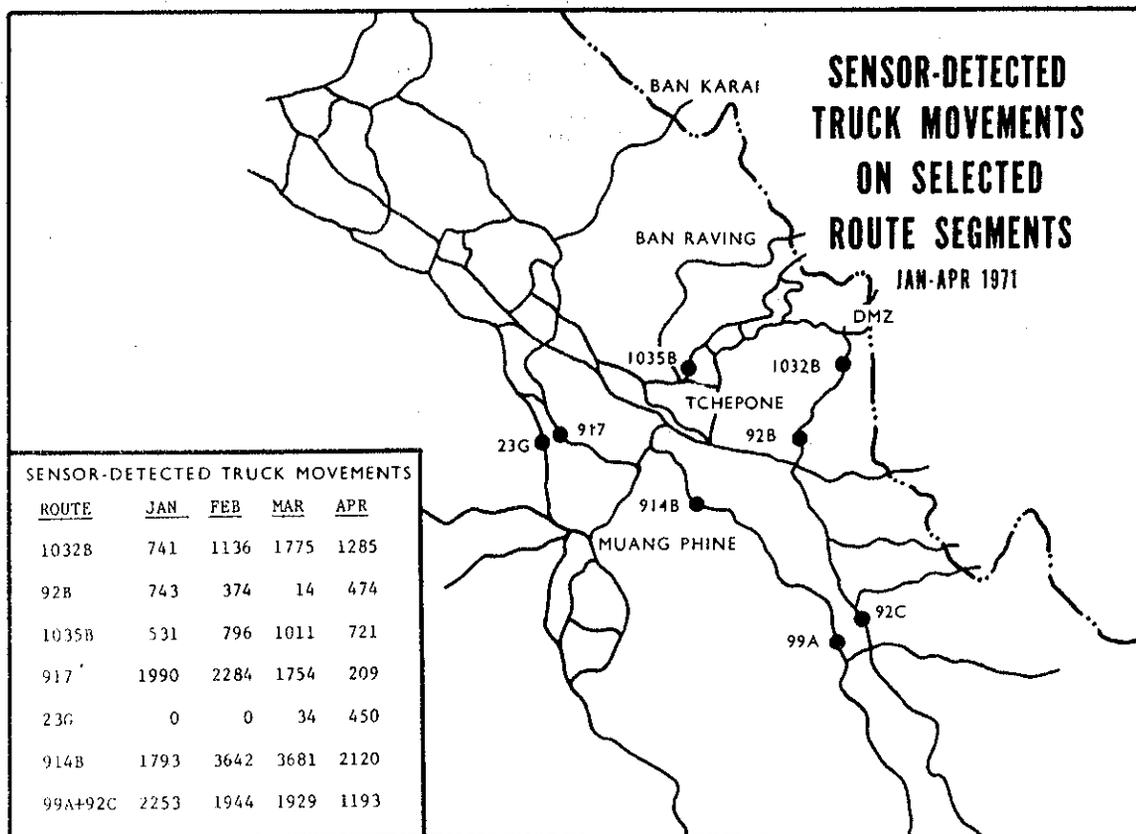


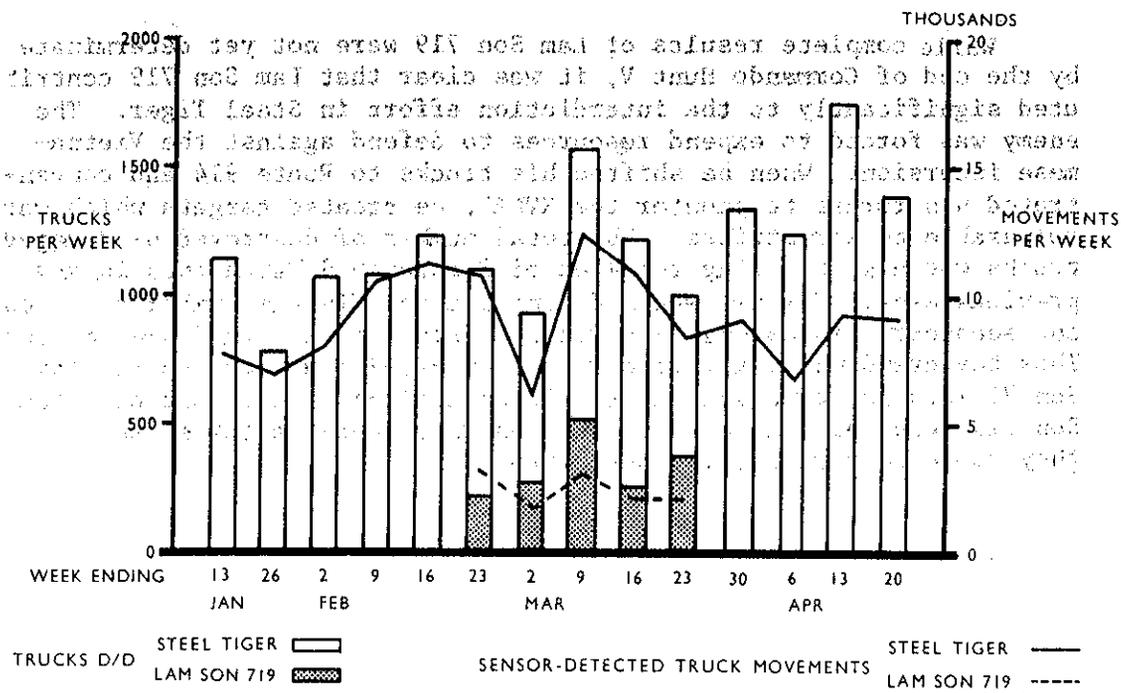
FIGURE IV-10

operation. Route 914 was not interdicted, and the rise in traffic on it compensated for that which would have used the routes cut by the ground forces.

The reported enemy losses of 13,642 troops killed and an undetermined number of wounded during the two months of fighting equate in manpower to over one and one-half divisions. Reports of enemy losses may have been inflated, but any inflation was mitigated by the fact that much damage sustained by the enemy was not observable by either ground or air elements. Without doubt the enemy's personnel and materiel losses reduced his capability for later large-scale tactical engagements. Accurate assessment of the extent of this reduction was not possible by the end of Commando Hunt V.

The air forces that supported the RVNAF in Laos were for the most part drawn from the interdiction campaign in Steel Tiger. Figure IV-11 shows that the overall trend in trucks destroyed or damaged in Steel Tiger continued upward during Lam Son 719. Variations about the trend correlated with variations in sensor-detected truck movements. Figure IV-12 shows that attacks against truck parks and storage areas

TRUCKS DESTROYED OR DAMAGED



STORAGE AREA FIRES AND SECONDARY EXPLOSIONS

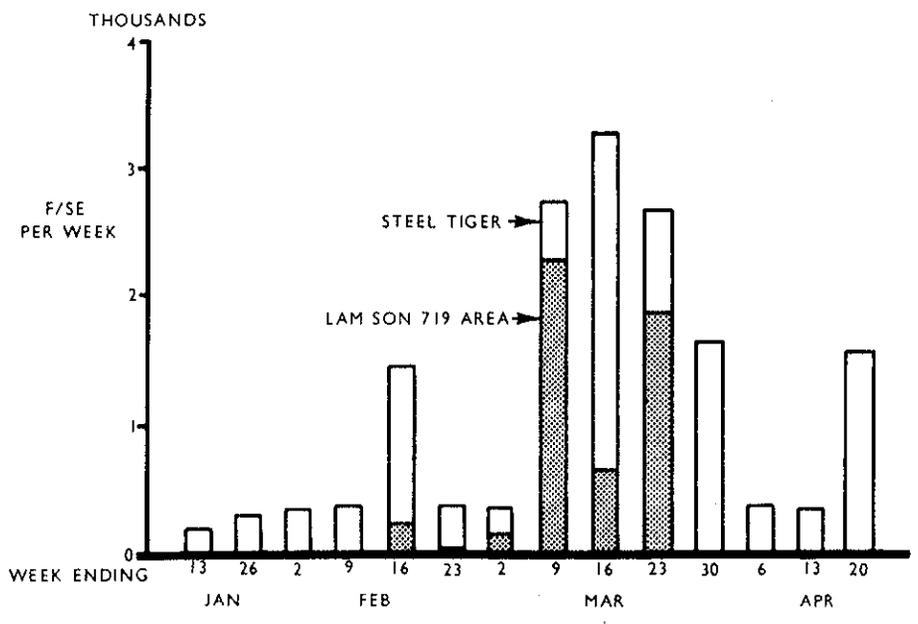


FIGURE IV-11/IV-12

achieved some spectacular results, both within the Lam Son 719 AO and in the rest of Steel Tiger.

While complete results of Lam Son 719 were not yet determinate by the end of Commando Hunt V, it was clear that Lam Son 719 contributed significantly to the interdiction effort in Steel Tiger. The enemy was forced to expend resources to defend against the Vietnamese incursion. When he shifted his trucks to Route 914 and concentrated his forces to counter the RVNAF, he created targets which were vulnerable to air strikes. The total number of destroyed or damaged trucks was higher during the week of 3 through 9 March than in any previous week. For two weeks during Lam Son 719 the number of fires and secondary explosions exceeded any previous week in Commando Hunt V. Thus the drawdown of air resources from Steel Tiger to support Lam Son 719 did not adversely affect interdiction; on the contrary, Lam Son 719 acted as a catalyst to concentrate enemy resources so that they could be more readily destroyed.

~~SECRET~~
CHAPTER V

ATTACKS AGAINST OTHER TARGETS

In addition to trucks, air forces struck a variety of other targets to interdict the enemy's total logistics system in Laos. Sixty-three percent of the tactical air strike sorties in Steel Tiger during Commando Hunt V attacked targets within three major categories: truck parks and storage areas, defenses, and lines of communications. Fighter and attack aircraft made almost all these attacks, but AC-119K and AC-130 gunships and B-57Gs struck these targets on occasions.

Arc Light strikes also struck these three types of targets. Because the bomb pattern from a single B-52 cell would in many cases enclose targets of all three types, categorization of Arc Light sorties according to target struck was arbitrary to some extent. Arc Light sorties that struck some storage are included here under truck parks and storage areas.

TRUCK PARKS AND STORAGE AREAS

In Southern Laos the enemy maintained a complex, well-dispersed system of truck parks and storage areas to handle supplies moved through his logistics system. He had developed extensive dispersal and camouflage techniques in reaction to air interdiction during Commando Hunts I and III. He used jungle-canopied areas, revetments, caves, tunnels, and small warehouse structures in facilities ranging from small, transient, overnight truck parks to semipermanent storage areas. The semipermanent facilities supported construction, operation and maintenance of the network and provided stockpile capability to assist in maintaining adequate supply flow. The location, size, and number of truck parks and storage areas varied within any particular Binh Tram, the basic unit of the logistics system. In most cases the enemy located his truck parks under jungle canopy 200 to 300 meters off the main roads and near water sources. Trucks were parked in clusters of two or three, 20 to 30 meters apart, sometimes in excavated inclined trenches. Leaves and branches placed over these revetments provided further protection from discovery from the air. Trellises arranged over the access roads leading to these truck parks or branches or potted plants positioned on the roadway were common forms of camouflage.

Figure V-1 shows a schematic diagram of a truck park and storage area. The storage areas and associated truck parks were located as much as one kilometer apart.

Truck Park and Storage Area Strike Results

The heavy tree cover and camouflage made detection of storage

COMPOSITE TRUCK PARK AND STORAGE AREA ARRANGEMENT

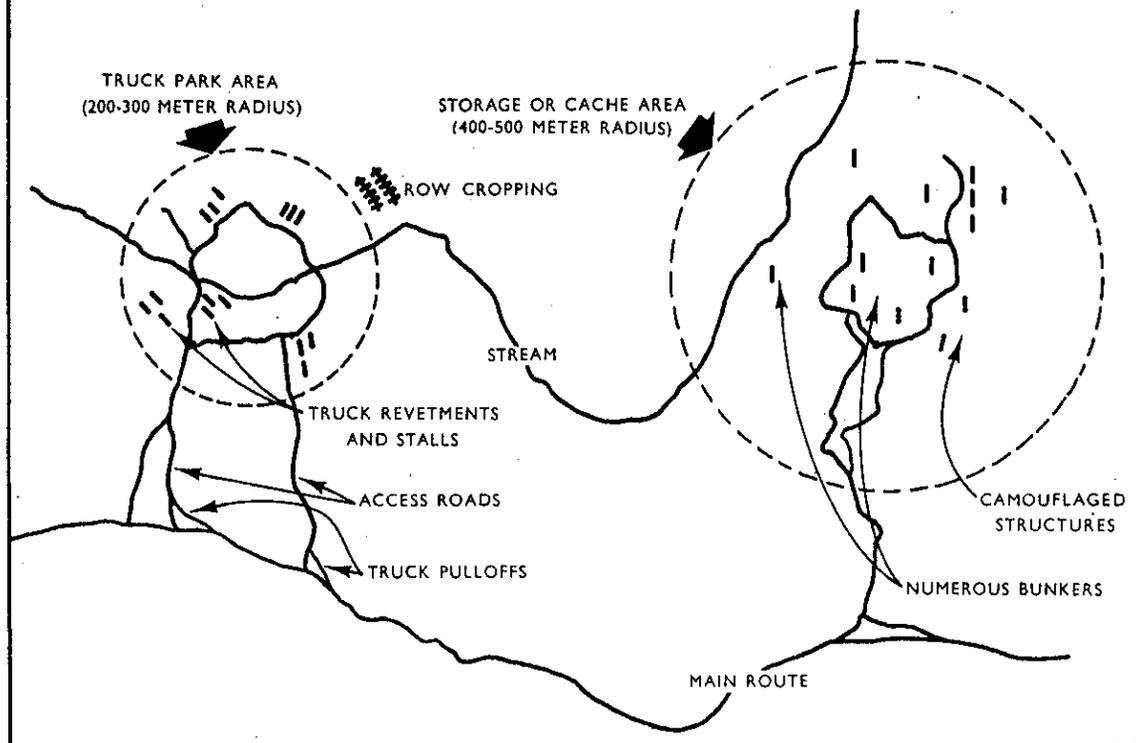


FIGURE V-1

areas difficult and hampered assessment of strike results. During Commando Hunt V, about one-half of all tactical air sorties against truck park and storage area targets reported that results were not observable (RNO). On a week-to-week basis, the percentage of sorties with RNO ranged from a low of 41 percent (16 through 22 December) to a high of 72 percent (6 through 12 January). Most observed results were fires and secondary explosions.

Depicted in Figure V-2 is a selected segment of the 914 Route complex. Not all of the truck park and storage area locations denoted in Figure V-2 were employed by the enemy at any one time. For instance, during February there were indications of logistics activity at 19 locations bordering this route segment. Assessed bomb damage from tactical air truck park and storage area strikes within this region typified the average Steel Tiger strike results from sorties against this class of target, that is, most of the sorties either had no visible results or reported obtaining very few fires and secondary explosions. During the campaign, 309 tactical air sorties struck truck parks and storage areas along this segment of Route 914. These sorties produced

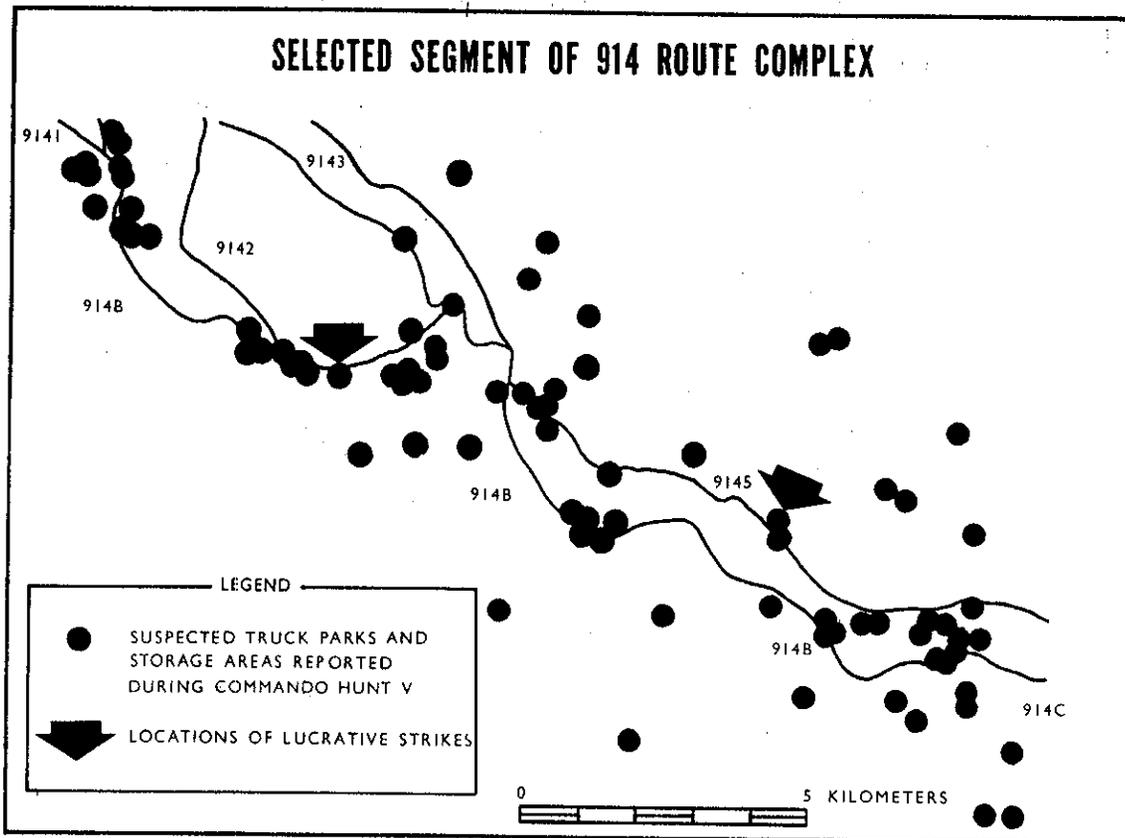
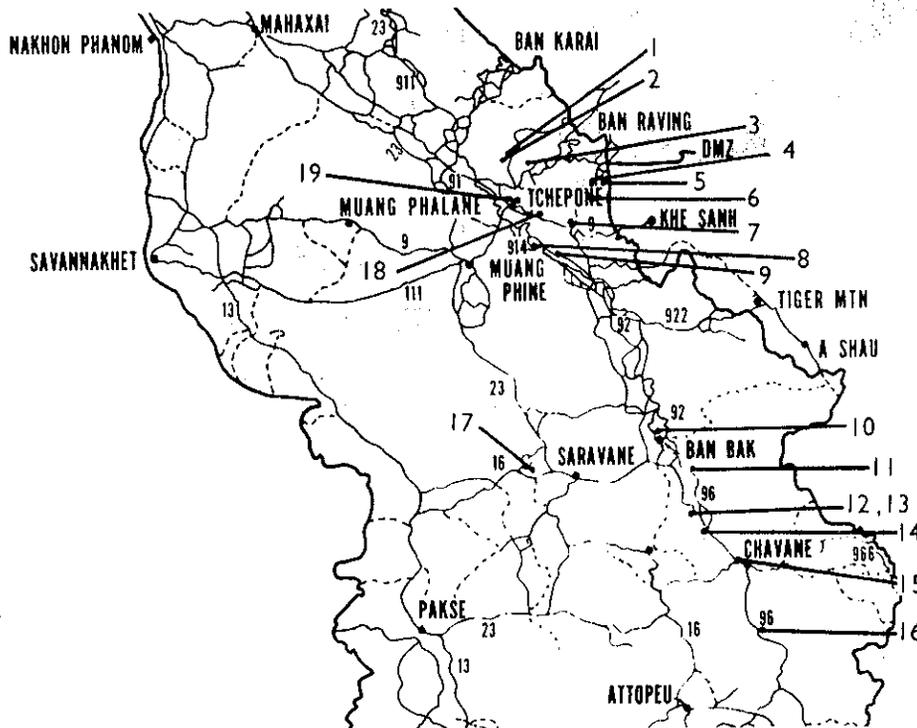


FIGURE V-2

147 fires and 2115 secondary explosions--with RNO reported for 55 percent of the strikes. Of the 2262 fires and secondary explosions, 94 percent came from 7 percent of the sorties. Four tactical air strikes during the latter half of March against two locations (indicated by arrow symbols in Figure V-2) produced 1803 fires and secondary explosions.

In most cases truck parks and storage areas were only suspected and required probing strikes designed to uncover the areas and produce fires and explosions should flammable supplies be present. A large percentage of these strikes produced no results, but when a lucrative area was uncovered, the target was hit with additional sorties to exploit it to the fullest extent. Figure V-3 shows data for lucrative targets struck during Commando Hunt V. In January in Steel Tiger, 2186 tactical air sorties were directed against truck parks and storage areas. Fires and secondary explosions totaled 3720, of which 73 percent came from nighttime strikes. Twenty-eight sorties against three lucrative target areas produced 2729 of these fires and secondary explosions. The remaining 2158 sorties against these and other truck

LUCRATIVE TACTICAL AIR STRIKES AGAINST TRUCK PARKS AND STORAGE AREAS



DATE	MAP LOC	SORTIES/ F & EXP	(SORTIES/ F & EXP)*	DATE	MAP LOC	SORTIES/ F & EXP	(SORTIES/ F & EXP)*
28-30 NOV	3	28/167	(2/150)	16-18 MAR	13	18/158	(2/130)
19 DEC-5 JAN	10	328/10605	(28/7607)	19 MAR	9	15/951	(2/801)
31 JAN-3 FEB	15	62/627	(4/127)	20 MAR	6	8/218	(2/152)
5 FEB	16	20/134	(2/127)	20 MAR	4	9/400	(4/400)
14-18 FEB	11	81/963	(2/800)	23 MAR	7	4/419	(2/294)
15-17 FEB	1	30/369	(4/241)	27-28 MAR	8	8/1002	(2/1002)
21 FEB	12	6/179	(3/105)	15 APR	5	20/679	(5/622)
8 MAR	19	20/2062	(10/1896)	19 APR	17	2/501	(2/501)
12-15 MAR	14	168/3064	(16/2550)	20-22 APR	2	33/4251	(4/4204)
13 MAR	18	9/369	(2/337)				

* FIGURES IN PARENTHESES INDICATE THE NUMBER OF SORTIES WHICH PRODUCED THE MAJORITY OF THE FIRES AND SECONDARY EXPLOSIONS AGAINST THE PARTICULAR TARGET AREA.

FIGURE V-3

██████████

parks and storage areas reported 991 fires and secondary explosions, an average of .46 fires and secondary explosions per sortie.

On 19 December, FAC-observed truck activity off the main road confirmed a storage area 5 km northwest of Ban Bak (No. 10 in Figure V-3). A QRF strike obtained numerous fires and explosions. Between 19 December and 5 January, 328 tactical air and 3 Arc Light sorties produced 10,609 fires and secondary explosions, destroyed 43 trucks, and damaged 11 others. Prior to this time the Xe Kong south of Ban Bak had been high and the enemy appeared to have used this location as a major storage area while waiting for the river to subside.

On 12 March, a storage area complex between Chavane and Ban Bak was uncovered. The storage area (No. 14 in Figure V-3) was struck by 174 tactical air sortie between 12 and 15 March and produced 3064 fires and secondary explosions, 12 trucks destroyed or damaged.

Figure V-4 shows the variation in the tactical air effort against

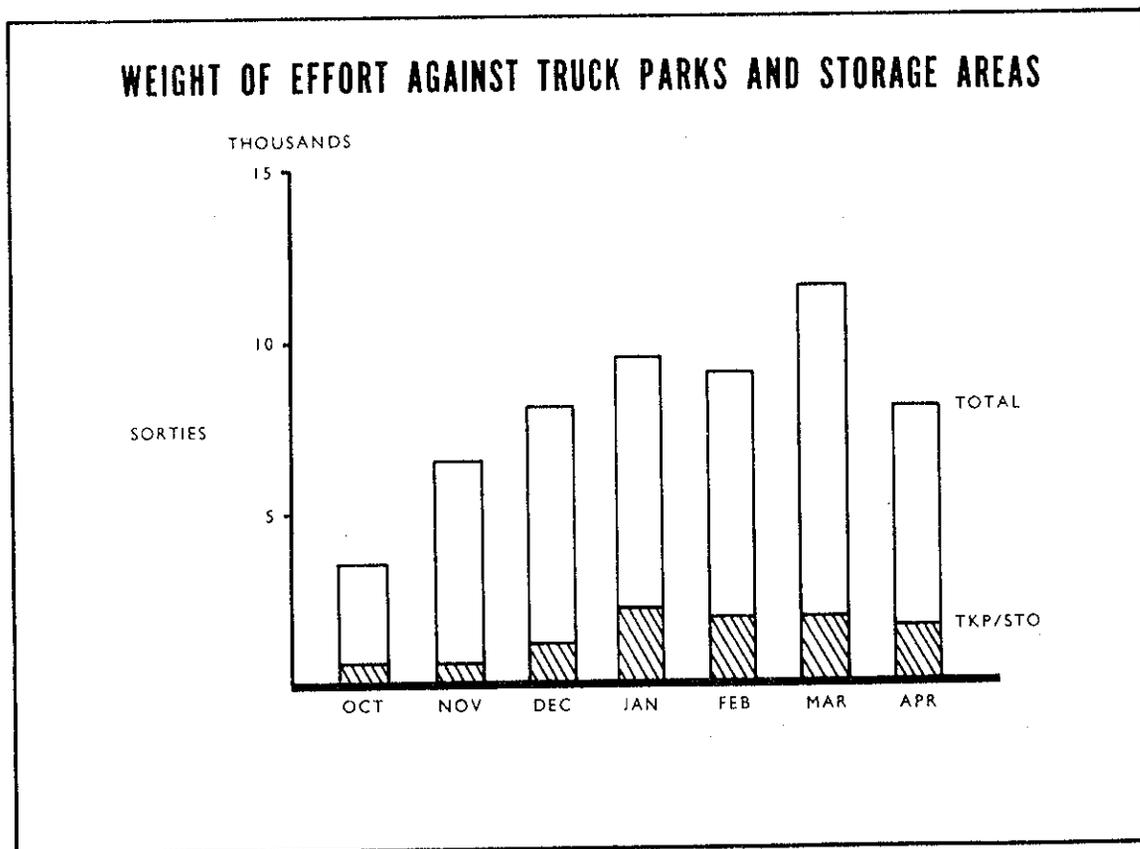


FIGURE V-4

trucks parks and storage areas in Steel Tiger. During Commando Hunt V, about one-sixth of the total effort struck these targets.

The ratio of fires and secondary explosions per tactical air sortie against truck parks and storage areas ranged from a low of .37 in October to a high of 8.07 in December (Table V-1). The high ratio

<u>MONTH</u>	<u>SORTIES</u>	<u>FIRES AND SEC EXP</u>	
		<u>TOTAL</u>	<u>PER SORTIE</u>
10-31			
OCT	359	132	.37
NOV	429	387	.90
DEC	1052	8485	8.07
JAN	2186	3720	1.70
FEB	1650	2552	1.55
MAR	1753	10457	5.97
APR	1437	6590	4.59
TOTAL	8866	32323	3.65

TABLE V-1

in December was due to the lucrative strikes near Ban Bak.

Targeting personnel treated Arc Light targets as composites of several target types. As noted, the subsequent categorization of Arc Light strikes by target type for recording purposes was somewhat arbitrary. Results for Arc Light sorties against targets including stored supplies are shown in Table V-2. These data are crude approximations at best, since B-52 bombing altitudes, often above cloud layers, prevented accurate assessment of results. Over the campaign, 58 percent of the Arc Light sorties reported results not observable. This percentage ranged from 80 for November to 32 for March.

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TRUCK PARK AND STORAGE AREA RESULTS-ARC LIGHT

<u>MONTH</u>	<u>SORTIES</u>	<u>FIRES AND SEC EXP TOTAL</u>	<u>PER SORTIE</u>
10-31			
OCT	148	127	.86
NOV	207	140	.67
DEC	120	92	.77
JAN	183	112	.61
FEB	470	339	.72
MAR	38	55	1.45
APR	167	299	1.79
TOTAL	1333	1164	.87

TABLE V-2

Tactical air recorded a total of 73,995 fires and secondary explosions in Steel Tiger during the campaign. Reducing this total by the 20,907 truck-associated fires and explosions leaves 53,088 fires and explosions, which may be a better indicator of the total damage inflicted by tactical air upon the enemy's stored supplies than the 32,323 shown in Table V-1. In addition, due to the heavy cover over most of the storage areas, damage to nonflammable supplies was seldom recorded; therefore, total damage to the enemy supply system was higher than these statistics indicate.

The number of fires and secondary explosions recorded in strikes against enemy storage areas was the highest of any dry season campaign in Steel Tiger.

ATTACKS AGAINST ENEMY DEFENSES

The cost to the enemy in terms of equipment destroyed or damaged and additional supply requirements represented but a partial measure of the effectiveness of attacks against defenses. Their most important effect was keeping the threat environment in Steel Tiger at a level that allowed other strike resources to conduct an effective campaign against the enemy and his logistics system. The active gun inventory in Steel Tiger remained below the levels experienced during Commando Hunt III, 795 guns during the peak week of the earlier campaign compared to 665 for the highest week of Commando Hunt V. These reduced defenses also resulted in a lower number of hits and losses to AAA as 179 aircraft were hit and 25 were lost compared to 310 hits and 60 losses for the previous dry season (Table V-3). Gunships, however, experienced a hit-per-sortie rate of .013, twice as high as the Commando Hunt III rate of .006.

HIT AND LOSS EXPERIENCE DUE TO AAA-STEEL TIGER

	10-31							TOTAL
	OCT	NOV	DEC	JAN	FEB	MAR	APR	
SORTIES FLOWN	5909	11130	13195	15742	15130	17827	14593	93526
REPORTED AAA REACTIONS	122	696	1721	2472	2358	3253	3378	14000
AIRCRAFT HIT	1	11	24	24	27	63	29	179
AIRCRAFT LOST	0	0	8	3	6	5	3	25
AIRCRAFT HIT PER 1000 SORTIES FLOWN	.17	.99	1.82	1.52	1.78	3.53	1.99	1.91
AIRCRAFT LOST PER 1000 SORTIES FLOWN	0	0	.61	.19	.40	.28	.21	.27

TABLE V-3

Attacks Against AAA

AAA positions were well-fortified and difficult to destroy. Destruction of AAA guns was accomplished with ordnance such as laser-guided 2000- and 3000-pound bombs or 500-pound bombs with instantaneous fuses. For AAA suppression to enable operations to proceed, it often sufficed to silence the AAA. Effective silencing munitions were the area weapons: CBU-24, CBU-49, M-36E2, and napalm. Fighters

employed them to suppress flak for gunships in their truck-killing role, and for B-52s during the entry interdiction program.

Except for escort missions, few preplanned sorties were scheduled to strike enemy defenses during the day; however, the quick reaction force was used a great deal to strike AAA positions acquired by FACs. These QRF aircraft carried laser-guided bombs. When QRF aircraft were not available, the Airborne Battlefield Command and Control Center diverted other aircraft, if available, to the FACs. Sorties and results against AAA in Steel Tiger are shown in Table V-4.

	ATTACK SORTIES AND RESULTS AGAINST AAA DEFENSES				
	STEEL TIGER				
	<u>SORTIES</u>	<u>GUNS DESTROYED</u>	<u>GUNS DAMAGED</u>	<u>GUNS D OR D PER SORTIE</u>	<u>POSITIONS SILENCED</u>
10-31					
OCT	37	23	5	.76	3
NOV	252	38	29	.27	27
DEC	555	98	37	.24	95
JAN	892	114	24	.15	176
FEB	1183	159	26	.22	186
MAR	1663	228	29	.15	155
APR	1283	174	20	.15	188
TOTAL	5865	834	170	.17	830

TABLE V-4

The majority of sorties attacking AAA in Steel Tiger were gunship escorts (Table V-5).

GUNSHIP ESCORT SORTIES ATTACKING AAA DEFENSES

	10-31 <u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
SORTIES	0	95	369	606	643	848	864	3425

TABLE V-5

The 2,000- and 3,000-pound LGBs were very effective against AAA and accounted for 58 percent of the guns destroyed or damaged in Steel Tiger during Commando Hunt V. An average of about two LGBs were required to destroy a gun (Table V-6). The number of guns destroyed

**LASER-GUIDED BOMB RESULTS AGAINST AAA
STEEL TIGER**

	<u>SORTIES</u>	<u>WEAPONS EXPENDED</u>	<u>GUNS DESTROYED</u>	<u>GUNS DAMAGED</u>	<u>D OR D/ SORTIE</u>	<u>D OR D/ WEAPON</u>
10-31						
OCT	23	32	10	5	.65	.47
NOV	68	111	33	20	.78	.48
DEC	74	113	61	10	.96	.63
JAN	83	128	63	18	.98	.63
FEB	141	178	91	7	.70	.55
MAR	157	278	132	10	.90	.51
APR	149	212	111	13	.83	.58
TOTAL	695	1052	501	83	.84	.56

TABLE V-6

[REDACTED]

or damaged per LGB sortie was much higher than the same ratio for all sorties striking AAA because of the size and accuracy of the LGB and the fact that gunship escort sorties were armed to suppress ground fire rather than to destroy guns. Figures V-5 and V-6 show pre- and

PRE STRIKE OF 100MM AAA

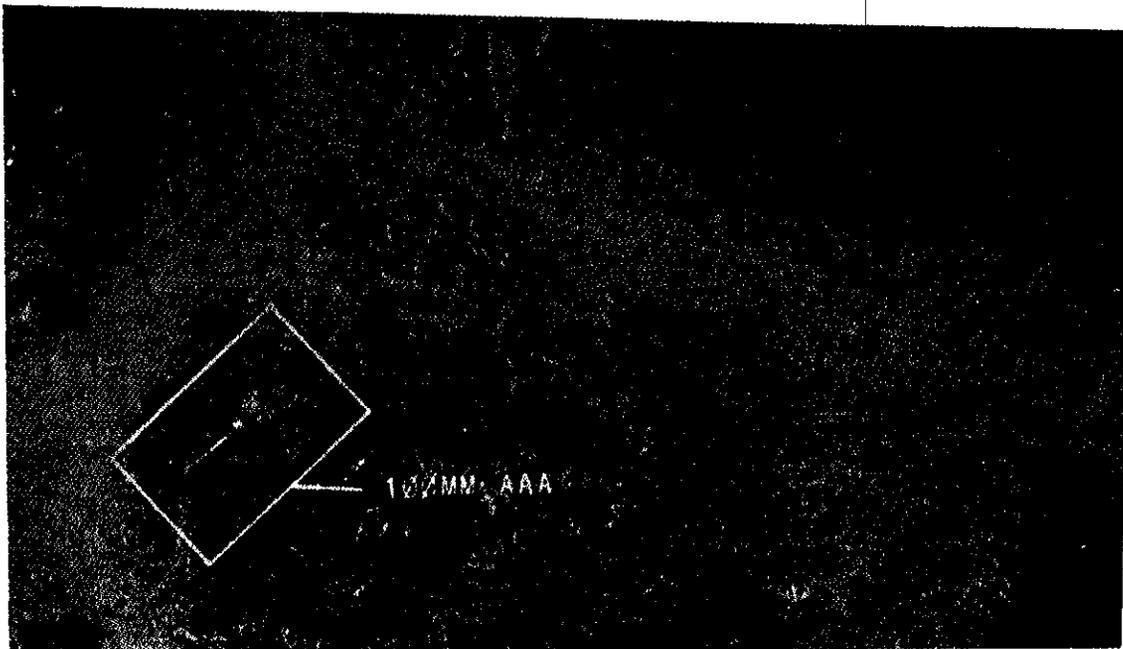


FIGURE V-5

post-strike photography of a 2000-pound LGB strike against a 100 mm AAA weapon. The gun was discovered on 23 April photography of Route 1036D about three miles west of the DMZ. It was struck on 25 April.

Attacks Against Surface-to-Air Missiles

Commando Hunt V saw the enemy's first deployment of SA-2 missiles into Laos. An active program of photo and visual reconnaissance and electronic intelligence searched for SAM sites in Steel Tiger throughout the campaign. The first site (LA-001) was found on 5 March from

POST STRIKE OF 100MM AAA - BLOWN 125 FEET BY LGB

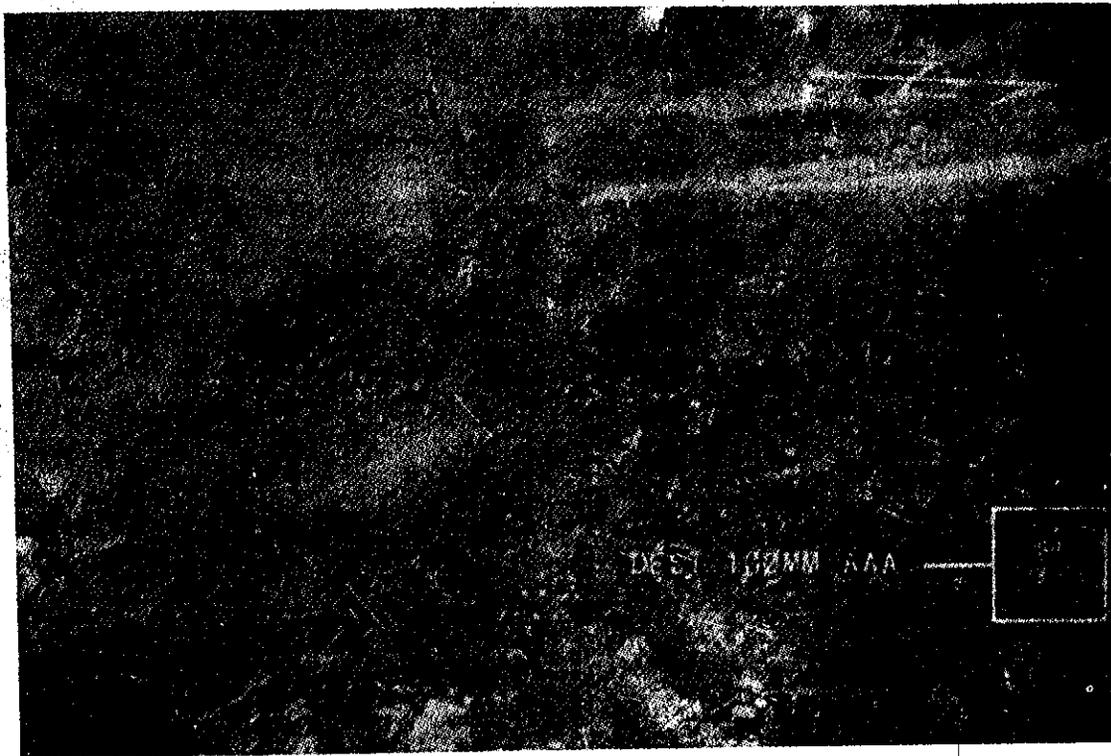


FIGURE V-6

tactical reconnaissance photography shown in Figure V-7. Photography taken the same day confirmed the continued presence of the equipment, but foliage and camouflage prevented a visual sighting and visual strike. However, priority derivation of Sentinel Lock Loran coordinates permitted 17 Air Force and Navy aircraft to strike the site using Loran delivery techniques. Post-strike photography of 6 March revealed the damage shown in Figure V-8. After follow-up strikes on 6 March, photography of 7 March revealed additional damage and the abandonment of the site. Strikes against two other SA-2 sites in Steel Tiger in March resulted in a destroyed Fan Song radar (LA-002) and abandonment of the third site (LA-003).

Iron Hand SA-2 suppression missions were flown by Air Force F-105Gs, Navy A-4s, A-6s, and A-7s. The F-105Gs supported Arc Light missions and reconnaissance missions flown in SA-2 threat areas. The Navy aircraft were used to locate and destroy active SA-2 sites in search and destroy operations. In mid-March, 7AF began scheduling Iron Hand aircraft for search and destroy operations in Steel Tiger,

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SAM SITE - LA-001

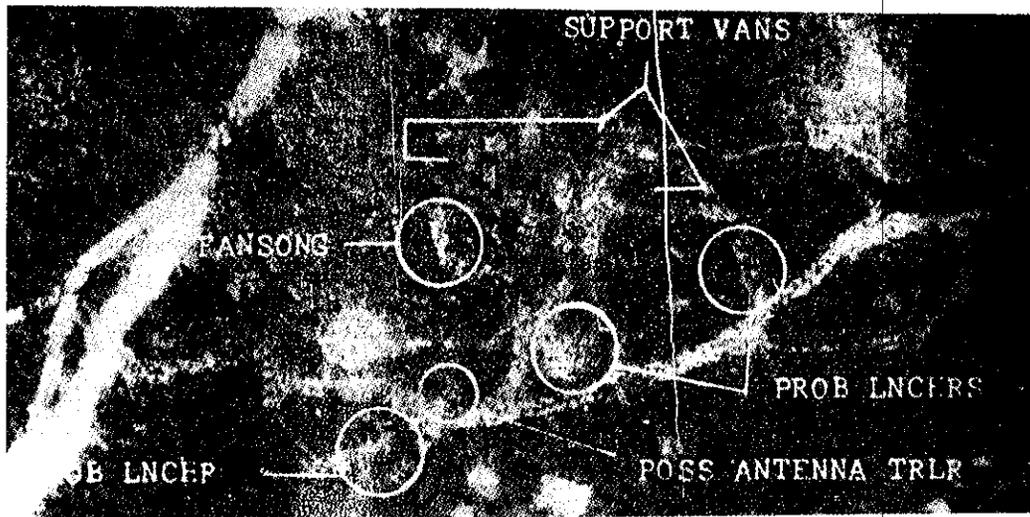


FIGURE V-7

POST STRIKE OF LA-001

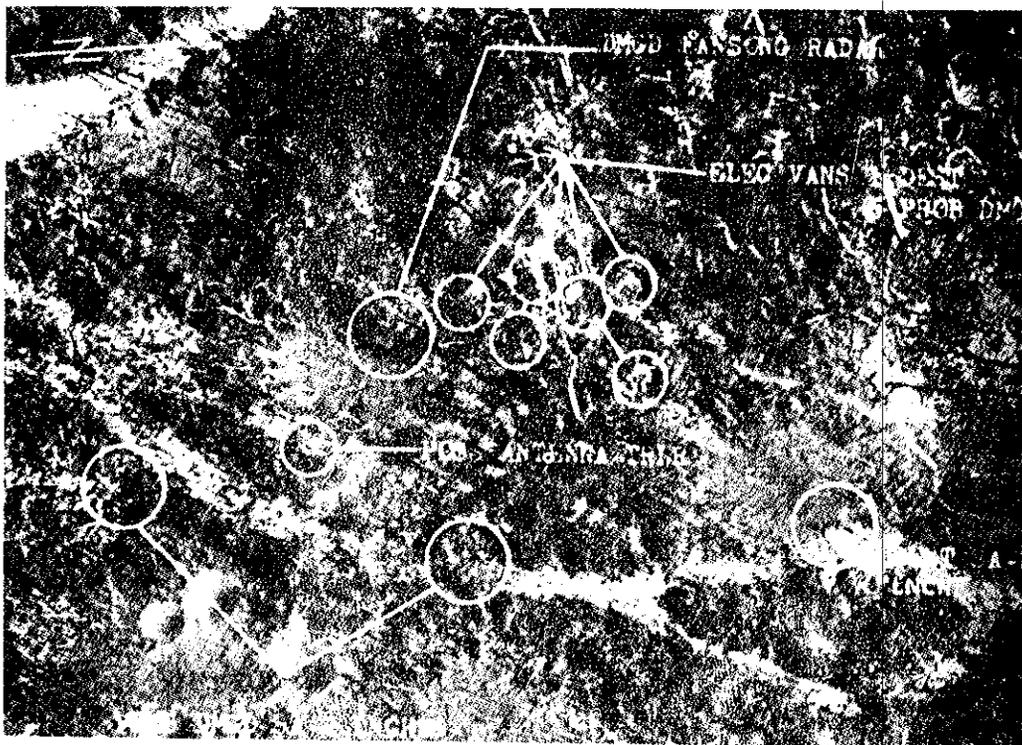


FIGURE V-8

[REDACTED]

suspended since early Commando Hunt III. Iron Hand aircraft carried the AGM-45 Shrike and the AGM-78A and B Standard ARM anti-radiation missiles which homed on radar signals. The A-6 carried Standard ARM and the A-4 and A-7 carried Shrike missiles. During Commando Hunt V, these aircraft launched missiles against Fan Song, Fire Can, and GCI radars (Table V-7). In the majority of instances results were not

SHRIKE AND STANDARD ARM STRIKES IN NVN

	<u>AGM-45</u>	<u>AGM-78</u>	<u>TOTAL</u>
F-105G	21	12	33
A-4	7	0	7
A-6	4	6	10
A-7	17	0	17
TOTAL	49	18	67

TABLE V-7

known, since weapons were launched at long range.

Protective-Reaction Strikes

Protective-reaction strikes in North Vietnam had three basic objectives:

1. to provide a realistic deterrent to enemy activity in North Vietnam which was a direct threat to the safety of US air operations in Laos, RVN, and NVN;

[REDACTED]

2. to destroy that enemy equipment which posed such a threat; and

3. to demonstrate to the North Vietnamese that North Vietnam was not a total sanctuary within which all hostile activity could go unnoticed and without reprisal.

The majority of the protective-reaction strikes were conducted by reconnaissance escorts against enemy positions firing on the reconnaissance aircraft or by F-105G SAM-suppression aircraft. Three major preplanned protective-reaction programs requiring higher headquarters approval were conducted during Commando Hunt V: Freedom Bait, Louisville Slugger and Fracture Cross Alpha. Freedom Bait and Fracture Cross Alpha were coordinated strikes simultaneously executed by units from 7AF and Task Force 77, each striking within an assigned area of responsibility.

Freedom Bait. The first preplanned protective-reaction effort of the campaign took place on 21 November following the 13 November loss of an RF-4 and crew to 23 mm AAA fire along Route 15 in NVN. Targets for the raid included SA-2 sites, POL storage, and key interdiction points along those routes used by the enemy to infiltrate men and supplies into Laos. A total of 431 strike sorties were scheduled in three waves; however, only 217 struck due to poor target weather. In addition to numerous fires and secondary explosions, the strikes produced 91 trucks destroyed or damaged, two 85 mm AAA guns destroyed, 1 Fire Can radar van damaged, 14 road cuts, 8 watercraft destroyed or damaged, and 190 meters of railroad track destroyed. Poor weather hampered bomb damage assessment on almost half of the targets.

Louisville Slugger. Increased SA-2 deployments to the lower panhandle of North Vietnam during November and December began to present a significant threat to air operations in Steel Tiger. Three SA-2 missiles were fired at US aircraft on 12 December, one at an A-7E near Ban Karai Pass and two at Iron Hand aircraft 10 NM east of Mu Gia Pass; however, the most troublesome threat was to the Arc Light aircraft striking the entry-interdiction boxes near the Ban Karai and Mu Gia Passes. On 1 January three SA-2s were fired at B-52s striking interdiction Box Bravo. As a result of these enemy activities, 7AF began operation Louisville Slugger on 10 January. At first, the concept of operation for Louisville Slugger entailed flying a photo-reconnaissance aircraft accompanied by a Fast FAC and two escort aircraft along segments of Routes 15, 101, and 137 in North Vietnam. The coverage was expanded to include segments of Routes 1036, 101, 1039, and 103B just north of the DMZ due to Fan Song radar activity in that area. If an SA-2 site or SA-2-associated equipment including AAA defenses was sighted, pre-strike photography was accomplished by the photo-reconnaissance aircraft which then returned to base. The

[REDACTED]

FAC identified the location and left the area with the two escorts to rendezvous with a tanker for refueling. While refueling, the FAC requested the launch of a prearranged strike package and provided required rendezvous information. After leaving the tanker, the FAC and escorts returned to the target, and the escorts expended their ordnance under FAC control. The FAC then awaited the arrival of the strike package to complete the mission.

Due to poor weather and the lack of target sightings, strikes were conducted on only three days of the operation--20, 21, and 28 February. The 67 strike sorties destroyed or damaged 5 SA-2s, 15 SA-2 transporters, and 14 vehicles. Post-strike photography of the 20 February strike is depicted in Figure V-9.

POST-STRIKE SEQUENCE OF SA-2 - OPERATION LOUISVILLE SLUGGER

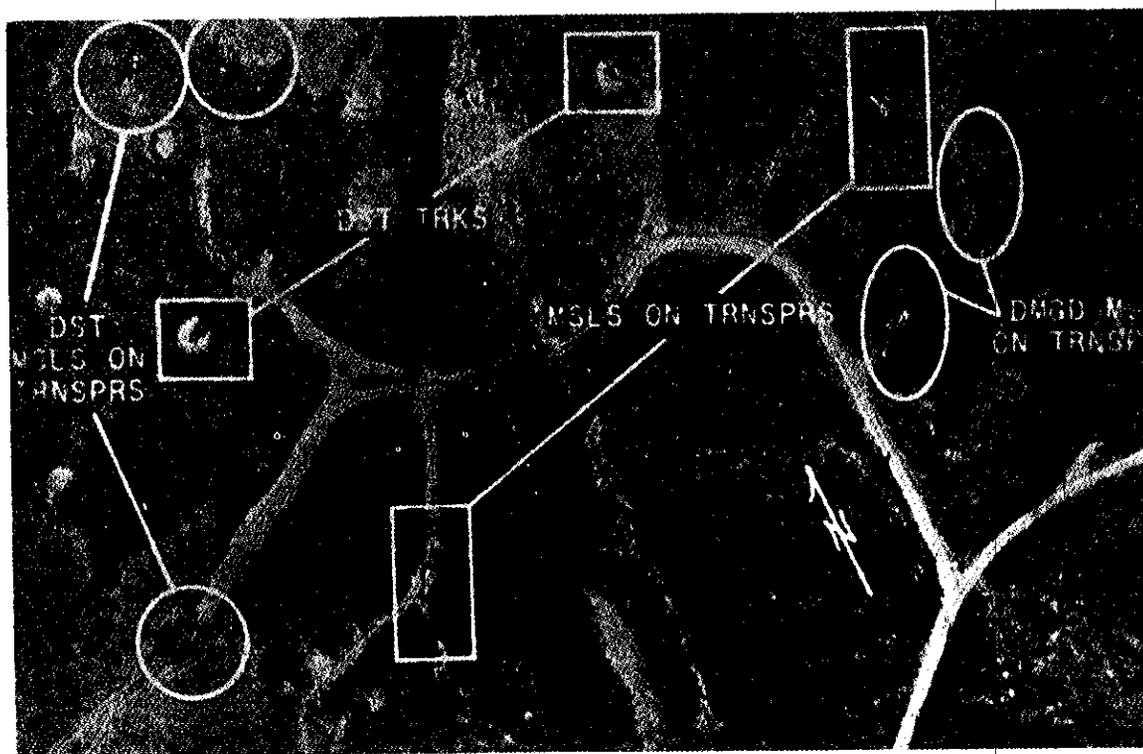


FIGURE V-9

Fracture Cross Alpha. Despite the Louisville slugger strikes in late February, the enemy, perhaps spurred by the Lam Son 719 operation, continued to employ his SA-2 defense in an aggressive manner against air operations in Steel Tiger. On 14 March a Royal Australian Air Force

[REDACTED]

Canberra was downed by an SA-2 while flying 6 NM east-southeast of the western end of the DMZ. Also, on 19 March one F-4 of a flight of two received heavy damage by an SA-2 14 NM east-southeast of Tchepone. Three B-52s supporting Lam Son 719 were fired upon by two SA-2s launched from NVN in the vicinity of the Ban Raving Pass. It became clear that the enemy intended to make extensive use of his SA-2 system in an attempt to disrupt the air operations so vital to the support of RVNAF troops in Laos. A total of 234 strike and 30 armed reconnaissance sorties were flown by the Air Force and Navy during Fracture Cross Alpha on 21 and 22 March. These missions destroyed or damaged 8 SA-2s, 2 SA-2 transporters, 1 Fan Song radar, 6 SA-2 support or control vans, 64 structures, and 45 trucks.

Impact. The total impact of protective-reaction strikes in North Vietnam was not known. Bomb damage was an obvious measure of the impact; however, less tangible objectives were of equal if not greater importance. Unopposed enemy employment of their SA-2 system against air operations in Laos would have hampered the US interdiction program, and in particular the Arc Light strikes supporting the entry interdiction program and Lam Son 719. The threat of protective-reaction strikes reduced the enemy's flexibility by forcing him to continue to shift, conceal, and defend his SAM sites and equipment. Above all, these strikes were a clear indication to the North Vietnamese of US determination in Southeast Asia.

STRIKES AGAINST LINES OF COMMUNICATION

Strikes against selected interdiction points (IDPs), fords, bridges, and ferries were made to stop or slow the enemy supply flow. While it was difficult to assess the results of these attacks, it was clear in some instances that they disrupted the enemy's logistics flow, for he was quick to respond with countermeasures. He built alternate fords and underwater bridges, he improved his waterway transportation system, and in areas where US air strikes against IDPs had been effective, he constructed new routes and bypasses. The most significant addition to the road structure was Route 99, a road built parallel to Route 92 and stretching from northwest of Delta 45 for 136 km to Waterway 4, southwest of Ban Bak. Between 26 November and 26 February, traces of 436 km of new roads were photo-confirmed by 7AF Intelligence.

The entry interdiction program discussed in Chapter II was a large-scale effort against LOC targets in terrain well-suited for interdiction. Successful LOC interdiction in the central and exit route structures, however, was more difficult than in the entry areas. Most of the good IDPs that had once existed in these regions had been eroded by sustained bombing during past campaigns. The proliferation of roads in southern Laos diminished the value of the few IDPs that remained. Severing one road would often not stop traffic; cuts had to be made on all the bypasses in an area as well as on the main route. All such considerations went into the selection of IDPs which were then attacked with sufficient

[REDACTED]

force to assure route severance.

Such attacks could absorb sizeable numbers of scarce strike sorties. To economize on sorties, F-4s used 2000-pound MK-84 and 3000-pound M-118 LGBs against the LOCs. The accuracy and power of these weapons well-suited them for IDP attacks. A total of 207 LGBs delivered on LOCs resulted in 156 cuts and slides.

Where terrain permitted, as on steep hillsides, strike crews guided LGBs to hit below the road. The concept was to steepen the slope as well as destroy the road bed in an attempt to preserve the value of the IDP.

Seeding packages composed of magnetic-influence mines and time-delay ordnance impeded traffic on route segments that did not have good IDPs. Some Navy mines used magnetic-influence fuzes whose sensitivity could be varied as a means of countering clearing techniques the enemy had developed. Navy aircraft implanted 1000 packages including mines on 50 route segments in Steel Tiger from December through April. The normal package was 10 to 12 MK-82 unretarded weapons, 5 to 6 of which were MK-82 bombs with fuzes having .01 second delays for cratering, 3 were magnetic influence mines, and 2 to 3 were time-delay mines. The package was delivered on a single run, simultaneously cutting and seeding the road. During its initial evaluation in December, this combination appeared to hinder traffic on Route 1032B. Precise evaluation of the success of seeding programs was not possible.

Table V-8 shows the weight of tactical air effort directed against LOCs in Steel Tiger, exclusive of sorties striking in the interdiction boxes. While they are not conclusive measurements of the impact of LOC interdiction on logistics flow, the number of cuts, slides, destroyed bridges, and fires and explosions are indirect indications of costs the enemy had to pay to attempt to resupply his forces in RVN and Cambodia.

Road cuts slowed traffic by making the vehicles backtrack or travel over longer and more hazardous routes, and by forcing them to stay on the roads for a longer period of time, the probability of their being struck by tactical air was increased. Although the expansion of this road network gave the enemy additional transportation options, deploying his forces over a larger area complicated enemy operations and reduced his efficiency. The engineering units tasked with these responsibilities showed no apparent increases in unit strength or equipment levels; rather, they were augmented in their activities by units which had been assigned other responsibilities. These units were redirected to engage in priority road construction and repair activities in anticipation of the forthcoming rainy season as a result of the unsatisfactory logistical posture induced by interdiction efforts.

TACTICAL AIR VERSUS LOCS IN STEEL TIGER

	<u>SORTIES</u>	<u>CUTS&SLIDES</u>	<u>BRIDGES</u>		<u>FIRES</u>	<u>EXPLO</u>
			<u>DES</u>	<u>DAM</u>		
10--31						
OCT	153	92	2	1	5	2
NOV	1215	277	4	1	21	4
DEC	1406	359	4	2	10	17
JAN	1463	400	0	1	97	36
FEB	1752	681	1	1	55	23
MAR	1944	937	7	2	62	71
APR	2407	1767	0	1	47	268
TOTAL	10340	4513	18	9	297	421

TABLE V-8

EXIT INTERDICTION

Up to the end of Lam Son 719 the enemy had achieved very low cumulative throughput of supplies into RVN and Cambodia. All-source intelligence indicated that he would make a major throughput effort during April before the southwest monsoon brought rains to Laos. To counter this effort an LOC interdiction program against the exit routes began on 28 March. The intent was to restrict the flow of supplies on the exit routes until rains rendered the roads unusable.

Planning

The four major throughput corridors were along Routes 922, 966, 110D-E, and 110A. Estimated throughput was more than 20 truckloads per week along these routes by 24 March, so the interdiction effort was concentrated there (Figure V-10). Much lesser amounts had been detected on Routes 925, 926 and 9H.

EXIT INTERDICTION ROUTES

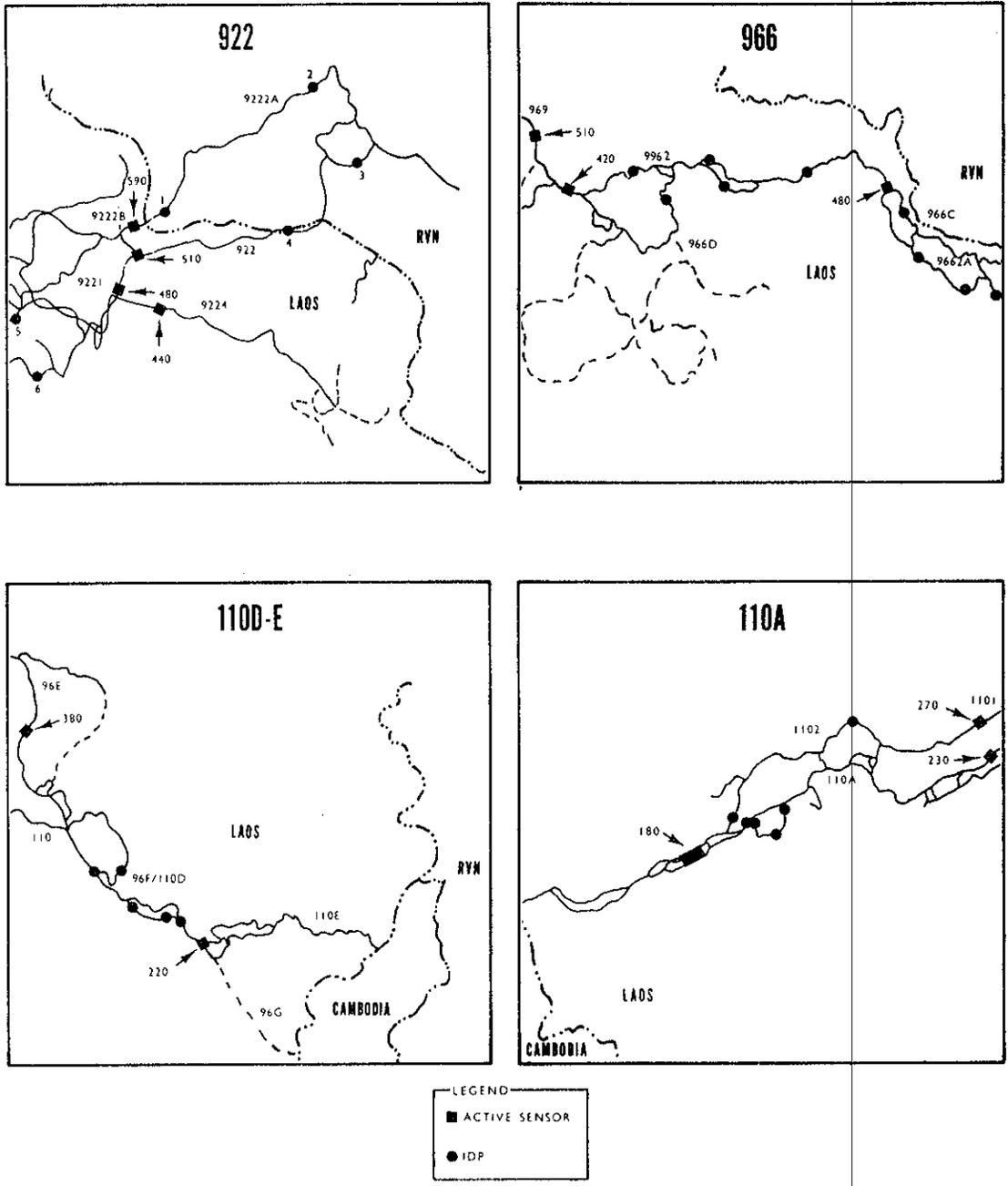


FIGURE V-10

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Route 922, which entered RVN through the A Shau Valley, was the enemy's primary supply artery into MR 1. In Laos it ran through flat terrain and had a web of bypass routes near the RVN border. On the Vietnamese side the terrain was rugged and suitable for road interdiction. Two IDPs were selected in Laos and four in RVN, the latter to impede the flow once it had crossed the border.

Route 966 entered RVN near the juncture of MR 1 and MR 2. It was characterized by the most rugged terrain on any of the exit routes. In reaction against years of bombing the enemy had built numerous bypasses and the structure assumed a web-like pattern near the border. Nine interdiction points were selected as possible targets.

Route 110D-E entered Cambodia and RVN in the Tri-border area. The terrain was flat and there were numerous small trails and bypasses along the main routes. Five IDPs were selected west of the junction of Routes 110D and 110E.

Route 110A, the main entry corridor for supplying the Communist forces in Cambodia, was in flat, swampy terrain. All five selected interdiction points were fords.

Execution

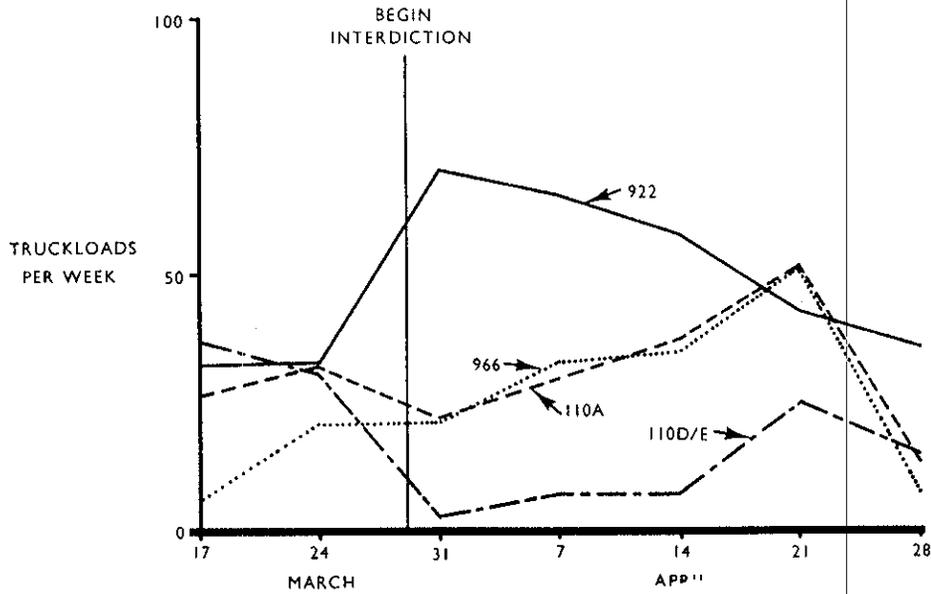
On 28 March, 85 tactical air sorties struck exit route IDPs. Most struck in the Route 966, 110D-E, and 110A complexes. The in-country IDPs on Route 922 were struck by only four sorties because of poor weather and conflicts with ground operations preceding the Lam Son 720 operations in western MR 1.

After this first surge of effort, sorties were flown at a rate of about 30 per day with most of the effort on Routes 966 and 110. Bombs delivered were fuzed for both instantaneous and delayed detonation. During the initial phase, 69 percent of the bombs used fuzes with delays of less than one second. At the end of the first 16 days throughput was still rising in all areas except Route 922 (Figure V-11).

On 14 April, the number of sorties striking exit IDPs increased. By 19 April the rate was about 45 per day and increased to 80 to 90 sorties a day by 30 April.

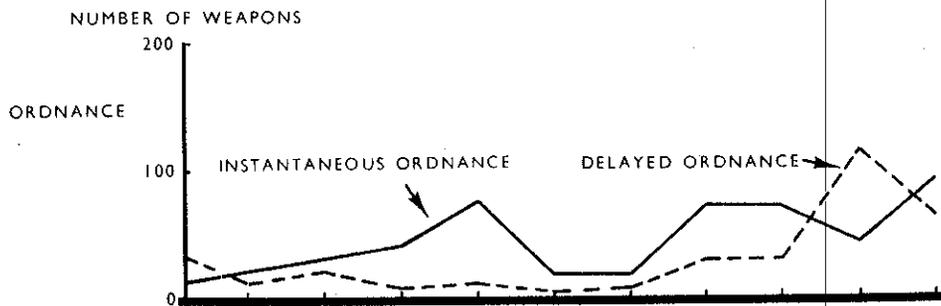
Figure V-12 shows that on Route 110A, there was an inverse correlation between southbound sensor-detected truck movements and the number of weapons expended. Delayed weapons appeared to be more effective in the flat, swampy, terrain. Similar relationships appeared to hold for the other exit routes except that no correlation with the type weapon used was noted.

ESTIMATED THROUGHPUT ON EXIT ROUTES



EXIT INTERDICTION ON ROUTE 110A 3 DAY AVERAGES

INSTANTANEOUS AND DELAYED ORDNANCE



SOUTHBOUND SENSOR-DETECTED TRUCK MOVEMENTS

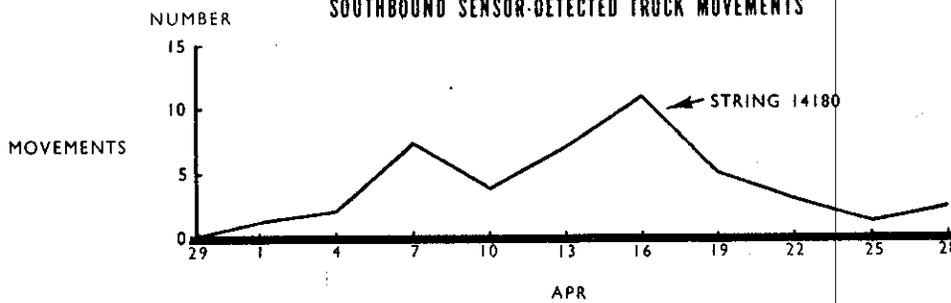


FIGURE V-11/V-12

[REDACTED]

The success of route interdiction depended not only on closing the roads but also on keeping them closed. Achievement of this objective required current knowledge of enemy efforts to open or bypass the interdicted points. To meet this requirement, 24-hour surveillance of the exit routes by FACs (or gunships) began on 27 April. During the last four days of April the four primary routes were covered by visual surveillance more than 80 percent of the time. Full effect of this tactic was still to be determined when Commando Hunt V ended, but it appeared that darkness and weather were allies of the enemy, at least in the dry season.

Three Arc Light sorties struck the 110A route structure on 30 April. Six more sorties struck Route 110D-E on 29 and 30 April. Throughput data for these two days were not enough to evaluate Arc Light effectiveness before Commando Hunt V ended. After the level of effort was increased to 70 to 80 sorties per day, the exit interdiction program succeeded in slowing the rate of throughput in all four major areas. Prospects for the program's ultimate success were good at the end of April and the program continued into May.

GROUND INTERDICTION OPERATIONS

The major interdiction operation in Steel Tiger, accomplished by air resources, was supplemented periodically during the campaign by ground interdiction, supported by air resources. With the exception of Lam Son 719, the ground operations were small scale and were normally supported out of the planned Steel Tiger sortie allocation. Small-scale operations support centered around support of Royal Lao outposts and Lao special guerrilla operations against selected enemy LOCs and storage areas. US tactical air support averaged 800 sorties per month through January. The geographic areas of the operations discussed in this section are shown in Figure V-13.

Operation Gauntlet II

At the beginning of Commando Hunt V, six battalions of Lao government troops were involved in Operation Gauntlet II. The ground troops were emplacing antivehicular and antipersonnel mines along routes west and south of Tchepone. Air support was provided by Royal Lao Air Force and US resources. A total of 220 US tactical air sorties supported the operation, which concluded 21 November when the ground forces were exfiltrated overland toward Muang Phalane.

Bolovens Plateau

In November, the enemy began an intensified offensive on the Bolovens Plateau which, added to Operation Gauntlet, increased the total requirement for air support. Friendly operations consisted of commando raider teams conducting systematic ambushes of vehicles and personnel. The enemy's objectives in the Bolovens were to neutralize the plateau and obtain further use of Route 16 and the Xe Kong for supply activity.

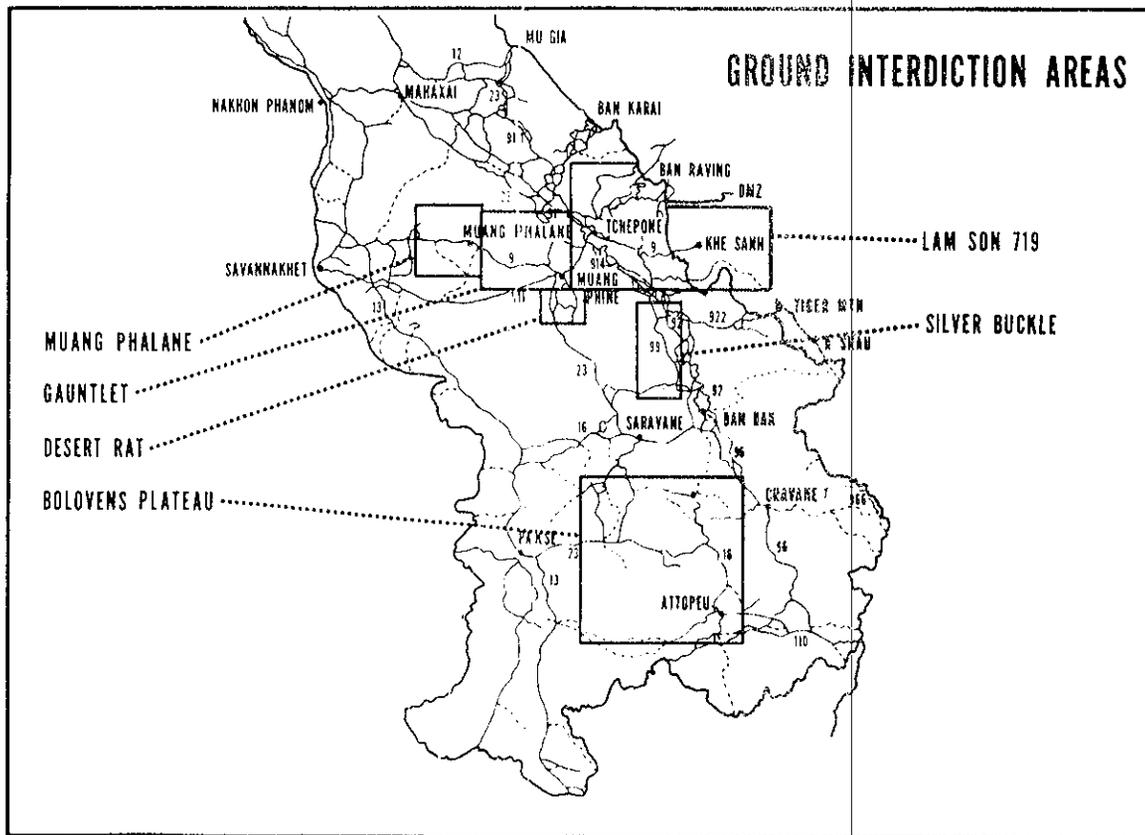


FIGURE V-13

During the period 10 October through 16 April, US tactical air supported the Lao defenders with 1604 sorties, or about 267 sorties per month.

Muang Phalane

North of the Bolovens Plateau the enemy initiated attacks on Royal Lao Army positions in the Muang Phalane area in late November. Lao forces in the area were reinforced by the troops from Operation Gauntlet. Defensive and offensive operations recurred in the area through the end of the Commando Hunt V campaign. US tactical air support averaged about 34 sorties per month.

Operation Silver Buckle

A peak in the relatively low level of US sorties supporting ground operations in Steel Tiger occurred when four Lao guerrilla battalions began Operation Silver Buckle, initiated to interdict Routes 9213 and 9214, south of Muang Nong. During the preparation of the landing area,

[REDACTED]

tactical air delivered CBU-42 antipersonnel mines to inhibit enemy troop operations and 2000-pound bombs to clear the landing zone. USAF helicopters with fighter escort airlifted the troops into the area. Lao ground operations encompassed the mining of roads and the location of vehicles and troop concentrations for tactical air strikes. Tactical air support continued until the operation terminated on 15 February, shortly after the start of Lam Son 719. The US tactical air effort was 578 sorties.

Operation Desert Rat

The termination of Silver Buckle was followed closely by the initiation of Desert Rat, a ground interdiction operation that involved cratering roads with explosive charges, felling trees across roads, ambushing trucks, and acquiring trucks for tactical air strikes. The purpose of the operation was to deny the enemy use of Routes 23 and 238, south of Muang Phine. US tactical air supported Desert Rat with 214 sorties.

Impact of Tactical Air Support

The impact of US tactical air support on these supplemental ground interdiction operations was great; many critical ground situations were saved by the use of tactical air. The impact of these supplemental ground operations, in turn, on the success or failure of the Commando Hunt V campaign, however, was minimal. They drew off a relatively small fraction of the sorties that might otherwise have been used elsewhere in the interdiction effort, and they produced very little in terms of direct damage to the enemy logistics effort in the form of truck and supply destruction. Possibly more damage was done indirectly in the form of increased supply consumption as the enemy either reacted to the Lao operations with military force or acted to seize more of the Steel Tiger logistics network and met armed opposition.

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CHAPTER VI

OPERATIONS IN OTHER AREAS

The Commando Hunt V interdiction effort in Steel Tiger was an integral part of the overall MACV air operation in Southeast Asia during the 1970-71 northeast monsoon season. Although the campaign plan emphasized Steel Tiger interdiction, it allocated 30 percent of the fighter-attack sorties for operations in Cambodia, RVN, and Barrel Roll. Adjustments to this planning allocation were made during the campaign based on level of enemy activity in each area.

CAMBODIA

Since the spring of 1970, when the NVA and VC were denied use of the port at Kompong Som and their sanctuaries in northeastern Cambodia were threatened, the enemy strategy for Cambodia depended upon the control he wielded in each area. In the Northeast the enemy planned to control the land and to continue using it as a rear support area. In the West, enemy activities were aimed at converting the rice production of the Tonle Sap area to their own use. For the remainder of the country the strategy was to interdict and harass Cambodian Army (FANK) and ARVN activities. Harassment and terrorism were used in provincial capitals to weaken the Cambodian government. The enemy also conducted aggressive campaigns to recruit and train indigenous forces.

The goal of US involvement in Cambodia was to deny freedom of movement to the enemy and at least maintain the status quo--that is, not lose any more provincial capitals or LOCs. The air role of US forces in Cambodia was to support friendly ground operations and included the interdiction of enemy routes and destruction of his storage areas.

Ground Operations

In September 1970, the FANK commander in charge of route security recommended the closure of Route 4 at night because FANK troops could not secure the route between Kompong Som and Phnom Penh during the night (Figure VI-1). At night the enemy moved about with impunity from positions to the west on the Kirirom Plateau. FANK efforts to clear the plateau and establish positions there failed.

By 24 November, Route 4 was closed to friendly traffic as NVA forces were in control of the Pich Nil Pass. The FANK launched a counteroffensive on that date in an attempt to reopen the route. A two-pronged attack from the north and west was made to secure Route 4. The northern task force met heavy opposition at Kompong Speu and stalled, while the western task force got within seven miles of the

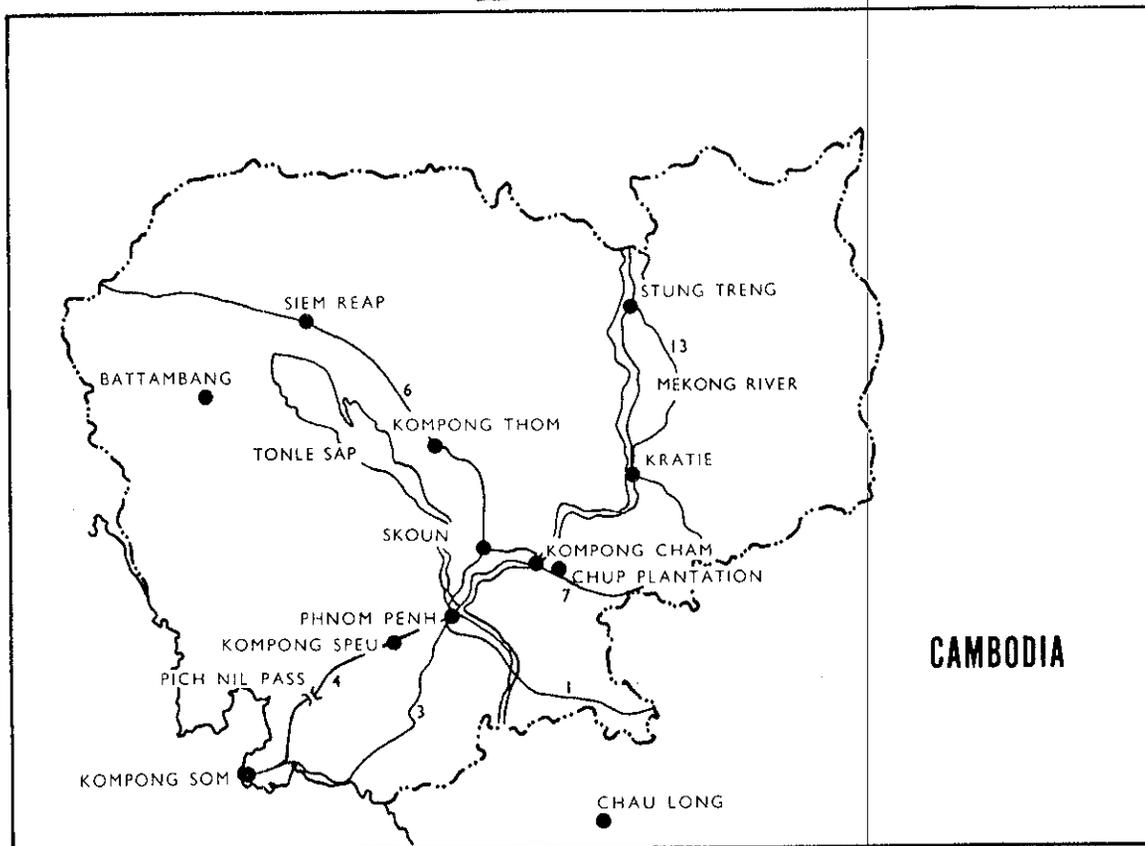


FIGURE VI-1

pass before stalling. After ARVN reinforcement of both task forces, Pich Nil Pass was returned to friendly control on 22 January. The enemy continued sporadic harassment along Route 4, but truck convoys were again able to make limited use of it.

On 3 April, Route 4 was again closed by the destruction of a bridge west of Pich Nil Pass, and by 10 April, Route 3, the alternate route for the pass, was closed by numerous road cuts and downed bridges. Thus, the LOC was again denied friendly use. FANK operations to reopen either or both routes before the wet season were still underway at the end of April.

The rest of the enemy interdiction campaign centered on the Mekong, at the junction of Routes 6 and 7 at Skoun, and at Kompong Cham. On the river, ambushes were employed to prohibit its use by friendly commerce. In mid-January the ARVN launched a series of operations in this area to minimize this threat. By that time, however, consumption and enemy interdiction had exhausted the civilian petroleum reserves and left the Cambodians with only a two-month

[REDACTED]

military reserve in Phnom Penh. Conditions eased somewhat when the first escorted river convoy arrived on 23 January. By the end of April, pressure on the Mekong River and Routes 6 and 7 had been reduced and Kompong Cham was still in friendly hands.

On 16 November, a force of 6000 ARVN soldiers began a sweep in Northeastern Cambodia that resulted in the capture of one of the largest caches of munitions and supplies ever found in Cambodia. Some 254 tons of 85 mm ammunition, 11,150 gallons of gasoline, and 10 tons of rice were captured. It was estimated at the time that these supplies were intended for support of enemy activities in South Vietnam during the dry season. In mid-December the ARVN launched another offensive in the series of Toan Thang operations with extensive sweeps in the Chup Plantation. With air support from the VNAF and USAF, the ARVN succeeded in capturing a number of large caches of petroleum, rice, ammunition, and heavy road repair equipment.

Air Operations in Cambodia

The command and control function in Cambodia was exercised through the airborne extension of the Tactical Air Control Center (TACC) at 7AF Headquarters, called the Tactical Air Control Center, Airborne (TACCA). Two EC-121R aircraft from Korat Royal Thai Air Force Base (RTAFB) provided almost continuous coverage from pre-dawn to dusk. TACCA was unique in that there were representatives from Cambodia, Thailand, South Vietnam, and the US on board. The Cambodian representative had authority to validate targets. As with the ABCCC in Laos, TACCA could order air strikes, but most often deferred the decision to TACC.

US air support in Cambodia was centered around the AC-119G gunship. The AC-119Gs performed three types of missions. Troops in contact were first priority, followed by convoy escort and armed reconnaissance in turn. On occasion, AC-119Gs performed all three missions on one sortie. The immediate result was the relief of the critical petroleum products shortage in Phnom Penh. Both river and road convoys were provided with escort.

Two or three days advance notice was provided by the Navy planners for river convoys. An AC-119G provided 24-hour coverage circling over the convoy at 3500 feet. In addition, during daylight a FAC was in the area at 2500 feet. Other air support during daylight consisted of an Army light fire team (one command and control helicopter, two Cobra helicopter gunships, and two light observation helicopters) flying at or below 1500 feet. These helicopters were stationed at Chi Lang and cycled between the convoy and Chi Lang for refueling. At night, the Navy provided two UH-1Bs and two OV-10s to accomplish the low altitude coverage. These Navy aircraft cycled between the convoy and the Navy command and control vessel anchored on the RVN side of the Mekong at Tan Chau. This composite of aircraft from the three services was designated an air cover package, and was controlled by

[REDACTED]

7AF through TACCA.

The escort of road convoys was difficult to plan, because the Cambodians scheduled their own road convoys and often gave no advance notice of intended movement. Escort of road convoys in most cases consisted of a single gunship or a FAC aircraft or both.

Armed reconnaissance was performed when there was no requirement to support TICs and no convoys required escort. In addition, the AC-119Gs were required to stay within fifteen minutes flying time of the Phnom Penh-Kompong Cham region. From time to time, AC-130 aircraft were used to sweep the routes and waterways from the Laotian border to Kompong Cham.

In addition to tactical air strikes in Cambodia, USAF B-52s flew a total of 354 Arc Light sorties in Cambodia. Most were strikes against known enemy locations in support of the Toan Thang operation.

The Air Force employed the concept of immediate sorties to conserve resources. Using this technique, USAF A-37s, F-100s, and F-4s were able to strike the most lucrative targets and provide the needed air support without flying unnecessary sorties. Table VI-1 shows US preplanned and immediate attack sorties flown in Cambodia during Commando Hunt V. The shift in sorties from immediate to preplanned sorties, beginning in February, reflected planned support of friendly ground activity in the Toan Thang operation. US fighter-attack effort in Cambodia was 11 percent of the total US fighter-attack effort in SEA (Table VI-1).

Table VI-2 shows reported results from US tactical air sorties during the dry season in Cambodia.

In keeping with the Commando Hunt V plan, the VNAF provided a large share of the air effort in Cambodia (Table VI-3).

The RTAF flew interdiction missions in the Cambodia-Thailand border area under the control of a Thai direct air support center at Battambang. The RTAF flew a total of 443 sorties in Cambodia during the dry season, 349 of which were flown before January.

On the evening of 22 January, sappers attacked Pochentrang Airfield and caused major damage to aircraft and airfield facilities. The Cambodian Air Force (AVNK) suffered the loss of 61 aircraft from an original inventory of 87. Of the remaining 26 aircraft, 19 were operational (5 T-28, 4 C-47, 4 YAK-18, and 6 Horizon aircraft). Before the attack the AVNK had flown an average of 817 sorties per month with Fouga Magisters, MiG-17s, and T-28s. In February, March, and April they flew a total of 897 sorties, almost all with the remaining T-28s.

In summary, the ground situation in Cambodia was maintained

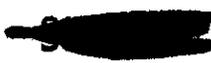
US SORTIES IN CAMBODIA

	<u>IMMEDIATE</u>	<u>PREPLANNED</u>	<u>TOTAL FTR-ATK</u>	<u>% SEA TOTAL</u>	<u>GUNSHIP</u>
10-31					
OCT	147	101	248	4	128
NOV	253	73	326	3	167
DEC	832	372	1204	10	266
JAN	1051	438	1489	11	170
FEB	723	896	1619	12	161
MAR	786	723	1509	9	174
APR	601	1071	1672	12	162
TOTAL	4393	3674	8067	9	1228

RESULTS OF US TACTICAL AIR STRIKES IN CAMBODIA

	<u>TRUCKS D OR D</u>	<u>WATERCRAFT D OR D</u>	<u>FIRES AND SEC EXP</u>	<u>GUN POSITIONS D OR D</u>	<u>KBA</u>	<u>STRUCTURES AND BUNKERS D OR D</u>
10-31						
OCT	0	7	23	9	0	79
NOV	4	5	89	61	22	146
DEC	22	35	151	13	33	330
JAN	15	161	267	10	37	461
FEB	0	25	158	1	23	531
MAR	29	245	390	8	118	400
APR	16	159	234	9	29	580
TOTAL	86	637	1312	111	262	2527

TABLE VI-1/VI-2


VNAF SORTIES IN CAMBODIA

	<u>IMMEDIATE</u>	<u>PREPLANNED</u>	<u>TOTAL FTR-ATK</u>	<u>GUNSHIP</u>
10-31				
OCT	116	593	709	27
NOV	243	1116	1359	29
DEC	243	1229	1472	72
JAN	105	1264	1369	35
FEB	28	1224	1252	47
MAR	31	1163	1194	23
APR	18	1056	1074	46
TOTAL	784	7645	8429	279

TABLE VI-3

throughout the period by assistance from air resources. The escorted river convoy procedures worked well and relieved the pressure on Phnom Penh for supplies and petroleum products. Pich Nil Pass remained in contention. Emphasis on the use of immediate sorties enabled US tactical air to be responsive to the environment while conserving resources.

THE REPUBLIC OF VIETNAM

Expectations of lower levels of enemy-initiated activity within RVN during Commando Hunt V than in previous dry seasons formed the basis for planning a decreased level of tactical air effort there. Events bore out these expectations as shown Table VI-4. Both the number of battalion or larger assaults and attacks by fire were much lower than during Commando Hunt III. The shift of enemy-initiated activity toward terrorist incidents indicated the enemy's need to conserve his limited resources.

Attack Sorties

Throughout the campaign, the VNAF was expected to and did assume an increased responsibility for the conduct of the air war in RVN.

[REDACTED]

**NUMBER OF NVA- AND VC-INITIATED
ACTIONS IN RVN--COMMANDO HUNTS III AND V**

COMMANDO HUNT	ASSAULTS BN AND LARGER		ATTACKS BY FIRE		INCIDENTS OF TERRORISM	
	<u>III</u>	<u>V</u>	<u>III</u>	<u>V</u>	<u>III</u>	<u>V</u>
10-31 OCT	0	0	92	105	124	144
NOV	3	0	157	56	124	116
DEC	2	0	144	98	120	181
JAN	3	0	128	66	117	176
FEB	0	0	95	95	119	205
MAR	3	2	85	110	198	272
APR	4	1	244	82	240	216
TOTAL	15	3	945	612	922	1310

TABLE VI-4

In February and March the majority of the attack sorties in RVN were flown by the VNAF (Table VI-5). US resources were used only as required. Increased friendly and enemy ground operations in MR 1 and MR 2 during April required a much larger number of US sorties to fulfill requirements than any other month. Reported bomb damage from US tactical air is shown in Table VI-6.

Support of Major Ground Operations

During Commando Hunt V, there were only four major Allied offensive or defensive operations in RVN. The first began on 1 December in the U Minh Forest area of the Mekong Delta (Figure VI-2) and sought to deny the enemy use of the area. The VC had held the area for years and used it for training and as a staging point for operations in MR 3 and MR 4. The U Minh Forest operation was an ARVN action supported by VNAF air. There was some US air support, but the VNAF carried most of the load (Table VI-7). By 14 February, the operation had netted 30 tons of rice, many small caches of small arms and

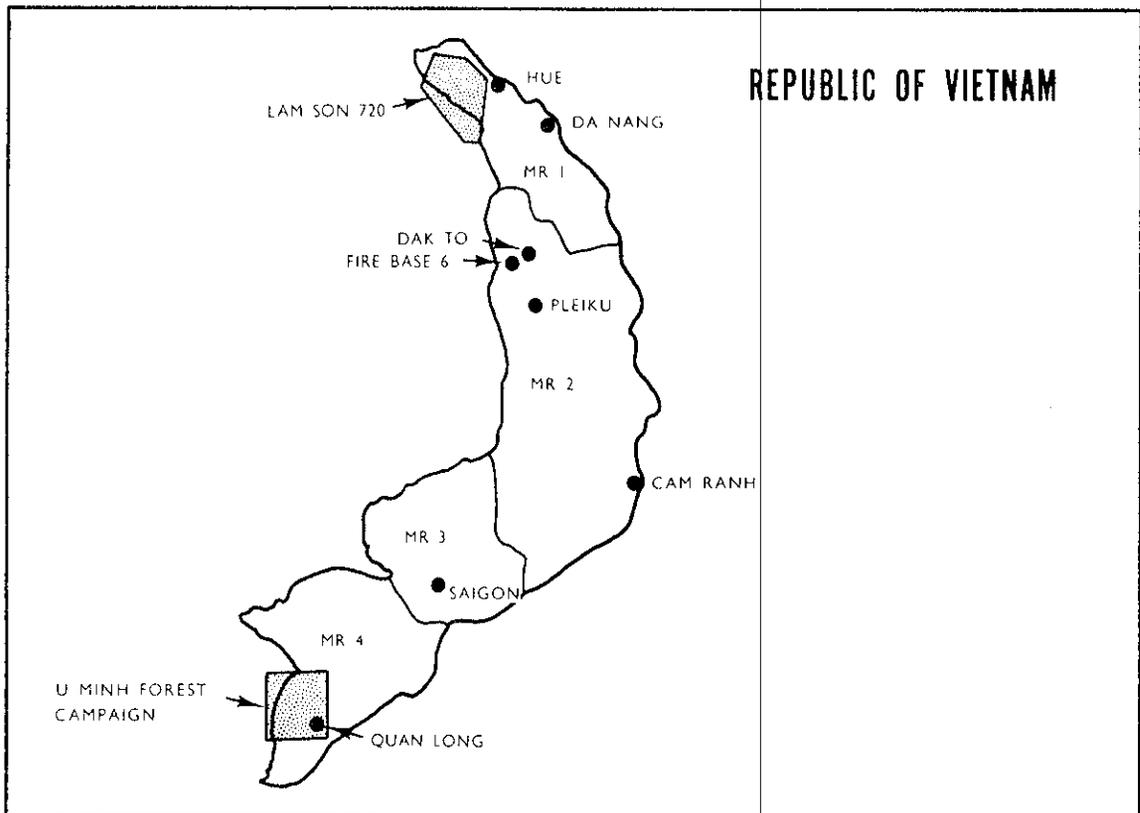
**US AND VNAF ATTACK SORTIES
REPUBLIC OF VIETNAM**

	<u>US</u>			<u>VNAF</u>		
	<u>FTR-ATK SORTIES</u>	<u>% SEA TOTAL</u>	<u>GUNSHIP SORTIES</u>	<u>FTR-ATK SORTIES</u>	<u>% SEA TOTAL</u>	<u>GUNSHIP SORTIES</u>
10-31						
OCT	1782	31	26	1184	51	24
NOV	2333	24	51	1460	45	27
DEC	2180	18	14	1866	54	50
JAN	2159	16	4	2037	53	50
FEB	1622	13	12	1926	54	43
MAR	1748	11	30	2137	53	42
APR	2809	20	29	2627	42	47
TOTAL	14633	17	166	13237	50	283

RESULTS OF US TACTICAL AIR STRIKES IN RVN

	<u>TRUCKS D OR D</u>	<u>WATERCRAFT D OR D</u>	<u>FIRES AND SEC EXP</u>	<u>GUN POSITIONS D OR D</u>	<u>KBA</u>	<u>STRUCTURES AND BUNKERS</u>
	10-31					
OCT	1	18	83	2	65	820
NOV	0	18	127	3	92	1198
DEC	2	18	150	4	142	1202
JAN	0	14	226	8	71	1011
FEB	7	12	219	15	134	954
MAR	2	9	868	9	132	724
APR	30	1	1113	12	393	998
TOTAL	42	90	2786	53	1029	6906

TABLE VI-5/VI-6



**US AND VNAF ATTACK SORTIES SUPPORTING
MAJOR GROUND OPERATIONS IN RVN**

	<u>US</u>	<u>VNAF</u>	<u>TOTAL</u>
U MINH FOREST (1 DEC - 14 FEB)	287	699	986
FSB 6 (31 MAR - 20 APR)	352	479	831
LAM SON 719 (30 JAN - 7 APR)	1122	146	1268
LAM SON 720* (14 MAR - 30 APR)	711	81	792

* LAM SON 720 WAS ONGOING AT THE END OF COMMANDO HUNT V.

FIGURE VI-2/TABLE VI-7

[REDACTED]

explosives, and over 500 Hoi Chanh. Captured documents stated that the operation had disrupted enemy supply routes, causing critical shortages in food and materiel.

In the late afternoon of 31 March, Fire Support Base 6 (FSB 6) near Dak To (Figure VI-2) was overrun by NVA forces after almost 12 hours of heavy fighting. By noon the next day, an ARVN battalion had recaptured FSB 6 and was reinforced by another battalion. Heavy fighting continued in the area until 21 April when major portions of the NVA force appeared to have redeployed. The VNAF provided the majority of the attack sorties, but US support was significant, averaging about 17 attack sorties per day.

The remaining two operations were Lam Son 719 and Lam Son 720. The Lam Son 719 operation focused on the ARVN incursion into Steel Tiger, and only a fraction of the total attack sortie effort for the operation was flown in RVN. Lam Son 720 was initiated on 14 April and was a small-unit search and destroy operation in the Route 616, A Shau Valley, and Route 547 areas (Figure VI-2). Contact with enemy forces was light and most often took the form of automatic weapons fire in the vicinity of landing zones during helicopter insertion and extraction of troops. The low level of activity was perhaps the result of the limited scope of Allied operations. No significant cache discoveries or major LOC interdiction operations were reported. US and VNAF attack sorties for each of the operations is summarized in Table VI-7.

The low levels of enemy-initiated activity in RVN during Commando Hunt V and the failure of the NVA to maintain their siege of Dak To reflected the success of the Steel Tiger interdiction program as well as the effectiveness of the Arc Light and tactical air support provided in RVN. The lull in enemy activity and the successes of ARVN forces boosted the Vietnamization program and increased its chances of success. Commando Hunt V saw the VNAF assume a greater share of the tactical air role as only 17 percent of the US fighter-attack sorties in Southeast Asia struck in RVN during the campaign. This low percentage in RVN allowed more of the effort to be expended in Steel Tiger to stem the flow of enemy supplies to the battlefield in RVN.

BARREL ROLL

Since the mid-1960s military operations in northern Laos had tended to follow a pattern of government offensives toward the east during the wet season and NVA and Pathet Lao offensives toward the west during the dry season. Prior to the beginning of Commando Hunt V, the US ambassador to Laos had indicated that the Lao government planned to follow a holding strategy during the 1970-71 dry season. The objective was to contain expected enemy pressure toward Luang Prabang from the north and toward Long Tieng and Sam Thong from the PDJ (Figure VI-3). It was to be accomplished without major offensive

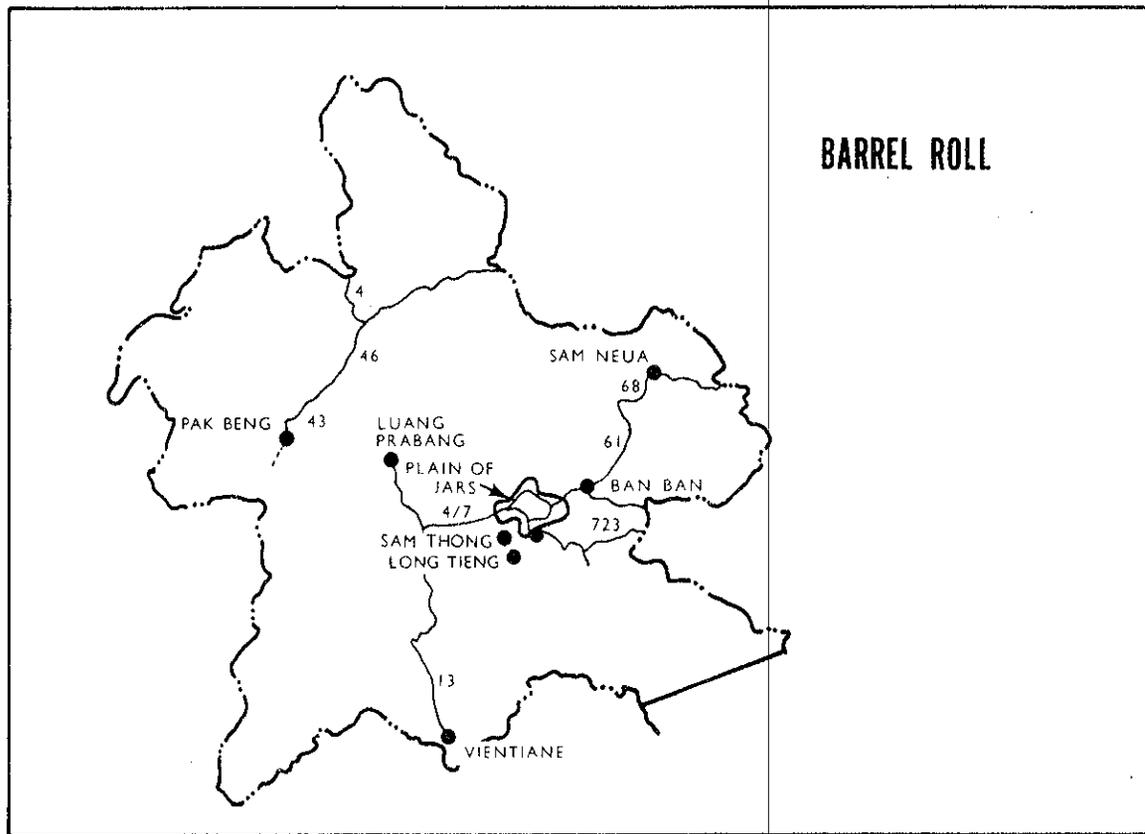


FIGURE VI-3

actions by the Royal Lao Army (RLA) or by Major General Vang Pao's guerrilla forces southwest of the PDJ. This strategy enabled the Commander, 7AF, to plan on economizing on US air support to the Royal Lao government (RLG) and guerrilla forces during Commando Hunt V, with the understanding that air support would be shifted to Barrel Roll (BR) to meet contingencies.

Situation on the Ground

PDJ. Near the end of Commando Hunt III, the enemy had pushed General Vang Pao from the western rim of the PDJ and brought his positions near Long Tieng and Sam Thong into jeopardy. The enemy pressure subsided with the arrival of the wet season and the attendant deterioration of the enemy's supply route along Route 7 under the combined effects of air attack and rain. On 3 August 1970, Vang Pao initiated offensive action with the limited objective of occupying key sites along the western PDJ. By 23 October, his forces had secured Muong Soui and pushed the enemy 30 km back from the western rim of the PDJ.

[REDACTED]

From October to the end of November, the enemy limited his activities to protecting the western and southwestern flanks of the PDJ and storage complexes in the Ban Ban area. By December the situation had stabilized with the enemy retaining the local initiative throughout the area. During the first week of December, General Vang Pao launched Operation Counterpunch III against supply caches in and around Ban Ban. The operation fell short of its goal and was terminated on 6 January, and his forces withdrew to positions southwest of the PDJ.

Near the end of December, the enemy staged major unit and supply redeployments westward for an offensive in northern Laos. By the end of February the enemy advance made the military situation critical with NVA forces deployed around pro-government positions southwest of the PDJ. Friendly positions in the area were under NVA heavy weapons fire, and ground fighting was fierce in an area three to six miles northeast of Long Tieng as opposing forces vied for high ground positions. US and Royal Lao Air Force (RLAF) strikes were effective against enemy troop concentrations and supply dumps, and toward the end of March the enemy was forced to disperse personnel and supply caches, making his logistics support more difficult. By the end of April, the friendly situation had improved with the addition of artillery pieces along the defensive line northeast of Long Tieng.

Luang Prabang. In late November, an RLA operation to extend government control into the Nam Ou Valley north of Luang Prabang, the royal capital, failed. NVA and Pathet Lao units reacted and pushed the RLA back from positions 23 miles north of Luang Prabang to an area just north of the capital. By February, the situation around the royal capital and the situation at Long Tieng had deteriorated to such an extent that a state of emergency was declared throughout Laos.

Reinforcements from southern Laos were moved to the Luang Prabang area, and a gradual push was started against the NVA and Pathet Lao. By 24 April, friendly forces had retaken villages 7 to 11 miles northeast and east of Luang Prabang and were advancing toward the north. RLAF and US tactical air supported friendly units and succeeded in clearing the enemy from several high-ground positions. Allied air strikes also hampered the movement of enemy supplies from the north to enemy units deployed in the vicinity of the royal capital.

Air Operations in Barrel Roll

The planned allocation of US fighter-attack sorties to Barrel Roll, 30 per day or about 900 per month, proved to be sufficient through December. Not until January did the number of quick reaction force sorties scheduled for Barrel Roll that were not flown drop below 100 per month. The enemy offensive southwest of the PDJ required an increased sortie level in Barrel Roll after that time (Table VI-8). Tactical air to meet the contingency was shifted as provided for in the campaign plan. During March and April the fighter-attack sortie

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US AND RLAF ATTACK SORTIES

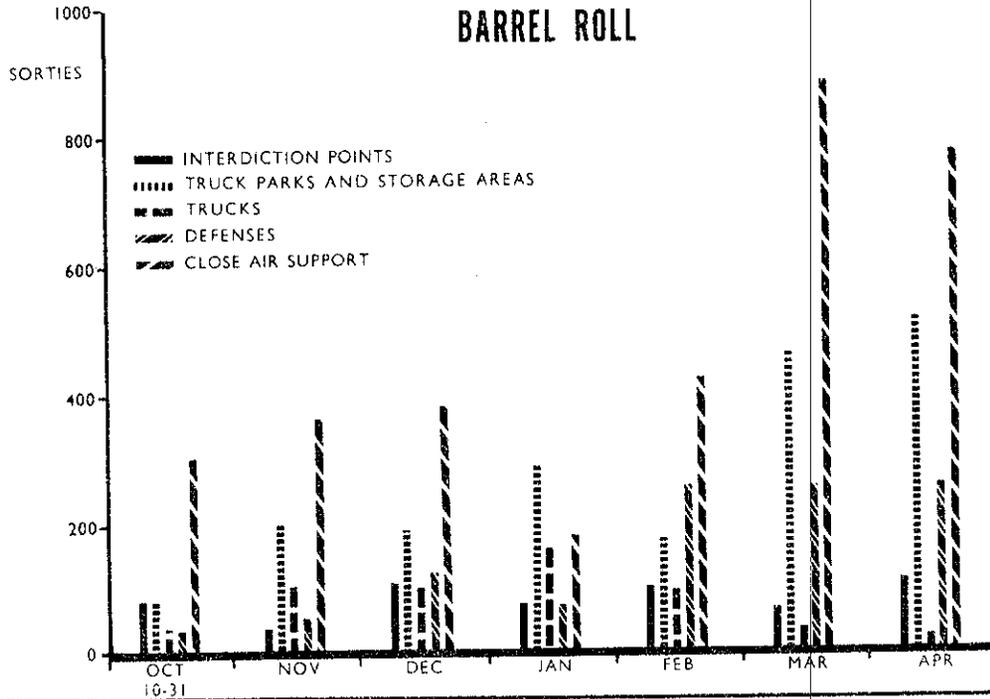
BARREL ROLL

	<u>US</u>			<u>RLAF</u>		
	<u>FTR-ATK SORTIES</u>	<u>% SEA TOTAL</u>	<u>GUNSHIP SORTIES</u>	<u>FTR-ATK SORTIES</u>	<u>% BR TOTAL</u>	<u>GUNSHIP SORTIES</u>
10-31						
OCT	454	8	28	1125	71	46
NOV	712	7	38	1371	66	72
DEC	829	7	47	1037	56	63
JAN	697	5	65	1536	69	61
FEB	997	7	75	2097	68	123
MAR	1588	10	100	2029	56	150
APR	1531	11	115	2001	57	150
TOTAL	6808	8	468	11216	62	665

TABLE VI-8

level in Barrel Roll was about 70 percent higher than the original planning figure. During the campaign eight percent of the total US fighter-attack sorties struck in Barrel Roll, or about 120 sorties per month more than the planned allocation of 900 sorties. As was the case with VNAF operations in RVN, RLAF sorties in Barrel Roll increased during the campaign. Fighter-attack sorties increased 50 percent in February, March, and April. During each month of the campaign, the RLAF flew the majority of attack sorties in Barrel Roll. It is to be recognized, however, that the RLAF T-28s delivered much lighter bomb loads than the larger US F-4s and A-1s. Also, the US AC-119K gunships used in Barrel Roll delivered heavier fire than the RLAF AC-47s. Figure VI-4 shows the emphasis placed on close air support in employing US tactical air in Barrel Roll. Toward the end of the campaign many of the strikes against storage areas struck supply points in the battlefield area southwest of the PDJ, reinforcing the troop-support nature of the air war in Barrel Roll. In addition to the results of US air strikes in Barrel Roll shown in Table VI-9, FACs reported 76,739 cubic feet of supplies destroyed or damaged. There was a significant reduction

US ATTACK SORTIES BY TARGET TYPE BARREL ROLL



RESULTS OF US TACTICAL AIR STRIKES IN BARREL ROLL

	<u>TRUCKS D OR D</u>	<u>FIRES AND SEC EXP</u>	<u>GUN POSITIONS D OR D</u>	<u>KBA</u>	<u>STRUCTURES AND BUNKERS D OR D</u>
10-31					
OCT	43	22	8	211	44
NOV	103	119	19	88	69
DEC	207	48	34	87	89
JAN	363	154	17	35	43
FEB	132	143	48	167	124
MAR	48	4696	24	80	91
APR	100	1773	52	154	82
TOTAL	996	6955	202	882	542

FIGURE VI-4/TABLE VI-9

[REDACTED]

in the number of trucks destroyed or damaged after January as interdiction sorties shifted to troop support.

By the end of the campaign, the RLG, with the help of tactical air, had succeeded in holding the enemy southwest of the PDJ, and the situation was much improved in the area near Luang Prabang. The US air support had been a major factor enabling the RLG to hold the enemy southwest of the PDJ and north of Luang Prabang. There had been a controlled shift of US airpower to counter the enemy threat in Barrel Roll, and the RLG military position in Barrel Roll at the end of Commando Hunt V was better than it had been at the end of the previous dry season.

CHAPTER VII
OVERALL ASSESSMENT

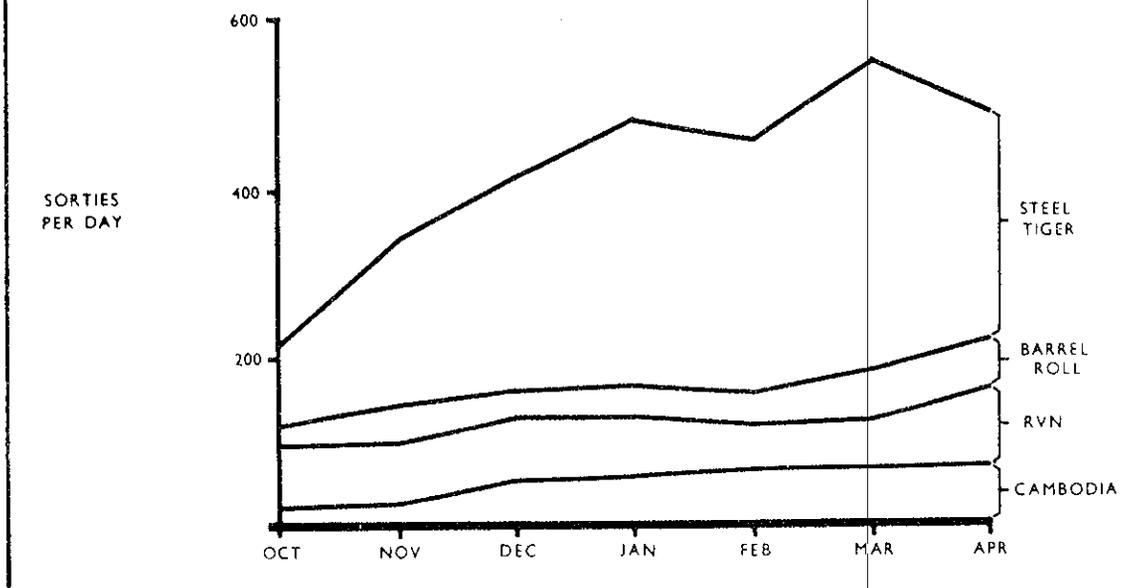
The primary objective of Commando Hunt V was to restrict the flow of supplies through Laos to enemy forces in RVN and Cambodia. The secondary objective was to increase the cost to the enemy of continuing his aggression in RVN and Cambodia. These objectives were achieved to a greater degree in Commando Hunt V than in either Commando Hunt I or Commando Hunt III. In the achievement of this result the air forces involved exploited the experience gained in the two earlier campaigns and the improved equipment provided by development efforts motivated by those earlier experiences. They also gave full support to the South Vietnamese ground-force incursion into Laos, a radical new departure in Steel Tiger interdiction that would not have been possible without the air support provided.

The success of the campaign must be viewed in its entirety to be meaningful. The entry interdiction program; air attacks against trucks, storage areas, defenses, and route structure; support of Lam Son 719; and other supporting efforts were interrelated so that it was not possible to attribute a certain fraction of the success to any particular program.

During Commando Hunt V, the Steel Tiger area received the preponderant weight of US air effort in Southeast Asia. Figure VII-1 shows the monthly distribution of US tactical air sorties. The upward trend in overall weight of effort corresponded with increasing enemy activity in Steel Tiger and peaked in March when air support requirements for Lam Son 719 and Barrel Roll were highest. The level of US air effort in Cambodia remained constant, averaging 11 percent of the US total in Southeast Asia. Emphasis on using immediate sorties enabled US tactical air to be responsive there while conserving resources. In RVN, the VNAF assumed an increasing share of the tactical air role as 17 percent of the US SEA total went into RVN on the average. During April, US support doubled to counter the intense enemy attacks in Military Region 2. US tactical air effort in Barrel Roll averaged 8 percent of the total. Troop support sorties increased in March and April to counter the enemy offensive southwest of the PDJ and to enable the RLG to hold the enemy north of Luang Prabang.

Within Steel Tiger the distribution of tactical air effort varied as depicted in Figure VII-2. In the first three months of the campaign, entry interdiction dominated. Daily average sorties flown in support of the entry interdiction program were 95 in the period 10 through 31 October, and had risen to 105 by December. In this three-month period,

US TACTICAL AIR SORTIES BY GEOGRAPHIC AREAS



TACTICAL AIR SORTIE DISTRIBUTION STEEL TIGER

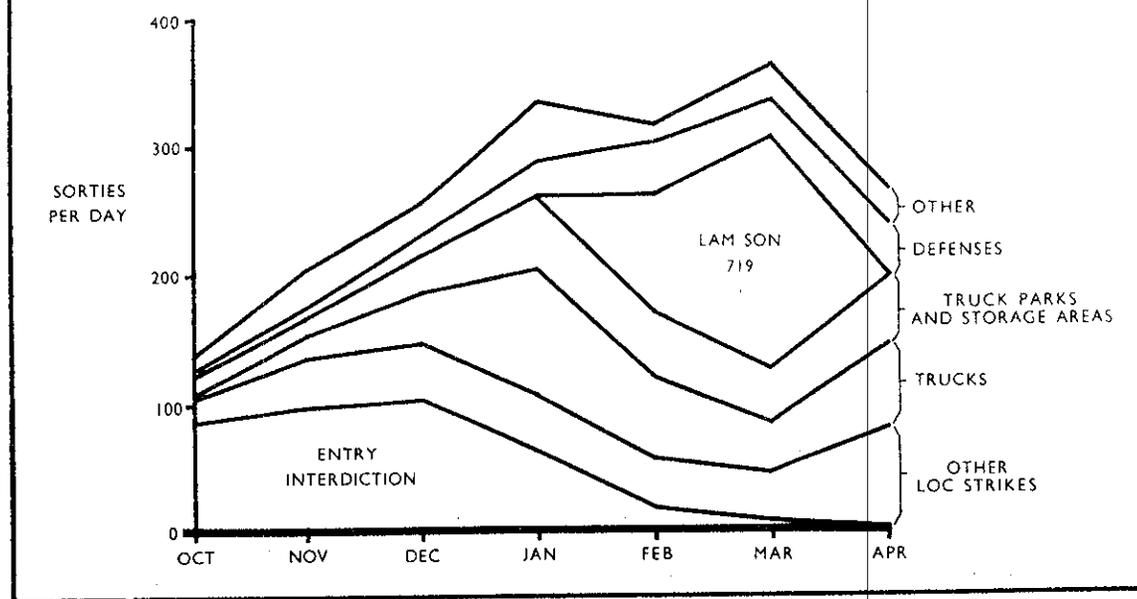


FIGURE VII-1/VII-2

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sorties flown against targets outside of the purview of the entry interdiction program increased at an even greater rate. Sorties striking against other LOCs, trucks, and truck parks and storage areas followed the flow of enemy logistics activity, hampered by entry interdiction, into the central route structure of Steel Tiger. Strikes against enemy defenses increased with the expansion of the weight and distribution of the air interdiction effort in Laos and the rise in the anti-aircraft threat level.

In January, a shift in emphasis was made when analysis showed that the effectiveness of entry interdiction had begun to decrease. The effort devoted to entry interdiction was reduced to 58 percent of its December level. The effort against trucks and truck parks and storage areas had made a decided increase, accounting for 50 percent of the January total as opposed to 29 percent of the smaller total effort in December. Strikes in support of small-scale ground interdiction efforts in western Steel Tiger reached their peak in January with support of the Silver Buckle operation, reflected in the "other" category in Figure VII-2.

Another decided shift in emphasis occurred in February; support for the Lam Son 719 ground interdiction effort in eastern Steel Tiger received 31 percent of the February tactical air effort, and 42 percent of the March effort. March saw the highest total effort of the campaign. March was also the peak month for enemy truck activity; many of the sorties that struck trucks--and all other target categories--during the Lam Son 719 period are included in the Lam Son 719 support category. The total truck effort in March produced the second highest total of trucks destroyed or damaged of the campaign.

April was the record month for trucks; 5699 were reported as destroyed or damaged. The high day came in April also; 305 trucks were reported as destroyed or damaged on 11 April. The April truck effort was integrated with an expanded effort against LOCs in the exit areas to keep throughput at the end of the dry season to a minimum.

The cost to the enemy was great. As the gunship and B-57G force built to full strength and proficiency and fighters were shifted from the entry interdiction program, more of his trucks were struck.

The number of trucks destroyed or damaged correlated well with the enemy's truck activity and rose throughout the campaign to the April high. In all, 20,926 trucks were reported destroyed or damaged in Steel Tiger during Commando Hunt V, twice the number reported for Commando Hunt III.

Tactical air attacks against truck parks and storage areas accounted for 32,323 fires and secondary explosions, two and a half

times the Commando Hunt III experience. Storage area targets continued to be difficult to find, but the tactic of probing suspected areas with strikes and following up promising results with additional sorties proved productive. Lucrative finds in December, March, and April were the major contributors and accounted for 55 percent of the total damage from all strikes against this target type.

Attacks against LOCs resulted in over 8000 cuts and slides and 28 bridges destroyed or damaged, creating urgent repair work for enemy LOC maintenance crews. Enemy defenses suffered over 1000 guns destroyed or damaged. Additional costs to the enemy included 4000 KBA and 300 watercraft destroyed.

Costs to the US in terms of aircraft hit and lost were lower in Commando Hunt V than in Commando Hunt III. The hit rate per 1000 sorties was halved, and the loss rate per 1000 sorties fell to .27 from the Commando Hunt III value of .74.

Of the 60,518 tons of supplies the NVA brought into Steel Tiger from NVN, only 7070 tons, or 11.7 percent, reached RVN or Cambodia (Figure VII-3). This throughput-to-input ratio of about one to nine stamped the Commando Hunt V interdiction campaign a success.

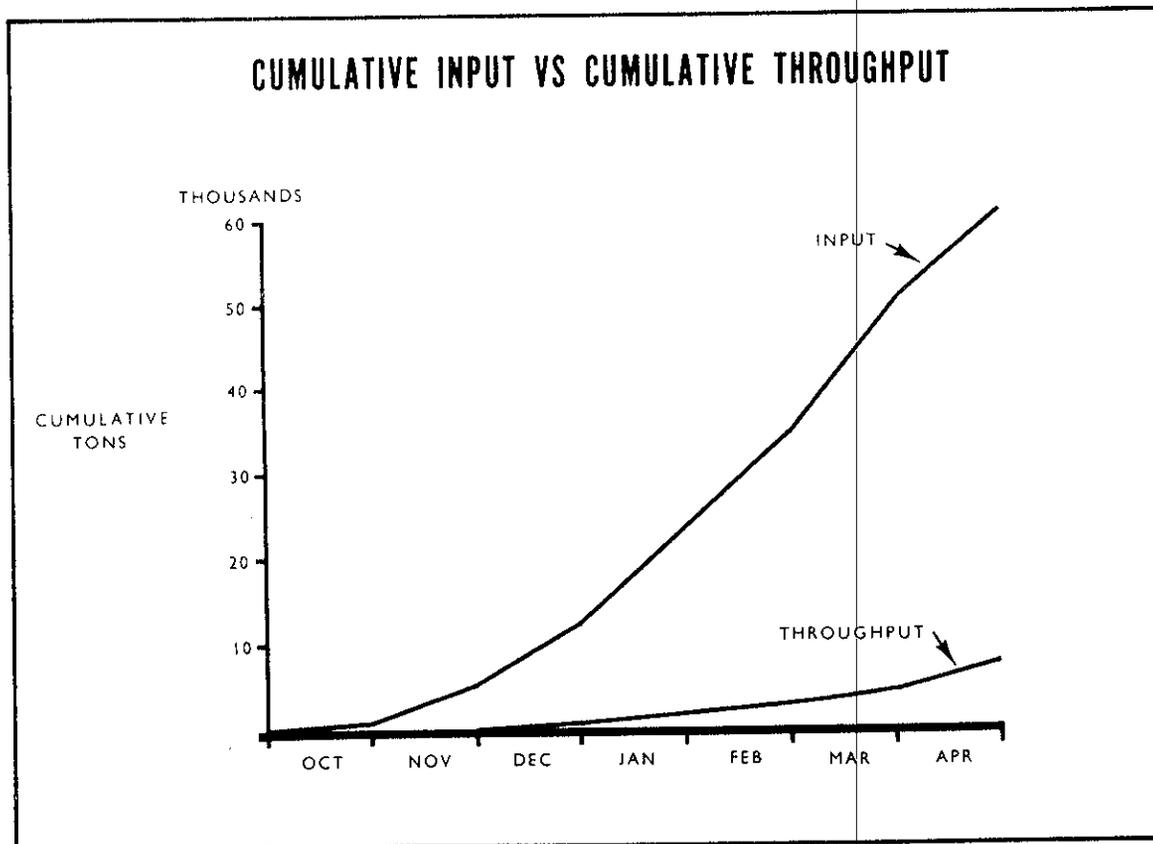


FIGURE VII-3

██████████
CHAPTER VIII

EPILOGUE: 1-14 MAY

Enemy resupply activity continued into the transitional period between the northeast and southwest monsoons. However, during this period weather began to affect the level of activity. A late season cold front from China brought extensive cloudiness and rain to most of the Indochina peninsula from 5 through 7 May. Toward the middle of May, as the southwest monsoon approached, afternoon and evening thunderstorm activity became more extensive and persistent, often lasting through the night. The impact of weather was reflected in large fluctuations in sensor detections from one night to the next. Sensor-detected truck movements during the first 14 days of May ranged from a high of 1218 on 2 May to a low of 402 on 6 May. The average was 814 per day, down from the April average of 1053. Input activity continued at a reduced level while the throughput rate increased about ten percent over April (Table VIII-1).

	<u>TOTAL</u>	<u>DAILY AVERAGE</u>
SENSOR-DETECTED TRUCK MOVEMENTS	11390	814
VISUALLY OBSERVED TRUCKS	2510	179
INPUT IN TONS	3526	252
THROUGHPUT IN TONS	1004	72

TABLE VIII-1

Entry interdiction was continued against Boxes C and D using Arc Light. Rains combined with the strikes to make the original boxes impassable. Most of the enemy traffic used the Route 1035A bypass around Box C and the western bypass around Box D. Route 1036 was also used as an input route for supplies moving through both the Box C and Box D areas. Other Arc Light sorties struck enemy locations in support of Lam Son 720 as well as storage areas in Steel Tiger (Table VIII-2).

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ARC LIGHT SORTIES IN STEEL TIGER

1-14 MAY

	<u>INTERDICTION BOXES</u>	<u>OTHER</u>
SORTIES	180	250
SECONDARY EXPLOSIONS	54	112

TABLE VIII-2

Exit interdiction by tactical air continued against IDPs on Routes 110A, 110D, 922, and 966. In addition, new IDPs were struck on Routes 9H, 925, and 926 as throughput activity increased in those areas. Table VIII-3 shows the distribution of tactical air strike sorties by target type.

**US TACTICAL AIR STRIKE SORTIES BY
TARGET TYPE IN STEEL TIGER**

(FIRST STRIKE)

1-14 MAY

<u>TARGET TYPE</u>	<u>TOTAL SORTIES</u>	<u>DAILY AVERAGE</u>	<u>PERCENT</u>
TRUCKS	849	61	23
TRUCKS PARKS AND STORAGE AREAS	558	40	15
LINES OF COMMUNICATION	1345	96	37
DEFENSES	428	31	12
OTHER	466	33	13
TOTAL	3646	260	100

TABLE VIII-3

The overall performance of the force against trucks (Table VIII-4) declined during the first two weeks of May.

~~XXXXXXXXXX~~

FORCE PERFORMANCE AGAINST TRUCKS

1-14 MAY

	<u>STEEL TIGER</u>	<u>BARREL ROLL</u>	<u>TOTAL</u>
SORTIES FLOWN	3646	781	4427
SORTIES STRIKING TRUCKS	1140	40	1180
PERCENT STRIKING TRUCKS	31	5	27
TRUCKS STRUCK	2166	87	2253
TRUCKS D OR D	1411	67	1478
D OR D/SORTIE STRK TRUCKS	1.24	1.68	1.25
D OR D/TRUCK STRUCK	.65	.77	.66

TABLE VIII-4

The reasons for this decline were:

1. a lower level of truck activity;
2. deteriorating weather;
3. decreased aircraft availability; and
4. revised truck BDA criteria for gunships.

The number of sensor-detected truck movements in VR sectors open to gunships declined seven percent from the number for the last two weeks of April. Poor weather not only affected the number of trucks observed but also made attacks more difficult. A decrease in the number of sorties flown against trucks was brought about by the emphasis on striking exit IDPs, by bad weather, and by a reduction in the available gunship force due to battle damage. The revised truck BDA criteria for AC-130 gunships, discussed in Chapter III, were implemented on 1 May for a period of evaluation. From 1 through 14 May there was no statistically significant decrease in terminal effectiveness of the gunship force as measured by the number of trucks destroyed or damaged per truck struck. However, fewer trucks were struck per gunship sortie compared to the last two weeks of April, even after making adjustments for decreased truck activity, and adjusting for weather effects on truck sightings. The average time per truck attack seemed to be increasing. How much of this increase was attributable to changes in tactics induced by the new

criteria versus how much to weather delay of strike execution could not be quantified.

A good example of immediate photographic confirmation of a gunship strike occurred on 7 May. An AC-130 reported destroying seven trucks and damaging ten in a convoy on Route 911C. Figure VIII-1 shows night photography taken shortly after the strike. Day-time photography of the strike area (Figure VIII-2), revealed eight destroyed trucks, six destroyed 85 mm guns, and one damaged 85 mm gun.

Tactical air results from strikes against other types of targets in Steel Tiger were as follows (Table VIII-5):

TACTICAL AIR REPORTED TARGET DAMAGE IN STEEL TIGER		
1-14 MAY		
<u>TARGET</u>	<u>TOTAL</u>	<u>DAILY AVERAGE</u>
TRUCK PARKS AND STORAGE AREAS		
FIRES	134	10
SECONDARY EXPLOSIONS	773	55
LINES OF COMMUNICATION		
CUTS, SLIDES, AND CRATERS	966	69
DEFENSES		
GUNS DESTROYED	55	4
GUNS DAMAGED	11	1
FIRES	38	3
SECONDARY EXPLOSIONS	116	8
OTHER		
FIRES	271	19
SECONDARY EXPLOSIONS	1057	76

TABLE VIII-5

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NIGHT PHOTOGRAPHY OF AC-130 STRIKE ON 7 MAY

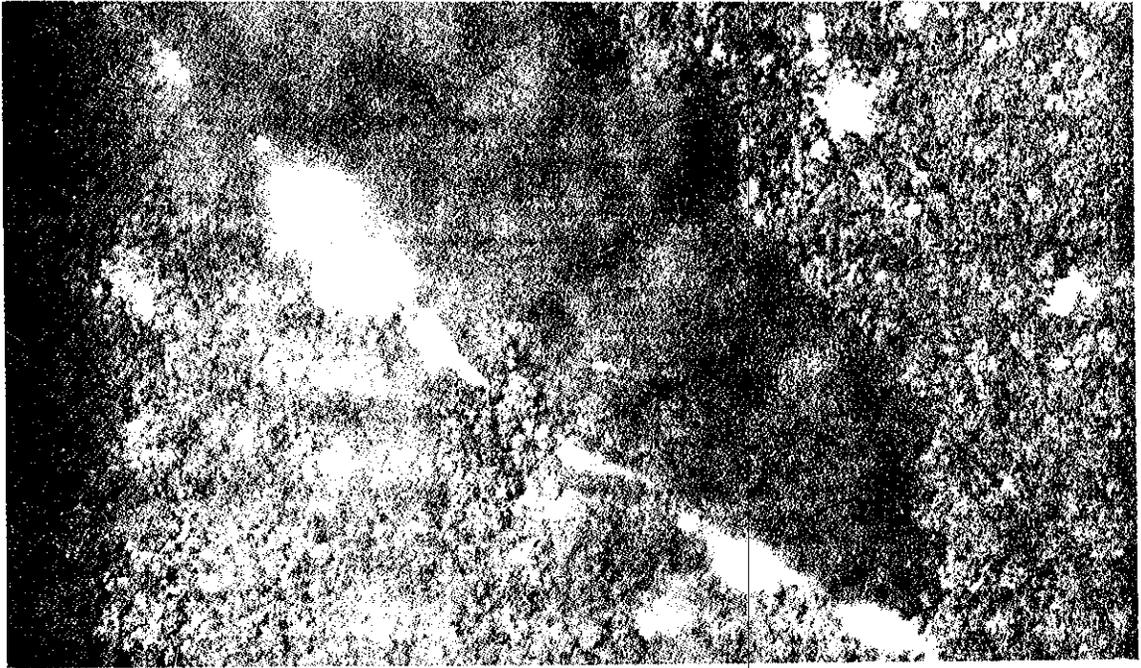


FIGURE VIII-1

DAYTIME PHOTOGRAPHY OF SAME VICINITY ON 8 MAY

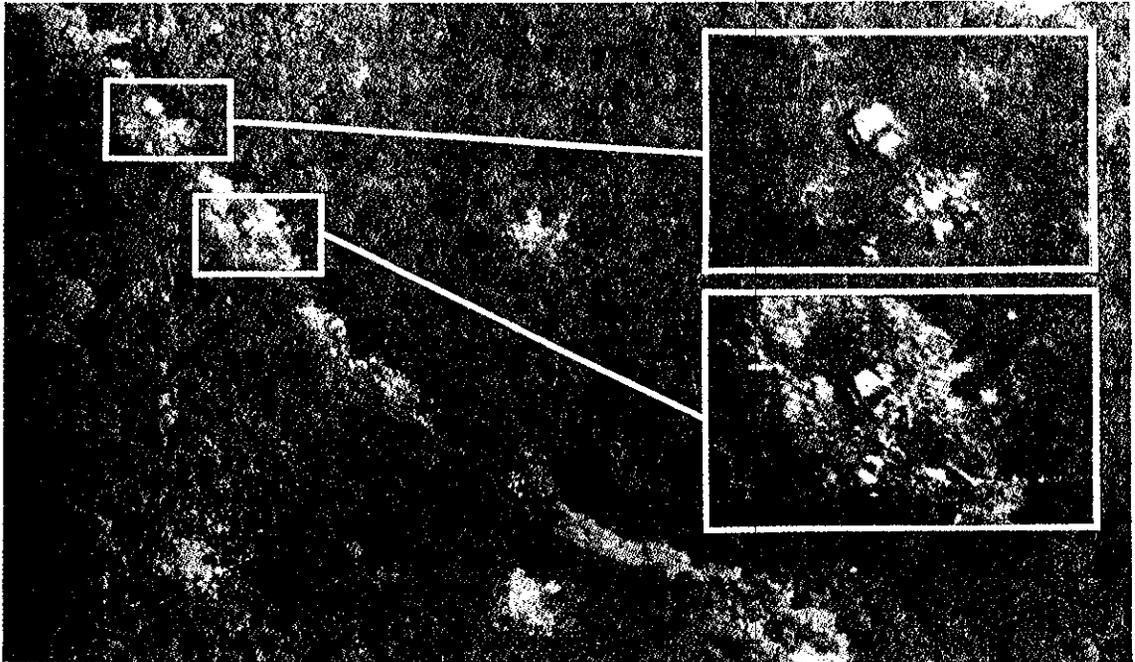


FIGURE VIII-2

[REDACTED]

Enemy AAA defenses continued to be active throughout the LOC structure in Steel Tiger. Firings were concentrated along the core routes near Tchepone and Muang Nong. However, defenses continued to increase along the western routes with two 37 mm and two 57 mm high-threat areas being added along Routes 23I and 23J. The gun count for all of Steel Tiger remained at about 650. Table VIII-6 shows the aircraft hit and loss experience during the first two weeks of May.

AIRCRAFT HIT AND LOSS EXPERIENCE		
1-14 MAY		
	<u>STEEL TIGER</u>	<u>BARREL ROLL</u>
SORTIES FLOWN	7207	1148
REPORTED AAA REACTIONS	1175	8
AIRCRAFT HIT	4	2
AIRCRAFT LOST	1	0

TABLE VIII-6

On 10 May, an OV-10 FAC operating in Barrel Roll southeast of Ban Ban was attacked by two MiG-21 aircraft at about 1230 Laos time. The MiGs broke off their attack after each had made a pass. The OV-10 pilot reported seeing four air bursts during the attack but his aircraft was not hit. The MiGs departed before F-4Ds could reach the area.

During early May, there was an increase in the number of photo-confirmed SAM battalions south of 18° 05' N. Intelligence estimates indicated eight battalions were operating in RP I and adjacent Laos border areas, with two of this number believed to be in the vicinity of Tchepone. The NVA appeared to be realigning their defenses with a concentration farther south than had been noted in past years.

Commando Hunt VI, the 1971 southwest monsoon air interdiction campaign, began on 15 May. Indicators at that time were that the enemy intended to continue his logistics activity into the rainy season.

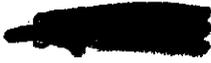
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APPENDICES



APPENDIX A
AIR RESOURCES

COMMAND AND CONTROL

US interdiction operations, the responsibility of COMUSMACV, were conducted by the Deputy COMUSMACV for Air, who was also the Commander, 7AF. In this capacity, the Commander, 7AF, was the single manager for all air operations in Laos, RVN, Cambodia and specified areas of NVN. He was the coordinating authority for COMUSMACV with the Navy carrier task force, 1st Marine Air Wing, and SAC forces supporting MACV operations. Figure A-1 shows these control relationships.

COMUSMACV provided broad general guidance on the allocation of tactical air resources between RVN and Cambodia and Laos. The Commander, 7AF, through his Deputy Chief of Staff for Operations, planned and directed the tactical air operations of the interdiction campaign.

Control

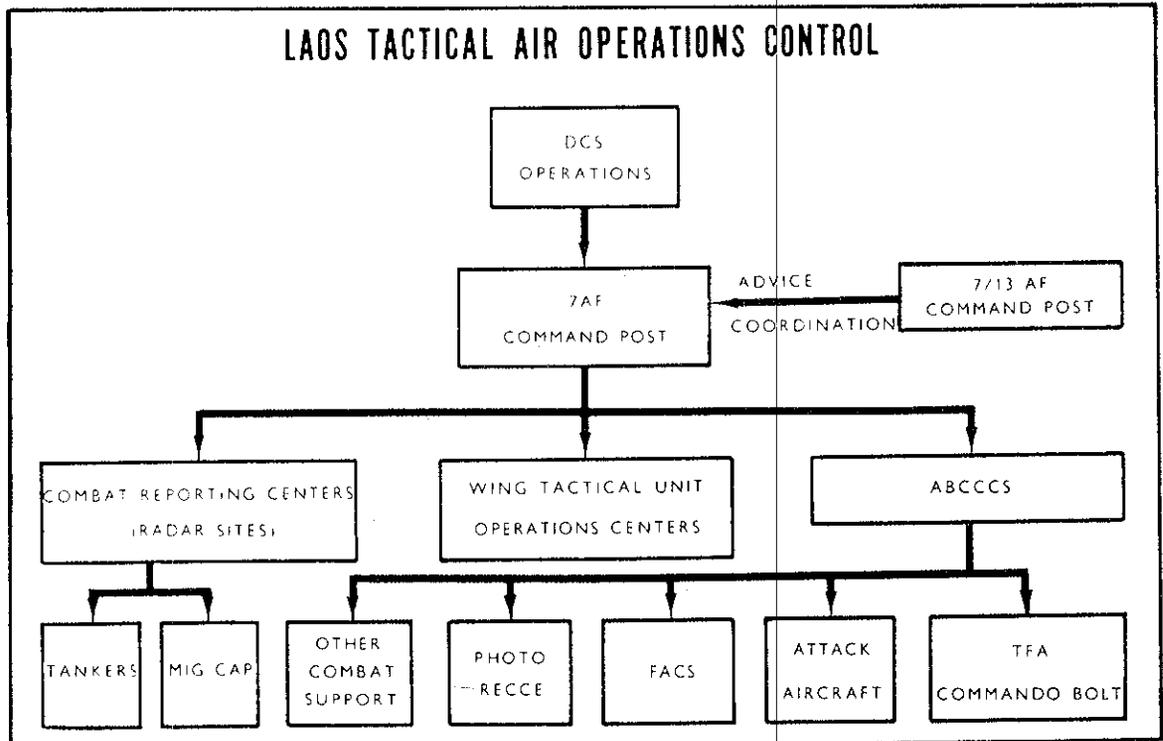
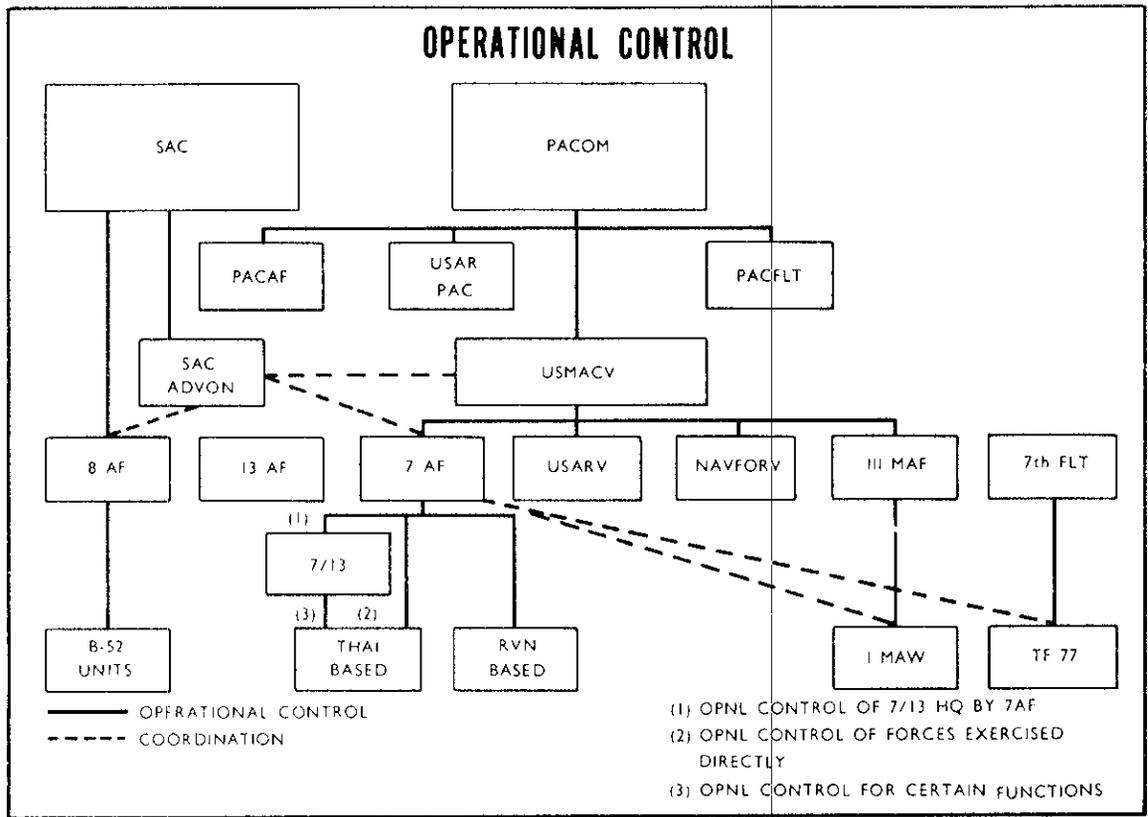
Control of the forces was centralized. The DCS, Operations planned the operations and published the fragmentary orders. He drew on intelligence sources in 7AF, 7/13AF, and others for assistance. The command post controlled and directed combat and support forces through subordinate command and control centers including airborne battlefield command and control centers. Figure A-2 shows these control relationships.

Tactical unit operations centers and forward air controllers (FACs) were extensions of the command and control system. Whenever possible, strike control was exercised directly from subordinate command and control centers to the strike flight leader.

Airborne Battlefield Command and Control Center (ABCCC)

Each ABCCC directed air activity in its zone of responsibility. Four orbits were flown each day by C-130s based at Udorn RTAFB. Two of the orbits were responsible for the Barrel Roll operating area--Cricket in the daytime and Alley Cat at night. The other two were responsible for the Steel Tiger operating area--Hillsboro in the daytime and Moonbeam at night.

All aircraft entering or leaving a zone were cleared and directed by the ABCCC. The controllers granted clearance for movement within the zone and assigned radio strike frequencies. The ABCCC diverted



FIGURES A-1/A-2

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aircraft when necessary because of weather or when more profitable targets developed. A portion of the strike force was assigned to the ABCCC for use against targets of opportunity discovered by FACs. Dedicated communications channels, including secure teletype, were maintained between 7AF CP and ABCCC and other control elements.

Forward Air Controller

The forward air controller (FAC) in Laos was an integral part of the tactical air control system and played a major role in the successful execution of the Commando Hunt V Campaign. A more exact term for the FAC mission in support of interdiction in Laos is strike control and reconnaissance, since the mission seldom involved the control of air strikes near friendly ground troops. However, the more common term FAC will be used here to avoid confusion. Forward air controllers were responsible for target development and evaluation, intelligence collection, weather reporting, control of fighter attacks against enemy targets, and assessment of bomb damage following such strikes. A variety of aircraft were used to accomplish these tasks, including O-2s, OV-10s, C-123Ks, and F-4s. Table A-1 shows FAC mission duration by aircraft type.

FAC MISSION DURATION				
(HOURS)				
<u>O-2</u>	<u>O-2</u>	<u>OV-10</u>	<u>C-123</u>	<u>F-4</u>
<u>DAY</u>	<u>NIGHT</u>	<u>DAY</u>	<u>NIGHT</u>	<u>DAY</u>
3.5	3.5	4.0	4.3	4.0*
* WITH AIR REFUELING				

TABLE A-1

As a rule, the O-2s and C-123Ks were used at night in Steel Tiger with only the C-123Ks operating as night FACs in Barrel Roll. F-4s and OV-10s provided day FAC coverage in both Steel Tiger and Barrel Roll. Tables A-2 and A-3 shows the numbers of FAC sorties flown in Steel Tiger and Barrel Roll.

██████████

FAC SORTIES FLOWN IN STEEL TIGER

	F-4	OV-10		O-2		C-123	TOTAL	
	DAY	DAY	NIGHT	DAY	NIGHT	NIGHT	DAY	NIGHT
NOV	143	719	7	6	329	115	868	451
DEC	137	846	0	11	388	117	994	505
JAN	129	754	1	18	369	78	901	448
FEB	111	837	1	4	394	71	952	466
MAR	134	1355	4	2	493	0*	1491	497
APR	129	725	0	8	304	46	862	350
TOTAL	783	5236	13	49	2277	427	6068	2717

* CANDLESTICK C-123S WERE USED AS FLARESHIPS IN SUPPORT OF LAM SON 719 DURING MARCH

TABLE A-2

FAC SORTIES FLOWN IN BARREL ROLL

	F-4	OV-10	C-123	TOTAL	
	DAY	DAY	NIGHT	DAY	NIGHT
NOV	115	67	61	182	61
DEC	102	74	60	176	60
JAN	62	57	43	119	43
FEB	55	45	53	100	53
MAR	57	74	84	131	84
APR	68	85	82	153	82
TOTAL	459	402	383	861	383

TABLE A-3

[REDACTED]

At night the Candlestick FACs were most often assigned to Sector 4. As a rule, the O-2s worked Sectors 6 and 9, the combined Sectors 12 and 13, and Sector 14. These FACs supplemented gunships in providing coverage of those areas of Steel Tiger where the enemy was active throughout the night.

To meet the requirements of the Lam Son 719 operations for FAC support of the ARVN forces involved, special Hammer FACs began operations in the Lam Son 719 area of Steel Tiger on 8 February 1971. The Hammer FAC area of operations shown in Figure A-4 is as it

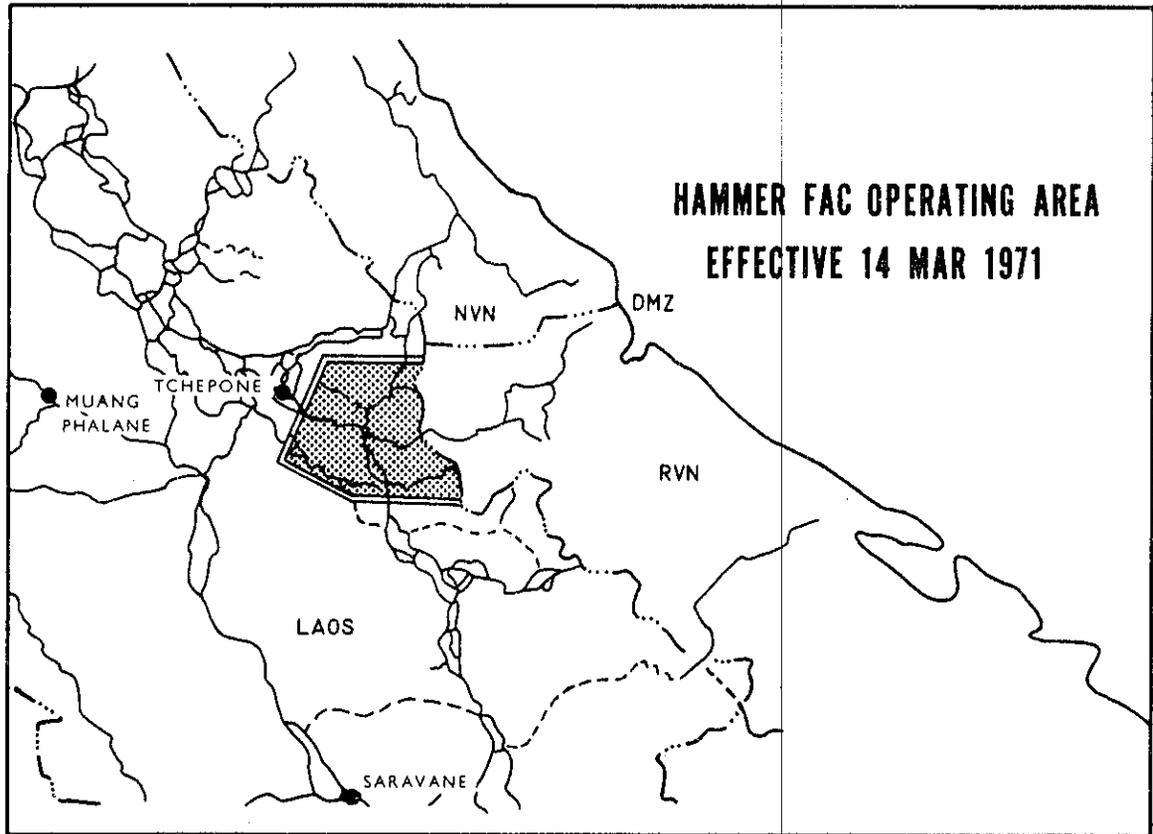


FIGURE A-4

appeared on 14 March 1971; however, the area changed numerous times during Lam Son 719 to keep pace with ARVN ground movements. As a rule, seven OV-10 aircraft were airborne over the Lam Son 719 area of Steel Tiger during all daylight hours, and two O-2s were kept airborne throughout the night. A Vietnamese was scheduled to fly each mission to facilitate communications with ARVN ground commanders.

[REDACTED]

FAC sorties by VR sector and in the Lam Son 719 area of Steel Tiger are shown in Table A-4. The Lam Son 719 area covered portions of VR Sectors 7, 8 and 9. Sorties shown for VR Sectors 7, 8 and 9 were those not in direct support of Lam Son 719.

Except in those sectors where Commando Bolt operations were conducted or when working in the same sector with a gunship, the FAC was responsible for air traffic control within his sector. Aircraft desiring to enter, cross, or depart a FAC's sector had to clear through the FAC before proceeding. When a FAC was operating within the same sector as a gunship, the gunship maintained control of the sector.

As a rule, four Fast FAC sorties per day and two Nail OV-10 sorties per day were scheduled into Barrel Roll during daylight hours. Two Candlestick sorties provided night coverage of the more active LOCs in the area when these routes were not being worked by gunships. The C-123Ks also provided flare support for besieged Lao ground positions when requested. In addition, there were other FACs who operated in Barrel Roll under the operational control of the US Ambassador to Laos.

Where possible, the individual FACs were scheduled to the same areas of Steel Tiger and Barrel Roll on a regular basis to enable each FAC to become familiar with his area of operation and thus more apt to detect areas of enemy activity or changes in the level of enemy activity. Utilizing all-source intelligence from 7AF and Task Force Alpha, the FAC could also identify areas of interest for increased visual reconnaissance, and a daily FAC Bulletin, forwarded to FACs by 7AF, requested VR of specific areas to ascertain road conditions, evaluate potential targets or otherwise report enemy activity in that area. Also, Task Force Alpha maintained a FAC liaison officer program in order to acquire additional intelligence from the FACs in support of the target development program, and to furnish the FACs with intelligence data that could enhance their operational effectiveness.

When a FAC discovered a target of opportunity, during either day or night, he passed a request for ordnance to ABCCC. ABCCC, together with 7AF CP, weighed the FAC-reported lucrativeness of the target against strike aircraft availability and determined if fighters should be sent to the FAC. If strike aircraft were routed to the FAC, it became his task to direct the fighters in their strikes against the target.

Strike control was an essential part of the FAC's responsibilities. In addition to those strike aircraft directed by the FAC against targets of opportunity, the majority of the visual strikes against 7AF-scheduled targets within the FAC's area of operation were controlled by the FAC. Upon completion of a strike the FAC finished his bomb

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FAC SORTIES BY STEEL TIGER VR SECTORS AND THE LAM SON 719 AREA
20 OCT - 30 APR

<u>VR SECTORS</u>	<u>F-4</u>	<u>OV-10</u>	<u>O-2</u>	<u>C-123</u>	<u>TOTAL</u>
1	0	243	7	1	251
4	0	1	194	230	425
6	3	4	269	12	288
8	0	0	5	30	35
9	0	408	350	4	762
14	0	661	493	20	1174
1-4	3	615	21	14	653
1-9	547	6	0	0	553
3-5	0	0	0	46	46
5-6	0	459	17	1	477
5,6,9	16	191	3	0	210
7-8	0	393	21	9	423
7-9	2	213	0	0	215
10-11	2	461	1	2	466
10-14	239	2	0	0	241
11-13	0	197	0	0	197
12-13	0	525	306	0	831
LAM SON	0	1058	416	0	1474
OTHER	22	160	312	99	593
TOTAL	834	5597	2415	468	9314

TABLE A-4

[REDACTED]

damage assessment and passed it to the strike aircraft if time allowed.

STRIKE PLANNING AND EXECUTION

Tactical Air Target Development

Target development for tactical air strikes during Command Hunt V involved a detailed process of evaluating all available intelligence in order to determine enemy movement and storage of supplies within Laos.

Intelligence sources consisted of photo, visual, infrared, side-looking airborne radar, and airborne radio direction finding reconnaissance; controlled American sources; sensor data analyzed by Task Force Alpha; daily intelligence summaries submitted by FACs and reconnaissance units; special intelligence; and visual sightings by strike crews. Intelligence from all of these sources contributed to target development; FAC visual reports and photo reconnaissance were excellent means of confirming lucrative tactical air targets while initial target leads were most often derived from special intelligence and Igloo White sensor data.

Enemy activity reported by all intelligence sources were filed in an automated multi-source activity file, plotted and referenced on a map overlay, and screened to determine target potential lucrativeness. The automated activity file provided an historical base for determining changes in enemy activity and for tracing the growth of potential targets until such time as they appeared lucrative enough to justify air strikes. When a target was identified and validated for strike within the rules of engagement, it was nominated to 7AF Deputy Chief of Staff, Operations, for strike. If the target had not been validated, a request was submitted to the American embassy in Vientiane for validation.

Priorities were established by weighing the targets against one another in terms of potential lucrativeness, vulnerability, tactical significance of location, the operational suitability of the target for strike, and the quality and reliability of the intelligence sources used to develop the target. The time involved in each phase of the target development cycle varied with the individual target. Some targets were developed in a few days or less because the intelligence picture developed in a short period of time from reliable sources which did not require follow-up actions. Other targets required weeks of slow painstaking compilation of many fragmentary items of intelligence information before the probability of their value were high enough and probable location well enough known to be considered suitable for strike.

[REDACTED]

Tactical Air Strike Scheduling

The strike schedule was effective for a period beginning at 0601H on the day of execution, and ending at 0600H the following day. The actual number of strike sorties available to be scheduled was determined on a day-to-day basis. For the Air Force and Marines, it was determined by multiplying each wing's daily possessed aircraft by a planning factor sortie rate which as a rule varied between 1.0 and 1.2. This sortie rate depended upon such factors as aircraft type, weather conditions, aircraft in-commission rates, mission duration, and enemy activity. During Lam Son 719 the planning factor sortie rate for USAF F-4s was increased and varied between 1.2 and 1.8 to meet the additional requirements for strike sorties during the period of that operation. The number of Navy sorties available was made known to 7AF by means of a daily Navy intent message which indicated the number of sorties and the times when they could be utilized. About 12 percent of the USAF capability was required for non-attack and support sorties such as fast FACs, Igloo White sensor emplacement, air defense alert, RP I reconnaissance escort, and Mig CAP. The actual strike sorties available were distributed to each area of operations such as Barrel Roll and Steel Tiger based upon the Commando Hunt V allocations and levels of enemy activity.

Targets validated and nominated for strike by intelligence planners were reviewed by operations planners 36 hours in advance of the day of execution. Based upon intelligence reports of enemy activity and the Commander's priorities established in daily conferences, tentative decisions were made concerning the force allocation that each target category and individual nominated target, if selected for strike, would require.

Following resource allocation, a tentative strike plan was developed. As part of this plan, tanker and support fuel requirements had to be determined. About 30 tanker sorties per day were available. This number was sufficient to fulfill normal requirements; tanker sorties were increased to 34 per day during March to support additional Iron Hand sorties flown to counter the increased SA-2 activity in RP I and Laos following the early phases of Lam Son 719. The EB-66 electronic warfare aircraft used 4 or 5 of these tanker sorties daily. The KC-135s filling this requirement, however, had to be configured for probe and drogue refueling, making them unsuitable for F-4s and F-105s. At least two tankers were required for photo-reconnaissance support, four for Fast FAC support, and one for RP I escort. Two tankers were required to support strike aircraft operating in Barrel Roll. Mig CAP missions in support of Arc Light, Fountain Pen leaflet drop, Giant Nail reconnaissance, and other special missions also required tanker refueling. The greatest single tanker requirement, however, was in support of gunship escort missions. Since most of the

[REDACTED]

available tankers were used for support missions, efficient utilization of the remaining refueling capability for strike sorties was essential. Strike aircraft from the various wings were scheduled to hit targets closest to their locations. From Korat, F-4s required tankers, regardless of whether they struck in Barrel Roll or Steel Tiger. Udorn was the only base from which fighters could reach Barrel Roll without air refueling, but most of the sorties from this base were committed to RP I escort and air defense alert. Thus, Korat was used to supplement Udorn-based strike missions in Barrel Roll. The locations of all other available resources were taken into account in the scheduling process and were utilized to the best advantage to strike anywhere in Steel Tiger without air refueling.

Other considerations in developing the tentative strike schedule included forecast weather and ordnance combinations for the various target categories. Coordination was also made with the Arc Light planners so that tactical air strikes could be scheduled around the B-52 strike times.

On the morning of the day following the development of the tentative strike plan, or less than 24 hours prior to execution, a planning conference with representatives from 7AF Intelligence and Operations and the Navy Liaison Office was held to finalize the plan. Target assessments and force allocation adjustments to specific targets were made based on update weather forecasts, intelligence information and sensor activation briefings. The finalized strike schedule was then disseminated to the flying units for execution. However, the plan was not considered "fixed in concrete," and revisions were made as necessary to meet the changing tactical situation. The 7AF CP at Tan Son Nhut was the primary vehicle for modifying the strike schedule. With direct communication to the Airborne Battlefield Command and Control Center and the flying units, 7AF CP could provide immediate direction or approve modifications in the execution of the strike schedule. The strike planning and execution cycle is shown in Figure A-5.

During the Commando Hunt V Campaign, except for some preliminary planning, the targets were selected and the strike schedule built within 24 hours of the day of execution. As a rule the schedule was disseminated at 1500H the day before execution with final changes and adjustments occurring before 1900H. Development and transmission of the strike plan was expedited through the use of an IBM 1130 computer and an IBM 3050 display coupled with an autodin capability. The timing of the strike scheduling process is shown in Figure A-6.

STRIKE PLANNING AND EXECUTION CYCLE

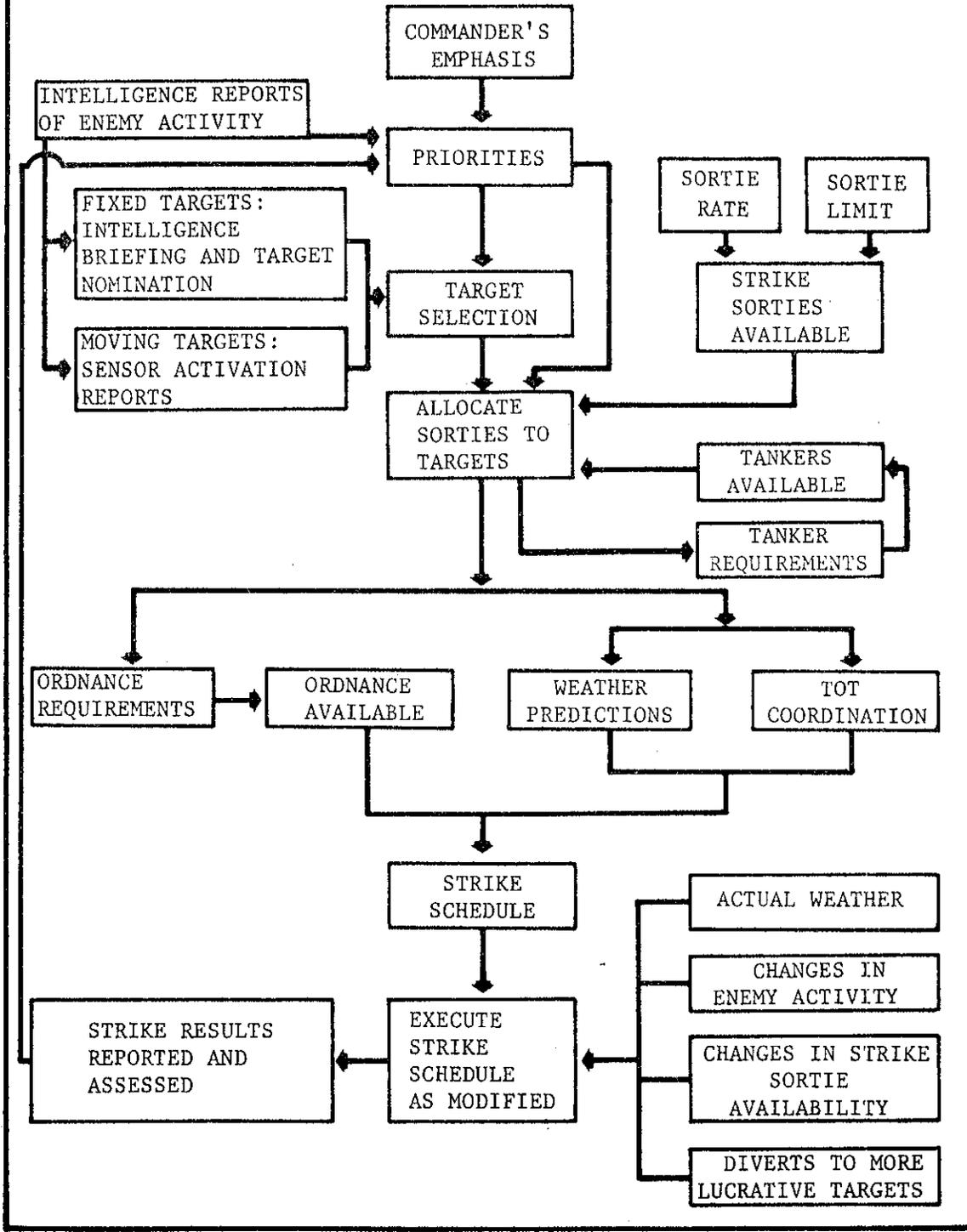


FIGURE A-5

TIMING OF STRIKE SCHEDULING SEQUENCE

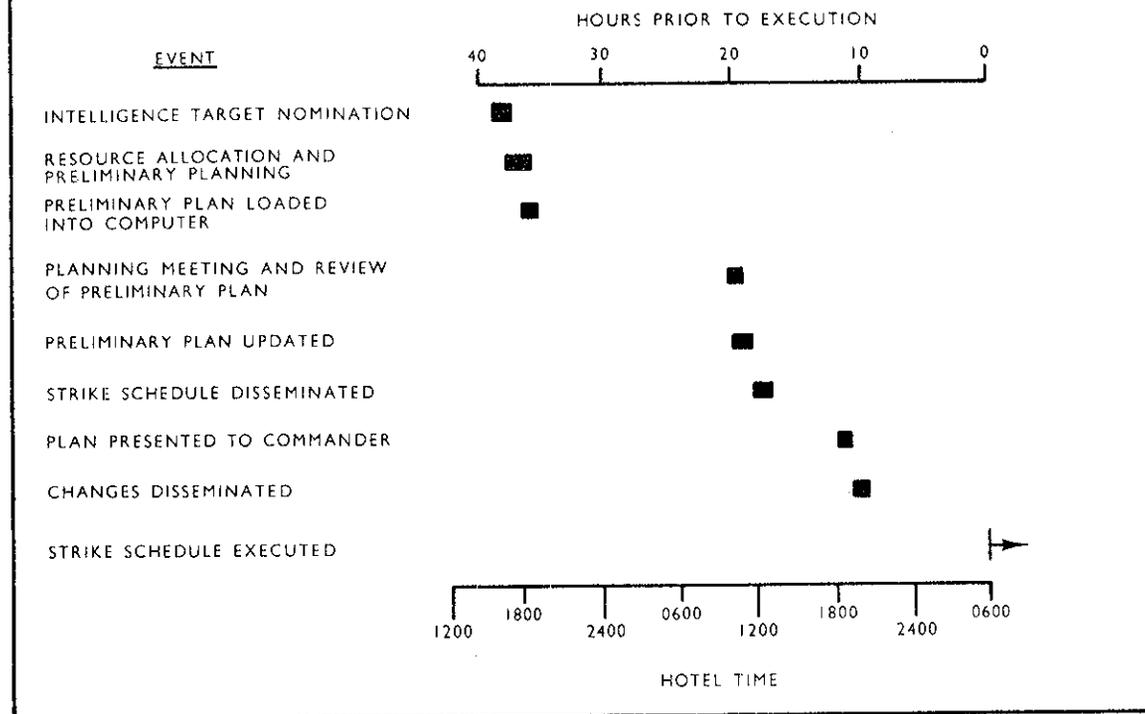


FIGURE A-6

Arc Light Target Development

The planning and execution of Arc Light strikes in Steel Tiger during Commando Hunt V remained much the same as during Commando Hunt III. COMUSMACV maintained overall responsibility for the generation, selection, clearance and approval of Arc Light targets. This responsibility was carried out by the MACV Assistant Chief of Staff for Operations Branch, J-3, and the Targets Division, J-2.

Seventh Air Force target development for Arc Light employment other than in the entry interdiction program was the same as that for tactical air. However, due to the area coverage capability of Arc Light strikes, most Arc Light target boxes encompassed clusters of various types of smaller targets. Photography was an important input for Arc Light target development and required readout in detail of all film coverage of Arc Light operating areas in Steel Tiger. Special intelligence, sensor data, and FAC reports were also relied upon for initial target leads. As a rule, Steel Tiger targets were

██████████
 nominated by 7AF; however, MACV on occasion nominated targets in that area. Target selection was made by MACV 24 to 36 hours in advance of execution.

Arc Light Strike Scheduling

Preliminary strike planning, including the determination of requirements for support aircraft such as flak suppression and electronic countermeasures (ECM) aircraft in accordance with 7AF OPLAN 715-70 for those targets selected, was accomplished by SAC ADVON in coordination with 8AF. The Arc Light strike planning and execution process is diagrammed in Figure A-7. Acting for the Commander, 7AF, SAC ADVON then dispatched the strike request message to JCS, CINCPAC, CINCSAC, and in the case of Steel Tiger targets, to the US Ambassador to Laos 24 hours prior to strike execution. The information in the

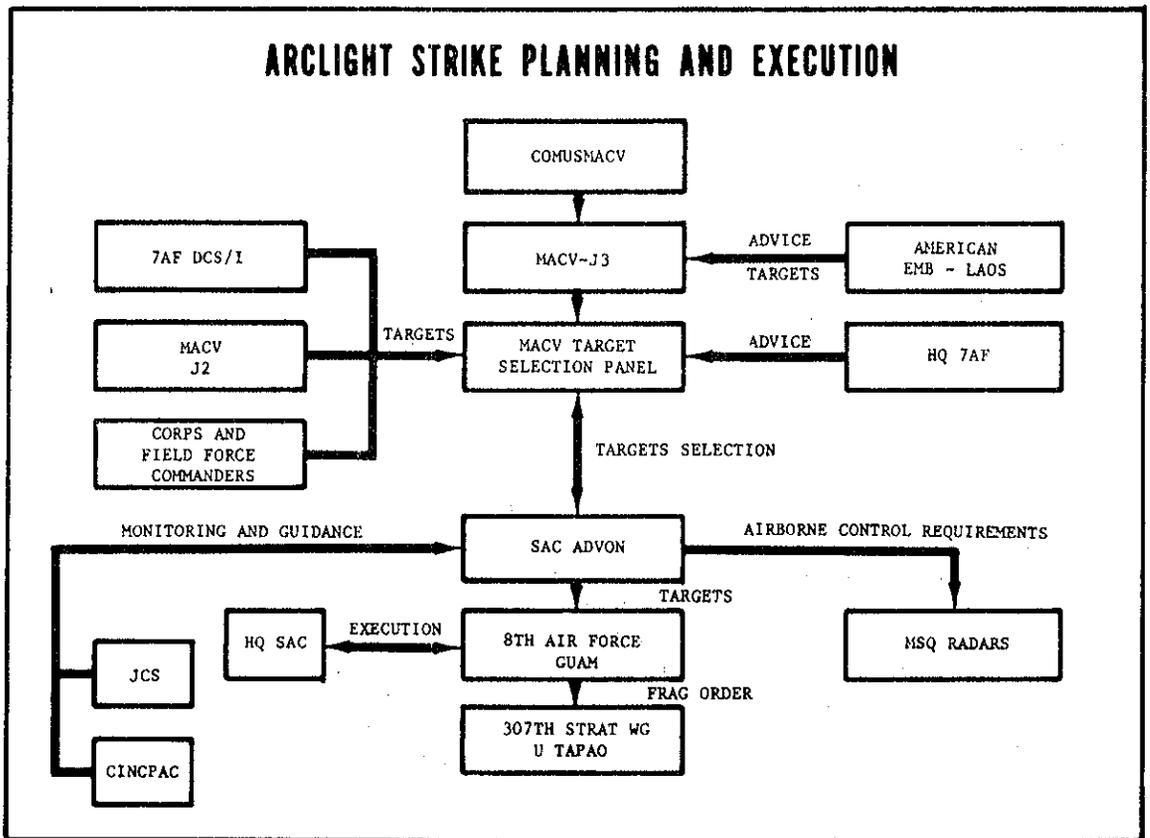


FIGURE A-7

[REDACTED]

strike request was also relayed by secure telephone to 8AF who in turn published the detailed fragmentary order, as a rule, 12 hours prior to strike execution. Although 8AF maintained operational control of the Arc Light force, Headquarters, Strategic Air Command, reserved authority for execution of the strikes and passed approval for execution two to three hours prior to bomber launch times.

STRIKE RESOURCES

Basing

Figure A-8 shows where Allied and other friendly strike resources were based in Southeast Asia during the Commando Hunt V campaign by aircraft type and service.

Table A-5 shows the number of aircraft possessed at each base in Thailand by location by month during the campaign. US Air Force resources located at Thai bases flew most of the sorties in Steel Tiger during Commando Hunt V.

Table A-6 shows the number of aircraft possessed by month at bases in the Republic of Vietnam. Seventh Air Force strike resources based in RVN contributed to the dry season campaign in Steel Tiger. The VNAF provided most of the close support required by RVNAF forces in RVN and Cambodia.

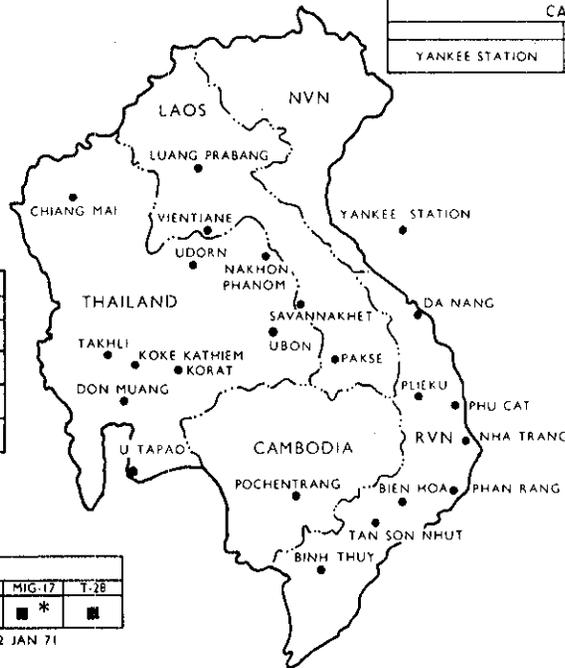
Table A-7 shows the aircraft carriers that were on station during the course of the campaign. Carrier aircraft flew almost exclusively in Steel Tiger. Their availability varied over the season; as few as 32 and as many as 173 strike aircraft were on station at any one time.

Table A-8 shows the number of aircraft possessed at each base in Laos and in Cambodia by location by month during the campaign. Most of these resources did not make a direct contribution to the Steel Tiger interdiction campaign. While some RLAF resources based in Steel Tiger flew in support of ground operations designed to interdict the western route structure, the contribution of those operations to the interdiction effort was small. An indirect contribution to Commando Hunt V was made by all non-US strike forces, however, by releasing US resources to the interdiction effort.

STRIKE AIRCRAFT LOCATIONS

THAILAND											
BASE	A-1	AC-47	AC-119	AC-130	B-52	B-57G	F-4	F-5	F-86	F-105	T-28
CHIANG MAI											●
UDORN			☆				☆				●
NAKHON PHANOM	☆		☆								
TAKHLI									●		
KOKE KATHIEM											●
KORAT							☆			☆	
UBON	☆	●		☆		☆	☆				●
DON MUANG		●							●		
U TAPAO					☆						

CARRIERS				
	A-4	A-6	A-7	F-4
YANKEE STATION	☆	☆	☆	☆



LAOS		
BASE	AC-47	T-28
LUANG PRABANG	○	○
VIENTIANE	○	○
SAVANNAKHET	○	○
PAKSE	○	○

CAMBODIA				
BASE	FOUGA	MIG-15	MIG-17	T-28
POCHNENTRANG	■*	■*	■*	■

*LOST TO SAPPER ATTACK 22 JAN 71

LEGEND	
☆	US
★	VNAF
□	RAAF
■	AVNK
○	RLAF
●	RTAF

SOUTH VIETNAM											
BASE	A-1	A-4	A-6	A-37	AC-47	AC-119	CANB	F-4	F-5	F-100	TA-4F
DA NANG	☆	☆	☆	★		☆		☆			☆
PLIEKU	☆										
PHU CAT						☆		☆			
NHA TRANG				★							
PHAN RANG						☆	□			☆	
BIEN HOA	☆☆			☆					★		
TAN SON NHUT					★	☆					
BINH THUY				★							

FIGURE A-8

**ALLIED STRIKE RESOURCES
LOCATED IN THAILAND**

BASE	AIRCRAFT		AIRCRAFT POSSESSED*						
	TYPE	SERVICE	OCT	NOV	DEC	JAN	FEB	MAR	APR
CHIANG MAI	T-28	RTAF	15	15	15	15	15	15	15
UDORN	AC-119K	USAF	4	0	0	0	0	0	0
	F-4D	USAF	34	35	36	36	35	31	31
	T-28	RTAF	14	14	14	12	12	12	12
NAKHON PHANOM	A-1E	USAF	50	53	39	39	22	19	20
	AC-119K	USAF	0	4	4	4	7	8	7
UBON	A-1H/J	USAF	0	0	0	0	2	2	0
	AC-130A	USAF	2	2	6	10	12	12	14
	B-57G	USAF	0	11	11	9	9	10	10
	F-4D	USAF	69	71	65	65	70	67	69
	AC-47	RTAF	2	2	2	2	2	2	2
	T-28	RTAF	15	15	15	15	15	15	15
KORAT	F-4E	USAF	32	30	32	32	30	31	33
	F-105	USAF	0**12	12	11	16	15	19	
TAKHLI	F-86	RTAF	18	18	18	18	18	18	18
KOKE KATHIEM	T-28	RTAF	10	10	10	10	10	10	10
DON MUANG	AC-47	RTAF	2	2	2	2	2	2	2
	F-5	RTAF	8	8	8	9	9	9	9
U TAPAO	B-52	USAF	42	42	42	42	42	50	50

* AS OF THE BEGINNING OF EACH MONTH

** AS OF 1 OCTOBER, F-105S WERE AT TAKHLI

TABLE A-5

**ALLIED STRIKE RESOURCES LOCATED
IN THE REPUBLIC OF VIETNAM**

BASE	AIRCRAFT		AIRCRAFT POSSESSED*						
	TYPE	SERVICE	OCT	NOV	DEC	JAN	FEB	MAR	APR
DA NANG	A-1E	USAF	11	7	9	2	2	2	2
	AC-119G	USAF	0	0	0	0	0	2	2
	AC-119K	USAF	6	8	8	8	7	6	7
	F-4D,E	USAF	48	48	49	49	46	44	53
	A-4E	USMC	23	23	23	26	24	24	23
	A-6A	USMC	13	13	13	13	13	12	10
	F-4B	USMC	22	23	23	24	14	0	0
	TA-4F	USMC	4	5	4	3	3	3	3
	A-37	VNAF	18	18	18	36	36	36	36
PLIEKU	A-1	VNAF	0	0	0	18	18	18	16
PHU CAT	AC-119G	USAF	4	2	2	2	1	1	0
	F-4D	USAF	33	34	33	33	29	30	32
NHA TRANG	A-37	VNAF	18	18	18	18	18	18	20
PHAN RANG	AC-119G,K	USAF	10	7	10	10	7	7	10
	F-100	USAF	67	73	77	77	75	86	70
	CANBERRA	RAAF	8	8	8	8	8	8	8
BIEN HOA	A-1E	USAF	0	0	0	0	1	2	2
	A-37	USAF	64	42	29	29	28	27	27
	A-1	VNAF	42	42	42	42	42	42	41
	F-5	VNAF	18	18	18	18	18	18	19
TAN SON NHUT	AC-119G	USAF	10	10	9	9	9	9	9
	AC-47	VNAF	16	16	16	16	16	16	15
BINH THUY	A-37	VNAF	36	36	36	36	36	36	42

* AS OF THE BEGINNING OF EACH MONTH

TABLE A-6

US NAVY STRIKE RESOURCES ON CARRIERS

<u>CARRIER</u>	<u>AIRCRAFT</u>		<u>ON-STATION TIME</u>						
	<u>TYPE</u>	<u>NUMBER</u>	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>
B.H. RICHARD	A-4E,F	42	10-20						
ORISKANY	A-7A,B	32	10-31	7-21					
AMERICA	A-6A,B,C	15	10-31	1-7					
	A-7E	28							
	F-4J	24							
SHANGRI-LA	A-4C,E	48		1-6					
HANCOCK	A-4F,E	42	19-30	1-7	1-14	1-20	9-31	1-9	
					30-31				18-30
RANGER	A-6A,C	16		22-30	1-7	1-12	3-28	1-17	1-17
	A-7E	26			30-31			25-31	
	F-4J	26							26-30
KITTY HAWK	F-4J	24			8-28	1-3	1-31		
	A-6A,B	15			13-31				
	A-7E	24					21-28	10-25	

FRIENDLY STRIKE RESOURCES LOCATED IN LAOS AND CAMBODIA

<u>LAOS</u>	<u>AIRCRAFT</u>		<u>AIRCRAFT POSSESSED*</u>						
	<u>TYPE</u>	<u>SERVICE</u>	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>
LUANG PRABANG	AC-47	RLAF	1	1	1	2	2	2	2
	T-28	RLAF	16	16	16	14	14	14	14
VIENTIANE	AC-47	RLAF	4	4	4	4	4	4	4
	T-28	RLAF	18	18	18	15	15	15	15
SAVANNAKHET	AC-47	RLAF	2	2	2	4	4	4	4
	T-28	RLAF	10	10	10	10	10	10	10
PAKSE	AC-47	RLAF	2	2	2	2	0	0	0
	T-28	RLAF	9	9	9	9	9	9	9
<u>CAMBODIA</u>									
POCHENTRANG	FOUGA	AVNK	4	4	4	4	0	0	0
	MIG-15	AVNK	2	2	2	1	0	0	0
	MIG-17	AVMK	13	13	13	13	0	0	0
	T-28	AVMK	9	9	9	9	9	7	8

* AS OF THE BEGINNING OF EACH MONTH

Sorties

US resources flew most of their sorties in Steel Tiger. Table A-9 presents sortie distribution and shows total sorties flown, whether or not ordnance was expended.

		TOTAL SORTIES FLOWN AND PORTION FLOWN IN STEEL TIGER BY US STRIKE RESOURCES IN SOUTHEAST ASIA							
<u>USAF</u>		<u>10-31</u> <u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
A-1	SEA	511	664	548	422	363	405	310	3223
	SL	176	258	219	200	172	166	136	1327
A-37	SEA	509	872	1195	1163	976	1070	1053	6838
	SL	0	0	0	0	0	0	0	0
AC-119	SEA	388	562	641	616	612	724	711	4254
	SL	37	82	186	216	200	175	166	1062
AC-130	SEA	5	93	271	328	391	343	337	1768
	SL	3	91	203	315	381	338	331	1662
B-52	SEA	727	979	1010	1017	930	1234	1194	7091
	SL	707	942	912	941	846	1099	812	6259
B-57G	SEA	40	192	259	255	286	291	264	1587
	SL	40	190	252	255	278	285	264	1564
F-4	SEA	3620	6331	6039	6337	6400	8155	6584	43466
	SL	2645	4863	4430	4654	4571	5567	3749	30479
F-100	SEA	1099	1736	2326	2560	1914	2546	2058	14239
	SL	61	538	948	1084	559	1086	562	4838
F-105	SEA	263	306	323	305	272	289	410	2168
	SL	4	16	0	0	11	9	24	64
USAF TOTAL	SEA	7162	11735	12612	13003	12144	15057	12921	84634
	SL	3673	6980	7150	7665	7018	8725	6044	47255

TABLE A-9

**TOTAL SORTIES FLOWN AND PORTION FLOWN
IN STEEL TIGER BY US STRIKE RESOURCES IN SOUTHEAST ASIA (cont)**

<u>USN</u>		10-31	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
		<u>OCT</u>							
A-4	SEA	410	617	381	1569	1416	1923	1614	7930
	SL	370	581	381	1546	1341	1728	1445	7392
A-6	SEA	126	264	539	391	496	602	561	2979
	SL	126	254	539	391	496	594	561	2961
A-7	SEA	608	1289	1541	1262	1673	2045	1765	10183
	SL	547	1232	1476	1232	1624	1896	1646	9653
F-4	SEA	0	297	1076	997	1007	1292	1024	5693
	SL	0	293	1068	995	1007	1284	1017	5664
<u>USN</u> <u>TOTAL</u>	SEA	1144	2467	3537	4219	4592	5862	4964	26785
	SL	1043	2360	3464	4164	4468	5502	4669	25670
<u>USMC</u>									
A-4	SEA	264	653	684	736	816	848	993	4994
	SL	0	165	368	328	407	466	376	2110
A-6	SEA	197	354	398	382	371	453	210	2365
	SL	0	131	213	218	213	268	119	1162
F-4	SEA	183	363	459	435	303	0	0	1743
	SL	0	224	290	305	109	0	0	928
TA-4F	SEA	28	62	49	59	57	122	63	440
	SL	0	0	0	0	2	44	20	66
<u>USMC</u> <u>TOTAL</u>	SEA	672	1432	1590	1612	1547	1423	1266	9542
	SL	0	520	871	851	731	778	515	4266
<u>US</u> <u>TOTAL</u>	SEA	8978	15634	17739	18834	18283	22342	19151	120961
	SL	4716	9860	11485	12680	12217	15005	11228	77191

TABLE A-9 (CONT)

Most strike aircraft flew at 1.0 sustained rate, and some up to a 2.0 rate in a surge, but special-mission aircraft in most cases did not. When times of surging occurred, aircraft were often turned around to fly a second or even third mission in one 24-hour period. Minimum turn around-times varied between 4 to 6 hours for most US strike aircraft flying in Laos.

Not all sorties by US strike resources expended ordnance. Table A-10 shows the monthly total of fighter-attack sorties flown and expending ordnance.

SORTIES BY US FIGHTER-ATTACK RESOURCES									
		10-31							
		<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
<u>FLOWN</u>									
SEA	US	7858	14000	15817	16823	16350	20041	16909	107848
	USAF	6042	10101	10690	11042	10211	12756	10679	71521
SL	US	3969	8754	10184	11208	10790	13393	9919	68208
	USAF	2926	5865	5849	6193	5591	7113	4735	38272
<u>EXPENDING</u>									
SEA	US	5673	9734	12127	13625	12864	16189	13733	83943
	USAF	4201	6961	8452	8998	8035	10816	9156	56619
SL	US	3146	6074	7096	9219	8505	11018	7603	53471
	USAF	2271	4045	4749	5381	4368	6415	3766	30995
<u>EXP/FLOWN</u>									
SEA	US	.721	.695	.766	.809	.786	.807	.812	.778
	USAF	.695	.689	.791	.815	.787	.848	.857	.791
SL	US	.793	.695	.697	.823	.788	.823	.767	.784
	USAF	.776	.690	.812	.869	.781	.902	.795	.810

TABLE A-10

In only one case were the total US (14,000) or USAF (10,000) Southeast Asia expending sortie limits for fighter-attack aircraft exceeded-- during the Lam Son 719 surge in March. This exception was authorized by higher authority.

Over the season, 61 percent of US flown fighter-attack sorties that expended ordnance did so in Steel Tiger. The percent of all

USAF strike sorties expending in Steel Tiger was lower (Table A-11).

FRACTION OF FLOWN FIGHTER-ATTACK SORTIES EXPENDING IN STEEL TIGER								
	10-31							
	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
SL/SEA US	.555	.624	.652	.677	.661	.681	.554	.637
SL/SEA USAF	.541	.647	.562	.598	.544	.593	.411	.547

TABLE A-11

Table A-12 shows target types struck by US air resources on their first strike.

STRIKE SORTIES BY US STRIKE RESOURCES (FIGHTER-ATTACK, GUNSHIP, AND B-52) THAT EXPENDED ORDNANCE, BY TARGET TYPE								
	10-31							
	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
TRUCKS	158	584	1344	2336	2262	1927	2155	10766
TKP/STO AREAS	507	636	1172	2369	2120	1791	1604	10199
IDPS	2798	4940	5464	4120	2334	2041	2766	24462
DEFENSES	40	216	433	651	1102	1737	1107	5286
OTHER	366	741	688	1097	1951	5086	1225	11172
TOTAL	3869	7117	9101	10573	9769	12582	8857	61886

TABLE A-12

Table A-13 shows the results of US air strikes in Steel Tiger.

OBSERVED TARGET DAMAGE

<u>TYPE TARGET</u>	10-31							<u>TOTAL</u>
	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	
<u>TRUCKS</u>								
DES	18	149	1021	2691	3404	4542	4401	16226
DAM	13	81	448	784	979	1097	1298	4700
FIRES	48	139	768	1853	1950	2322	87	7169
SEC EXP	62	229	1070	2331	2560	2782	101	9135
<u>TKP/STO</u>								
TAC AIR								
FIRES	52	102	480	700	808	1607	594	4343
SEC EXP	80	285	8005	3020	1744	8850	5996	27980
ARC LIGHT								
FIRES, EXP	127	140	92	112	339	55	299	1164
<u>LOCs</u>								
CUTS, SLIDES	623	1298	1459	1160	818	954	1766	8078
BRIDGES DES	2	5	4	0	1	7	0	19
BRIDGES DAM	1	1	2	1	1	2	1	9
TAC AIR								
FIRES	174	189	158	178	65	63	47	874
SEC EXP	84	99	187	102	28	72	268	840
ARC LIGHT								
FIRES, EXP	540	793	840	587	82	16	664	3522
<u>DEFENSES</u>								
GUNS DES	21	41	100	129	173	277	178	919
GUNS DAM	6	29	37	25	34	41	23	195
FIRES	1	6	31	117	109	257	123	644
SEC EXP	33	18	64	84	154	381	278	1012
<u>OTHER</u>								
KBA	144	584	181	120	571	2165	243	4008
WBA	44	21	2	6	3	20	104	200
WCFT DES	9	15	13	43	11	15	2	108
WCFT DAM	6	5	19	19	3	0	0	52
BULL DES	5	2	5	9	6	6	8	41
BULL DAM	2	4	5	5	3	3	6	28
TAC AIR								
FIRES	45	194	410	591	589	900	2232	4968
SEC EXP	61	328	334	1009	2574	8812	3932	17050
ARC LIGHT								
FIRES, EXP	0	0	0	0	58	2243	404	2705

TABLE A-13

[REDACTED]

Allied resources flew most of their sorties outside of Steel Tiger, freeing US resources for the Laotian interdiction mission. (Table A-14).

		TOTAL SORTIES FLOWN AND PORTION FLOWN IN STEEL TIGER BY ALLIED STRIKE RESOURCES IN SOUTHEAST ASIA							
		10-31							
<u>RAAF</u>		<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
CANB	RVN	157	187	263	265	246	272	260	1650
<u>VNAF</u>									
A-1	SL, RVN	912	2145	1317	1674	1698	1741	1545	10132
	SL	0	0	0	0	0	0	2	2
A-37	SL, RVN, CAM	1435	2094	2504	2427	2324	2693	2932	16408
	SL	0	0	0	0	6	232	14	252
AC-47	RVN, CAM	406	531	554	533	389	494	452	3359
F-5	RVN, CAM	357	608	653	617	506	519	447	3707
VNAF	SL, RVN, CAM	3110	4478	5027	5251	4917	5447	5636	33866
TOTAL	SL	0	0	0	0	6	232	16	254
<u>RLAF</u>									
AC-47	LAOS	64	117	149	146	209	247	212	1144
	SL	18	45	86	85	86	97	62	479
T-28	LAOS	1822	2389	1831	2685	3377	3371	2911	18386
	SL	697	1018	774	1149	1280	1342	910	7233
RLAF	LAOS	1886	2506	1980	2831	3586	3618	3123	19530
TOTAL	SL	715	1126	860	1234	1366	1439	972	7712

TABLE A-14

**TOTAL SORTIES FLOWN AND PORTION FLOWN
IN STEEL TIGER BY ALLIED STRIKE RESOURCES IN SOUTHEAST ASIA (cont)**

		10-31							
<u>AVNK</u>		<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
FOUGA	CAM	272	396	454	196	0	0	0	1318
MIG-15	CAM	1	0	0	0	0	0	0	1
MIG-17	CAM	0	60	125	68	0	0	0	253
T-28	CAM	393	469	537	299	237	383	277	2595
AVNK TOTAL	CAM	665	925	1116	563	237	383	277	4166
<u>*RTAF</u>									
AC-47	THAI, CAM	15	7	10	3	15	6	14	70
F-5	THAI, CAM	9	11	11	11	10	11	0	63
F-86	THAI, CAM	11	15	15	15	14	15	3	88
T-28	THAI, CAM	70	95	99	99	88	99	132	682
RTAF TOTAL	THAI, CAM	105	128	135	128	127	131	149	903
ALLIED TOTAL	SEA SL	5923 715	8224 1126	8521 860	9038 1234	9113 1372	9851 1671	9445 988	60115 7966

* DAILY AVERAGE TIMES NUMBER OF DAYS PER MONTH FOR OCT-MAR

TABLE A-14 (CONT)

The sorties flown by Allied resources in areas other than Steel Tiger, when combined with those flown by US resources, more than met all known requirements. The total US and Allied sorties flown in Steel Tiger are shown in Table A-15.

~~SECRET~~

**TOTAL SORTIES FLOWN IN SEA AND
STEEL TIGER BY US AND ALLIED STRIKE RESOURCES**

	10-31 <u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
SEA	14901	23858	26260	27872	27396	32193	28596	181076
SL	5431	10986	12345	13914	13589	16676	12216	85157

TABLE A-15

The Specialized Truck Force

AC-119K. The AC-119K is described in detail in Appendix C. The AC-119K/Gs maintained about their planned sortie rate of .70; their surge rate was .73 in March during Lam Son 719. (Table A-16).



FIGURE A-9

AC-119K

SORTIE RATE BY MONTH - AC-119K/G

	10-31 <u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>
AVG A/C POSSESSED	33	32	32	33	31	32	35
SORTIES FLOWN	388	562	641	616	612	724	711
SORTIE RATE	.53	.59	.65	.60	.71	.73	.68

TABLE A-16

The AC-119K, the model best suited to the Commando Hunt effort, concentrated on two target types throughout the campaign--trucks and other, the latter including close air support-related targets (Table A-17).

**STEEL TIGER SORTIES EXPENDING ORDNANCE BY
TARGET TYPE STRUCK ON FIRST STRIKE - AC-119K**

	<u>10-31</u> <u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
TRUCKS	3	19	69	101	98	76	123	489
OTHER	11	20	71	60	53	70	27	312
TOTAL	14	39	140	161	151	146	150	801

TABLE A-17

AC-130 The AC-130 is described in detail in Appendix C. AC-130s consistently flew at about a 1.0 sortie rate, as Table A-18 shows.



FIGURE A-10

AC-130

SORTIE RATE BY MONTH - AC-130

	<u>10-31</u> <u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>
AVG A/C POSSESSED	2	4	8	11	12	13	14
SORTIES FLOWN	5	93	271	328	391	343	337
SORTIE RATE	.11	.78	1.09	.96	1.16	.92	.94

TABLE A-18

The sorties that the AC-130s flew in Steel Tiger expended for the most part on trucks (Table A-19).

**STEEL TIGER SORTIES EXPENDING ORDNANCE BY
TARGET TYPE STRUCK ON FIRST STRIKE - AC-130**

	10-31 <u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
TRUCKS	1	49	127	242	252	309	305	1285
TKP/STO AREAS	0	10	5	4	0	3	2	24
OTHER	1	3	11	6	15	7	3	46
TOTAL	2	62	143	252	267	319	310	1355

TABLE A-19

B-57G. The B-57G is described in detail in Appendix D. It exceeded a 1.0 sortie rate during the Lam Son 719 surge (Table A-20).



FIGURE A-11

B-57G

SORTIE RATE BY MONTH - B-57G

	10-31 <u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>
AVG A/C POSSESSED	11	11	10	9	9	10	10
SORTIES FLOWN	40	192	259	255	286	291	264
SORTIE RATE	.17	.58	.84	.91	1.13	.94	.88

TABLE A-20

The B-57G struck trucks almost exclusive of other target types (Table A-21).

**STEEL TIGER SORTIES EXPENDING ORDNANCE BY
TARGET TYPE STRUCK ON FIRST STRIKE - B-57G**

	10-31							
	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
TRUCKS	5	43	93	162	141	211	157	812
TKP/STO AREA	1	4	9	16	20	22	24	96
IDPS	0	1	2	7	5	3	11	29
DEFENSES	0	0	0	0	1	2	4	7
OTHER	0	0	6	5	3	2	15	31
TOTAL	6	48	110	190	170	240	211	975

TABLE A-21

Fighter Aircraft

A-1. Because of its ability to loiter in an area for a relatively long time and to deliver large amounts of ordnance with great accuracy, and because of its small numbers, the A-1 was reserved for missions in which it had a comparative advantage--close support, search and rescue, and special missions. These aircraft, due to their long sortie lengths, age, and special uses, did not achieve above a .5 sortie rate until the surge during Lam Son 719 (Table A-22).



FIGURE A-12

A-1

SORTIE RATE BY MONTH - A-1

	10-31						
	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>
AVG A/C POSSESSED	61	54	45	34	25	23	22
SORTIES FLOWN	511	664	548	422	363	405	310
SORTIE RATE	.38	.41	.39	.40	.52	.57	.47

TABLE A-22

Although the A-1s expended ordnance principally in the other category, a significant number of their sorties struck first against truck park and storage area targets (Table A-23).

**STEEL TIGER SORTIES EXPENDING ORDNANCE BY
TARGET TYPE STRUCK ON FIRST STRIKE - A-1**

	10-31							
	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
TRUCKS	1	2	6	6	0	2	6	23
TKP/STO AREAS	22	2	22	14	2	22	20	104
IDPS	0	2	4	2	0	0	2	10
DEFENSES	0	0	0	2	0	2	4	8
OTHER	66	140	80	94	26	58	46	510
TOTAL	89	146	112	118	28	84	78	655

TABLE A-23

A-4. The A-4 was a delta-wing, single-engine, high-performance, carrier-based, lightweight jet attack aircraft. The TA-4F/J was similar to the A-4. It was normally used as a training aircraft although the Marines did use it as a strike aircraft in Steel Tiger in the second half of the campaign. Comparatively simple and easily maintained, the A-4 surged to a 1.6 sortie rate during March (Table A-24).

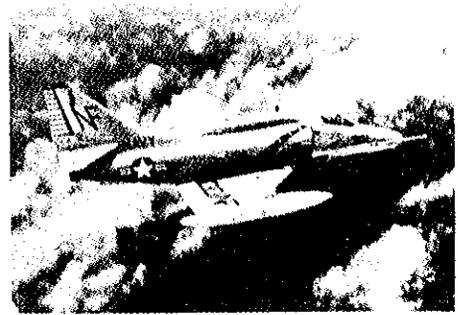


FIGURE A-13

A-4

SORTIE RATE BY MONTH - A-4

	10-31						
	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>
AVG A/C POSSESSED	48	54	39	58	57	58	57
SORTIES FLOWN	702	1332	1114	2364	2289	2893	2670
SORTIE RATE	.67	.82	.92	1.32	1.43	1.61	1.56

TABLE A-24

The A-4 was principally flown against prescheduled fixed targets such as IDPs and truck park and storage areas targets in areas within its limited range (Table A-25).

A-6. The A-6 was a medium-size, all-weather, low-altitude, two-place attack aircraft capable of high subsonic performance and broad mission versatility, including tanker capability. An integrated attack-navigation and central digital computer system, the airborne moving target indicator, allowed the A-6 to find, track and destroy moving targets and large fixed targets in all-weather conditions. With its complex avionics systems, the A-6 reached a 1.0 sortie rate only in December (Table A-26).

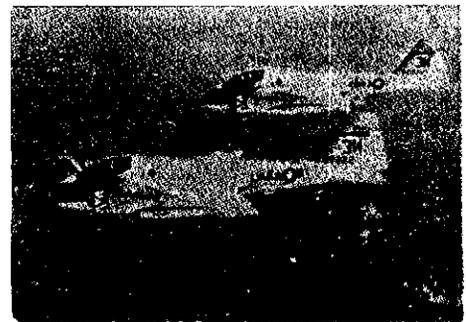


FIGURE A-14

A-6

**STEEL TIGER SORTIES EXPENDING ORDNANCE BY
TARGET TYPE STRUCK ON FIRST STRIKE - A-4**

	10-31							
	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
TRUCKS	11	5	43	211	286	200	291	1047
TKP/STO AREAS	52	37	91	586	279	348	300	1693
IDPS	147	341	461	590	366	294	707	2906
DEFENSES	0	2	0	18	78	160	18	276
OTHER	34	57	24	124	379	695	177	1490
TOTAL	244	442	619	1529	1388	1697	1493	7412

TABLE A-25

SORTIE RATE BY MONTH - A-6

	10-31						
	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>
AVG A/C POSSESSED	28	21	28	28	34	39	29
SORTIES FLOWN	323	618	937	773	867	1055	771
SORTIE RATE	.52	.98	1.08	.89	.91	.87	.89

TABLE A-26

Although utilized for a variety of tasks, the A-6 was predominantly used in the entry interdiction program in the first half of the dry season, and against trucks in the second half, when truck traffic ran at its highest levels (Table A-27).

**STEEL TIGER SORTIES EXPENDING ORDNANCE BY
TARGET TYPE STRUCK ON FIRST STRIKE - A-6**

	10-31 <u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
TRUCKS	10	19	131	177	257	209	127	930
TKP/STO AREAS	40	44	39	54	113	127	139	556
IDPS	111	339	419	167	99	179	196	1510
DEFENSES	0	0	2	0	6	15	2	25
OTHER	5	64	66	108	66	150	78	537
TOTAL	166	466	657	506	541	680	542	3558

TABLE A-27

A-7. The A-7 was a subsonic, high-performance, single-engine, single-place, jet-propelled, carrier-based aircraft. Six squadrons of new A-7Es/were assigned to Task Force 77 during Commando Hunt Five. The A-7E is equipped with an integrated navigation weapons delivery system that is designed around a tactical computer. In the weapons delivery modes the computer provides the pilot steering cues to computed releases for more accurate deliveries (Table A-28).



FIGURE A-15

A-7

The A-7 was used in the entry interdiction program during the first part of the campaign; in the second half, it was used in support of troops during the Lam Son 719 operation. It was a very versatile aircraft and was employed against all target types (Table A-29).

SORTIE RATE BY MONTH - A-7

	10-31 <u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>
AVG A/C POSSESSED	32	26	24	25	34	44	32
SORTIES FLOWN	608	1289	1541	1301	1673	2045	1765
SORTIE RATE	.86	1.65	2.07	1.63	1.76	1.50	1.84

TABLE A-28

**STEEL TIGER SORTIES EXPENDING ORDNANCE BY
TARGET TYPE STRUCK ON FIRST STRIKE - A-7**

	10-31 <u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
TRUCKS	15	7	143	294	431	324	428	1642
TKP/STO AREAS	63	82	160	204	387	460	315	1671
IDPS	477	983	1147	619	397	331	613	4567
DEFENSES	0	7	5	2	77	136	18	245
OTHER	34	19	40	148	296	661	224	1422
TOTAL	589	1098	1495	1267	1588	1912	1598	9547

TABLE A-29

F-4. The F-4 was the work horse of the fighter-attack force and was used by the Air Force, Navy and Marines in SEA. The F-4 was a two-place land-and-carrier-based twin-engine, jet-propelled tactical fighter.



Of particular note were the Pave Phantom Loran-equipped F-4s introduced to SEA during Commando Hunt V.

FIGURE A-16

F-4

Initially, three squadrons were to be assigned to the 8th TFW, Ubon RTAFB. The first two squadrons were assigned to Ubon with all aircraft in place by 1 January. The third squadron was assigned to Udorn and the aircraft were being received by the end of the campaign.

The system was developed and deployed on a compressed schedule. As a result, only limited testing was completed prior to deployment; therefore, the 8th TFW was asked to conduct a combat evaluation of the equipment. The evaluation was still in progress at the end of Commando Hunt V. Items being evaluated were the crews' ability to operate the equipment, aircraft and Loran reliability, and Loran targeting systems.

The principal improvement of the Pave Phantom-equipped aircraft over the previous Loran-equipped F-4Ds was the mating of a ballistic computer with the Loran computer. This increased the flexibility of Loran-equipped F-4Ds, allowing them to attack a target on random headings, altitudes and airspeeds. Prior to this modification, the Loran-equipped F-4D was restricted to preplanned release parameters. An additional improvement was the modified receiver which reduced the breaklock problems previously experienced during high-G maneuvers. In previous Loran tests, non-Pave-Phantom-equipped aircraft achieved a 150 meter circular error probable (CEP). With the incorporation of the Pave Phantom modification, the CEP was reduced to 110 meters.

Also, adding to F-4 force effectiveness was the coupling of laser technology to Loran-equipped aircraft. The first laser system to be introduced was Pave Sword, which consisted of a laser-seeker system installed on F-4D aircraft. During the introduction, the Pave Sword system demonstrated a capability to deliver laser-guided bombs on targets illuminated by other aircraft. Its employment with gunships is described in Appendix C.

The Pave Knife system was introduced in the combat theater near the end of the campaign and combat evaluation was begun at Ubon RTAFB. Equipped with a laser illuminator and low-light-level television (LLLTV)

Pave Knife F-4Ds had the capability of illuminating the target and delivering ordnance during daylight and reduced lighting conditions. The Pave Knife system permitted delivery while maneuvering as necessary to avoid enemy defenses. In addition to the self-delivery tactic, Pave Knife was capable of illuminating for other strike aircraft, including a Pave Sword aircraft.

The F-4, flying at about 1.0 sortie rate for most of the season, surged up to a 1.2 level during Lam Son 719 (Table A-30).

SORTIE RATE BY MONTH - F-4

	10-31						
	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>
AVG A/C POSSESSED	274	257	262	264	258	247	250
SORTIES FLOWN	3803	6991	7574	7769	7710	9447	7608
SORTIE RATE	.63	.91	.93	.95	1.07	1.23	1.01

TABLE A-30

F-4s flew many sorties against every category of target; they tended to fly more against IDPs during the entry interdiction program, and shifted to close support and AAA suppression during Lam Son 719, (Table A-31).

F-100. The F-100s unrefueled combat radius covered only the southern portion of Steel Tiger; it was well-suited and based to perform close support in RVN.

Table A-32 shows that the F-100 reached a 1.0 sortie rate in December where it remained for the rest of the campaign.



FIGURE A-17

F-100

**STEEL TIGER SORTIES EXPENDING ORDNANCE BY
TARGET TYPE STRUCK ON FIRST STRIKE - F-4**

	<u>10-31</u> <u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
TRUCKS	134	440	715	1106	793	560	692	4440
TKP/STO AREAS	244	243	490	629	541	630	528	3305
IDPS	1700	2151	2075	1837	958	862	569	10152
DEFENSES	45	196	411	618	932	1247	1049	4498
OTHER	235	341	307	374	915	1983	305	4460
TOTAL	2358	3371	3998	4564	4139	5282	3143	26855

TABLE A-31

SORTIE RATE BY MONTH - F-100

	<u>10-31</u> <u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>
AVG A/C POSSESSED	70	75	77	76	80	78	70
SORTIES FLOWN	1099	1736	2326	2560	1914	2546	2058
SORTIE RATE	.71	.77	.97	1.08	.85	1.05	.99

TABLE A-32

[REDACTED]

While most F-100 sorties were flown in RVN, those that were flown and expended ordnance in Steel Tiger did so principally against interdiction points. The exception occurred in the Lam Son 719 period; the close-support capabilities of the F-100s were used then as shown in the other column of Table A-33.

**STEEL TIGER SORTIES EXPENDING ORDNANCE BY
TARGET TYPE STRUCK ON FIRST STRIKE - F-100**

	10-31							
	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
TRUCKS	0	0	27	37	4	36	26	130
TRK/STO AREAS	0	6	235	679	208	137	109	1374
IDPS	55	387	557	139	281	310	309	2038
DEFENSES	0	11	11	10	4	82	10	128
OTHER	2	59	86	180	54	464	82	927
TOTAL	57	463	916	1045	551	1029	536	4597

TABLE A-33

F-105. Flying the specialized Iron Hand SAM-suppression role involving long sorties, the F-105s had a sortie rate that, except for October, never fell below .55 (Table A-34). In October, the F-105s were still stationed at Takhli RTAFB. The low sortie rate in that month was due to the fact that the unit stood down for redeployment to Korat and CONUS.

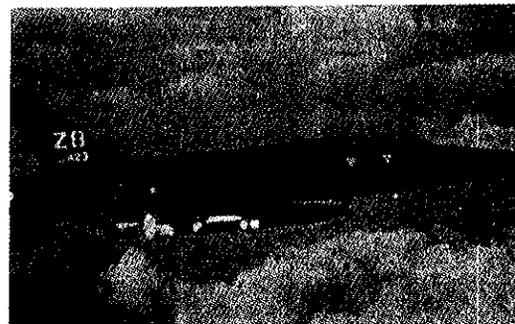


FIGURE A-18

F-105

SORTIE RATE BY MONTH - F-105

	10-31						
	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>
AVG A/C POSSESSED	37	12	12	14	15	17	19
SORTIES FLOWN	263	306	323	305	272	289	410
SORTIE RATE	.33	.88	.87	.70	.65	.55	.72

TABLE A-34

The Iron Hand F-105s did not often expend in Steel Tiger; they struck in NVN for the most part, albeit in support of air operations in Steel Tiger. Only 10 F-105 sorties were reported striking in Steel Tiger during the campaign.

B-52. Arc Light B-52s were normally flown in cells of three. B-52Ds were used, modified to carry conventional ordnance. The B-52s maintained a sortie rate near .80 throughout the campaign, as Table A-35 shows.



FIGURE A-19

B-52

While B-52s in SEA did not strike point targets, and as a consequence did not always strike targets that were homogeneous in composition, they did strike in support of identifiable operations or phases of Commando Hunt V. Those sorties that expended in the entry interdiction boxes are classified here as IDP strikes, and those that struck in support of Lam Son 719 or against troop positions in general as the other category. The rest are classified as strikes against truck park and storage areas, the most common target for B-52s in Steel Tiger in previous dry-season campaigns. Table A-36 shows the sortie breakout by month.

[REDACTED]

SORTIE RATE BY MONTH - B-52

	10-31						
	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>
AVG A/C POSSESSED	42	42	42	42	42	50	50
SORTIES FLOWN	727	979	1010	1017	930	1234	1194
SORTIE RATE	.79	.78	.78	.78	.79	.80	.80

TABLE A-35

**STEEL TIGER SORTIES EXPENDING ORDNANCE BY
TARGET TYPE STRUCK ON FIRST STRIKE - B-52**

	10-31							
	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
TRUCKS	0	0	0	0	0	0	0	0
TKP/STO AREAS	148	207	120	183	470	38	167	1333
IDPS	559	735	792	758	228	61	359	3492
DEFENSES	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	148	1000	286	1434
TOTAL	707	942	912	941	846	1099	812	6259

TABLE A-36

[REDACTED]

Hits and Losses from Enemy Antiaircraft Defenses.

The number of US fixed-wing aircraft hit by and lost to enemy AAA fire in Laos during Commando Hunt V were much lower than during Commando Hunt III. This reduction was due in part to a lower number of active AAA guns in Steel Tiger. All-weather delivery tactics used to strike entry interdiction boxes also reduced fighter exposure to ground fire. Table A-37 shows US hit and loss experience for Steel Tiger and Barrel Roll, respectively. Isolated incidents caused the increase in Steel Tiger losses in December. Concentrated fighter operations during Lam Son 719 prompted the heaviest enemy defensive reactions of the campaign and resulted in increased losses in February and March. AAA reactions in March and April were the only ones that approached the levels of comparable months during Commando Hunt III.

Table A-38 shows US fixed wing hits and losses by type AAA weapon in Steel Tiger. Small arms and automatic weapons were by far the most effective antiaircraft defenses in terms of the number of aircraft hit and downed. The more numerous 23 mm and 37 mm AAA were the most active; 87 percent of the reported firings were due to these weapons. However, the number of hits per reaction for the 23 mm and the 37 mm was very low. The 23 mm had the highest ratio of aircraft downed per aircraft hit. The large number of losses for which the caliber of the weapon was unknown made the latter ratio for each weapon subject to question. The majority of the 100 mm firings were against Arc Light strikes in the vicinity of Ban Karai Pass.

Table 39 shows that strike control and visual reconnaissance proved to be the most dangerous missions flown in Steel Tiger as indicated by the rather high number of aircraft lost per 1000 sorties flown. Escort and cover missions in Steel Tiger experienced the second-highest loss rate due to the loss of two A-1s providing cover for search and rescue efforts and two F-4s flying gunship escort. The 68 hits, including 9 losses for strike aircraft, were little less than the 84 hits and 10 losses for strike control and reconnaissance, however; the large number of strike missions flown resulted in a lower hit and loss rate.

Examination of hits and losses by altitude revealed that the majority of aircraft hits were sustained at the normal operating altitudes of the various aircraft. F-4s received a large number of hits in the 4000- to 5000-foot range, and this correlates with their normal dive bomb release altitude of 4500 feet. The fact that AC-130s operated at 9500 feet was emphasized by the high percentage of hits this aircraft received between 9000 and 10,000 feet.

FIXED-WING COMBAT AND COMBAT-SUPPORT AIRCRAFT
HIT AND LOSS EXPERIENCE DUE TO ANTI-AIRCRAFT FIRE

10 OCT - 30 APR

	<u>SORTIES FLOWN</u>	<u>REPORTED AAA REACTIONS</u>	<u>AIRCRAFT HIT</u>	<u>AIRCRAFT LOST</u>
<u>STEEL TIGER</u>				
10-31 OCT	5909	122	1	0
NOV	11130	696	11	0
DEC	13195	1721	24	8
JAN	15742	2472	24	3
FEB	15130	2358	27	6
MAR	17827	3253	63	5
APR	14593	3378	29	3
TOTAL	93526	14000	179	25
<u>BARREL ROLL</u>				
10-31 OCT	1198	19	0	0
NOV	1705	81	5	0
DEC	1743	95	11	1
JAN	1455	156	6	1
FEB	1772	115	3	0
MAR	2493	39	5	0
APR	2495	36	6	1
TOTAL	12861	541	36	3

TABLE A-37

SECRET

AIRCRAFT HITS AND LOSSES BY TYPE WEAPON

STEEL TIGER

10 OCT - 30 APR

	<u>AAA REACTIONS</u>	<u>ACFT HIT</u>	<u>ACFT LOST</u>
SMALL ARMS/ AUTO WPNS	392	73	6
23 MM	2576	29	4
37 MM	9617	39	1
57 MM	1373	1	0
85 MM	12	1	0
100 MM	30	0	0
TOTAL	14000	143*	11

* THERE WERE 36 HITS, INCLUDING 14 LOSSES, FOR WHICH THE CALIBER OF THE WEAPON WAS UNKNOWN.

TABLE A-38

Most hits and losses were sustained during daylight hours, although the majority of reported firings were at night. The fraction of an aircraft type's sorties flown at night had a significant influence on AAA reactions per sortie. Enemy gun crews were more apt to hit their targets during daylight hours because they used visual sights. The bias in firings reported at night versus day was due to the increased ability of aircrews to see tracer rounds and ground flashes at night. The rather high number of hits per AAA reaction for the A-1, RF-4, and OV-10 was in part due to their primary use on day missions. The nature of these missions exposed the aircraft to more accurate groundfire, all of which was not observed. The AC-130 and AC-119 gunships experienced the largest number of AAA reactions per sortie flown, although a small fraction of these sorties were hit and no aircraft were lost. The A-1s experienced the largest number of hits per AAA reaction. These aircraft flew low-level day-light mission which exposed them to more accurate ground fire. USAF, Navy, and Marine F-4s flew the largest number of sorties and also accounted for the largest number of hits and losses sustained by any single aircraft type.


**FIXED-WING HIT AND LOSS EXPERIENCE DUE TO
 ANTI-AIRCRAFT FIRE BY MISSION FUNCTION
 STEEL TIGER**

10 OCT - 30 APR

	STRIKE	STRIKE CONTROL/ VISUAL RECCE	PHOTO RECCE	ESCORT/ COVER	OTHER COMBAT SUPPORT
AAA REACTION/ 1000 SORTIES	202	159	102	27	1.78
AIRCRAFT HIT 1000 SORTIES	1.19	6.28	.39	3.19	.21
AIRCRAFT LOSSES/ 1000 SORTIES	.16	.75	0	.61	.14
AIRCRAFT LOST/ AIRCRAFT HIT	.13	.12	0	.19	.67

TABLE A-39

NAVIGATION AND BOMBING SYSTEMS

The TACAN System

TACAN was the primary aid to navigation employed in Southeast Asia. Stations were strategically located throughout the Republic of Vietnam, Thailand, and Laos. At altitudes above 15,000 feet, overlapping TACAN coverage existed in almost the entire operational area. TACAN radial and distance fixes provided the primary method for designating initial points (IPs) for Combat Skyspot, as well as rendezvous points for strike and FAC aircraft. All aircraft used in the interdiction campaign were equipped for receiving azimuth and distance information from TACAN stations. Although an excellent aid to navigation, TACAN had one significant limitation: it was a line-of-sight transmission, and in the mountainous terrain of SEA its use at low altitudes was thus impaired.

[REDACTED]

All-Weather Systems

Three systems were used to conduct strikes during adverse weather in Commando Hunt V: airborne radar, MSQ-77/TSQ-96 Combat Skyspot, and Loran. They enhanced all-weather and night bombing capabilities, and were also utilized when conditions of good visibility existed. MSQ-77/TSQ-96 sites were employed for night strikes on targets which were difficult to locate visually, and for day and night Arc Light missions. Loran was used for precise navigation to implant seismic and acoustic sensor, even when weather was suitable for visual emplacement, as well as to guide LGB aircraft to the area of a release basket, and to guide reconnaissance aircraft to post-strike objectives.

MSQ-77/TSQ-96

The MSQ-77 was a ground-based, pencil-beam I-band radar which was utilized for directing level aircraft weapon releases. The equipment was deployed to Southeast Asia in 1966 to fulfill a continuing demand for an accurate all-weather and night bombing capability. The TSQ-96 I-band radar was deployed to SEA in 1970 to provide a more sophisticated system with improved accuracy and flexibility. The nickname for the operation was Combat Skyspot, and although the system was operated and maintained by SAC personnel, it was under the operational control of Seventh Air Force.

Combat Skyspot was used for directing nearly all B-52 Arc Light missions. It was an accurate back-up system for tactical aircraft when visual strikes could not be made due to darkness or adverse weather. In SEA, analysis of live drops indicated a circular error average of around 180 meters at ranges up to 50 miles.

Some equipment limitations of the system warrant noting. The MSQ/TSQ tracking radar had a range limitation of 40 to 50 miles and a loss in accuracy when controlling aircraft which did not possess an operating beacon, notably the Navy A-4s. With an operative beacon, aircraft could be controlled to ranges of about 196 miles, although there was a definite accuracy degradation beyond 100 miles. Combat Skyspot radar was limited to line of sight and was therefore affected by earth curvature and obstructions between the site and the aircraft. Insofar as possible, sites were located to provide obstruction-free operations in all quadrants within the range limitations of the system. The one-degree pencil-beam radar had a limited search capability. Aircraft had to be directed to an accurate IP to prevent an excessive delay in establishing contact. Each site could control only one aircraft or flight of aircraft at a time; however, with scheduled sorties this was not a limiting factor.

Commando Nail

The radar bombing system in A-6 and F-4 aircraft afforded a

[REDACTED]

capability for effecting weapon releases. A validation program of a similar system in A-7 aircraft was conducted during Commando Hunt V. This bombing method was nicknamed Commando Nail. The procedure entailed determining a release point resolved from crosshair placement upon a radar return, and employed precomputed and preset ballistics information. Since exact targets often were not radar-definable an offset-aiming capability was available, requiring only the existence of some identifiable radar return within usable range of the target.

Certain factors limited the effectiveness of Commando Nail procedures. Perhaps the most significant limitation was that the precise distance between the target and an offset aiming point, when used, had to be predetermined. This determination was dependent upon the accuracy of charts available for the target area, and in Southeast Asia the availability of accurate charts for many areas was limited.

Another limitation upon Commando Nail accuracy was imposed by features inherent in the bombing system. The physical size of the electronically-generated crosshairs represented a relatively sizeable area on the three-inch radar scope. Because of this, crosshair placement inaccuracies resulting in bomb impact errors exceeding 1000 feet were not uncommon.

Loran

International air and marine craft, both civil and military, have depended upon Loran (long range navigation) for overwater navigation since World War II. With the development of Loran C and the Loran C/D receivers, this navigation system was extended over land areas of the world. In Southeast Asia, Loran C/D provided an automatic weapon delivery and target destruction capability for night and all-weather operations.

The Loran system was a pulsed-type hyperbolic navigation aid in which time differences of radio signals received from three or more ground transmitters were used to obtain an accurate position fix. The Loran C/D computer, employed in modified F-4D and A-6 aircraft in Southeast Asia, provided fully-automatic long-range aircraft navigation and automatic weapon delivery. The receiver performed both search and track operations and converted time difference coordinates to latitude and longitude and UTM. The automatic weapon delivery system incorporated previously-stored multiple target coordinates. Weapons could be delivered in all-weather conditions with acceptable accuracy (CEP of 300 feet or less).

Due to the limited number of Loran C/D receiver-equipped aircraft, Pathfinder procedures were often utilized. This technique involved using a Loran-equipped F/RF-4 to lead other F-4s not possessing the equipment to the bomb release point, with all aircraft releasing

[REDACTED]

weapons on the flight leader's command.

Loran delivery accuracy was dependent upon the accuracy of the coordinates developed for targets. At the beginning of Commando Hunt V, one method of deriving Loran coordinates was already in use and two were in the process of being developed. The Diogenes correction system was already developed and in use. It involved the use of Loran-equipped RF-4s stationed at Udorn RTAFB to photograph corners of 15 by 15 nautical mile boxes. The Loran coordinates of the corners were compared to the coordinates of the corners of equivalent topographic features on available maps, and the direction and amount of error were computed. The average error of the four corners was then applied to the box. When Commando Hunt V opened, virtually all of Steel Tiger was covered with Diogenes corrections. Such average-error factors, derived in a manner that was not as precise as the state of the art would allow and making no compensation for map error, were subject to refinement.

Two systems employed during Commando Hunt V provided such refinements with approximately the same response time. These were Combat Thunder and Sentinel Lock Loran. The first utilized photo-interpreter techniques to provide Loran coordinates through analysis of photography taken with a boresighted camera installed in a Loran-equipped RF-4C. This method was used for either individual targets or to provide coverage on an area basis known as Loran Targeting by Grid Annotated Photography (LT GAP). At the close of Commando Hunt V, Loran photography of Combat Thunder quality had been acquired for seven selected areas representing over 4000 square miles in addition to the major routes in RP I.

The second, a more precise method, the Sentinel Lock Loran target positioning system (also known as the Deployable Data Base System) was developed by the USAF Aeronautical Chart and Information Center (ACIC). The system included geodetically-controlled SR-71 and U-2 photography, precise-point transfer and measuring equipment, and the necessary associated computer software for making refined computations. The system provided 7AF with the capability of determining an accurate geographic position of a target for use with other all-weather bombing systems, and also a locally-corrected set of Loran coordinates. The conversion is accomplished by applying a local Loran system bias to the target's geographic position. This bias, which varied widely both in terms of magnitude and direction throughout SEA, was predetermined by analysis of thousands of Loran photographs provided to ACIC by 432 TRW at Udorn RTAFB, Thailand. Nine one-degree squares, with coverage of approximately 35,000 square miles in Laos and Cambodia, were provided 7AF by the end of Commando Hunt V. In addition, coverage and calibration of RP I in North Vietnam and MR I in South Vietnam were nearing completion.

[REDACTED]

At the end of Commando Hunt V, Combat Thunder and Sentinel Lock Loran were being used in a complementary manner. Targets were being identified on a duplicate set of LT CAP photographs at 12 RITS from photo coordinates called in by 7/13AF at Udorn RTAFB. Precise geodetic and Loran coordinates were then determined for these targets by transferring them into the Sentinel Lock Loran System.

MUNITIONS

During the Commando Hunt V campaign, US airpower was faced with a wide variety of targets that included personnel, watercraft, cave and bunker storage areas, trucks, bulldozers, and AAA weapons, and this diversity of target types required the use of many different types of munitions.

General Purpose Bombs

General purpose bombs produced both blast and fragmentation and could be employed with good effect against a wide variety of targets ranging from personnel to reinforced structures. Fuze extenders were available for above-ground bursts, while various time delay options provided for delayed bursts where penetration and cratering were desired. General purpose bombs used during the campaign were the MK-82 (500-1b), MK-83 (1000-1b), MK-84 (2000-1b), M-117 (750-1b), and the M-118 (3000-1b). Through the use of the FMU-72 fuze, these bombs could be delivered with time delays of up to 36 hours. Magnetic influence and seismic fuzes provided for converting general purpose bombs into mines, and through the use of mines and time-delay bombs, enemy lines of communication were interdicted for longer periods of time.

Cluster Bomb Units

Cluster Bomb Unit (CBU) was the name given a broad group of munitions, each of which incorporated a dispenser and a number of bomblets (BLU). Some CBUs included canisters which formed intermediate packages for bomblets. Dispensers were divided into two general categories: the first type remained on the aircraft and dispensed the bomblets or canisters of bomblets, while the second type of dispenser was dropped as a unit and opened at a lower altitude to dispense the bomblets. CBUs used most often in SEA were the CBU-24, CBU-49, and CBU-38 (delivered from high angle dive), and the CBU-25, CBU-42, and CBU-46 (delivered from low altitude in level flight). The MK-20 Rockeye was also used extensively by Navy aircraft.

Laser- and Electro-Optical-Guided Bombs

Laser-guided bombs (LGB) and electro-optical-guided (EOG) bombs were developed for targets requiring extreme delivery accuracy. Some LGB deliveries required two aircraft, one to spotlight the target with

[REDACTED]

a laser target designator and one to drop the bomb within the release envelope. This procedure was utilized by F-4 aircraft to drop MK-82, MK-84, and M-118 bombs modified by a laser guidance kit. The MK-84 and M-118 LGB deliveries were accomplished by two F-4 aircraft working as a team. F-4s, flying as gunship escorts, dropped MK-82 LGBs with the AC-103 gunships acting as target illuminators beginning in February. The B-57Gs and F-4s with the Pave Knife modification had the capability to illuminate the target for their own LGB drops. The F-4s employed MK-82 and MK-84 LGBs, while the B-57Gs used MK-82s only. EOG bombs used a TV guidance system to home on target-lighting contrast. Only MK-84 bombs were delivered with this system.

Incendiary and Smoke Munitions

Incendiary munitions used in SEA were the napalm fire bombs (BLU-27 and BLU-32), the M-36 cluster of thermite and magnesium bombs, and the phosphorous munitions (M-47, CBU-12, and CBU-22). The bombs containing phosphorus were primarily used for smoke, but the CBU-12 and CBU-22 also produced incendiary effects when delivered from low altitude (150 feet).

Air-to-Ground Missiles

The Bullpup (AGM-12), Shrike (AGM-45), Standard ARM (AGM-78), and Walleye (AGM-62) were designed to provide a standoff capability against ground targets. The Bullpup was radio-controlled from the cockpit of the employing aircraft, and the Walleye was TV guided. The Shrike and Standard ARM homed on emissions from enemy radar sites, and were utilized by F-105 and Navy aircraft in strikes against the radar guidance systems of enemy AAA and SAM sites.

Ammunition

The 7.62 mm ammunition used by gunships and A-1 aircraft consisted of ball and tracer ammunition and was intended for use against personnel or materiel targets. Gunships and fighter aircraft used high explosive incendiary (HEI) or armor piercing incendiary (API) 20 mm ammunition. The API was designed for use against armored vehicles while the HEI, because of its fragmentation and incendiary effects, was more effective against light vehicles. The AC-130 gunship aircraft also utilized 40 mm and HEI ammunition in attacks on trucks.

The BLU-82, a 15,000-pound high-explosive weapon, was used periodically during the campaign, and was delivered by parachute extraction from C-130 aircraft under Combat Skyspot control. This weapon was designed for helicopter landing zone preparation; however, the tremendous blast effect it produced indicated it might be suitable for attacks against IDPs (roads) and suspected truck parks and storage areas. When used against storage areas, the weapon was equipped with a fuze extender

[REDACTED]

in order to achieve an air burst. The air burst was effective in clearing a large area of foliage, allowing fighters to make a follow-up strike against exposed targets, but lack of cratering effect made it unsuitable for use against IDPs.

Table A-10 shows the compatibility of munitions with strike aircraft flown by the Air Force, Navy and Marines during the Commando Hunt V campaign.

New Munitions

In addition to the standard munitions used during previous dry-season campaigns, four new munitions or modifications of standard ordnance were tested during the Commando Hunt V campaign.

M-36E2. The M-36E2 was a modified version of the M-36 incendiary cluster bomb which could be carried on high-speed tactical aircraft. The munition was given a hard back which strengthened the dispenser, thus eliminating the maximum speed restriction of the M-36. This modification was accomplished at the expense of removing six of the M-126 incendiary bombs. This munition was used primarily by the F-4 but was compatible with any aircraft that carried the M-36.

40 mm HEI Ammunition with Misch Metal Liner. The improved 40 mm HEI ammunition was a variation of the standard 40 mm round, modified by the addition of a one-eighth-inch Misch metal liner which provided increased incendiary effects. The projectile characteristics were not changed except for weight and amount of explosive charge. An SEA evaluation was conducted by the 8 TFW beginning in January. Use of the ammunition was discontinued in April due to shell extraction problems.

CBU-38/A. The CBU-38 fragmentation munition was evaluated by the 432 TRW. This munition was designed to achieve higher fragment velocities (5500 feet per second) and larger fragments (25 to 40 grains) than the CBU-24. The munition was composed of 40 BLU-49/B bombs which weighed 13 pounds each. It was used primarily against trucks, truck parks, and AAA sites.

MK-36 Mod 2 and 3 (Unretarded). The MK-36 Mod 2 and 3 mine was used by the Navy during the campaign. This weapon was a modified version of the MK-36 Mod 1 with the following changes incorporated:

1. The fuze was strengthened to withstand impact velocities of up to 900 feet per second, allowing the weapon to be dropped in an unretarded configuration;
2. The signature of the weapon was reduced to make it less sensitive to mine sweeping; and

AIRCRAFT AND MUNITIONS COMPATIBILITY

	AIR FORCE						NAVY & MARINE			
	A-1	B-52	B-57	F-4	F-100	F-105	A-4	A-6	A-7	F-4
MK-82	X	X	X	X	X	X	X	X	X	X
MK-83							X	X	X	X
MK-84				X		X	X	X	X	X
M-117	X	X		X	X	X				
M-118				X		X				
BLU-31				X	X	X				
BLU-27	X		X	X	X	X				
BLU-32	X				X					
M-36	X		X							
M-36E2	X		X	X						
M-47	X									
CBU-12				X	X					
CBU-22	X									
CBU-24	X		X	X	X	X	X	X	X	X
CBU-25	X									
CBU-38				X						
CBU-42				X	X	X				
CBU-46				X	X	X				
CBU-49	X		X	X	X	X				
ROCKEYE				X	X	X	X	X	X	X
BLU-52	X			X	X	X				
CBU-30	X			X	X	X				

TABLE A-40

[REDACTED]

AIRCRAFT AND MUNITIONS COMPATIBILITY (CONT)

	AIR FORCE					NAVY & MARINE				
	<u>A-1</u>	<u>B-52</u>	<u>B-57</u>	<u>F-4</u>	<u>F-100</u>	<u>F-105</u>	<u>A-4</u>	<u>A-6</u>	<u>A-7</u>	<u>F-4</u>
M-1A4	X									
EOGB				X			X		X	
LGB			X	X						
AGM-45				X		X	X	X	X	
AGM-62				X			X		X	
AGM-78						X		X		
7.62 MM*	X									
20 MM*		X		X	X	X	X		X	
40 MM*										

* AC-119 AIRCRAFT EMPLOYED 7.62 AND 20 MM AMMO.

AC-130 AIRCRAFT EMPLOYED 20 AND 40 MM AMMO.

TABLE A-40 (CONT)

3. The selectable destruct time feature, removed from previous models, was replaced.

While the higher impact velocity limit allowed the mine to be emplaced without the tell-tale fins being left near the impact point, the delivery airspeed still had to be less than 400 knots if the weapon was released about 5000 feet AGL in an unretarded configuration. This increased the vulnerability of the delivery aircraft to ground fire.

PHOTO RECONNAISSANCE

US photo-reconnaissance assets in SEA accomplished a wide range of support missions for Allied ground and air activities during the Commando Hunt V campaign. In Barrel Roll and Steel Tiger, photo

[REDACTED]

reconnaissance was used to monitor the enemy's ground force deployments and combat and logistics operations to assist tactical air and Arc Light strike planning, to evaluate strike results, and to support such missions as sensor seedings, cartographic updates, and evaluation of new weapon systems. Within North Vietnam, enemy defense sites, lines of communications, and logistic complexes were scheduled for frequent reconnaissance using both drone and manned photo-reconnaissance resources.

Resources.

Two USAF tactical reconnaissance wings participated in the Commando Hunt V Campaign; the 460 TRW and the 432 TRW. Table A-41

TACTICAL RECONNAISSANCE WINGS IN SEA				
<u>UNIT</u>	<u>TYPE AIRCRAFT</u>	<u>AIRCRAFT</u> <u>30 NOV 70</u>	<u>POSSESSED</u> <u>17 APR 71</u>	<u>LOCATION</u>
HQ 432 TRW				UDORN
14 TRS	RF-4	23	24	UDORN
HQ 460 TRW				TAN SON NHUT
DET 1	RB-57	4	4	TAN SON NHUT
12 TRS	RF-4	17	21	TAN SON NHUT
360 TEWS	EC-47	19	18	TAN SON NHUT
360 TEWS, DET 1	EC-47	5	6	NAKHON PHANOM
361 TEWS	EC-47	18	18	PHU CAT
362 TEWS	EC-47	12	12	DA NANG

TABLE A-41

shows the operational units and possessed aircraft of these wings. The number of reconnaissance aircraft remained fairly constant throughout the campaign, with the only major change being the redeployment to the US of the RF-101 squadron assigned to the 460 TRW at Tan Son Nhut. These aircraft commenced stand-down on 20 October for redeployment and flew no operational sorties after that date.

Both reconnaissance wings had dual missions. The 432 TRW maintained and operated two F-4 tactical fighter squadrons and the Airborne Command and Control Center in addition to performing its reconnaissance mission. The 460 TRW managed all EC-47 aircraft in SEA in addition to performing its photo-reconnaissance mission. Each wing had internal resources to perform processing and initial exploitation of its film. The 12th Reconnaissance Intelligence Technical Squadron at Tan Son Nhut AB performed detailed studies of the photos and maintained permanent records of the coverage in the Southeast Asia Imagery Reconnaissance File (SIRFA).

Photo-reconnaissance missions were assigned to these two organizations on a requirement basis and units were programmed in order to balance the level of effort (Figure A-20).

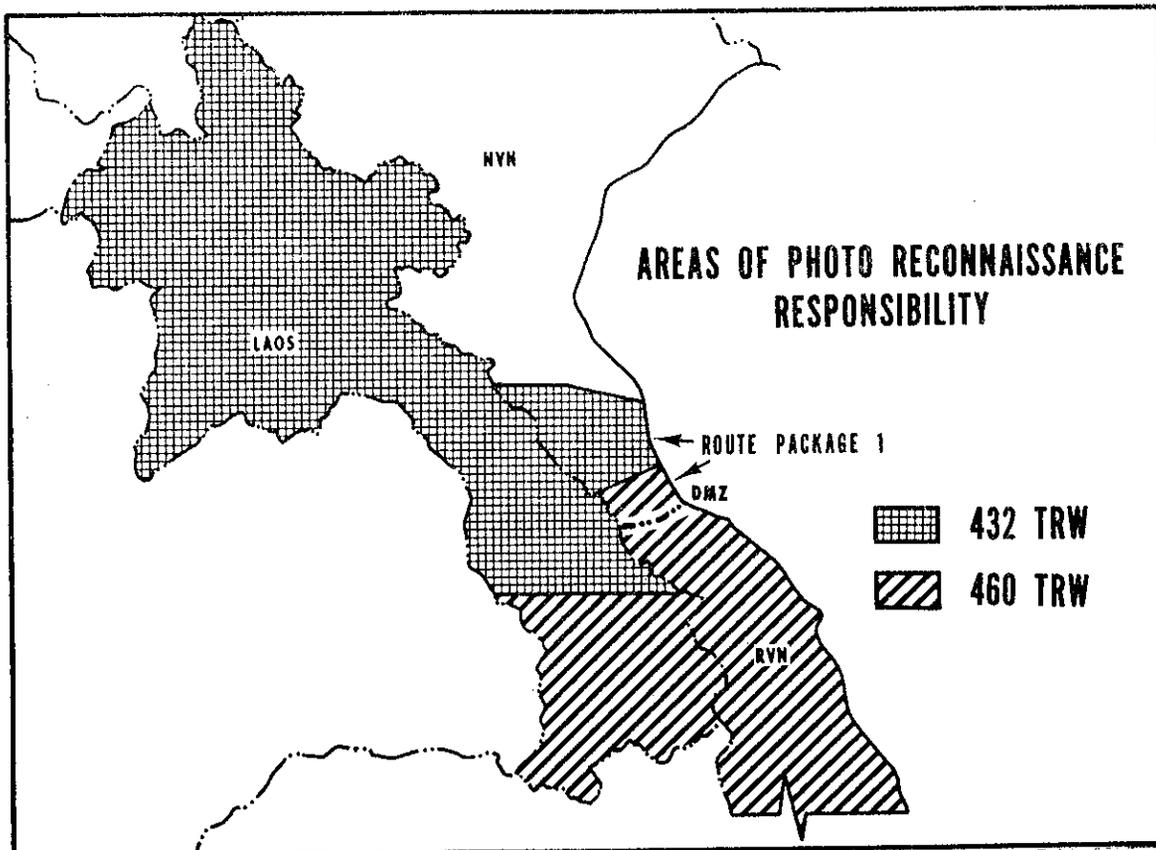


FIGURE A-20

[REDACTED]

The US Navy flew photo-reconnaissance missions in Steel Tiger and North Vietnam using carrier-based RA-5 and RF-8 aircraft. These aircraft were not scheduled to cover 7AF objectives but were employed for post-strike evaluation of Navy strike missions. US Army reconnaissance missions were flown in Barrel Roll, Steel Tiger, and adjacent to RP I using side-looking airborne radar (SLAR)-equipped OV-1 Mohawks. Occasional photo-reconnaissance missions were also flown by these aircraft. On some missions the SLAR-equipped aircraft were teamed with AC-119K gunships in truck hunter-killer operation. The OV-1s provided additional search capability which allowed the gunships to employ more of their limited flight time in striking trucks rather than looking for them.

Figure A-21 illustrates the process by which users obtained photo reconnaissance. All levels of command initiated requests; however, most were generated by 7/13AF, Task Force Alpha, and internally within the 7AF staff.

Validated targets were entered into the SIRFA. Daily retrievals of photo-reconnaissance objectives, designated Auto Frags, were provided to the Reconnaissance and Electronic Warfare Division, DCS, Operations, the 7AF agency responsible for photo reconnaissance. They updated the objective list to remove any requirements which had been accomplished but not yet entered into the system and scheduled aircraft to meet the remaining requirements. In general, the criteria for successful coverage were 65 percent of a route, 85 percent of an area, or 100 percent of a pinpoint objective.

Film was processed by the units performing the mission and the first stage of exploitation was accomplished. Immediate photo-interpretation reports (IPIRs) were distributed to all interested parties within 12 hours of aircraft touchdown. IPIRs provided a description of the coverage and a brief resume of the EEIs observed. Often when high-interest photography was accomplished, aircraft of the 432 TRW would recover at Tan Son Nhut AB in order to provide immediate information to 7AF. After the IPIR was completed, the film was sent by courier to the 12 RITS at 7AF where succeeding stages of exploitation were accomplished. Supplemental photo interpretation reports (SUPIRs), an expansion of the IPIR, were distributed within 24 hours of completion of the first stage exploitation. In the final stage of exploitation, special studies were conducted on high interest objectives; and prints blowups, and mosaics were prepared for the requesters. Complete records of all available photo reconnaissance were kept in the SIRFA so requesters could review changes over time.

Impact of Weather on Operations

Weather played a key role in the photo-reconnaissance operations in SEA. The weather from RP I to the western slopes of the Annam Mountains was often unsuitable for photo reconnaissance. All photo-reconnaissance targets associated with the entry interdiction program

PHOTO RECONNAISSANCE REQUEST FLOW DIAGRAM

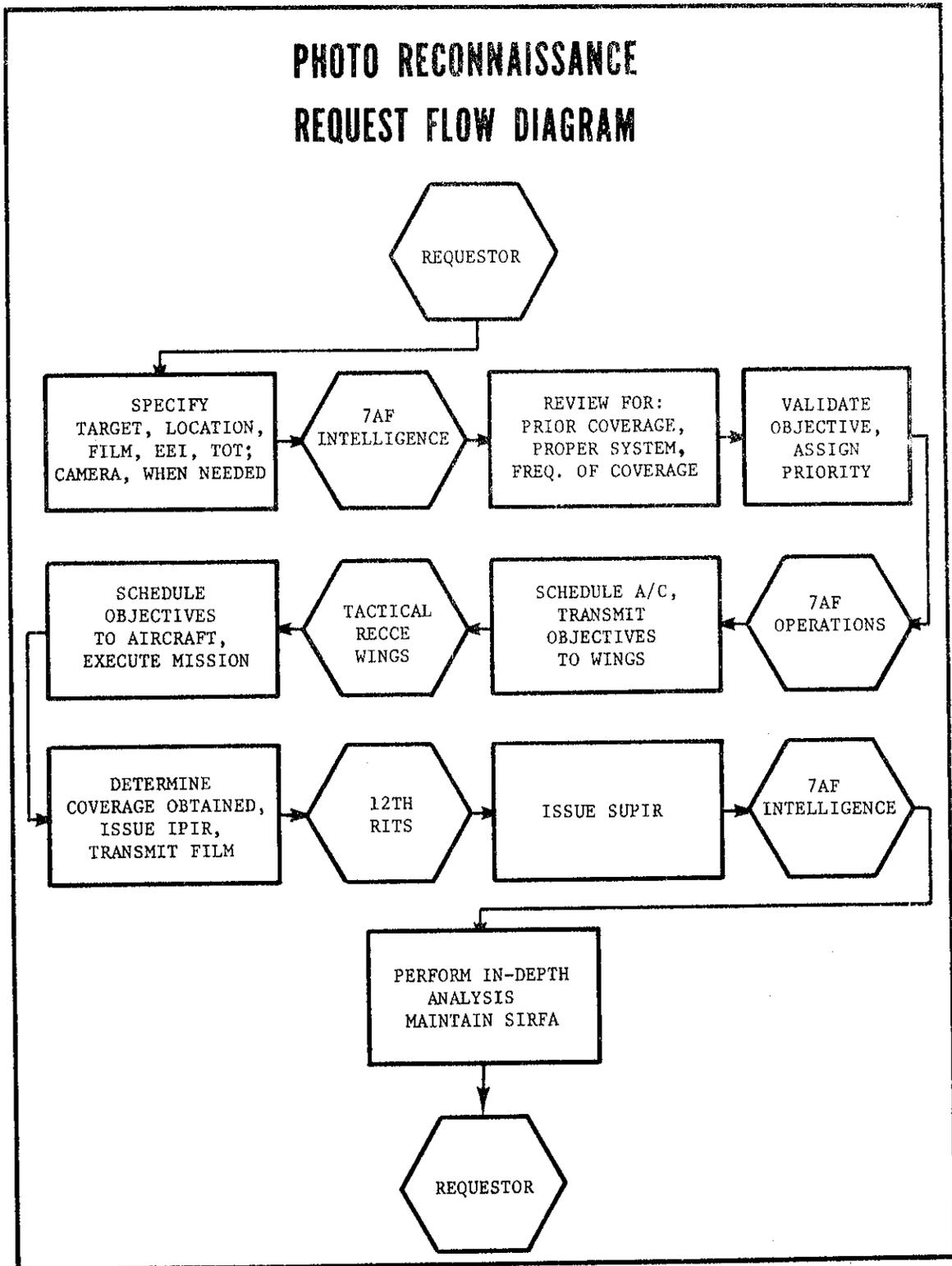


FIGURE A-21

[REDACTED]

were in the poor weather areas. All NVN defense sites threatening US air operations in Steel Tiger were also in this area. The ends of the major throughput routes to RVN, Routes 926, 922 and 966, and their extensions in MR I also were in areas of poor weather.

Considerable reconnaissance resources were expended in marginally successful or unsuccessful attempts to photograph important targets in the poor weather areas.

Operations in Laos

One of the principal missions for photo reconnaissance in Laos was the surveillance of enemy roads, waterways, trails, and pipelines. Illustrated in Figures A-22 and A-23 are the LOCs scheduled for recurring coverage in Steel Tiger and Barrel Roll. The frequency of coverage was determined by consolidating the requirements of MACV, 7/13AF, TFA, and 7AF. Area coverage of suspected enemy truck parts and storage areas and pinpoint photography of such targets as interdiction points and enemy defense positions were also performed as part of normal scheduled operations.

In addition to missions where specified objectives were covered, both the 432 TRW and 460 TRW flew RF-4 quick reaction reconnaissance (QRR) missions in Steel Tiger and Barrel Roll. QRR missions could be assigned 7AF-scheduled targets, but in most cases they performed visual reconnaissance and photographed both FAC-recommended targets and those identified by unit intelligence officers. Targets discovered by the RF-4 crews were relayed to the FAC for strike. Areas considered suspicious or worthy of further coverage were photographed by the RF-4. These procedures eliminated the time consumed in the normal request and approval process. The film from the QRR mission was processed immediately on return to base, and the QRR and FAC crews assisted with the initial photo interpretation. The results of this interpretation were passed to the FAC unit for use by follow-on FACs, so that time-sensitive targets were brought under attack with little delay.

In addition to regular route and area coverage for confirmation of BDA, 7AF CP scheduled reconnaissance coverage of significant gunship strikes at first light. The first-light program was later augmented by scheduling night reconnaissance of significant strikes. RF-4 aircraft worked with the gunships, and as soon as a strike was reported, they photographed the area. Five photoflash cartridges were expended on the photo run with the third cartridge centered on the coordinates of the target provided by the gunship.

This program was not as successful as anticipated, due for the most part to the difficulty of getting an accurate fix on the target location. All but one AC-130 gunship had to estimate Loran target

FREQUENCY OF RECONNAISSANCE ROUTE COVERAGE IN STEEL TIGER

APRIL 1971

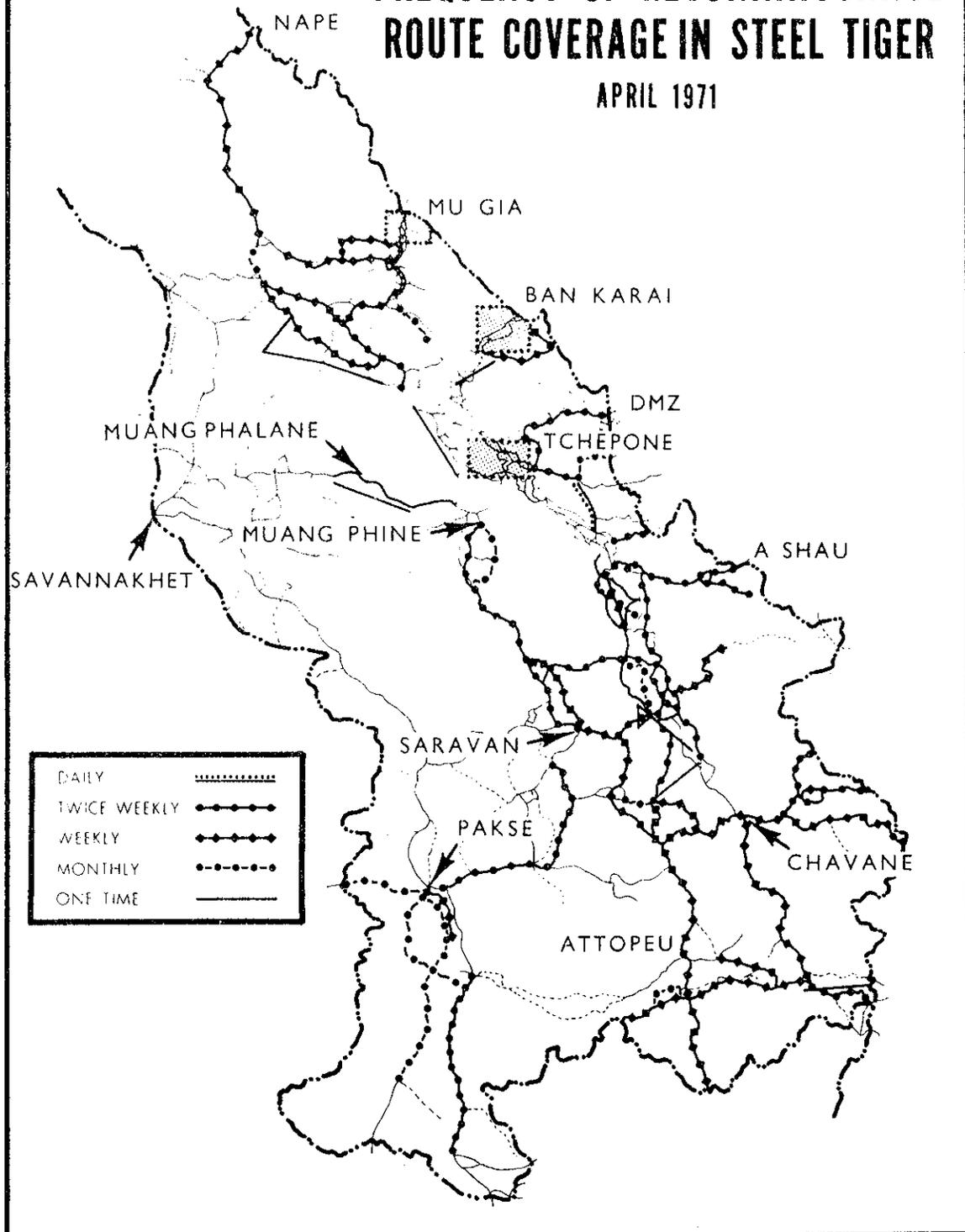


FIGURE A-22

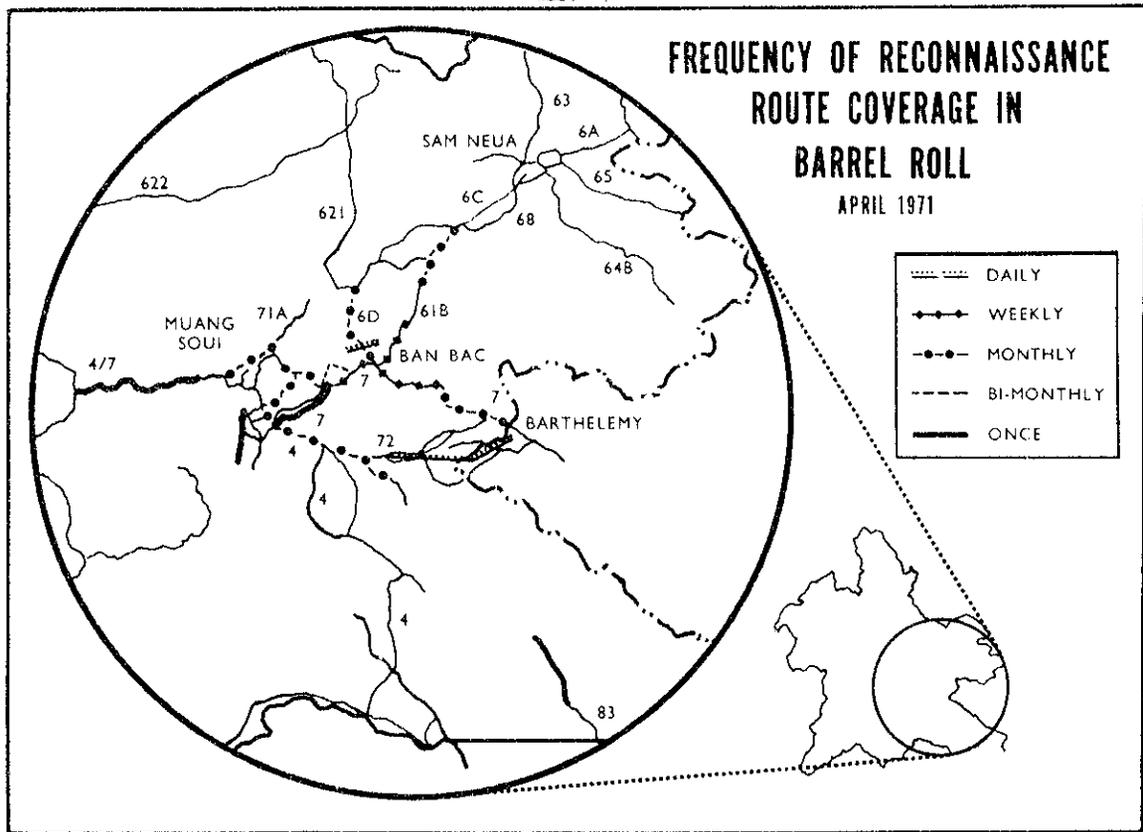


FIGURE A-23

coordinates based on the coordinates of the gunship at the time of the strike. AC-119 gunships were not able to establish their positions in Loran coordinates to position reconnaissance aircraft. The RF-4 flew at lower altitudes at night, and this reduced the field of view. An aircraft at 2500 feet, using a 6-inch focal-length lens, had a field of view of 600 meters. If the target coordinates were in error by more than 300 meters, the photography would not cover the target. The possible error in target coordinates also affected the day follow-on photography, though the higher altitudes of the day flights did give a larger field of view.

At first, large numbers of trucks destroyed or damaged were reported at one set of coordinates. Gunships began supplying coordinates for groupings of trucks within a major strike, thus providing the reconnaissance aircraft with more data for locating all the targets.

Weather was a continual problem in attempting to get photo-confirmation, and any delay in obtaining photo coverage gave the enemy the

[REDACTED]

opportunity to camouflage or remove damaged vehicles.

Special Reconnaissance for SAMs

Firings of ground-to-air missiles of undetermined type in Laos led to the belief that SA-2s may have been introduced into Steel Tiger. On 5 March a special reconnaissance area was established for SAM search. The search area extended from Mu Gia Pass to south of Muang Phine; then east to the RVN border; then north along the North Vietnamese border returning to Mu Gia. The area was subdivided into 5 NM square blocks, which were photographed on a regular basis.

Level of Effort

The level of effort by photo-reconnaissance aircraft in Steel Tiger and Barrel Roll is shown in Tables A-42 and A-43. Not shown in the photo reconnaissance tables are the sorties flown by US Army OV-1 SLAR-equipped aircraft scheduled by 7AF.

**PHOTO-RECONNAISSANCE SORTIES BY MISSION TYPE
AND SERVICE - STEEL TIGER**

	USAF <u>QR RECCE</u>	USAF <u>PHOTO RECCE</u>	NAVY <u>PHOTO RECCE</u>	US <u>TOTAL</u>
10-31				
OCT	66	114	49	229
NOV	90	207	42	339
DEC	93	287	67	447
JAN	90	323	89	502
FEB	83	360	101	544
MAR	93	426	103	622
APR	90	396	128	614
TOTAL	605	2113	579	3297

TABLE A-42

[REDACTED]

PHOTO-RECONNAISSANCE SORTIES BY MISSION TYPE

USAF - BARREL ROLL

	<u>QR RECCE</u>	<u>PHOTO RECCE</u>	<u>TOTAL</u>
10-31			
OCT	22	24	46
NOV	30	17	47
DEC	31	45	76
JAN	30	44	74
FEB	28	29	57
MAR	31	44	75
APR	30	42	72
TOTAL	202	245	447

TABLE A-43

Operations in Route Package I

Aircraft from the 432 TRW and 460 TRW flew most of the photo reconnaissance in RP I. Normal daily scheduling during favorable weather called for four RF-4 sorties from the former and two RF-4 sorties from the latter. Most of the Navy reconnaissance flown in NVN was in RP II, but some sorties were also flown in RP I. Because of the importance of photo reconnaissance in RP I, 7AF, rather than the operational units, scheduled the photo objectives to specific flights. The 7AF CP made final decisions on whether to cancel these flights because of bad weather. Often the first scheduled aircraft would fly, even though the weather forecast was unfavorable, in order to insure that no opportunity to obtain photography was missed.

The level of effort in RP I for the Commando Hunt V campaign is tabulated in Table A-44. Table A-45 contains total photo-reconnaissance sorties by aircraft type for the campaign.

The recurring coverage requested in RP I during the month of April is illustrated in Figure A-24. In support of RP I tactical

**PHOTO-RECONNAISSANCE SORTIES BY MISSION TYPE
AND SERVICE - RP 1**

	USAF		NAVY	US
	<u>PHOTO RECCE</u>	<u>BUFFALO HUNTER</u>	<u>PHOTO RECCE</u>	<u>TOTAL</u>
10-31				
OCT	38*	6	0	44
NOV	54	14	0	68
DEC	68	12	0	80
JAN	80	12	0	92
FEB	57	7	1	65
MAR	127	13	1	141
APR	110	10	0	120
TOTAL	534	74	2	610

* DOES NOT INCLUDE 2 RF-101 SORTIES PRIOR TO REDEPLOYMENT
TO THE US.

TABLE A-44

photo-reconnaissance operations, two F-4 escort sorties were required for each of the reconnaissance aircraft and helicopters were airborne for potential SAR operations.

Buffalo Hunter Operations.

In addition to tactical reconnaissance operations, Buffalo Hunter drones operated by the Strategic Air Command also performed photo reconnaissance in NVN. Since Buffalo Hunter aircraft were considered national assets, 7AF was in competition with other organizations for their services. From the 7AF list of objective requirements, the 7AF DCS, Intelligence, selected critical targets and made one-time requests to MACV for photo reconnaissance. The Buffalo Hunter was useful in obtaining photos of high threat areas and those where the cloud cover was often below minimums for tactical reconnaissance.

PHOTO-RECONNAISSANCE SORTIES BY AIRCRAFT TYPE

10 OCT - 30 APR

	<u>STEEL TIGER</u>	<u>BARREL ROLL</u>	<u>RP I</u>	<u>TOTAL</u>
USAF - RF-4	2220	447	534	3201
USAF - RB-57	575	0	0	575
USAF - DRONE	0	0	74	74
NAVY - RA-5	364	0	2	366
NAVY - RF-8	245	0	0	245
TOTAL	3404	447	610	4461

TABLE A-45

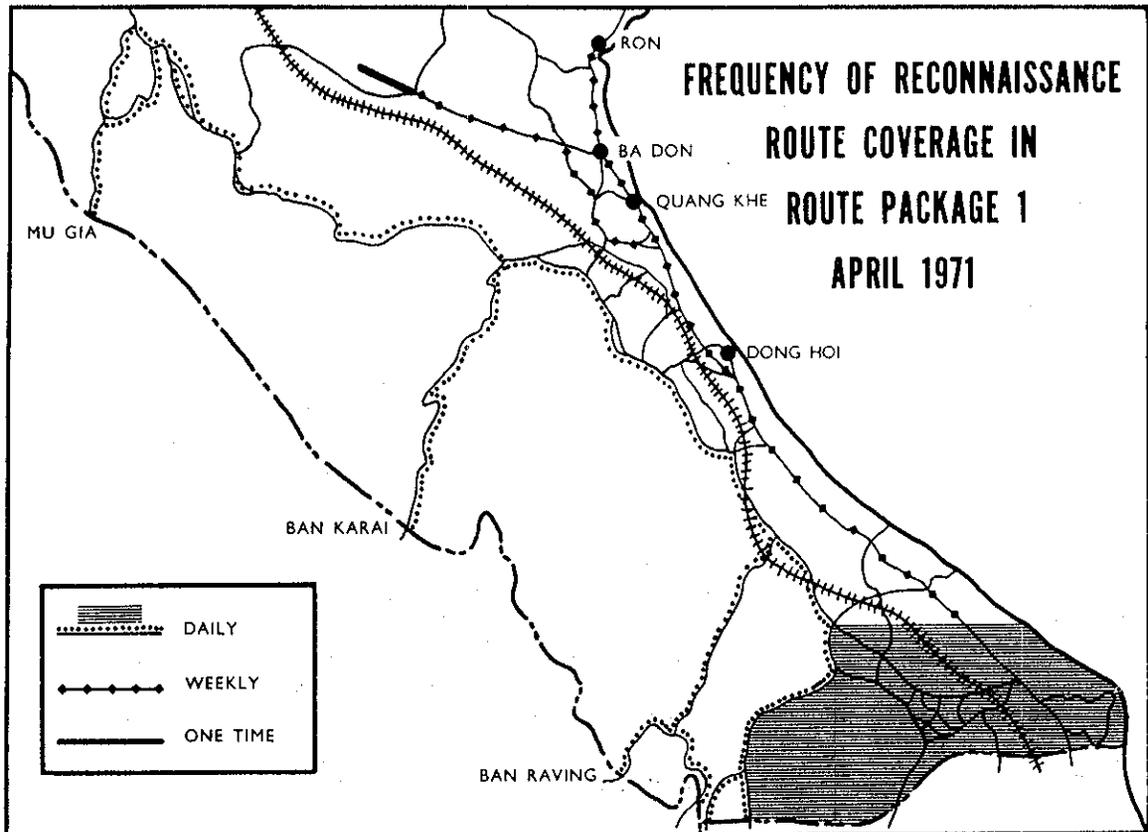


FIGURE A-24

ELECTRONIC WARFARE

The electronic warfare effort during Commando Hunt V concentrated on two missions: electronic intelligence (ELINT) collection, and stand-off jamming.

ELINT Collection

Of primary concern to 7AF was the establishment of SAM defenses near key interdiction areas. During the first weeks of Commando Hunt V, weather conditions prevented sustained photo coverage and left ELINT as the principal means for fixing the location of the enemy's SAM units as well as for providing SAM warnings. In view of the 24-hour threat from and regular movement of the SAM units, daily 24-hour ELINT coverage was required, but ELINT resources were limited.

EB-66s were the principal vehicles for collecting ELINT on SAMs. The five EB-66Cs of the 42nd TEWS at Korat were able to fly about three sorties per day or about eight of the twenty-four hours of coverage. 7AF and CTF-77 developed a coordinated ELINT operations schedule in which the Navy flew EA-3B, EA-121, and EP-3B collector platforms at times interspersed between EB-66 coverage. A request for the release of national resources to provide additional ELINT coverage did not receive the support hoped for because of worldwide force limitations. Support received from SAC's Combat Apple RC-135 forces covered RP I twelve hours a day on 2 consecutive days per week, and, combined with the EB-66 and Navy efforts, made possible the desired 24-hour ELINT coverage. With the bombing surge during Lam Son 719 and the increased threat at that time, Marine EA-6As were brought in to intensify the coverage provided by the other ELINT forces. They flew five two-hour missions per day.

ELINT forces flew over Laos and the Gulf of Tonkin and monitored radar activity in the critical input pass and RP I areas. The majority of the Fan Song SAM radar intercepts south of 19° N were made by EB-66 crews. PACOM ELINT statistics for the 11 December through 10 February period, for example, showed that the EB-66s flew 144 missions and made 280 intercepts, while Navy resources flew 123 missions and made 67 intercepts, and the SAC Combat Apple force flew 107 missions and made 88 intercepts.

Other ELINT operations included the airborne radio-direction-finding (ARDF) effort to intercept enemy-operated radio transmissions in Southeast Asia. Requirements, with recommended priorities, were submitted through collection-management authorities (CMAs) to MACV, J-211-4 for validation. ARDF forces were then tasked through the ARDF Coordination Center (ACC) to satisfy validated requirements. Short response times to changes in priority tasking were the rule. USAF ARDF resources consisted of EC-47 aircraft assigned to the 460th TRW.

[REDACTED]

During Commando Hunt V, USAF ARDF emphasis shifted from RVN to Cambodia and Laos. The level of sorties supporting Cambodia and Laotian operations increased 31 percent from the first to the third quarter of FY 71. The level of ARDF operations reached a peak, when 3375 sorties flew during the first three months of 1971. This level was eight percent higher than that of the same period in 1970.

Stand-off Jamming

Stand-off jamming stemmed for the most part from the enemy's SAM threat. The EB-66Es of the 42nd TEWS provided jamming support throughout the Commando Hunt V campaign. For allocating the limited jamming resources first priority was assigned to B-52 Arc Light support. Support of photo reconnaissance also had a high priority. Other support, such as to Buffalo Hunter drones and psychological-warfare leaflet drops, had to be allocated on a case-by-case basis.

To protect B-52s from radar-directed weapons, two EB-66Es accompanied each B-52 cell and jammed the pertinent radar frequencies. In a typical mission, the EB-66s would air refuel and proceed to separate start-jam points. These points were on the edge of the enemy's early warning (EW) and ground-control intercept (GCI) coverage and were selected to give the widest jamming possible. After starting to jam, the EB-66Es flew a crossing track which terminated in orbits in the target area. The crossing-track technique proved to be an effective method of interrupting EW and GCI tracking of a specific target. Perhaps the best indicator that electronic warfare was effective was the fact that of the 900 or more B-52s entering threat areas per month, none was hit or damaged by SA-2 missiles.

IGLOO WHITE

The Igloo White electronic surveillance system was the prime source of reliable data on enemy logistics movements in Steel Tiger. It used acoustic and seismic sensors emplaced in enemy territory to detect and track vehicles along the LOCs in Laos. It was not affected in an adverse manner by bad weather, darkness, or enemy defenses, and provided all-weather real-time and historical intelligence.

The Commando Hunt I report of May 1969 and the Commando Hunt III report of May 1970 describe the system, its operation, and its contribution to interdiction efforts. This section describes changes to the system since Commando Hunt III and reviews Task Force Alpha's employment of the sensor information.

Sensors

During Commando Hunt III, Phase I (noncommandable) and Phase II (commandable) sensors were used. During Commando Hunt V a conversion

[REDACTED]

to Phase III sensors was accomplished. Phase III sensors were the ADSID III (Air Delivered Seismic Intrusion Detector), ACOUSID III (Acoustic and Seismic Intrusion Detector), and the COMMIKE III (Commandable Microphone). They differed from Phase II sensors in having 32 frequency channels available as opposed to 31, and 64 sensor addresses instead of 27 per channel. This increased number of channels and addresses per channel provided more total sensor addresses than in the previous dry-season campaigns, allowing more flexibility in sensor field management. The Phase III devices also had a higher degree of emplacement survivability and longer average lifetimes than the earlier sensors. At the start of Commando Hunt V, 88 percent of the sensor strings in Steel Tiger consisted of Phase III sensors. Conversion of the northernmost third of the sensor field was completed by 1 October; at the central field, by 1 November, and of the remainder, by 17 February.

Sensor Strings

Three types of sensor strings were employed: strike, intelligence, and reconnaissance-by-acoustics (RBA) strings. Strike strings were used to support Commando Bolt operations. Intelligence strings provided data on traffic movement into and out of Steel Tiger and within the system. RBA strings supplemented intelligence string coverage.

Sensor String Deployment

In the previous interdiction campaigns sensor strings were located in a linear fashion along the main roads of Steel Tiger. The linear pattern originated in a time when the route structure was much simpler and was itself linear, and when truck parks and storage areas were less numerous and dispersed. As the enemy constructed bypasses, alternate roads, and truck parks and storage areas, three problems became apparent. First, trucks not using the main road or using bypasses around sensorized sections would not be counted by any sensor string. Second, strings along the main roads were located near enough to one another so that multiple counting of individual trucks was common. Third, strings were not positioned as well as they might be to fix the position of truck parks and storage areas beyond indicating possible road stretches where turn-offs were made.

The new sensor string deployment concepts were developed for Commando Hunt V. Commando Bolt strike strings would continue to be emplaced as before. Strings for gathering truck traffic intelligence data were to be emplaced in bands across the enemy's route structure. Strings within these bands would be emplaced along the major road, alternate roads, and bypasses in lines cutting across the route structure so that any vehicle moving from above to below a band would be detected by one sensor string and counted only by that string, no matter what road was used (Figure A-25). Additional sensor groups made up of COMMIKE acoustic

[REDACTED]

sensors would be emplaced in those areas that all-source intelligence indicated were likely truck or storage areas.

In general, sensor string deployments during Commando Hunt V were made according to the monitor band concept. However, linear deployments were made in response to specific tactical requirements, and COMMIKE deployments were made late in the season after the concept was developed. Sensor string location depended upon the purpose of the string, analysis of the traffic flow during the campaign, the road segment or area to be monitored, terrain masking restrictions, and line of sight requirements. Figure A-26 shows locations of the LOC monitoring bands during December.

The type and number of sensors in a string depended upon the purpose of the string. To be considered effective, the data from an LOC monitor string had to have consistent correlation as to direction and velocity. As a rule, three active sensors met the minimum requirements for an effective string. Sensor implant success rate was about 65 percent. This meant that an average of five sensors had to be implanted for each effective string. The average sensor spacing was about 220 to 320 meters, so the road monitored had to have one straight segment that was at least 1100 meters long. The average LOC monitor sensor string contained seven sensors. In general, two ACOUSIDs and five ADSIDs were used in such a string. The ACOUSIDs were placed in positions number two and six so that the mover could be monitored acoustically as it entered and left the string.

Commando Bolt strike modules were made up of either very long strings of up to 18 sensors or two or three shorter strings. A sufficient number of sensors was required to determine a truck's speed and direction. The strike module had to be long enough to allow sufficient time for the strike aircraft to attack movers while TFA kept the trucks under surveillance. ACOUSID and ADSID distribution within the module was similar to that within a LOC monitor string. An additional ACOUSID was often added in the center of long strings.

Areas of a four- to five-mile radius where all-source intelligence indicated truck parks and storage areas were likely to be were selected for possible COMMIKE implant. Photography was often used to identify areas of moderate or heavy canopy most likely to conceal enemy facilities, able to support a COMMIKE string, and free of terrain masking. COMMIKES were then implanted at least 700 meters away from the nearest route segment to insure that sounds of moving vehicles passing by the suspected target were not picked up.

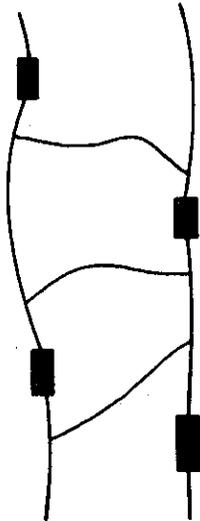
Shown in Table A-46 are the average number of effective sensor strings in each VR sector and in the field during each month of the campaign.

Relay Aircraft

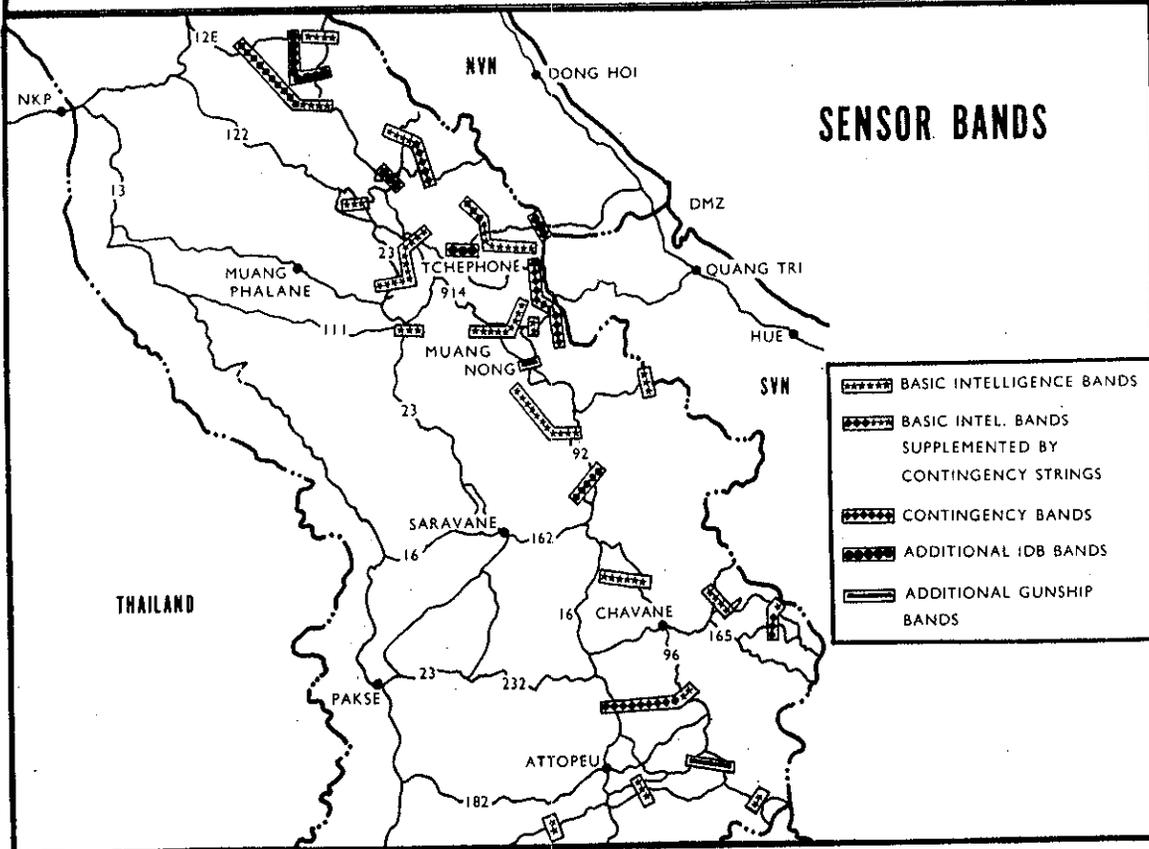
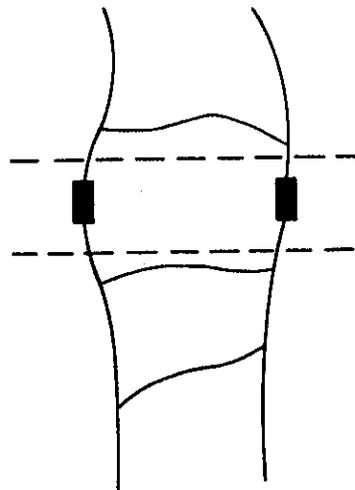
As part of the program to improve the Igloo White system, the QU-22B

SENSOR STRING DEPLOYMENT CONCEPTS

LINEAR CONCEPT



BAND CONCEPT



FIGURES A-25/A-26

**EFFECTIVE SENSOR STRINGS
BY VR SECTOR**

	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>TOTAL</u>
10-31														
OCT	0	0	9	1	11	1	6	14	4	4	0	3	3	56
NOV	0	0	11	2	17	3	10	11	6	6	1	5	3	75
DEC	1	1	11	4	21	4	12	13	7	7	2	5	5	93
JAN	1	2	11	5	23	4	15	12	9	10	3	5	9	109
FEB	0	2	11	5	29	8	15	12	12	10	4	6	9	123
MAR	0	2	11	5	30	9	11	10	14	9	7	7	9	124
APR	0	0	9	8	30	12	8	11	16	9	8	7	9	127

TABLE A-46

aircraft was introduced on 1 October 1970 to replace some of the EC-121R sensor signal relay aircraft. The single-engine QU-22B (Figure A-27), codenamed Pave Eagle, contained the same Phase III radio relay equipment as the EC-121R. It normally flew at 20,000 to 23,000 feet, which was about 6000 feet higher than the EC-121R. This higher altitude increased the area which the QU-22B orbit was able to cover and improved the probability of obtaining all sensor activations from sensors in the field. Although there was a pilot in the aircraft, the Pave Eagle was normally flown in a remote mode by the use of an aircraft flight control group (AFCG) on the aircraft and flight control radar (AN/TPW-2) on the ground.

Figure A-28 shows representative orbit locations flown by relay aircraft. After an in-theater evaluation from 3 July to 10 September 1970, the QU-22B began full-time coverage of the Green Orbit on 1 October (12 hours total, 3 sorties per day). On 15 December the QU-22B assumed coverage of the first half of the Blue Orbit (10 hours total, 3 sorties per day) and on 31 January it assumed coverage of the last half of the Blue Orbit (10 hours total, 3 sorties per day). At this time, the QU-22B was fulfilling all of its intended commitment, full coverage of the Green and Blue Orbits.

QU-22B - SENSOR SIGNAL RELAY AIRCRAFT



FIGURE A-27

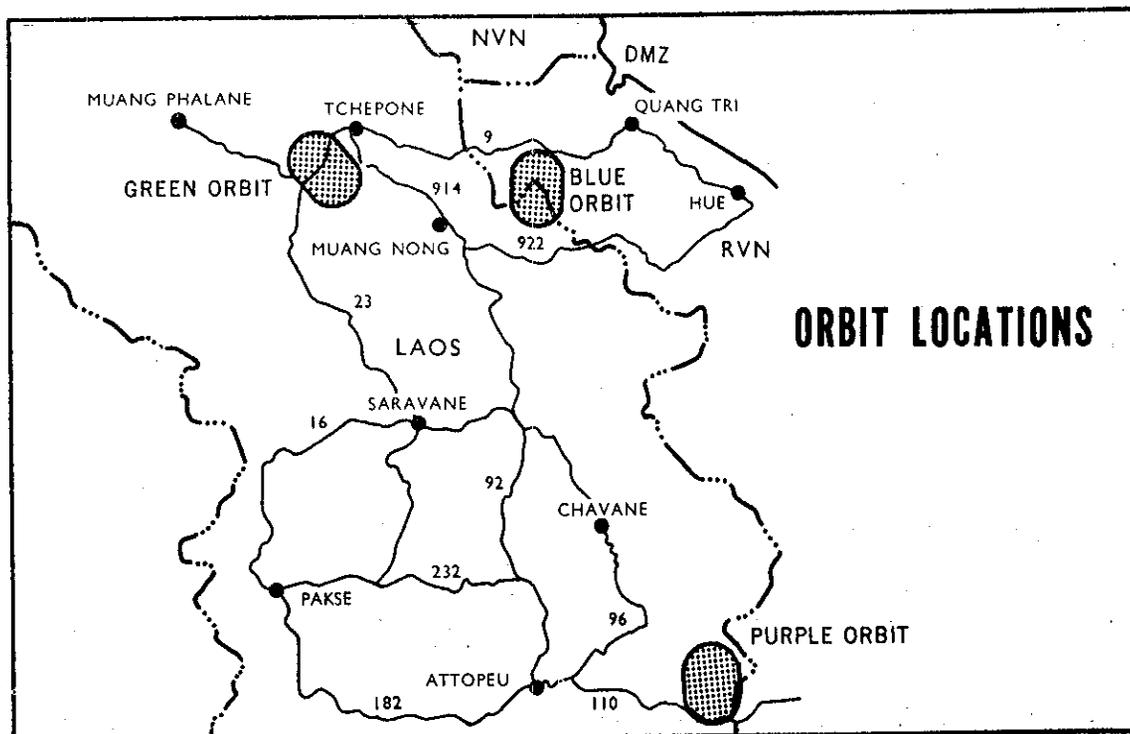


FIGURE A-28

[REDACTED]

By early December increasing problems with the QU-22B were encountered in the areas of system engineering, maintenance, and supply. These problems continued to worsen, resulting in increasing lost orbit time. The increase in QU-22B operational commitment on 15 December 1970 and 31 January 1971 was necessary, nevertheless, because the remaining EC-121Rs could no longer maintain the extra sorties being flown during this period. On 21 February, the QU-22B was relieved of half of the Blue Orbit, and the EC-121R began again to fly an extra sortie to compensate. On 23 March the EC-121R relieved the QU-22B of all Blue Orbit commitments, leaving the QU-22B to fly only the Green Orbit at the rate of 3 sorties per day.

On 6 April an AFSC/AFLC/Contractor assistance team completed a one-month investigation of the QU-22B problems. Major deficiencies were identified in the areas of engineering design of engine peripheral equipment, parts supply, test AGE, training, and maintenance. The team initiated action to resolve all of these problems, and estimated that the QU-22B could return to full service (9 sorties per day) by mid-September 1971.

Operation of the Sensor System

TFA equipment and operating procedures for Commando Hunt V were similar to those used in Commando Hunt III. One change, an economy measure completed in July 1970, eliminated one of two IBM 360/65 computers. The primary impact of losing one computer was a loss of backup and flexibility. During Commando Hunt V the remaining computer was used for real-time processing of sensor data from 1600G to 0500G daily. The other 11 hours of the day were used for data base and machine maintenance as well as a variety of data processing applications. A test in late November showed that TFA could extend its period of sensor-field coverage from 12 to 20 hours per day. However, this extended coverage was achieved only at the expense of other data processing requirements. By mid-February, installation of a 200 pen X-T plotter readout capability permitted readout of up to 198 selected sensors at any time without the computer being on-line. This capability was used for periodic daytime traffic monitoring of the Green and Blue Orbit areas and to permit around-the-clock support of Lam Son 719 operations. Samples of daytime enemy truck activity taken throughout the campaign showed that less than five percent of total sensor-detected truck movements occurred outside the normal 12 hour period during which sensors were monitored.

Night Truck Targeting

Igloo White sensor data were used for moving target development in much the same manner as in Commando Hunt III. The TFA advisory service was expanded to provide information directly to FACs and strike aircraft. Prior to 1 October these advisories had been passed to the ABCCC for action. The ABCCC was limited in the number of advisories it could

[REDACTED]

control at one time. Therefore, a filter level had been established specifying the minimum number of movers for which a TFA traffic advisory would be accepted. Without this restriction, TFA was able to transmit a much larger number of advisories. The advisory service was further improved in December when the target advisory system within TFA became automated. Table A-47 summarized the TFA advisory experience during

TFA ADVISORY SUMMARY

JAN - APR

SEQUENCES:

NUMBER OF SEQUENCES PROCESSED	69723
NUMBER OF SEQUENCES PASSED	21368

SEQUENCES PASSED TO:

COMMANDO BOLT	7716
FACS	3911
GUNSHIPS	4863
ARMED RECCE	1889
ABCCC	2984
7AF CP	10

OPREP-4 REPORTED BDA RESULTING FROM ADVISORIES

TRUCKS DESTROYED	2739
TRUCKS DAMAGED	586
EXPLOSIONS	1793
FIRES	1490

TABLE A-47

the most active truck-killing months of Commando Hunt V. Most of those sequences that were not passed were accounted for by no aircraft being available at the time or by aircraft busy with other strikes.

[REDACTED]

Night Truck Operations

In addition to providing real-time advisories on truck targets moving throughout Steel Tiger to all strike forces, TFA controlled the operations of certain strike forces in selected areas. This operation, known as Commando Bolt, began in Commando Hunt III. Figure A-29 shows

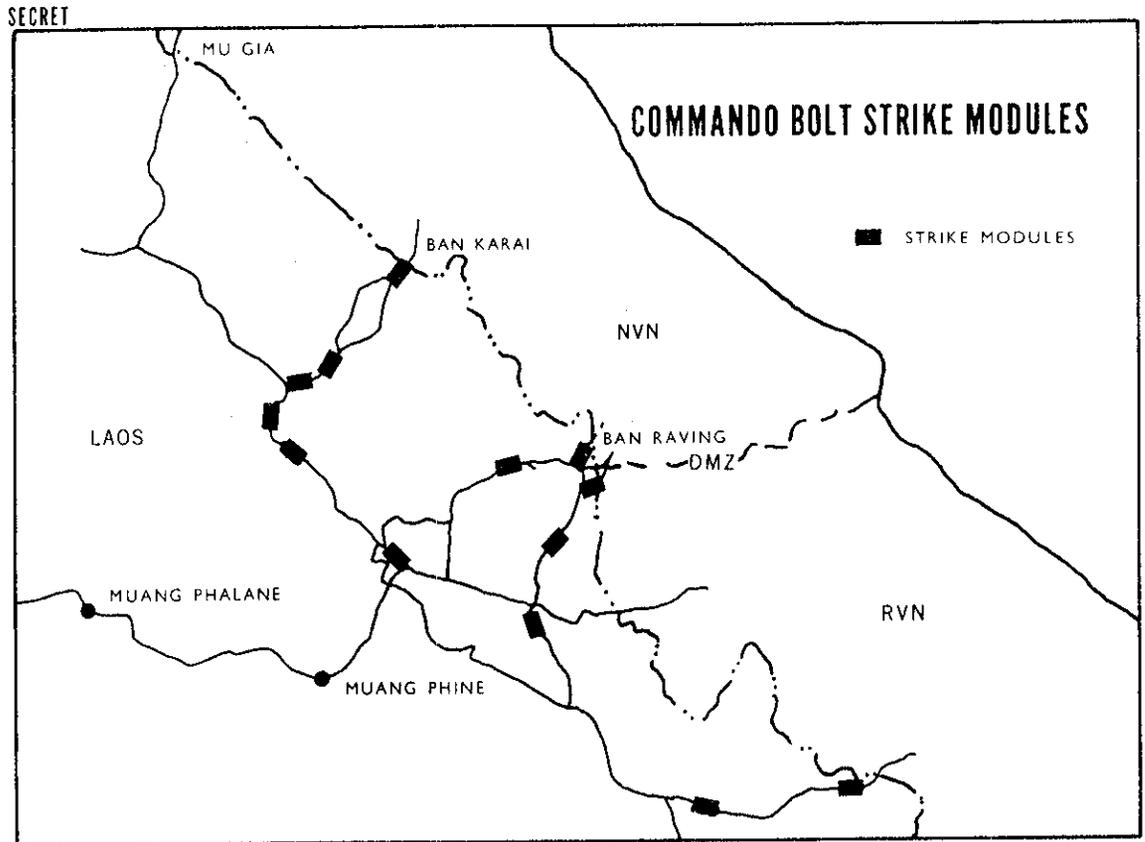
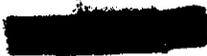
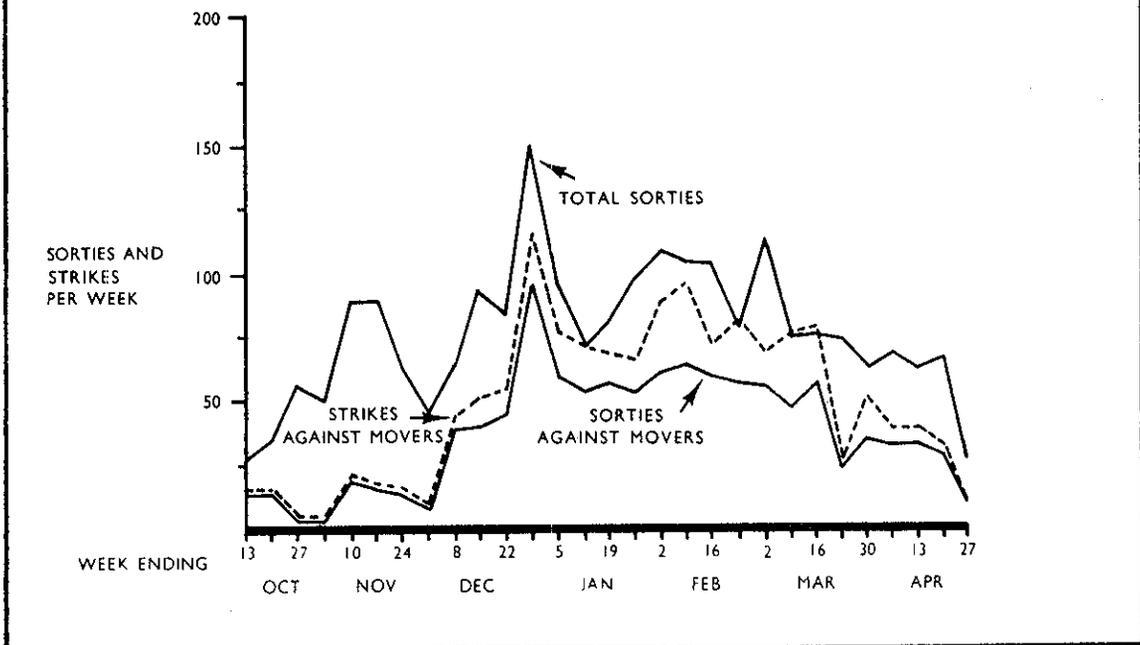


FIGURE A-29

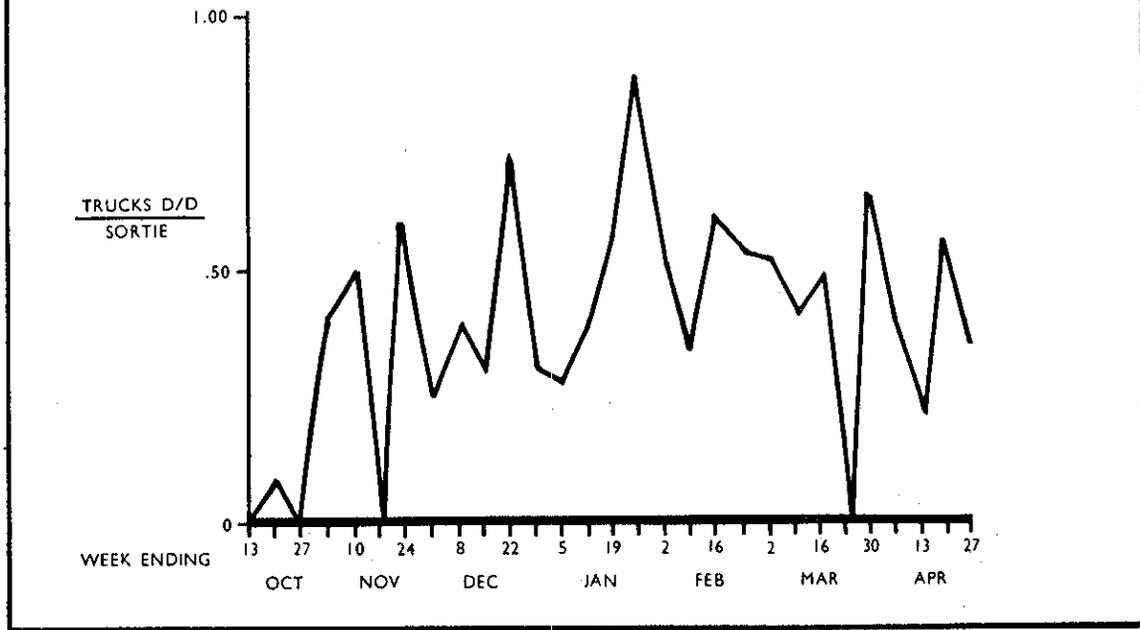
the locations of the Commando Bolt strike modules. TFA directed scheduled aircraft to an intercept with trucks moving through strike modules. The details of the Commando Bolt operation are described in the Commando Hunt III report. Commando Bolt operations were conducted in Commando Hunt V as Figure A-30 shows. The number of sorties striking trucks and strikes against trucks went up and then down in relation to sorties flown as the dry season went on and the LOC structure became more and then less lucrative. The performance of Commando Bolt per sortie striking trucks varied greatly over the season, as Figure A-31 shows; the aircrews' inability to observe target damage due to the adverse weather in the area of Commando Bolt operations accounted for



COMMANDO BOLT OPERATIONS



TRUCKS DESTROYED OR DAMAGED PER SORTIE COMMANDO BOLT OPERATIONS



FIGURES A-30/A-31



most of the variation.

Night Fixed Targeting

In January, TFA implemented a night targeting operation. The two tasks of the operation were to develop perishable fixed-target leads for quick exploitation by 7AF strike forces and to analyze sensor data so as to predict the arrival of enemy movers at a particular point along an LOC. Procedures used in this operation were similar to those used in all-source target development by the day targeting staff. One important difference was that almost all targets developed at night were based on sensor-derived leads. The on-line sensor analyst's knowledge of current and historical traffic patterns in the general area and his knowledge of traditional sensor activation patterns enabled him to judge whether or not particular sensor activations were reliable indicators of target-related activity. If he believed they were, he passed the information to the targets officer as a positive target lead.

Use of Sensor Intelligence for Operations Planning

In addition to the normal use of sensor data as an aid to target development and traffic analysis, a special effort was made during Commando Hunt V to predict traffic patterns by route segment and time. These predictions, based on past trends and daily TFA reports of movers by hour and VR sector, were provided to strike planners at 7AF each morning for use in allocating strike resources to geographic areas and routes.

During Lam Son 719 the Deployable Automated Relay Terminal (DART) monitoring facility at Quang Tri, operated by the Air Force for the Army, also read out selected Igloo White strings in the Lam Son 719 area of Steel Tiger. This sensor-derived information was then given to XXIV Corps for transmittal to ARVN elements engaged in Lam Son 719 operations.

[REDACTED]

APPENDIX B

ENEMY RESOURCES

PERSONNEL AND ORGANIZATION

The General Directorate of Rear Services of the North Vietnam Army High Command was responsible for overall direction of the enemy's logistics operations in Laos. The Directorate's 559th Transportation Group operated the logistics network and moved personnel and materiel through the Laos panhandle into the Republic of Vietnam and Cambodia. The logistics system was divided into geographic sections which were assigned to subordinate units called Binh Trams (literally military stations). Boundaries were not always contiguous with known concentrations of enemy storage facilities and shifted as LOC responsibilities changed. Each Binh Tram accomplished all logistics operations in its sector including construction and maintenance of roads, trails, and waterways. Each had the necessary transportation, engineer, and AAA battalions to insure movement and security of materiel and personnel; specific types and number of facilities depended on unit location and mission. Billeting, provisioning, and guiding NVA infiltrators and exfiltrators through the extensive trail network was accomplished by commo-liaison units assigned to each Binh Tram.

In April 1971, the 559th was estimated to have 35,000 personnel, organized into 18 Binh Trams, 15 in Laos and 3 in RVN. Not all Binh Tram locations were known; the approximate locations of those known are shown in Figure B-1. Transportation battalions accomplished movement of supplies within each sector. An average of three of these battalions were assigned to each Binh Tram. Each battalion had approximately 75 trucks, between 30 and 40 of which were estimated to operate on any given night.

LINES OF COMMUNICATION

Road Network

The road network in Steel Tiger was the enemy's primary supply line for his forces in southern Laos, the Republic of Vietnam, and Cambodia.

Input Corridors. From North Vietnam, the enemy used three major input corridors to bring supplies into Laos: Mu Gia, Ban Karai, and the Ban Raving/Demilitarized Zone (DMZ) complex (Figure B-2). The Laotian route structure began to fan out as it left the North Vietnam-Laos border, providing the enemy with many alternate routes. NVA Route 15A fed into the Mu Gia pass area where it became Route 12 with alternate Routes 12F, 1201, and 1202 all leading down into the Route 23 complex of

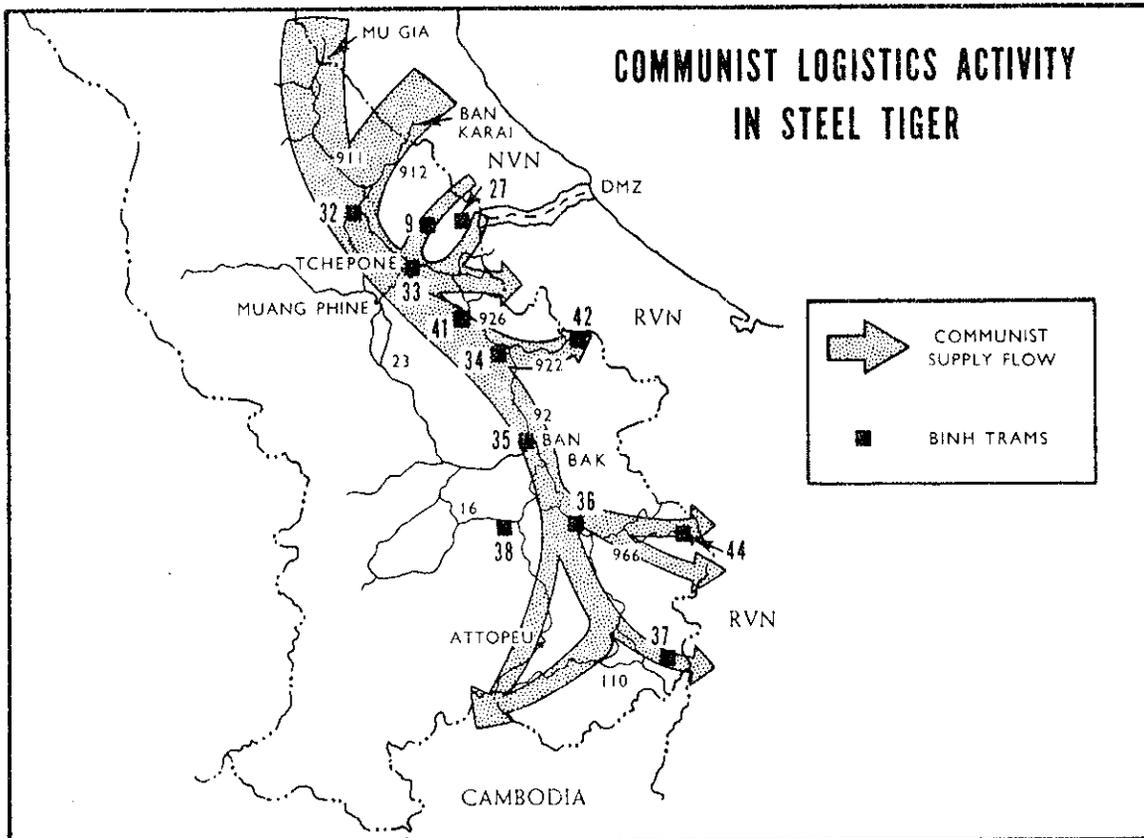


FIGURE B-1

the central route structure. NVN Route 137 was the input route into the Ban Karai Pass area. At the North Vietnam-Laos border, Route 137 became Route 912 with a proliferation of alternate routes which fed into the central route structure. Input to the Ban Raving/DMZ complex was via Route 1036 which branched into Routes 1039A and 1036C north of the DMZ. Route 1039A crossed the border and branched into 1039B and 1038 at Ban Raving. Just inside NVN, Route 1036C extended southward to the DMZ where it joined Routes 92 and 1032.

Central Route Structure. The principal north-south roads of the central route structure were Routes 23, 911, 91, 914, 92, and 96. Each had a number of bypasses which had been built because of LOC interdiction over the past several years.

Exit Corridors. The principal exit corridors into South Vietnam were along Routes 922 and 966; the principal throughput route into Cambodia was 110. Each of these exit routes had alternates and bypasses.

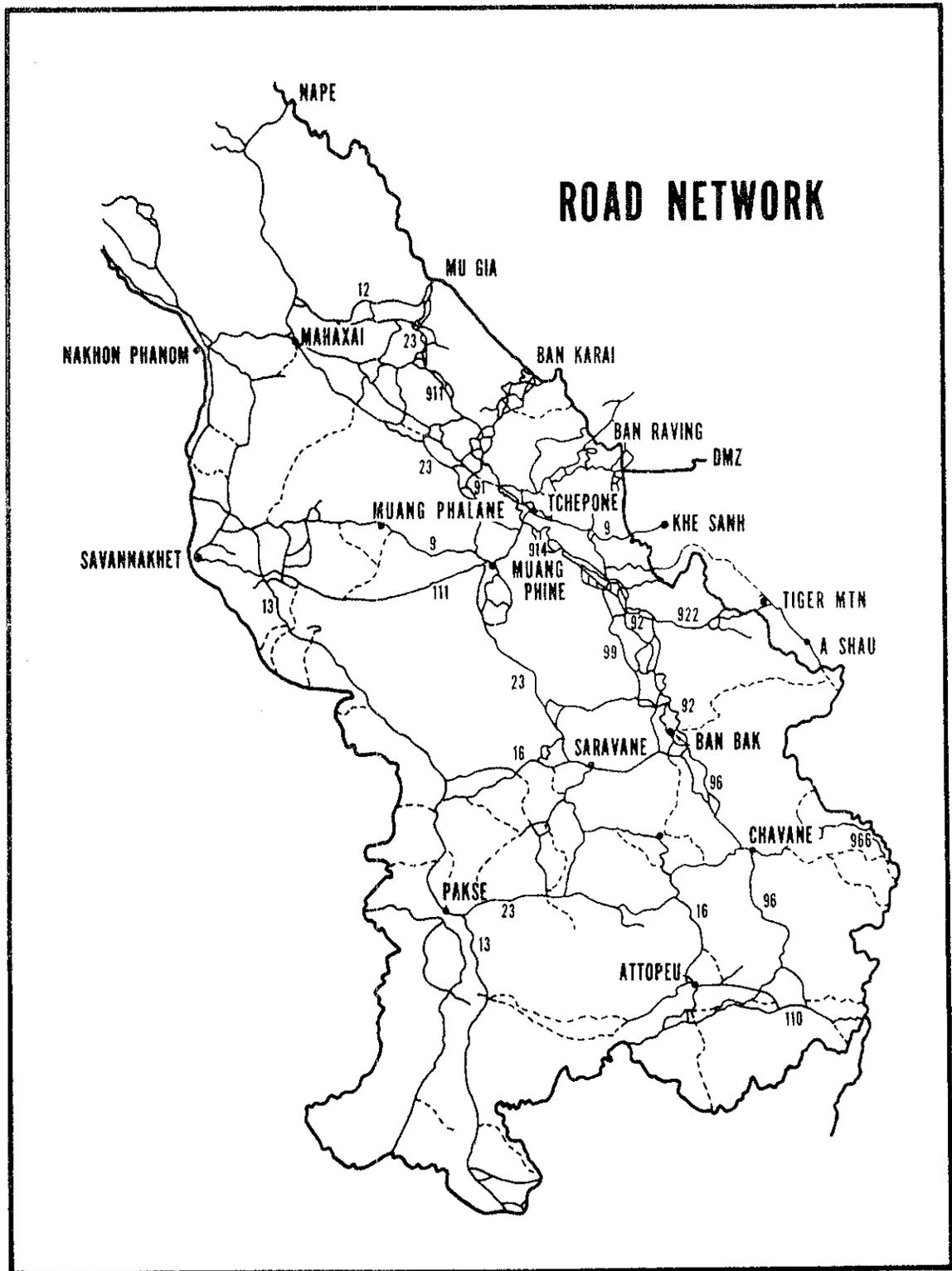


FIGURE B-2

Table B-1 shows the distances and travel times from each input corridor

SUPPLY TRAVEL TIMES		
<u>FROM</u>	<u>DISTANCE TO RTE 922</u>	<u>NUMBER OF DAYS</u>
MU GIA	307 KM	10-12
BAN KARAI	264 KM	9-11
BAN RAVING/DMZ	165 KM	5-7

TABLE B-1

to Route 922. These travel times were based on an average shuttle distance of 30 km per night.

Road Proliferation. During Commando Hunt V, the enemy added 436 km of motorable road. Perhaps the most important addition was Route 99 which paralleled Routes 92 and 96 from Muang Nong to Waterway 4, south of Ban Bak. Saturation bombing in the entry corridors forced the enemy to build alternate input routes. In the Ban Karai area, Route 9127 was a 15 km section built to bypass Box B to the east and was the longest single route constructed in response to the saturation bombing. During Lam Son 719 the enemy opened Route 233, connecting Route 23 with Route 99 northwest of Ban Bak.

Road Characteristics. Most of the roads in Steel Tiger were natural surfaced. Some were developed along foot trails which, after extensive use, required little improvement to make them suitable for truck traffic. Often the smaller bypasses developed in that fashion. The enemy had heavy equipment such as bulldozers and road graders available for major road construction and repairs.

Table B-2 shows a sampling of major route segments in Steel Tiger. The estimates of dry season capacity were extracted from the road capacity tables developed by the US Army, Pacific, based on SEATO methodology. Capacities are only approximations, and road conditions changed rapidly in Laos.

Waterway Network

The waterway network in Steel Tiger, part of the Mekong river system, played a relatively minor role in Commando Hunt V with only

SAMPLE STEEL TIGER ROUTE SEGMENT CHARACTERISTICS

<u>ROUTE SEGMENT</u>	<u>SURFACE TYPE</u>	<u>WIDTH (METERS)</u>	<u>CONDITION</u>	<u>TERRAIN</u>	<u>CAPACITY (TONS/DAY)</u>	<u>DISTANCE (KM)</u>
9H	UE/IE	3.2-3.8	GOOD	UND	152	20.3
12E	IE	2.7-3.0	FAIR	UND	378	25.9
12F	IE	3.0	FAIR	HILLY	337	12.9
92A	IE	2.8-3.4	GOOD	HILLY	337	42.0
92C	IE	3.6-4.2	FAIR	UND	378	37.0
99	IE	3.3-6.0	GOOD	MT	253	108.0
110A	IE	2.2-3.0	FAIR	UND	378	43.5
110E	UE/IE	2.4-2.8	FAIR	MT	101	14.8
912B	IE	2.8-3.1	FAIR	HILLY	337	27.7
914B	IE	2.4-3.0	FAIR	MT	253	33.3
917	UE/IE	2.1-2.4	POOR	HILLY	89	32.4
922	UE/IE	2.4-3.7	GOOD	UND	134	58.3
966C	IE	2.4-2.6	FAIR	HILLY	134	35.1
1032B	IE	1.8-2.4	FAIR	HILLY	337	22.0
1035A	UE	2.7	FAIR	HILLY	134	18.6

NOTE: SURFACE TYPE: UE - UNIMPROVED EARTH, IE - IMPROVED EARTH

TERRAIN:

<u>TYPE</u>	<u>CURVATURE</u>	<u>GRADIENT</u>
MOUNTAINOUS (MT)	100 FT OR LESS	8% OR GREATER
HILLY	100 TO 150 FT	5% TO 8%
UNDULATING (UND)	150 TO 200 FT	3% TO 5%

TABLE B-2

[REDACTED]

sporadic input observed on Waterway 7 (W7). Most streams were navigable during the high water period, from July to October. From January to May, the water level was low, and sandbars and rapids made use of the waterways hazardous. Estimated input on W7 during December through January was 53 tons. Five percent of the throughput into Cambodia (58 tons) were recorded exiting Laos on Waterway 4. Reconnaissance revealed channeling guides along W4 and W7 during the campaign. These prevented floating cargo from hanging on protrusions or in shallows and guided the cargo to shore for transshipment. Figure B-3 shows the principal waterway routes used in Steel Tiger during Commando Hunt V.

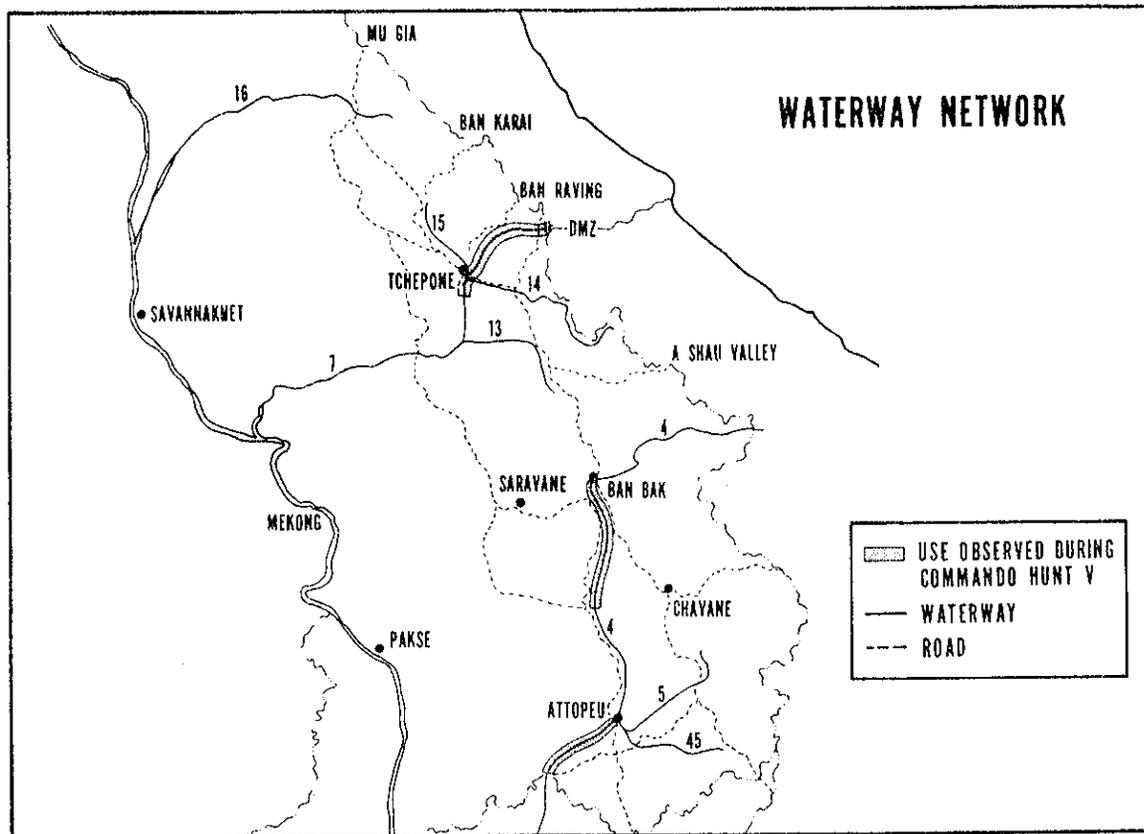


FIGURE B-3

Pipeline Network

During Commando Hunt V, pipeline construction paralleled route construction. Where the enemy made new or improved route structures, he also expanded his POL pipeline system to provide lines to these areas.

[REDACTED]

The initial pipeline through the Mu Gia Pass extended 25 km into Laos in 1969. The enemy expanded this to three lines through the pass and dispersed it along the route structure to serve major truck parks and storage areas located south of the Mu Gia Pass area.

The second POL pipeline input corridor supported the Ban Raving and DMZ areas, and was developed during the 1969-70 dry season. It possessed the most extensive and well-equipped POL facilities in southern Laos. Initial pipeline segments paralleled enemy construction of new routes along the Xe Bang Hiang (W7) and terminated along the 913 route structure. The enemy added additional segments of pipeline to complement the construction of Routes 92B and 1032B, providing a multiple option of POL routings in this area. An accurate and complete trace of the pipeline was impossible to obtain, and reconnaissance efforts could not determine pipeline entry points into Laos.

During Commando Hunt V, the enemy began to develop a pipeline system for throughput of POL into South Vietnam. Pipeline segments were identified along the 922 and 9224 route structures, and photographic confirmation was obtained along Route 9224. The pipeline in this area extended to within seven kilometers of the South Vietnamese border. Segments photo-confirmed within South Vietnam were traced to within five kilometers of the border. Heavy canopy and rough terrain prevented confirmation of a connecting segment crossing the border.

The pipeline was composed of 4-inch diameter lightweight pipe of lengths from 4 to 20 feet, with the most common length being 19.3 feet (6 meters). Sections were joined by a wide metal band with clamps and bolts. Three types of pipe were in use in Steel Tiger. Rigid pipe was the most common and could be placed either on the surface or in a shallow trench. To surmount terrain obstacles, flexible pipe or pre-shaped metal pipe was used. Rubber hosing was used to connect pumping equipment to the POL pipeline or to effect quick repair of damaged sections. Control valves at intervals allowed moving the fuel in and out of available storage areas and controlling fuel flow in the event of interdiction of the pipeline. Fuel observation globes were placed along the pipeline to permit visual monitoring of flow by patrol teams.

Figure B-4 shows the pipeline network in Laos and NVN. Locations of the pipeline were confirmed by aerial photography except where otherwise indicated. The capacity of the 11 major storage areas in the RP I area of NVN was estimated to be 2,700,000 gallons.

Use of POL pipelines correlated with the level of vehicular activity. During Commando Hunt V, input into Laos by pipeline was believed to be restricted to gasoline and estimated to average about 125 tons per week from December through April. The theoretical capacity was estimated by Fleet Intelligence Center, Pacific, as 1243 tons per day for each pipe segment, a capacity which far exceeded the enemy's consumption needs in

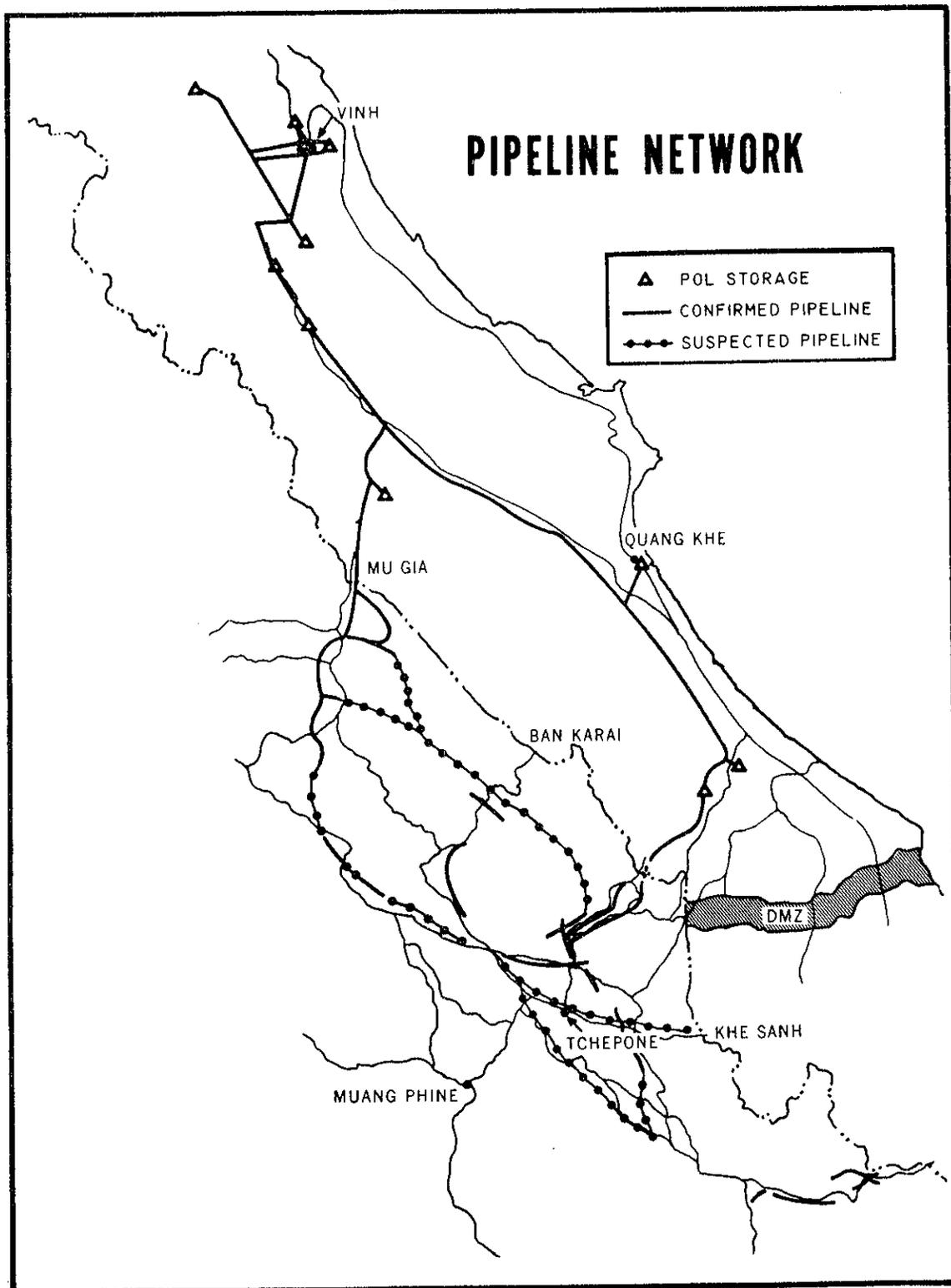


FIGURE B-4

[REDACTED]

Laos. The pipeline was easy to construct, difficult to interdict, and freed trucks for transportation of other supplies.

ENEMY LOGISTICS VEHICLES

The North Vietnamese employed trucks, watercraft and waterborne floatation devices, porters, and animals to transport goods in Steel Tiger.

Trucks

Of the various vehicles used, the truck was by far the most important to the enemy during Commando Hunt V. Enemy truck capacity in Laos ranged from 3/4 ton to 10 tons. Use of these vehicles varied with weather, terrain, and road conditions. The YAAZ-210 truck, with a 10-ton capacity on hard-surface roads, was reported on Route 110 in southern Laos. Due to poor road conditions throughout much of the enemy network, it is probable that this vehicle carried only very light loads. Other trucks with medium and low capacities could probably be used throughout the system. The ZIL-157 (Figure B-5), used in large

ZIL-157 TRUCK

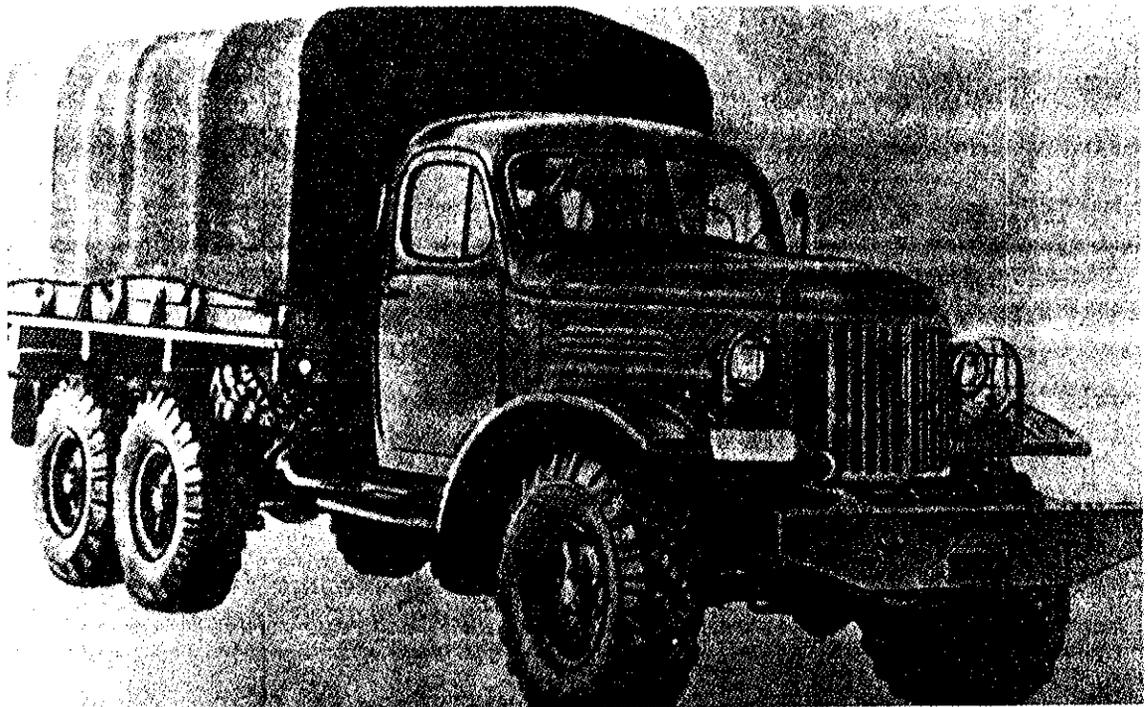


FIGURE B-5

numbers during the previous campaign, was still much used, although it was being replaced by the newer ZIL-131. Table B-3 gives statistics for the five most-used truck types. During the campaign the

NVA TRUCK DATA					
	<u>GAZ-66</u>	<u>ZIL-130</u>	<u>ZIL-131</u>	<u>ZIL-151</u>	<u>ZIL-157</u>
DRIVE	4X4	4X2	6X6	6X6	6X6
CAPACITY (TONS)	2.20	4.40	5.50	2.75	2.75
WEIGHT (LBS)	7585	9923	14774	12304	11990
CLEARANCE (INCHES)	12.2	10.8	13	10.4	12.2
SLOPE (DEGREES)*	30	21	30	28	28
ENGINE					
HP	115	148	148	92	109
CYL	V8	V8	V8	6	6
MAX SPEED (KPH)	85	94	80	60	65
CRUISING RANGE (KM)	525	475	525	600	430
* MAXIMUM GRADIENT TRUCK WILL CLIMB.					

TABLE B-3

only specialized vehicles reported were POL tanker trucks of the ATZ-3-151 type.

Truck Content and Capacities

The enemy most often used trucks as cargo carriers, travelling in convoys and operating at night. He used a shuttle system between truck parks or transshipment points, with the same drivers travelling the same stretch of road every night. Some of the vehicles operated in a support capacity, hauling road building material and crews, supplies for use within the system, and vehicle repair personnel and equipment.

Higher authorities determined the actual content of the cargo

[REDACTED]

vehicles, based on a priority system. Vehicles returning north often carried wounded personnel or assisted in repositioning AAA weapons and engineer teams. Content affected not only lucratives as targets but also the vulnerability of trucks to different kinds of attacks.

The amount of cargo carried by trucks varied according to the truck type used and also according to road conditions. The PACOM Conference on Logistics, held just prior to the opening of Commando Hunt V, examined the question of a common truckload factor for use for the entire Laotian system. It was agreed that four tons per south-bound truck was a good estimate.

Truck Operating Parameters

Convoy Size. There was no set convoy size. The amount of cargo that had to be transported on any given evening determined the number of vehicles sent out from a particular storage area or truck park. If vehicles travelled in groups, they appeared to maintain at least 50 meters between individual trucks, with speeds varying between 5 and 30 kph. Captured documents indicated that a 60 to 80 km round trip would be made every night. TFA estimated that no more than 1000 trucks moved on any one night.

Average truck cluster size had decreased from a 3.7 trucks for Commando Hunt I to 2.4 for Commando Hunt III as the enemy appeared to respond to increased interdiction efforts by attempting to decrease vulnerability to attack. TFA defined a cluster as a group of trucks travelling together no more than 300 meters apart. The enemy appeared to disperse these clusters along the route structure since TFA observed no sequential patterns when the enemy moved large numbers of vehicles. During Commando Hunt V, cluster size averaged 1.7 trucks. The enemy appeared to have dispersed vehicles to a greater extent than ever before in a further attempt to reduce his vulnerability to increased air interdiction efforts.

Cluster size alone did not, however, provide an adequate picture of traffic movement within Steel Tiger. Cluster sizes were greater in the vicinity of the entry corridors and in areas with heavy AAA defenses.

The term cluster size also does not describe an often-observed type of pattern in which vehicles moved in an extended convoy type organization. An extended convoy was a continuous pattern of small clusters of one to three trucks spaced at regular intervals of 5 to 15 minutes. The Infiltration Surveillance Center (ISC) at TFA often observed this sequential pattern to continue for periods of one to two hours.

Moon Effects. Moon illumination had a significant effect on enemy truck traffic in Steel Tiger. The number of sensor-detected truck movements varied in a direct relationship with moon phase. Interrogation of

[REDACTED]

ralliers who served in NVN transportation units in Laos confirmed that the enemy drove without lights during periods of high moon illumination. They felt this made them less vulnerable to air attack and thus allowed them to increase their truck movements during high moon phases. During Commando Hunt III, gunships did not fly along the routes with most traffic during periods of high moon illumination due to the extensive AAA threat. This factor may have encouraged increased truck movements. During Commando Hunt V, the gunships for the most part did not alter their coverage of the route structure as the moon phase changed; however, the enemy appeared to prefer bright moonlight for heavy truck activity. Figure B-6, which shows weekly sensor-detected truck movements

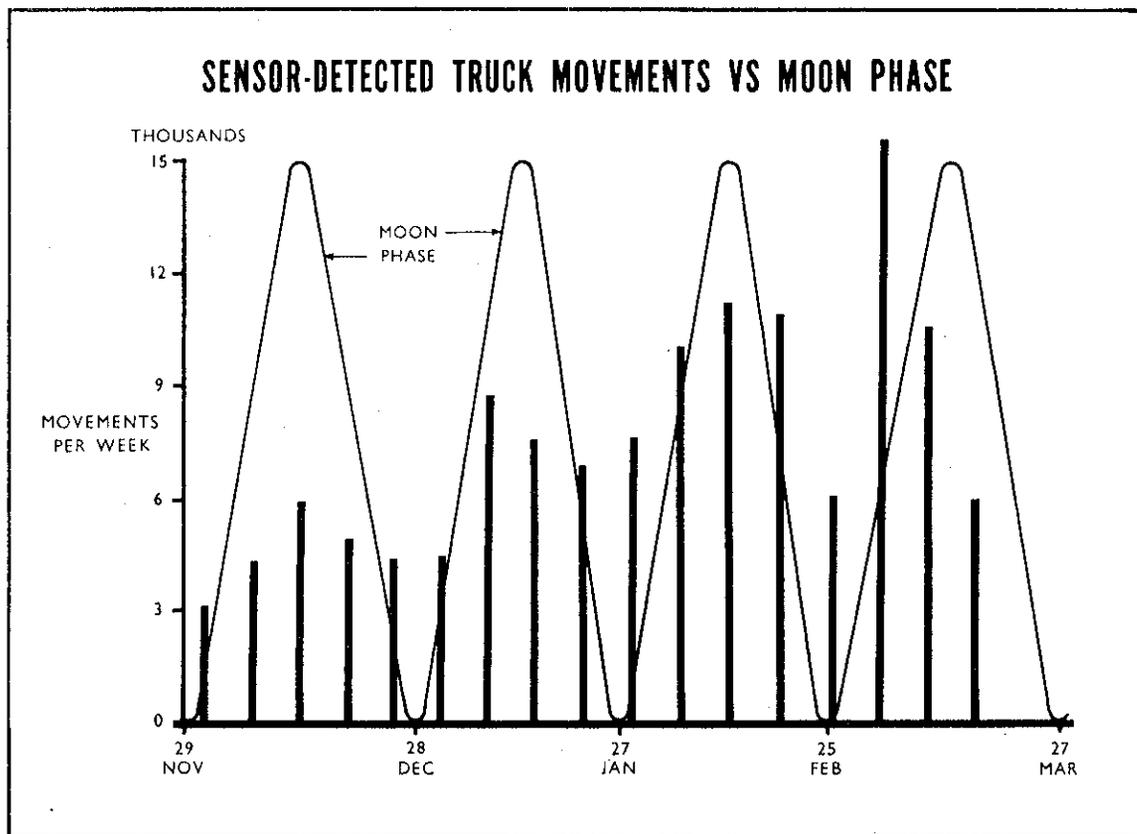


FIGURE B-6

beginning with the new moon on 29 November, illustrates the relationships between these movements and the phase of the moon.

A regression analysis, based on data from 29 November to 27 March, confirmed the correlation of sensor-detected truck movements with moon phase. Data prior to 29 November were not used in this analysis due to the low level of activity at that stage of the campaign. Data after

[REDACTED]

27 March were not considered since other factors such as periodic rains affected the information. Daily activity averaged over three-day periods provided inputs to the regression program, and the following equation gave an estimate for the number of sensor-detected truck movements:

$$\text{Sensor-Detected Truck Movements*} = 280 + 5.04(\text{Moon Phase}) + 28.89(\text{Time})$$

where: sensor-detected truck movements are night movements, moon phase is given in % of full moon, and time refers to the 3-day periods of the campaign, numbered chronologically beginning 29 November.

*Regression coefficients significant at the .01 level of significance.

This model shows that as moon illumination increased from 0 percent (new moon) to 100 percent (full moon), sensor-detected truck movements increased an average of 504. This relationship is displayed in Figure B-7. While there was a definite correlation between the moon phase and sensor detections during the entire period, the correlation decreased after 8 February. This decrease infers that the Lam Son 719 operation forced the enemy to deviate from his normal pattern of movement to a certain extent.

POL Consumption. The following petroleum, oil, and lubricant (POL) consumption data came from information taken from a captured TO&E of the 559th Transportation Group. The Soviet ZIL-series trucks could travel about 3 miles per gallon of gas while the GAZ-series could cover about 4.3 miles per gallon. The PACOM conference selected three miles per gallon as a standard average figure to apply in studies of the Laotian logistics system. Most of the enemy's fuel appeared to have been moved southward in drums or in pipelines, since tanker trucks did not appear numerous enough to supply the system. It is probable that the fuel remained in drums until it was needed, and personnel then siphoned or handpumped it into the using vehicles. The appearance of a few tanker trucks might have reflected an effort by the enemy to increase the speed, efficiency, and capacity of his refueling operations.

Maintenance and Repair. The in-commission rate for enemy truck units during the Commando Hunt V campaign was unknown. It appeared that the NVA drove each truck until it was destroyed, wrecked, or damaged beyond repair. In the event of a breakdown or battle damage on the road, the driver or escort gave a prearranged signal of several shots. This signal alerted a repair team which effect on-the-spot repairs to the truck or repaired the road, as required. If a truck were damaged beyond repair, the enemy stripped the usable parts from the vehicles, and

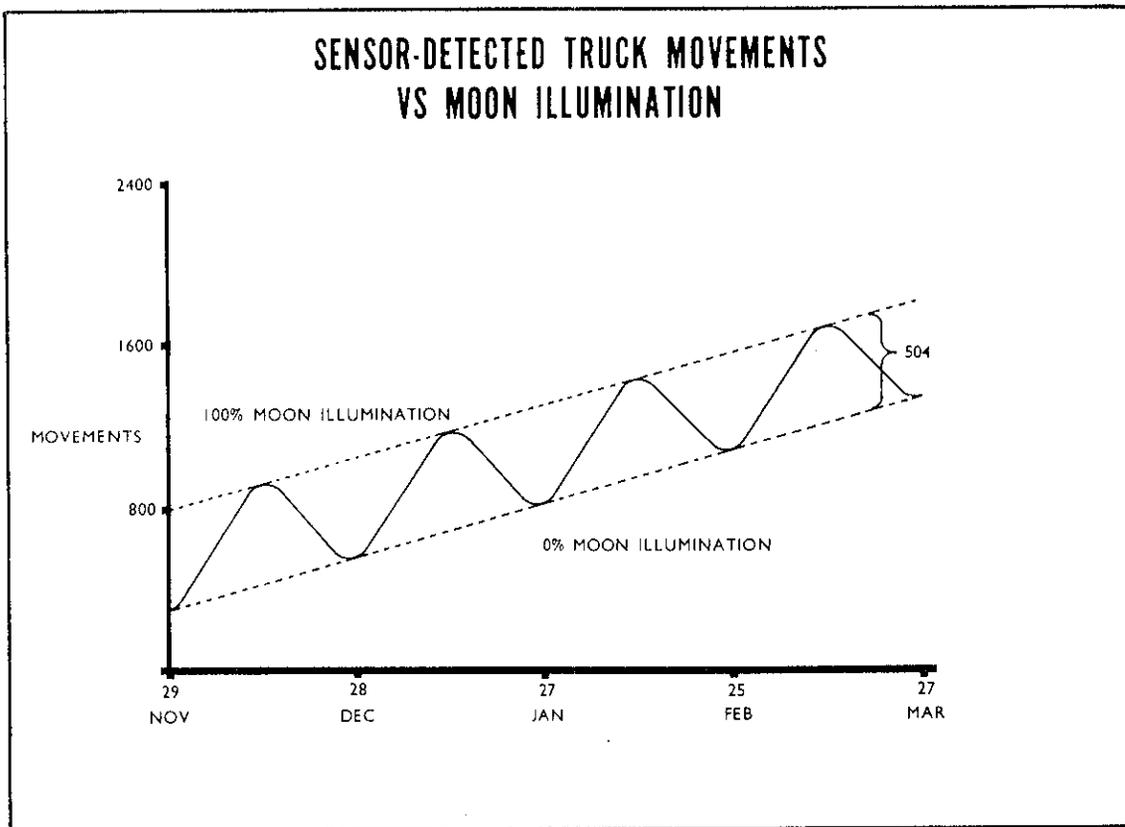


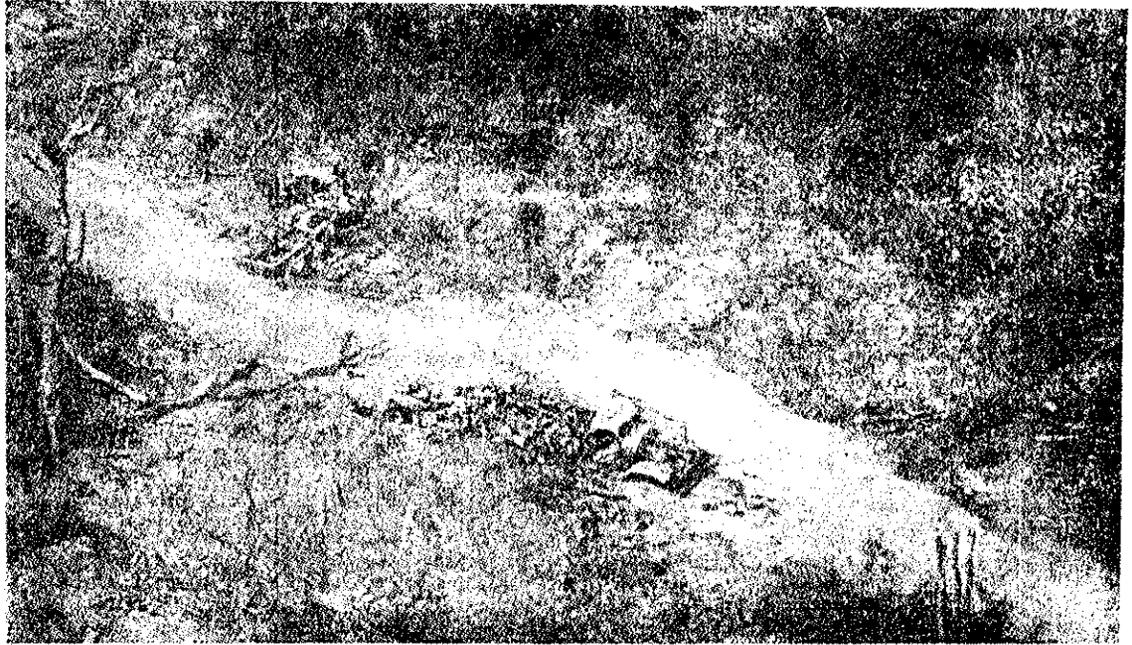
FIGURE B-7

left it beside the road as a derelict (Figure B-8).

Rough terrain and US air strikes caused a high vehicle loss rate. It was necessary for the enemy to continue to introduce new vehicles into the system and to do everything in his power to protect and maintain vehicles already in the system. Information obtained from captured documents emphasized the importance the enemy placed on maintenance and repair procedures. Roadside spot checks were common, and maintenance personnel completed periodic inspections in certain truck parks (Figure B-9). The NVA gave a special driver training course, conducted at the Tien Bo Military Truck Driving School in NVN, to all drivers of the 559th. The course lasted six months and stressed driving techniques and maintenance procedures required of a driver on the Ho Chi Minh Trail. In order to minimize destruction from air attacks, the enemy

[REDACTED]

DERELICT TRUCK



TRUCK REPAIR FACILITY

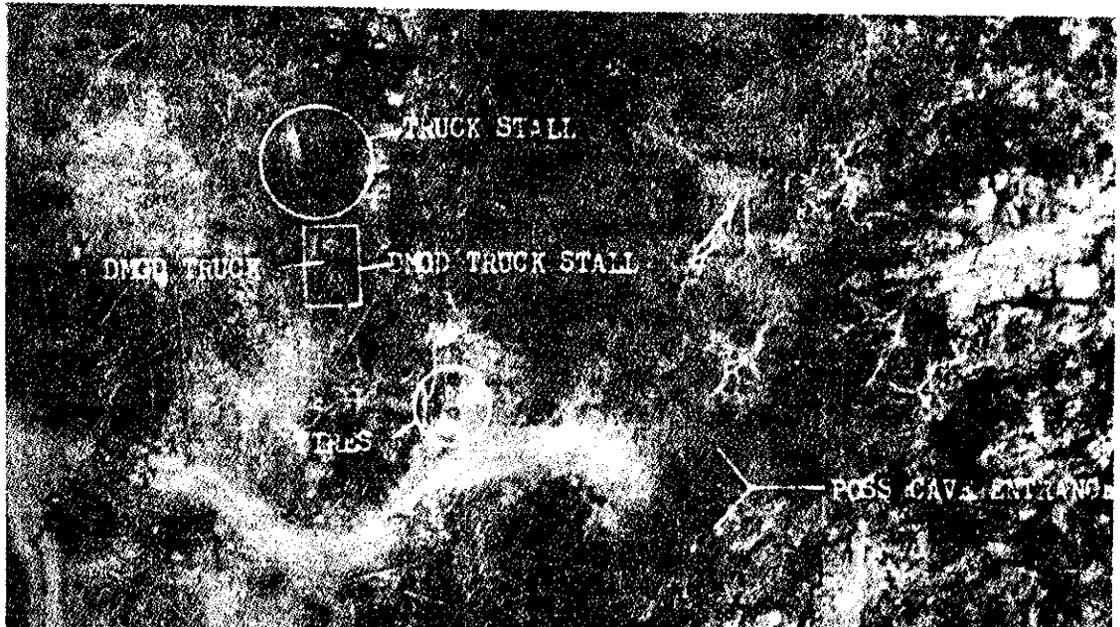


FIGURE B-8/B-9

[REDACTED]

[REDACTED]
lightly armored his trucks with bamboo (Figure B-10).

TRUCK WITH LIGHT BAMBOO ARMOR

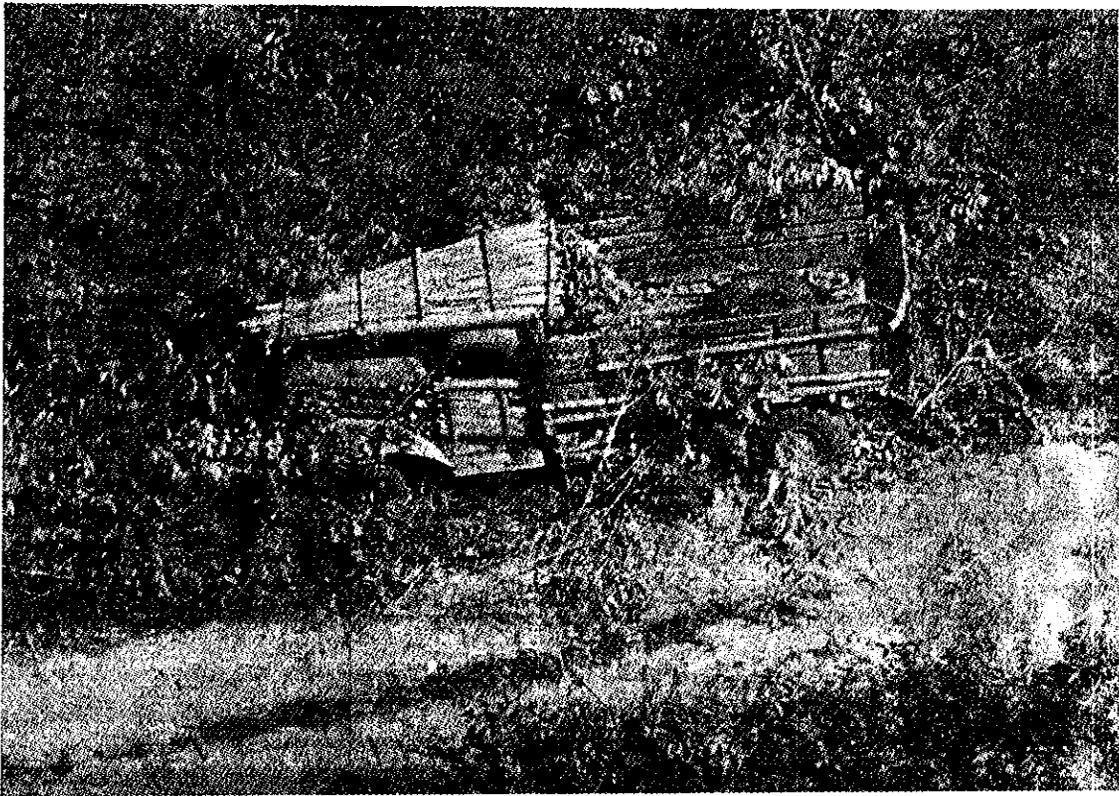


FIGURE B-10

Watercraft and Floatation Devices

The enemy's second most-important type of logistics vehicle in Commando Hunt V consisted of watercraft and waterborne floatation devices. Intelligence estimated that watercraft and floatation devices accounted for 0.1 percent of the input tonnage and 0.8 percent of the throughput tonnage recorded in Commando Hunt V. These figures were much lower than the levels expected before the Commando Hunt V campaign began. The entry interdiction program and its aftereffects blocked W7, the most active route for floatation devices in the past, for most of the campaign. The enemy had hundreds of watercraft available within the system, and he requisitioned still more from the local populace. He constructed boats from local materials in some areas, but the extent of this activity was unknown.

Enemy transportation elements in Laos used no standard size or configuration of watercraft. The watercraft varied in size from 1-foot

[REDACTED]

pirogues to sampans up to 45 feet in length (Figure B-11). River-watch

PIROGUES

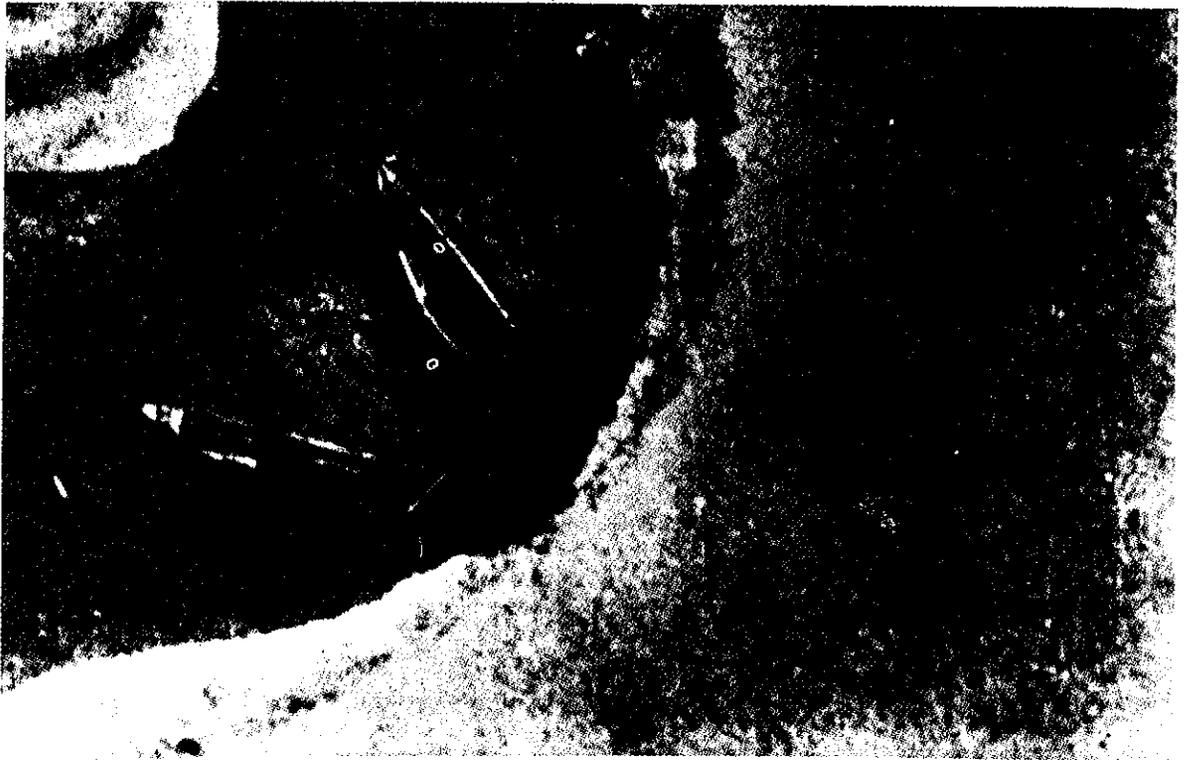


FIGURE B-11

teams reported some motorized watercraft. Load capacities of these watercraft varied from one to five tons.

Porters

The enemy used porters to a limited extent in Commando Hunt V; their contribution was most noteworthy during the entry interdiction program before he built bypasses and when bombing closed the bypasses for short periods. In the exit areas, porters supplemented trucks in transporting supplies into RVN and Cambodia. Porterage was the least-efficient mode of transportation available to the enemy and he used it in most cases only as a last resort.

Porters transporting supplies for the enemy in Laos came from two sources: military personnel and impressed civilian laborers. The proportion of military to civilian porters was unknown; however, it is estimated that short-term civilian labor gangs did most of the portering and returned home after release. This was common enemy practice

[REDACTED]

in RVN, and it is probable that he also used it in Laos. All military personnel and civilians under NVA control in Steel Tiger were available for portering during the Commando Hunt V campaign.

Porters used a variety of aids to increase their effectiveness, and these included bicycles, wheelbarrows, and carts. A porter could transport varying amounts of supplies, depending on the equipment used. Loads varied from 40 pounds (unaided) to 1100 pounds (transported in pushcarts). The average distance a porter could transport supplies varied from 5 to 20 miles, depending on terrain, physical condition of the porter, and type of equipment used. The enemy also used horses, mules, water buffalo, bullocks, and elephants to transport supplies, either by pack or by crude two-wheeled cart. The capacities of these animals varied from 150 pounds for a horse to 1200 pounds for an elephant. Carts drawn by water buffalo carried up to 2000 pounds. Distances covered by this mode of transportation ranged from 15 to 25 miles per day. Both the load capacities and the distances travelled depended on terrain and condition of the animals.

INPUT AND THROUGHPUT

Calculations based on sensor-detected truck movements and visual observations of trucks by aircrews and road-watch teams provided estimates of tonnages of supplies input into Steel Tiger and throughput into RVN and Cambodia. TFA analyzed sensor-detected truck movements to eliminate duplicate movements by the same truck through more than one sensor string. After eliminating sensor duplicates, a comparison of these truck movements with visual truck observations prevented duplicate counting. Finally, the number of trucks visually observed but not detected by sensors were added to the sensor-detected truck movements to arrive at total truck movements on a route. The estimated number of total southbound trucks multiplied by four tons per truck provided tonnage estimates.

Input

Truck movements entering Steel Tiger through routes in the Mu Gia and Ban Karai Pass areas and the routes around the western end of the DMZ provided estimates of input tonnages. In addition to truck traffic, supplies entered Laos through the pipelines and via Waterway 7J west of the DMZ. Based on the number of truck movements, stockpile buildup, and target damage assessment, an estimated average POL input of 13 tons a day entered through the pipelines over the course of the campaign. The input estimate on Waterway 7J was only 53 tons, far below that of Commando Hunt III. The only period of input activity on Waterway 7J during Commando Hunt V was between 23 December and 19 January. Table B-4 shows the estimated input into Laos during Commando Hunt V.

COMMANDO HUNT V

INPUT IN TONS

10 OCT - 30 APR

<u>DATE</u>	<u>MU GIA</u>	<u>BAN KARAI</u>	<u>BAN RAVING/DMZ</u>	<u>W7J</u>	<u>PIPELINES</u>	<u>TOTAL</u>
10-31 OCT	74	315	45	0	0	534
NOV	1528	2300	1120	0	89	5037
DEC	1524	2768	2580	44	466	7382
JAN	2820	6888	2724	9	465	12906
FEB	2428	4208	3044	0	445	10125
MAR	3908	5620	4676	0	681	14885
APR	2620	3212	3364	0	453	9649
TOTAL	15002	25311	17553	53	2599	60518

TABLE B-4

Throughput

Subtraction of trucks destroyed between the final sensor string on the exit routes, (shown in Table B-5), and the Laotian border from the southbound sensor-detected truck movements recorded by these strings provided an estimate of trucks entering RVN and Cambodia. Multiplying this figure by four gave an estimate of throughput tonnage. River-watch teams also reported southbound watercraft entering Cambodia on W4D for inclusion in throughput calculations. Table B-5 shows the estimated throughput into RVN and Cambodia during Commando Hunt V.

ENEMY DEFENSES

The AAA Threat

The buildup in enemy antiaircraft defenses in Steel Tiger during Commando Hunt V proceeded at a slower pace than anticipated from the


COMMANDO HUNT V
THROUGHPUT IN TONS
10 OCT - 30 APR

<u>DATE</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>TOTAL</u>
10-31 OCT	0	0	0	0	0
NOV	40	76	0	29	145
DEC	156	0	4	30	190
JAN	784	8	88	61	941
FEB	864	36	232	108	1240
MAR	748	256	480	450	1934
APR	1220	576	264	560	2620
TOTAL	3812	952	1068	1238	7070

A - ROUTES 925, 9H, 926, 921B, 922 (TO RVN--MR 1)

B - ROUTE 966C/969 (TO RVN--MR 2)

C - 110D (TO RVN--MR 2)

D - 110A AND W4D (TO CAMBODIA)

TABLE B-5

experience of Commando Hunt III. The estimated active gun count rose from 295 in October to 665 during the third week of April, the highest level of the campaign; however, this high point was 130 guns less than the peak week of Commando Hunt III. This lower level in gun count did not result in a reduction in area of coverage but in density of guns within the high-threat envelope. The number of AAA reactions was 14 percent below that of Commando Hunt III.

[REDACTED]

At the onset of the campaign, the enemy concentrated most of his active weapons in Steel Tiger along the input corridors and the supply routes leading from them. As the campaign progressed and the enemy pushed supplies farther south in the logistics system, he also improved defenses along the most-travelled routes. By March the enemy had bolstered his defenses along the southern routes in Steel Tiger leading into South Vietnam. Figure B-12 depicts the growth in antiaircraft high-threat areas (HTAs) during the campaign.

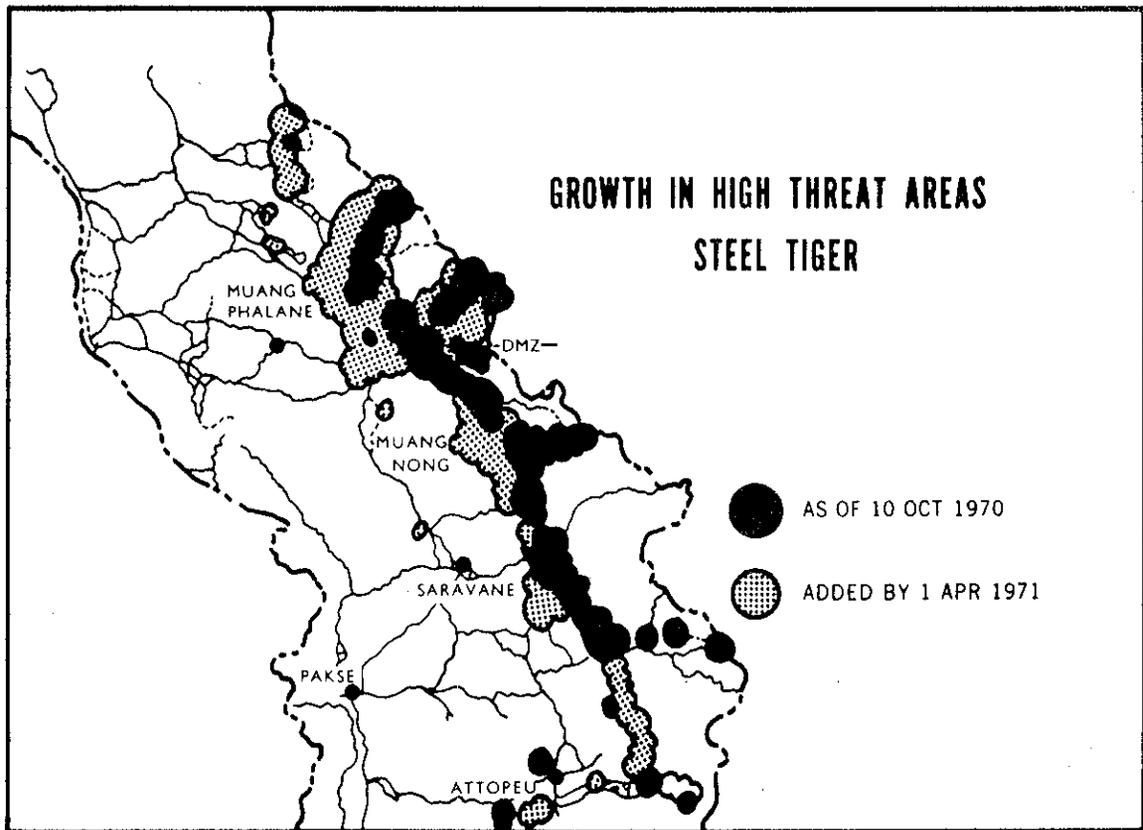


FIGURE B-12

In Barrel Roll, the enemy oriented his AAA defenses toward protection of Route 7, the major logistics corridor leading from North Vietnam. As in Steel Tiger, the dry season in Barrel Roll brought increased enemy-initiated activity and an associated rise in the active gun count. The estimated gun count grew by just over 50 percent during the campaign to a peak of 154 guns during the first part of April, in the most part due to increases in 23 mm and 37 mm guns, the backbone of enemy AAA defenses in Barrel Roll. Figure B-13 shows HTAs in Barrel Roll as they appeared

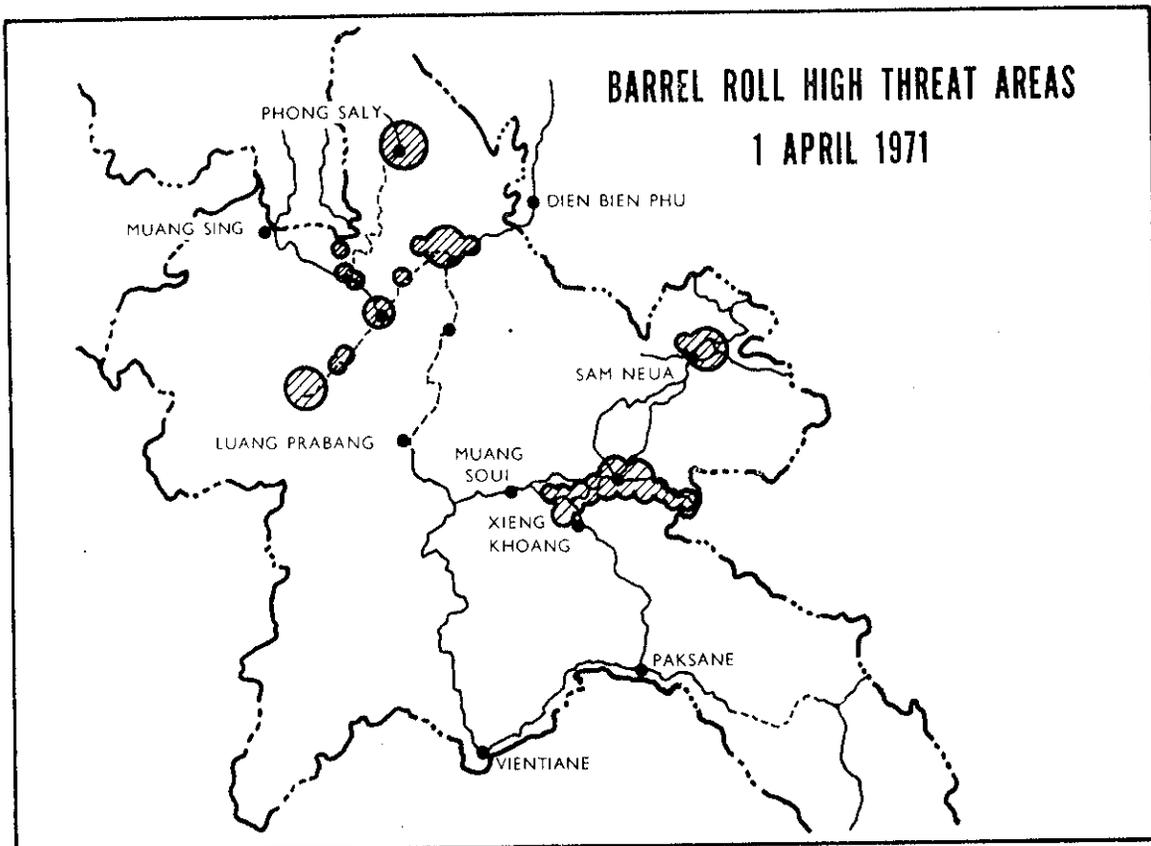


FIGURE B-13

on 1 April. The HTAs in northwestern Barrel Roll were associated with Chinese AAA units defending their road construction efforts in that area and were not part of the North Vietnamese or Pathet Lao defenses.

Tables B-6 and B-7 show the estimated gun count by type weapon for Steel Tiger and Barrel Roll. Seventh Air Force Intelligence derived these order-of-battle estimates from all sources; however, observed firings were the primary source. The extensive and successful use of camouflage and mobility by enemy AAA units made a photo-derived order of battle impractical for Laos. Intelligence established HTAs in areas of reported firings, where visual or photo reconnaissance found AAA, or where other sources of intelligence indicated their existence. The number of high-threat areas then provided an estimate of the active gun count. This method proved satisfactory for identifying active enemy defenses and was not meant to indicate the total inventory of guns in Laos.

The most widespread deployment of a AAA weapon in Laos was that

[REDACTED]

AAA ORDER OF BATTLE

STEEL TIGER

WEAPON TYPE

	<u>AUTOMATIC</u>	<u>23 MM</u>	<u>37 MM</u>	<u>57 MM</u>	<u>85 MM</u>	<u>100 MM</u>	<u>TOTAL</u>
10 OCT	26	99	168	2	0	0	295
31 OCT	26	100	180	2	0	4	312
30 NOV	26	120	222	12	0	4	384
31 DEC	26	123	237	15	0	4	405
31 JAN	30	154	317	20	0	4	525
28 FEB	32	152	336	29	0	4	553
31 MAR	32	147	354	46	2	6	587
30 APR	32	159	406	51	2	6	656

TABLE B-6

of the 37 mm which constituted a threat along all the major lines of communication. The 23 mm gun was the second most-deployed weapon with a gun count about half that of the 37 mm. The heavier 57 mm AAA weapons were few in number at the campaign's beginning with just two suspected guns in the Ban Karai area. By January, 57 mm guns appeared in increasing numbers in the Tchepone area as well as in the input corridors, and by mid-April the number of 57 mm guns had increased to 54 and were deployed as far south as Route 96C in the Chavane area. In Barrel Roll the 57 mm did not appear until 21 February when four guns were discovered at two sites along Route 7 near Ban Ban.

Reports of 85 mm firings in Steel Tiger during the first part of the campaign had indicated possible, though unverified, deployment into that area. Near the beginning of March, however, tactical reconnaissance photography showed a possible Fire Can gun-laying radar collocated with two probable 85 mm weapons about seven nautical miles north of Tchepone. Further photography on 10 March indicated that the weapons and possible radar were no longer present. On 7 March, photography disclosed two possible 85 mm guns on Route 912, two nautical

[REDACTED]

AAA ORDER OF BATTLE

BARREL ROLL

WEAPON TYPE

	<u>AUTOMATIC</u>	<u>23 MM</u>	<u>37 MM</u>	<u>57 MM</u>	<u>85 MM</u>	<u>100 MM</u>	<u>TOTAL</u>
10 OCT	20	14	65	0	0	0	99
31 OCT	15	11	63	0	0	0	89
30 NOV	20	9	72	0	0	0	101
31 DEC	22	25	77	0	0	0	124
31 JAN	12	40	87	0	8	0	147
28 FEB	12	42	83	4	8	0	149
31 MAR	12	43	87	4	8	0	154
30 APR	12	42	78	2	8	0	142

NOTE: DOES NOT INCLUDE GUNS LOCATED ALONG THE CHINESE ROAD IN NORTH-WESTERN BARREL ROLL.

TABLE B-7

miles south of the Ban Karai Pass. Heavy camouflage prevented acquisition of the guns for visual strike. On 5 January, photography of the Sam Neua area near the North Vietnamese border showed eight 85 mm guns, reflected in Table B-7, along with probable Fire Can radars.

The enemy intended to harass and deter Arc Light missions, with special emphasis on those striking in the areas of major input corridors from North Vietnam, by using 100 mm guns. Two 100 mm high-threat areas developed along Route 912 in the Ban Karai Pass area in late October. Other suspected 100 mm areas included Mu Gia Pass and Muang Nong, south-east of Tchepone. Tactical reconnaissance photography of 7 March revealed two camouflaged 100 mm guns on Route 1032B, four miles west of the DMZ. Strikes destroyed these guns on 12 March.

Characteristics of enemy defense weapons were as follows:

[REDACTED]

12.7 mm Heavy Machine Gun. The 12.7 mm heavy machine gun had a normal rate of fire of 80 rounds per minute per barrel and a range of 3300 feet. Although the weapon was available in either a single- or quad-barrel configuration, only the single-barrel version was detected in Laos. The 12.7 mm had a speed-ring sight.

14.5 mm ZPU. The 14.5 mm ZPU had a normal rate of fire of 150 rounds per minute per barrel. The weapon could be found in either 1- , 2- , or 4-barrel configurations; however, the twin-barrel version was by far the most common. The maximum effective range of the 14.5 mm was 4600 feet. These guns had an optical or mechanical computing sight.

23 mm AAA. The 23 mm AAA had a normal rate of fire of 200 rounds per minute per barrel. The enemy used the twin-barreled version of the gun throughout Laos. It fired a stream of tracer rounds with an effective range of 6600 feet. These rounds self-destructed at a range of 12,500 feet. The 23 mm had an optical or mechanical computing sight and the gunners often used it in conjunction with a hand-held stereoscopic rangefinder.

37 mm AAA. The 37 mm AAA had a practical rate of fire of 80 rounds per minute. The maximum effective range of the 37 mm gun was 8200 feet, although the 1.6-pound projectile self-destructed at 14,400 feet in a white burst with a lethal radius of 20 feet. The gun had an optical or mechanical computing sight, and a gun commander used a telescope for fire correction.

57 mm AAA. Much less common than the 37 mm weapon, the 57 mm AAA had a normal rate of fire of 70 rounds per minute. The 6.18-pound projectiles used in Laos were in most cases point-detonating. Self-destruction resulted in an airburst with a lethal radius of 33 feet. The weapon had a mechanical computing sight, a reflex optical sight, and had an effective range of 13,000 feet.

85 mm AAA. During the latter part of Commando Hunt V, Intelligence estimated two 85 mm guns were in Steel Tiger and eight were in Barrel Roll. The 85 mm guns fired a 21.1-pound projectile at a practical rate of 15 to 20 rounds per minute. The effective range of the weapon was 27,500 feet.

100 mm AAA. The enemy deployed only a few 100 mm weapons in Steel Tiger, most of them in the Ban Karai Pass area. The gun fired a 34.6-pound projectile at a rate of 15 rounds per minute. The effective range of the weapon was 39,000 feet using on-carriage telescopic sighting.

Fire Control Radar. There were no confirmed reports of radar-directed AAA firings in Laos during the campaign, but fire-control

[REDACTED]

radars may have existed in several areas. Following the discovery of a possible Fire Can radar north of Tchepone, a FAC found what he suspected to be a Fire Can concealed in a large circular pit along Route 1032B, 10 NM southeast of the DMZ on 25 March. Strikes controlled by the FAC destroyed the object, and analysis of post-strike photography revealed that it may have been a Fire Can radar. On 15 April, a FAC reported seeing a probable Fire Can associated with four 57 mm guns on Route 912A, about 15 NM southwest of Ban Karai Pass. Photography on the same day confirmed that a possible Fire Can was in the area; however, FACs performed visual reconnaissance of the area for strike on 16 and 17 April and reported the positions unoccupied.

Enemy Employment and Deception Techniques

To the extent possible, AAA site locations took into account anticipated aircraft flight paths and target run-in profiles. Once the enemy had discovered a repetitive pattern, he adjusted his defenses. He established sites in areas with easy ground approach and with suitable surroundings for effective camouflage. In general, he arranged his sites to provide mutual fire support and often prepared a number of positions for each gun in operation, providing a flexible relocation capability. The mobility of the weapons and the expert use of camouflage made the location and attack of occupied positions difficult. The battery or battalion commander moved the guns whenever he thought a position had been compromised, either by firings or by reconnaissance overflights. Figure B-14 shows tactical reconnaissance photography of a 37 mm site in Steel Tiger, indicating the effectiveness of enemy camouflage techniques.

Other techniques of deception included the simulation of actual weapons by the use of dummy guns constructed from logs inclined to resemble AAA weapon barrels and placed in prepared positions. These decoy sites were often in open areas near tree lines, and when friendly aircraft attacked them, concealed weapons among the trees opened fire. Pilots reported decoy vehicles and buildings constructed for use as bogus targets and flak traps. At night, for example, a truck parked in the open with lights on was an inviting target for gunships; however, upon attacking the truck, the aircraft sometimes encountered a cross fire from nearby AAA weapons.

Personnel Requirements for Manning and Maintaining AAA

Table B-8 shows the all-source intelligence estimate of the numbers of enemy personnel required to man and maintain the anti-aircraft defense system in Laos, including command, administrative and support personnel, as well as gun crews assigned to AAA units. The AAA units in Steel Tiger were part of the 559th Transportation Group and were assigned to the various Binh Trams which made up the

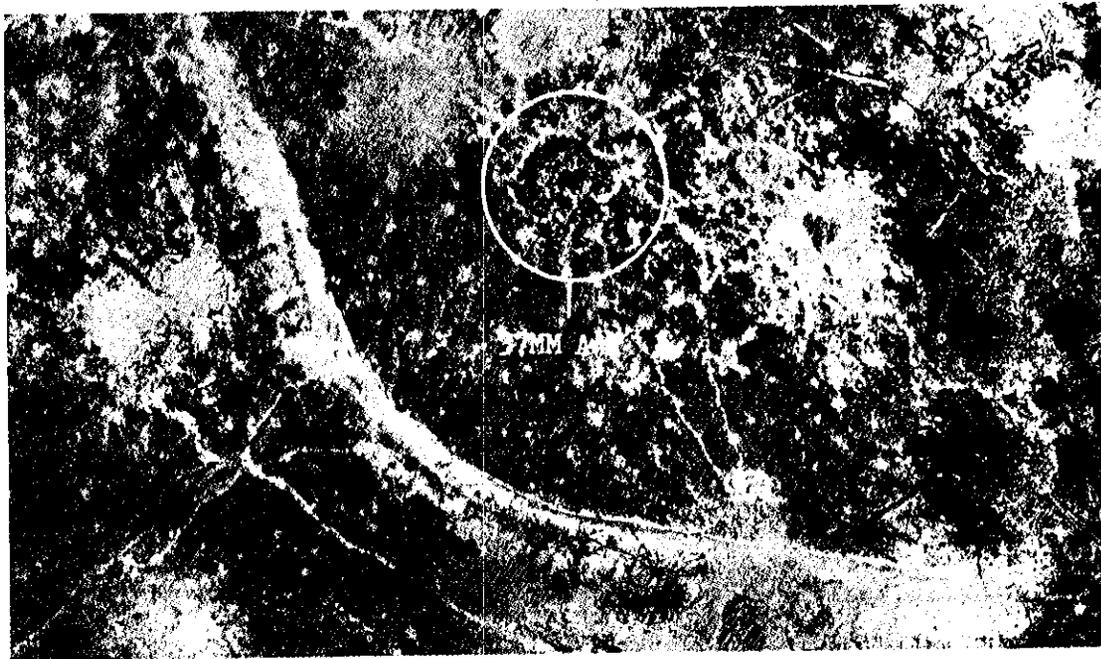


FIGURE B-14

PERSONNEL MANNING AND MAINTAINING AAA

<u>PERIOD</u>	<u>STEEL TIGER</u>	<u>BARREL ROLL</u>
OCT	7500	1800
NOV	8500	1900
DEC	9500	2300
JAN	11500	2800
FEB	12500	2800
MAR	12500	2800
APR	12500	2800

NOTE: BARREL ROLL FIGURES DO NOT INCLUDE THE CHINESE ROAD AREA.

TABLE B-8

[REDACTED]

group. The AAA battalions subordinate to a Binh Tram protected that Binh Tram's assets from air strikes. The AAA personnel spent a great deal of time training and reviewing past engagements as a means of gaining more experience. By March, the estimated number of personnel manning and maintaining AAA defenses constituted about 15 percent of the total North Vietnamese and Pathet Lao forces in Laos.

Unguided-Rocket Firings

During Commando Hunt V, the enemy also made use of modified ground-to-ground rockets in an anti-aircraft role to harass gunships and their escorts. Intelligence sources indicated that the rockets being used for this purpose were 102 mm, 107 mm, 140 mm, and six-foot versions of the 122 mm rocket.

Aircrews reported 64 such unguided-rocket firings in 26 separate incidents during the period 10 October through 28 February; however, there was a significant increase in the tempo of rocket firing during March when 158 firings occurred in 41 incidents. On 2 March, gunship and fighter crews observed 12 firings in the Tchepone area. Signals on aircraft radar homing and warning (RHAW) equipment accompanied these firings, indicating possible SA-2 firings; however, descriptions of the rockets by the reporting aircrews did not correlate to known SA-2 characteristics. No aircraft were hit, even though one crew reported a miss distance of 75 feet, a distance that should have produced a detonation from the proximity fuze of an SA-2. Additional intelligence from other sources tended to strengthen the conclusion that the firings were unguided rockets. It was possible that the enemy fired some SA-2s in conjunction with the unguided rockets or that he coordinated Fan Song radar emissions with rocket firings for purposes of deception.

Other barrage launches of unguided rockets occurred in March. On 20 March, an F-4 crew reported two salvos of 14 rockets each; on 24 March, a B-52 crew reported 30 rocket launches in three groups of 10. This pace slackened during April when crews reported 55 rocket firings in 19 separate incidents.

Most of the rocket firings observed during the campaign occurred along the major route structure, with the vast majority of the incidents taking place within 25 NM of Tchepone or Chavane. The remaining incidents were scattered throughout Steel Tiger. The rockets represented a minimal threat due to the unguided mode of firing. There were 11 reports of miss distances less than 1000 feet; however, most misses were greater than one mile.

The SA-2 Threat

Although perhaps a less obvious threat to air operations in Laos

[REDACTED]

than AAA, the enemy's SA-2 deployments were a major disruptive factor and of continuing concern during Commando Hunt V. Because of the SA-2 threat, photographic and electronic intelligence collectors made a substantial and sustained effort to locate the SAM battalions operating in RP I and Laos. The need for support aircraft to perform SA-2-suppression and electronic-countermeasures (ECM) missions increased the cost of the complexity of scheduling and command and control. Review of support policies and planning on a continual basis provided for the maximum protection possible. US support forces gathered and processed more electronic intelligence (ELINT) and photography during the campaign than in any previous Commando Hunt campaign. The enemy fired a total of 49 missiles at aircraft operating in NVN and Laos below 19°30'N, resulting in three aircraft downed and two aircraft damaged. Figure B-15 shows the firing sites. Had there not been

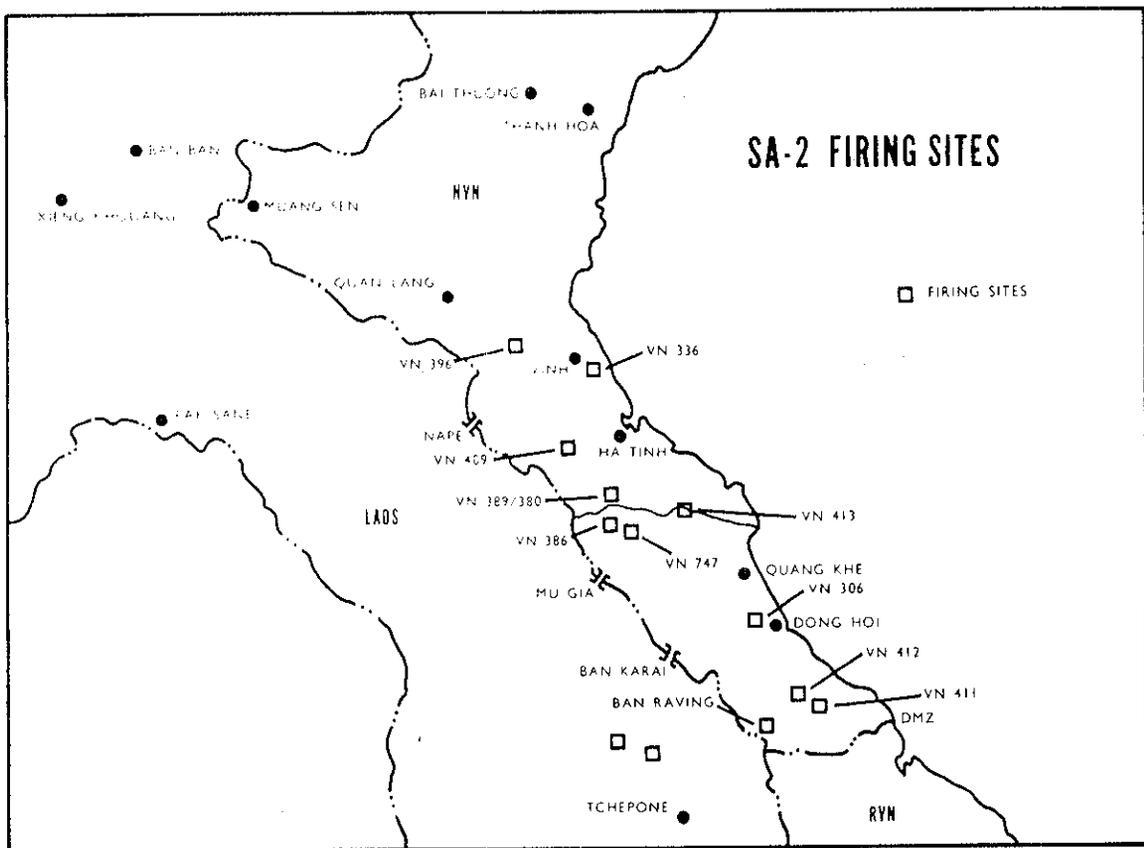


FIGURE B-15

protective reaction strikes against enemy defenses in NVN, there no doubt would have been more firings.

[REDACTED]

Tactical photo reconnaissance of 1 November showed empty missile canister trailers about 27 NM south of Vinh, providing the first evidence that North Vietnam intended to employ its SA-2 missile system against the air interdiction program during Commando Hunt. Photographs taken on 2 November revealed that this equipment had been moved. Other photography of 2 November showed numerous pieces of SAM equipment in the travel mode in a SAM complex 13 NM northwest of Vinh. This sudden increase in sightings of SAM equipment being deployed provided reliable indications of the forthcoming substantial changes in the overall SAM threat in the lower NVN panhandle.

Photography of 3 November through 19 December showed 93 pieces of SA-2-associated equipment at various locations in RP I, generally along Route 101. This verified the speculated southern deployment of SAM equipment.

In mid-November, following the introduction of SA-2-associated equipment into RP I, ELINT aircraft began intercepting Fan Song radar signals from the area. The number of signal intercepts remained constant until late December when they showed a significant decrease. This was a possible reflection of improved North Vietnamese electronic security practices aimed at preventing detection of established firing positions. The points of origin of these signals tended to fall into three general areas: northeast of Mu Gia Pass, northeast of Ban Karai Pass, and in the area north of the DMZ.

The frequent ELINT intercepts of Fan Song radar signals verified the presence of SAM installations and identified their general locations; however, the terrain and heavy tree canopy in RP I, together with the North Vietnamese practice of shifting SA-2-firing units from site to site and their extensive use of camouflage, made individual SAM sites difficult to pinpoint. Actual locations could only be established by visual or photo reconnaissance. At the end of November, there were an estimated four SAM-firing battalions in RP I. There were battalions in the Ban Raving, Ban Karai, and Mu Gia areas, and one battalion was unlocated. The first SAM was fired at a Navy A-6A in the vicinity of Ban Karai Pass on the evening of 12 December. Four hours later, two more missiles were fired at an F-105 Iron Hand aircraft from the vicinity of VN-386 or VN-747, 12 NM north of Mu Gia Pass.

On 1 January, the enemy fired at B-52s striking interdiction Box Bravo near Ban Karai Pass. This incident assisted in locating the launch position within an area along Route 137 extending northward from the Laos border for about 7 NM. The sighting of an empty missile transporter on Route 137, 10 NM north of Ban Karai Pass, marked the first detection of SA-2-associated equipment on routes leading to the pass areas. Fan Song signal activity during January confirmed the presence of SA-2 units in those areas. Reconnaissance detected a total of 151 pieces of equipment in RP I during the month of February. SA-2

launches at B-52s occurred on 15 and 16 February, again in the Ban Karai area. In both cases, the firings occurred during post-bomb-release turns at Bravo Box.

Photography of 9 and 21 February which showed Fan Song antenna trailers near the junction of Routes 1036 and 1039 established a probable operating area near Ban Raving. On 25 February, the enemy fired one SA-2 at a flight of Navy A-7s from the area of the junction of Routes 1036 and 1039 near Ban Raving. Neither aircraft received damage. Figure B-16 shows the estimated SA-2 threat periphery in the

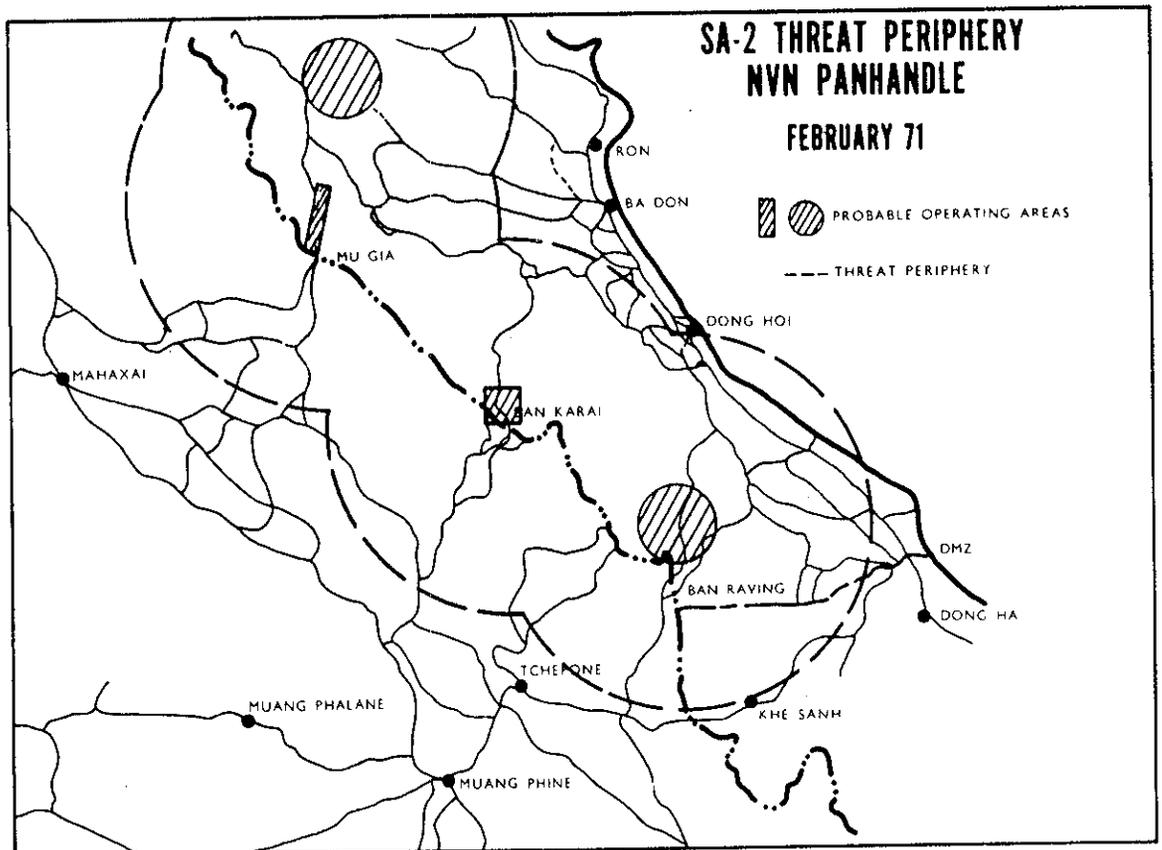


FIGURE B-16

NVN panhandle at the end of February.

Numerous SA-2 firings occurred in March and four SA-2 sites were discovered in Laos. Two aircraft were lost and one damaged as a result of 21 missile firings during the month, as the enemy began to employ his SAM system in a more aggressive manner. On 2 March, photography revealed a field-deployed site (VN 411) 11 NM north of the central DMZ. This was the farthest south a SAM unit had been deployed in the RP I area since 1968. On 3 March, five sites were estimated to be deployed in RP I.

[REDACTED]

On 6 March, VN 411 was unoccupied, but a new operational site, VN 412, was located two miles northwest on 7 March. One or two SA-2s, believed to have been fired from VN 412, downed an RAAF Canberra on 14 March. The aircraft was flying approximately three nautical miles south of the western end of the DMZ when hit. The crew was rescued.

On 22 March, an SA-2 downed one of a flight of four F-4s escorting a photo-reconnaissance mission over RP I near Dong Hoi. The flight was operating about seven nautical miles south of Dong Hoi on a southerly heading when they received typical Fan Song RHAW indications. The flight sighted three SA-2 missiles 30 to 60 seconds later. It was probable that the three missiles were fired from VN 306, which was shown to be occupied in 21 March Giant Scale photography. The same Giant Scale mission also discovered VN 413. These three sites (VN 412, VN 306, and VN 413) provided continuous SAM coverage over the major portion of RP I.

A significant change in the Steel Tiger SAM threat developed during March with the discovery of the first SA-2 site in Laos. LA-001 was discovered four nautical miles south of Ban Karai on 5 March from photography of 28 February. Aircraft struck this site on 5 and 6 March; 7 March post-strike photography showed the site to be incapable of conducting a controlled launch, and it was downgraded to an unoccupied status.

On 17 March, a cell of three B-52s bombing a target 11 NM southwest of the western end of the DMZ reported two SA-2 missile firings from the Ban Raving area. One detonation occurred at about 200 feet from the number two aircraft, and the concussion shook the aircraft; however, none of the aircraft sustained damage. On 19 March, one or two SA-2 missiles fired from a position in Laos five miles north of Tchepone damaged an F-4 from Da Nang.

The establishment of SAM firing positions just north of the DMZ and three sites in Laos, LA-702 and LA-002, 10 NM north of Tchepone, and LA-003, at the western end of the DMZ on Route 1036, illustrated the enemy's attempt to bring positive pressure to bear on Allied air operations in support of Lam Son 719. On 20 March, photography of strikes against other targets revealed LA-702 contained one damaged or destroyed Fan Song radar; no other equipment was seen. Research of photography of 28 February and of 1 and 4 March showed that this site contained three launchers and a Fan Song radar but no missiles. Further photographic research revealed that the site was unoccupied on 11, 17, and 20 March.

On 25 March, aircraft discovered and struck SAM site LA-003 on highway 1036, approximately 100 meters from the NVN border. Figure B-17 shows the location of the SA-2 sites discovered in Laos and Figure B-18 shows the estimated SA-2 threat periphery in the NVN panhandle at the end of March.

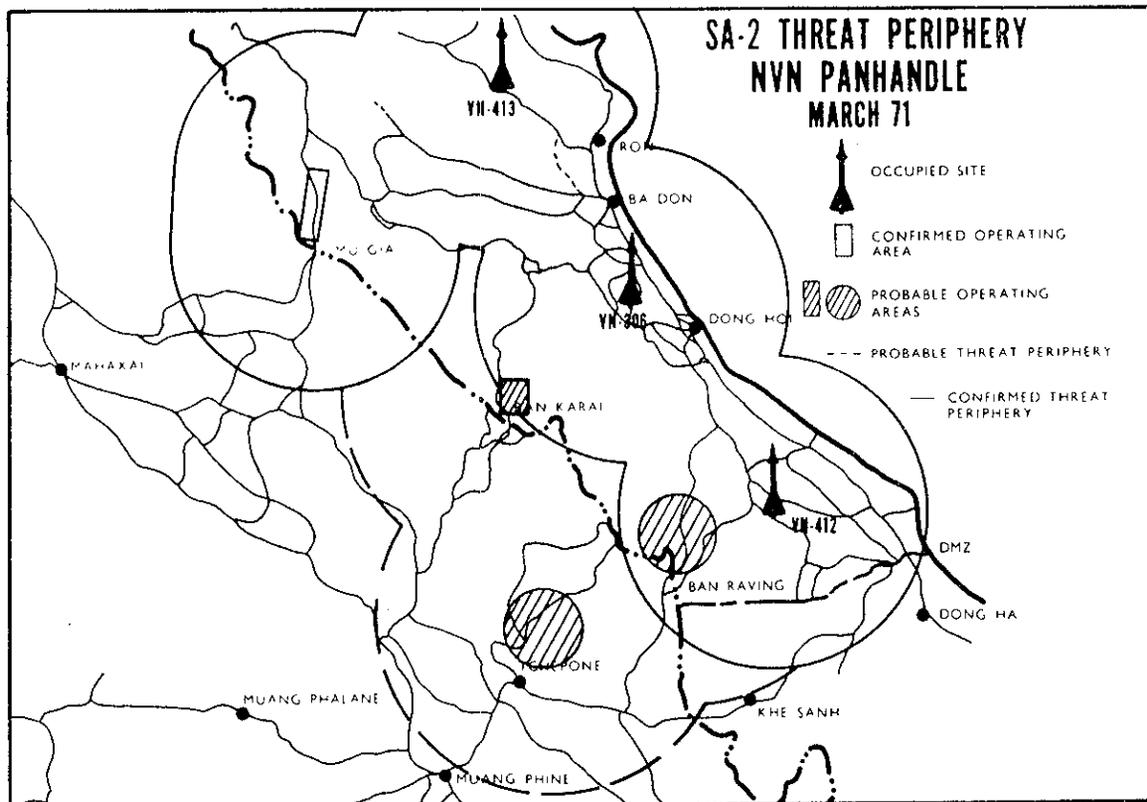
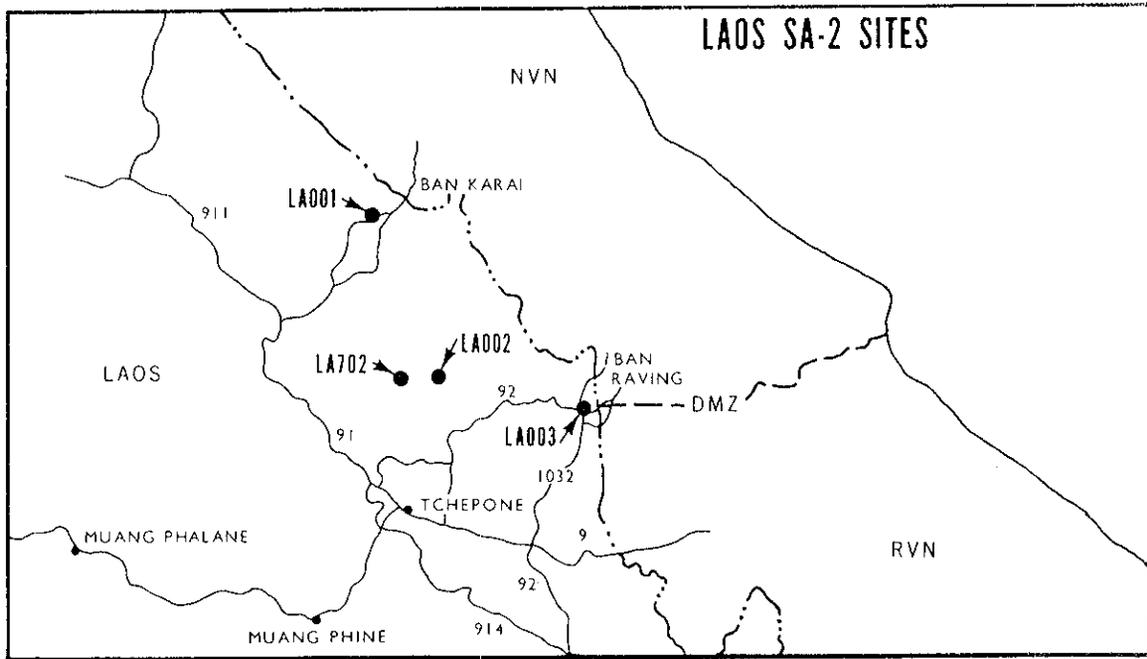


FIGURE B-17/8-18

[REDACTED]

The increased level of SAM firings continued into April when 16 SA-2s were launched. An AC-130 and its F-4 escort reported SAM firings on 6 April from a position 25 NM northwest of Tchepone and on 8 April from a position 45 NM northwest of Tchepone. Concerning the latter incident, no firm determination was made as to whether this was a SAM or rocket firing. On 12 April, an A-6A aircraft reported two SAMs fired southeast of Tchepone. In all cases, observations and data reported were incomplete, but as a result of these firings, intelligence established two probable operating areas.

On 22 and 23 April, three separate firings involving six SA-2 missiles occurred; one of these was southeast of Quan Lang airfield. Another took place in the area of Mu Gia Pass directed at a flight of F-4Js in pursuit of a MiG-21. One F-4 sustained minor battle damage. The third firing occurred on 23 April from VN-413 at a flight of Navy photo-reconnaissance aircraft and escorts flying north of the site. An immediate protective-reaction strike reported unknown results.

One of two missiles estimated to have been fired from the confirmed SAM operating area north of the pass along Route 15 downed an O-2 FAC on 26 April, approximately 11 NM south of Mu Gia. On 28 April, a flight of Navy aircraft conducting route reconnaissance in RP II observed two missiles launched from the vicinity of VN 409 and two possible missiles launched from the area near VN 380 and 389. They expended Rocketeyes and one AGM-45 with unknown results.

Of the 49 SA-2 missiles fired at US and Allied aircraft flying below 19°30'N, 84 percent were fired at tactical aircraft and the remainder at B-52s. This firing rate was four and one-half times greater than that experienced during the 1969-70 dry season, when only 11 missiles were fired at US aircraft. The 472 tactical reconnaissance and 79 Buffalo Hunter drone sorties flown in RP I during the campaign detected a total of 792 pieces of SAM-associated equipment. These sightings are indicative of the determination with which the enemy pursued the deployment of his SA-2 system to the southern panhandle of NVN. By April, the North Vietnamese had established a confirmed SA-2 threat periphery in RP I and Laos as depicted in Figure B-19.

The enemy demonstrated the tactical flexibility of the SA-2 system as well as his ingenuity in its use. He used excellent camouflage techniques, and past experience indicated that soon after reconnaissance aircraft had passed overhead, he moved the equipment. Also, the North Vietnamese maintained surveillance of B-52s by other than Fan Song radar to avoid detection prior to firing.

The MiG Threat

The MiG threat did not result in the loss of a US aircraft during

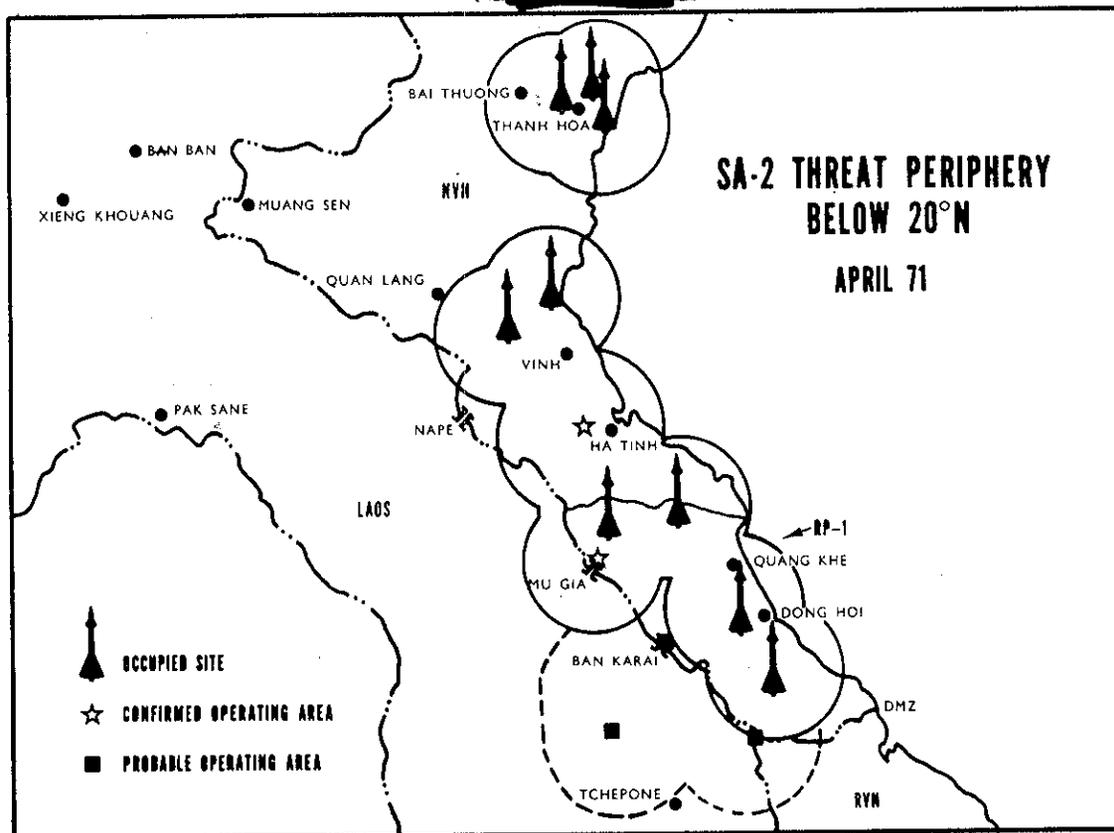


FIGURE B-19

the campaign, but constant vigilance and the expenditure of numerous resources for MiG combat air patrol (CAP), early warning, and air defense were required to insure the protection of US air operations. Prior to the Commando Hunt V campaign, the North Vietnamese Air Force (NVAFA) had shown little propensity to fly combat missions beyond the NVN geographic boundaries. Beginning in November, however, the North Vietnamese appeared to be willing to take more aggressive actions.

MiG Deployments to RP I and Laos. During the period 10 October through 30 April, there were no operational airfields in RP I capable of receiving MiG aircraft, but North Vietnamese MiGs could conduct operations over all of RP I from Bai Thuong, Vinh, and Quan Lang airfields. Photography of 20 November revealed the presence of two MiG-21 aircraft at Vinh airfield as well as four camouflaged parking areas. On the same day, a MiG-21 staging through Vinh airfield penetrated Lao airspace 20 NM north of Mu Gia Pass. The aircraft penetrated 25 NM before returning to NVN. Arc Light aircraft scheduled to strike entry interdiction Box Alpha diverted, but it was not known if these aircraft were the MiG's target. Similar penetrations involving two MiG-21s took place on 20 December and 5 January. Although

[REDACTED]

the target of the 20 December overflight was unknown, the two MiGs involved in the 5 January occurrence appeared to be in pursuit of a Nail FAC operating near Mu Gia Pass. The FAC took evasive action and the MiGs did not engage him. In all three incidents, US air defense fighters scrambled but did not make contact. A typical MiG-21 track through Vinh is shown in Figure B-20.

In addition to the penetrations, MiGs deployed to Vinh on 5 and 6 January and 5 February. There might have been more such deployments but for the positive reactions by US tactical air. One such reaction took place on 9 February when USAF and USN aircraft entered the Vinh area and caused MiGs deploying to Vinh to turn back. One of the MiGs was believed to have been lost due to fuel exhaustion while attempting evasive maneuvers.

On 31 January, four MiGs occupied the airfield at Bai Thuong. The discovery on 17 March Giant Scale photography that the enemy had resurfaced the runway at Quan Lang with pierced steel planking was further evidence that the enemy intended to bolster his MiG capability in RP I. This gave the enemy an airfield with all-weather capability below 19° N and increased the MiG threat to Steel Tiger air operations. On 6 April, Giant Scale photography revealed one camouflaged MiG-21 and another unidentified aircraft at this airfield. It was the first time that the enemy had used Quan Lang airfield since its completion in October 1969.

In addition, the enemy deployed a new ground-controlled-intercept site approximately 20 NM north of Dong Hoi in March, extending the NVN warning and ground-controlled-intercept capability as far south as Hue in South Vietnam and Tchepone in Laos.

The enemy made quick use of his added capabilities when on 13 April one MiG-21 staging out of Quan Lang penetrated the Lao border and attempted to intercept a Nail FAC flying an OV-10 in the area west of the Mu Gia Pass. The MiG made one combat pass, but the OV-10 took evasive action and escaped without battle damage. The MiG penetrated about 20 NM into Steel Tiger. US fighters scrambled and chased the MiG back into NVN.

On 16 April, again staging from Quan Lang, a single MiG-21 attempted to intercept another FAC OV-10 operating in the Mu Gia area. US fighters from Udorn flying MiG CAP for an Arc Light mission diverted and intercepted the MiG as it entered Laos. The F-4s maintained lock-on with the MiG for 8.5 minutes but did not expend because no visual identification was possible due to darkness.

On 22 April, at 1738H, a Navy RA-5C and an F-4J escort aircraft flying a tactical reconnaissance mission over Quan Lang airfield

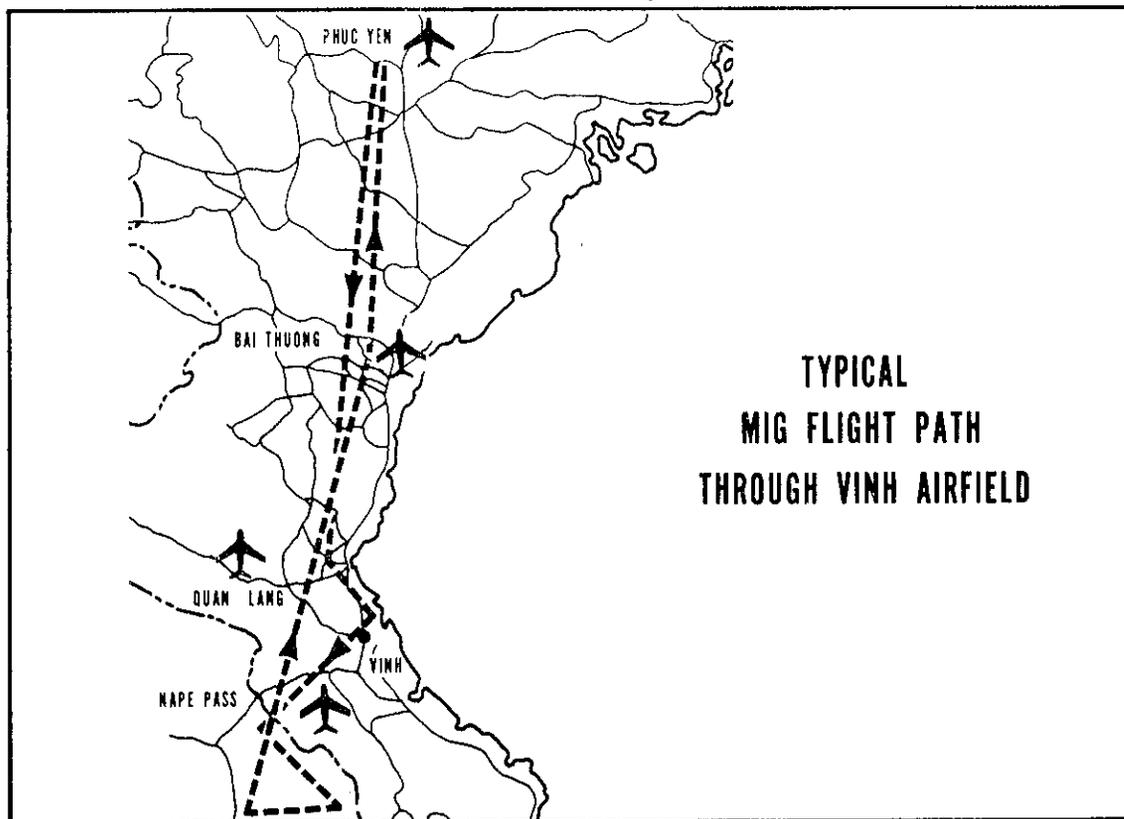


FIGURE B-20

received SAM and heavy AAA fire from air defense units in the vicinity of the airfield. The Navy aircraft reported two SA-2 missile firings, multiple Fan Song radar activations, and heavy 57 mm fire. US Navy flak-suppression and Iron Hand aircraft responded in a protective reaction. They expended Rocketeers on the AAA sites and fired two AGM-78B Standard ARM and two AGM-45 Shrike missiles at SAM sites in the Vinh SAM complex. Photography from an A-7E escort aircraft revealed the following BDA: one MiG burning in a revetment, a second MiG obscured by smoke at the northwest end of the runway, and two AAA sites adjacent to revetments destroyed or damaged. Figure B-21 shows both MiGs prior to strike.

Following the Navy protective-reaction strike, one MiG-21 staging out of Vinh overflew Laos in an area north of Mu Gia Pass. The MiG penetrated about 30 NM; a Nail FAC in an O-2 operating west of the Mu Gia Pass was its target. Navy and USAF F-4s responded to this penetration and chased the aircraft back into NVN.

[REDACTED]
PRE-STRIKE OF QUAN LANG AIRFIELD, NVN

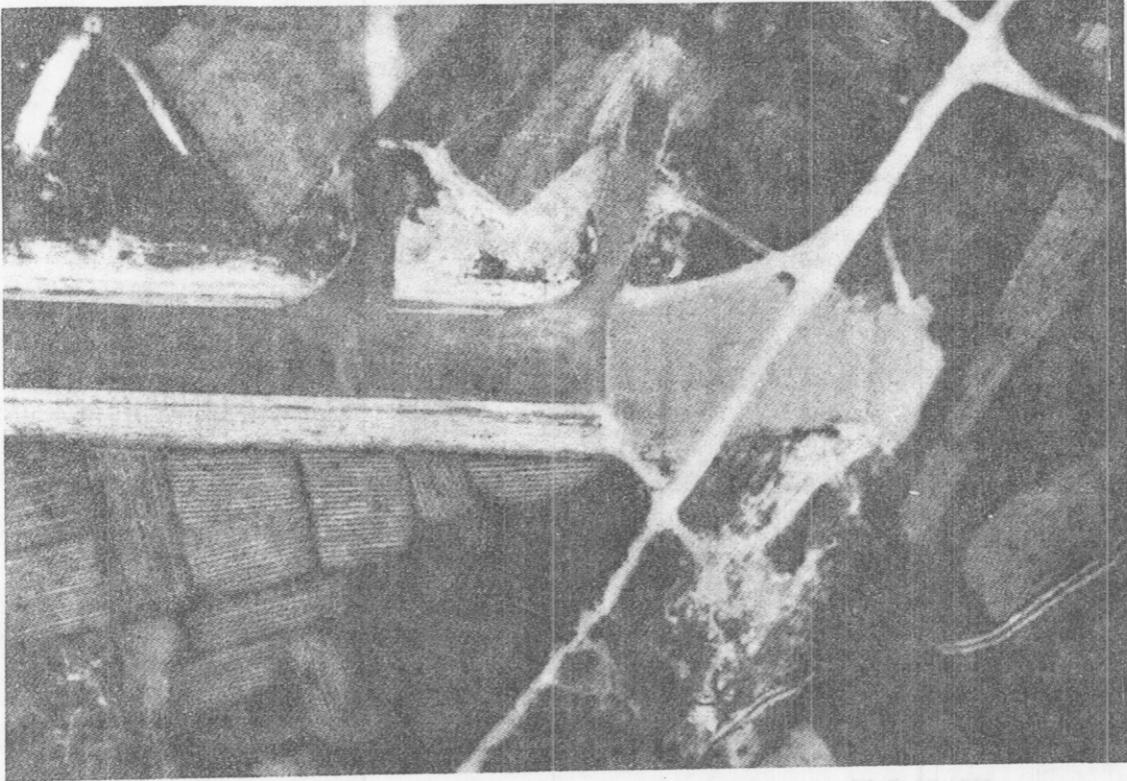


FIGURE B-21

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APPENDIX C

REINTRODUCTION OF THE GUNSHIPS

The fixed-wing gunship (Figure C-1), first devised as a vehicle for close support of ground troops, evolved into the most sophisticated of the night truck-killers. While gunships operated in most cases during darkness, the specialized sensors and computerized fire control system, together with long times on target, provided the capability to inflict severe damage on the enemy.

Gunships were the most effective truck-killing weapon systems during Commando Hunt III, recording 48 percent of the reported truck kills while flying only 8 percent of the sorties. As a result, the gunship force was increased for the Commando Hunt V campaign with new and improved AC-130s.

AC-130

During Commando Hunt V, three versions of the AC-130 were used in the interdiction role (Table C-1).

Surprise Package

The Surprise Package aircraft, introduced during the Commando Hunt III campaign, returned for Commando Hunt V and flew the first AC-130 combat mission on 25 October. This aircraft filled its primary role as a truck-killer but also served as a test bed for new innovations in the field of tactical equipment.

Pave Pronto

The Pave Pronto aircraft, patterned after the Surprise Package, were deployed for the first time in this campaign. The first one delivered flew in combat on 22 November and the last one delivered flew its first mission on 22 January. Two additional aircraft released by Tactical Air Command (TAC) arrived at Ubon RTAFB on 21 and 22 March.

Update

Of the six standard versions deployed during the Commando Hunt III campaign, five returned for this campaign. These aircraft were in the US between campaigns for extensive IRAN as well as equipment modification, including the installation of Black Crow and two 40 mm guns. The first aircraft flew in combat on 2 November and the last one delivered flew on 27 December.

SECRET

AC-119K AND AC-130 GUNSHIPS

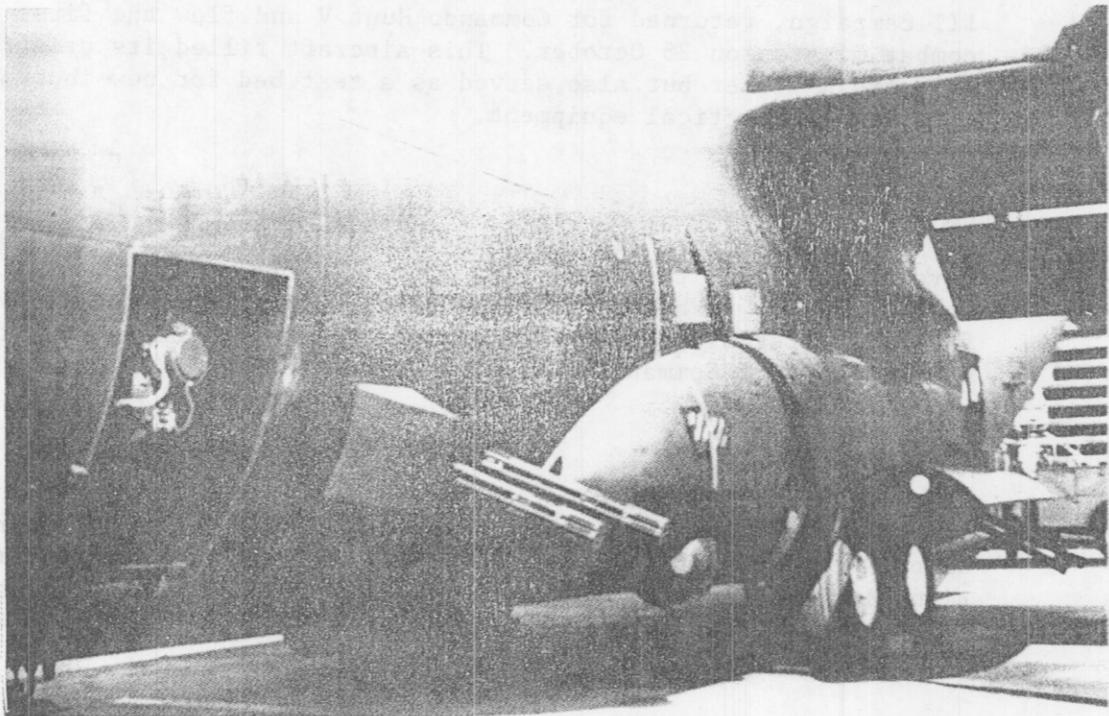
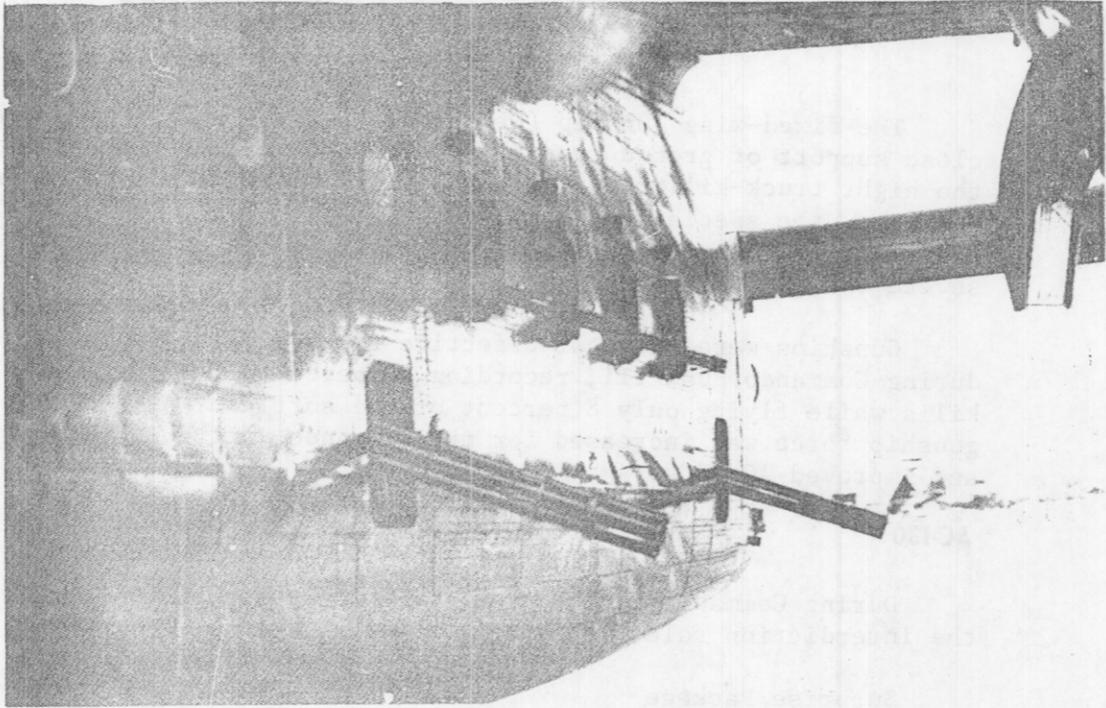


FIGURE C-1

SECRET

[REDACTED]

AC-130 EQUIPMENT CONFIGURATION CHART

<u>EQUIPMENT</u>	<u>SURPRISE PACKAGE</u>	<u>PAVE PRONTO</u>	<u>UPDATE</u>
DIGITAL COMPUTER	X		
ANALOG COMPUTER	BACK-UP ONLY	X	X
RADAR W/MTI	X	X	X
FORWARD-LOOKING IR (FLIR)	AAD-4 (MOD)	AAD-6	AAD-4
LASER RANGE DESIGNATOR	X		
LASER TARGET DESIGNATOR	X	X	X
LOW-LIGHT-LEVEL TV (LLTV)	X	X	
BEACON TRACKING RADAR	X	X	X
HELMET SIGHT	X		
IGNITION DETECTOR (BLACK CROW)	X	X	X
NIGHT OBSERVATION DEVICE (NOD)			X
LORAN/DOPPLER	X	X	X
INERTIAL NAV/TARGET SYSTEM	X		
FLARE LAUNCHER	X		X
2 KW ILLUMINATOR	X	X	X
ECM WARNING AND JAMMER	X	X	X
VIDEO TAPE RECORDERS	X	X	X
7.62 MM GUNS	2 HOUR INSTALLATION CAPABILITY		
20 MM GUNS	X	X	X
40 MM GUNS	X	X	X

TABLE C-1

[REDACTED]

Scheduling

At the start of the campaign, scheduling rates were set at one sortie per aircraft per day, and stabilized at .9 during most of the campaign. In the beginning the AC-130s were restricted from working in VR Sectors 4, 6, and 9 of Steel Tiger due to the AAA threat in these areas. On 15 February, these areas were opened to AC-130 gunships. Only the northern half of Sector 4 and the northeastern two-thirds of Sector 6 were restricted because of the concentration of large caliber guns in those areas.

The aircraft were scheduled to provide area coverage during hours of darkness with heavier coverage during the periods of heaviest truck activity.

Normal Tactics

The key to the gunship's survivability was to avoid stereotyped attack and flak-evasion tactics to the extent that equipment design would allow. The one tactic that remained standard for all attacks was firing from a left orbit above the target at a constant airspeed and altitude. This period was the most vulnerable time for the aircraft, and every effort was made to spend as little time in the "firing circle" as possible. To decrease vulnerability and increase accuracy, the crew performed a sensor alignment check at cruise altitude over the departure base. On some missions the guns and sensors were checked for alignment over a permissive area where the rules of engagement allowed.

A standard procedure was to position a scanner on the right side of the aircraft and the illuminator operator in the prone position over the cargo ramp in the rear and secured to the aircraft by a cable. These scanners reported all AAA reactions to the pilot as either inaccurate, which required no evasive action, or they called for a "break", or a "hard break" to the right or left to avoid accurate fire. When the scanner called for a break the pilot put the aircraft into a 60° bank in the indicated direction. If the scanner indicated that a hard break was required, a 90° bank was used.

The AC-130s had no flak suppression capability of their own; therefore, fighter escorts performed that function. Rendezvous with escorts was normally performed near the assigned VR sector. The escort maintained a position above and to the right of the gunship. When AAA fired, the fighter rolled in and delivered ordnance to destroy or silence the gun. During the campaign AC-130s sustained battle damage on 22 occasions, but none were lost.

Gunships performed armed reconnaissance by flying either parallel to or performing random cuts across the route structure. The first was the faster method but had the disadvantage of keeping the aircraft

[REDACTED]

straight and level along a predictable path and making it a much easier target for AAA defenses. It was seldom used except in low threat areas. Random cuts, though slower, had the advantage of giving the sensors a view down the route which alleviated the effect of masking by foliage and provided coverage over small trails that paralleled the main route structure (Figure C-2).

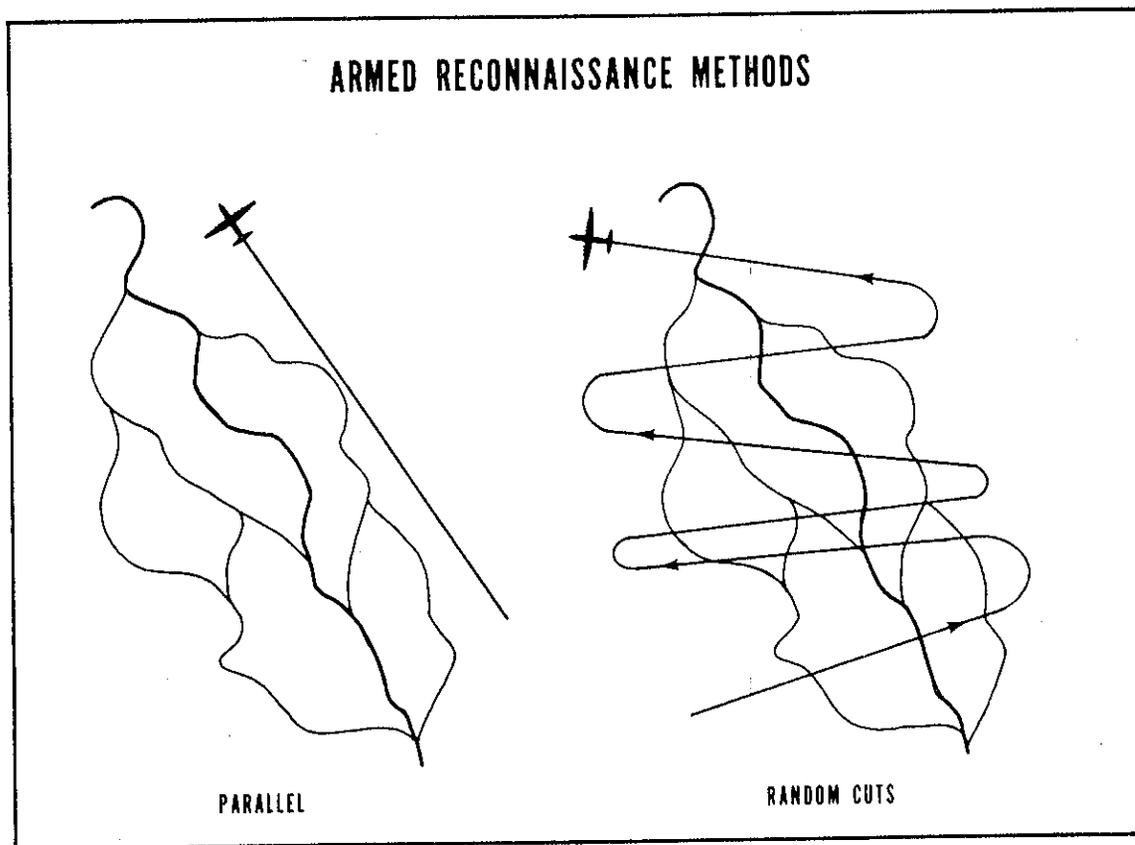


FIGURE C-2

Except in very low-threat areas the AC-130 flew armed recce sorties at 9500 feet above ground level. Figure C-3 shows normal gunship coverage of Laos.

Special Tactics

Ubon Plan A. The gunship required VFR weather for all sensors except Black Crow. Under IFR conditions, the crew could not adjust fire or assess bomb damage using Black Crow alone. Under Ubon Plan A, when the Black Crow operator detected a moving target in IFR weather, the aircraft entered the firing circle and the navigator plotted Loran lines of position every 45 degrees. When reliable estimates of speed

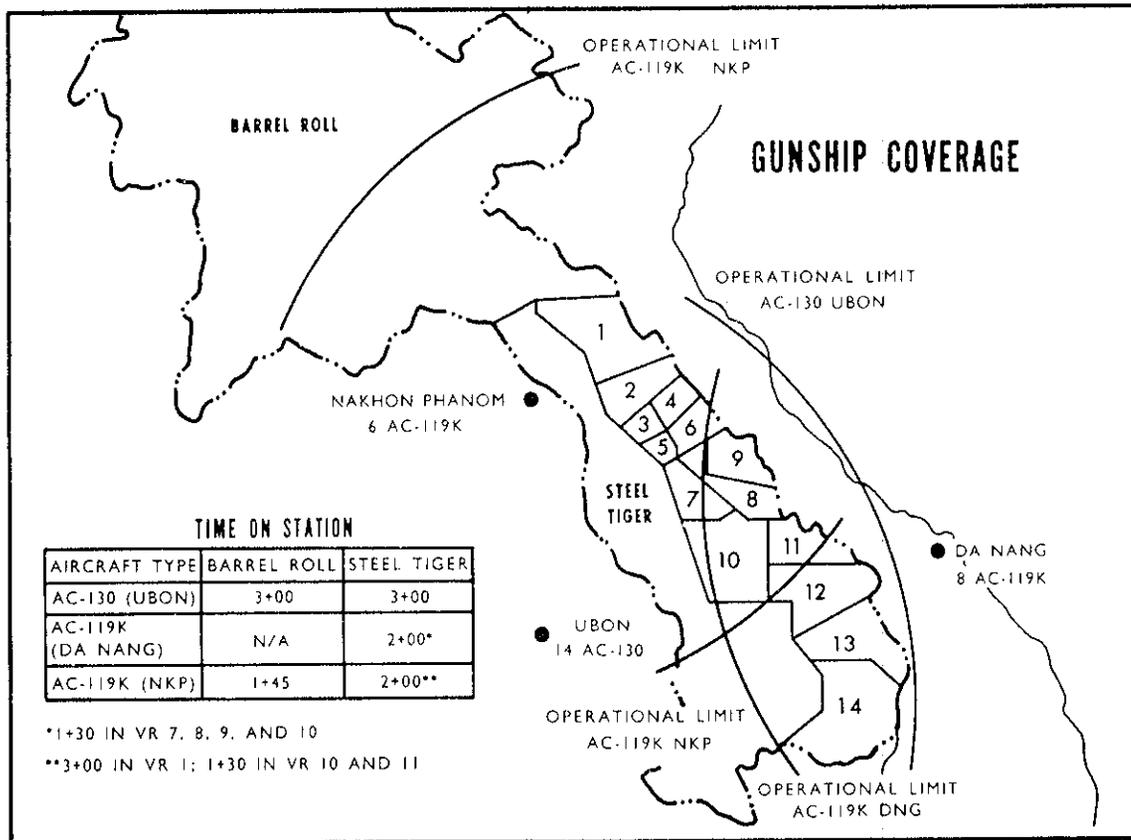


FIGURE C-3

and direction had been obtained, the gunship fired at the target and continued to fire until the target stopped (Black Crow indications ceased). The escort then made a pass parallel to the known orientation of the road and released area munitions using Loran coordinates passed by the AC-130. Normal ordnance was two CBU-24s.

Ubon Plan B. If a target were detected which precluded the use of normal escort ordnance, the gunship would request a scramble of the laser-guided-bomb (LGB)/Loran-equipped alert aircraft at Ubon. The fighter aircraft made a Loran release of the LGB as the gunship laser designated the target. A similar plan, designated Pave Sword, was tested and evaluated in February. The Pave Sword system utilized a pod on the F-4 aircraft that received the reflected energy from the AC-130 laser-illuminated target. Once the pod locked on to the target, steering and release information were provided to the pilot through instruments in the cockpit. Five pod-equipped aircraft were in place at Ubon on 1 March. The system was effective for flak suppression.

Problems

The accelerated modification and production program conducted during the wet season caused problems with both crew training and hardware.

~~SECRET~~

Trained personnel inputs were not commensurate with the accelerated input of airframes. The training of aircrews and maintenance personnel was therefore accelerated. Even though all personnel received the best training that time permitted, there still appeared to be gaps in the training on the new fire control computer.

Trained maintenance personnel, test equipment, and mock-ups were slow to arrive and caused considerable down-time on particular equipment. This lack of training and degraded performance of equipment was reflected in the low BDA during the early part of the campaign.

As crew and maintenance personnel gained experience, combat effectiveness went up, and during the 13th, 14th, and 15th of January, over 100 trucks were destroyed or damaged by AC-130s alone. The campaign high was reached on the 4th, and 5th of March when AC-130s destroyed or damaged 218 and 216 trucks respectively. Figures C-4 and C-5 show results of AC-130 strikes.

AC-130 STRIKE RESULTS

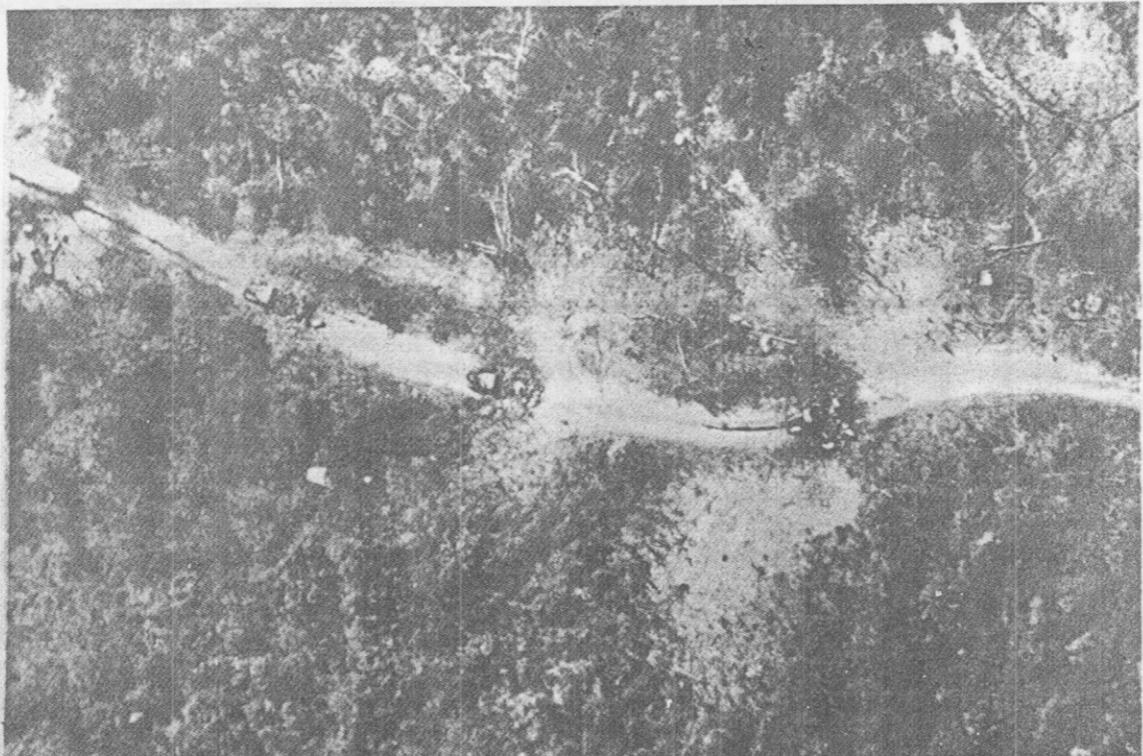
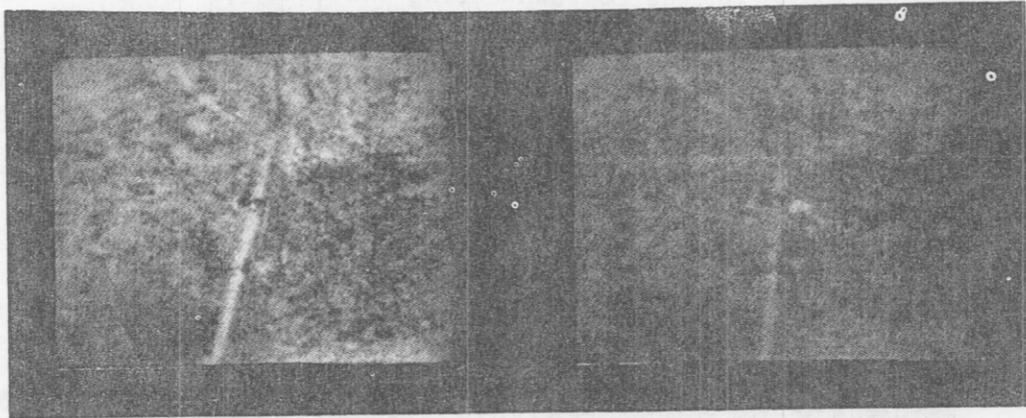


FIGURE C-4

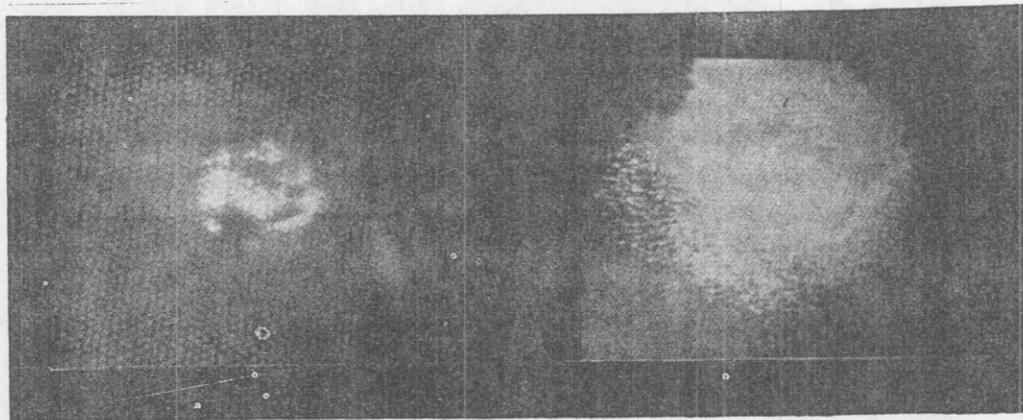
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AC-130 LLLTV STRIKE SEQUENCE



1. A TRUCK AS SEEN ON LLLTV

2. A NEAR MISS



3. IMPACT

4. SECONDARY EXPLOSION

FIGURE C-5

[REDACTED]

Video Tape BDA Recorders

One of the innovations tested on the Surprise Package aircraft during Commando Hunt III and incorporated into the Pave Pronto aircraft was a system to record the visual display of either the FLIR or LLLTV on video tape. In December, a program was initiated to have the crew view these tapes with photo-interpreters to verify the reported truck damage. The system was installed on the Update aircraft in February at Ubon to record the FLIR only.

The system had several limitations that made total verification impossible. The controls for monitoring the tape supply and selecting the sensor to be recorded were located at the fire control officer console. Manning for this position was not always provided, except for the Surprise Package aircraft. The LLLTV operator monitored the tape supply looking across the aisle between the consoles, but had to leave his seat to change sensor selections for the recording. Since the primary (firing) sensor selection was sometimes changed during an attack, there were times when the nonprimary sensor was taped. In these instances, the tape might or might not show the target being attacked. Another factor which limited tape coverage was that each tape lasted only 23 minutes. Since the tape was only turned on during attacks, the depletion of a reel always cost some target coverage. Installation of a new reel required from three to five minutes and also required one of the sensor operators to leave his console to effect the change. A final factor was the interpretation of the tapes themselves. The interpretation of film was difficult; the interpretation of video tape even more so. The images on the FLIR were small, and the precise point of impact was often difficult to determine. LLLTV pictures gave a better view of the target but the flash from the impacts often hid the target and made precise scoring impossible. A final problem was that direct scoring from the video tapes made it impossible to slow down or stop the action during the evaluation process.

In spite of the difficulties in obtaining full target coverage and in evaluating the tapes, 52 percent of all AC-130 truck-kills during Commando Hunt V were confirmed by photo-interpreters.

AC-119K

The opening of the campaign found 16 AC-119Ks in Southeast Asia. Nine were based at Da Nang, four at Udorn, and three in scheduled maintenance at Phan Rang. In November, the four aircraft at Udorn were moved to Nakhon Phanom in order to provide coverage for Steel Tiger as well as the Barrel Roll section of northern Laos. In January, the aircraft were reallocated between the two operating locations so that eight were located at Da Nang and six at Nakhon Phanom with two in scheduled maintenance. On 14 December, two aircraft were deployed to Tan Son Nhut to fly LOC armed reconnaissance missions in Cambodia. The road traffic was minimal and most attacks were against river traffic

[REDACTED]

on the Mekong. The AC-119 20 mm guns were also employed against bunkered automatic weapons positions. The aircraft were redeployed to Da Nang on 25 January. The aircraft configuration was essentially the same as during Commando Hunt III (Table C-2).

AC-119K CONFIGURATION CHART

ANALOG COMPUTER

ADVANCED ANALOG COMPUTER - INSTALLED IN FEBRUARY

FORWARD-LOOKING RADAR - (APQ-136)

BEACON TRACKING RADAR - REMOVED DECEMBER 70

FORWARD-LOOKING INFRARED (FLIR) - AAD-4

NIGHT OBSERVATION SIGHT

DOPPLER

FLARE LAUNCHER

20 KW ILLUMINATOR

ECM WARNING DEVICE - (APQ 25/26)

7.62 MM GUNS

20 MM GUNS

TABLE C-2

The AC-119Ks were operated at a rate of .7 sorties per aircraft per day for most of the campaign. The AC-119Ks operated in Steel Tiger and Barrel Roll. In Steel Tiger, they were restricted from entering VR Sectors 4, 6 and 9 at anytime and Sector 8 during periods of more than 50 percent moon illumination. These restrictions were necessary due to the heavy defenses found in these areas and the 7000-foot working altitude of the aircraft. All other restrictions due to high-threat areas and moon illumination were discontinued during February.

[REDACTED]

Normal Tactics

Normal tactics for the AC-119K were about the same as for the AC-130. The sensor-alignment and wet-boresight procedures were abandoned in December because they consumed excessive fuel and ammunition, both of which were critical to achieving the desired two hours time on target.

The AC-119K used the same flak-evasion-and suppression tactics that the AC-130 used. One problem peculiar to the reciprocating-engine-equipped AC-119K was torching from the exhausts. Flame patterns increased the chances that the aircraft would be seen from the ground. As a result the jet engines were operated at all times during armed reconnaissance to allow the reciprocating engines to be operated at a lower RPM and leaner mixture. All required power changes were made with the jet engines. During this campaign the aircraft suffered battle damage on 6 occasions, and none were lost.

Problems

The AC-119K was the same system that was employed during Commando Hunt III. There were some training problems encountered during the initial phases of the campaign. A large turnover of crew and maintenance personnel occurred during November and December. Many of the pilots had minimum reciprocating engine time, and additional training was required to qualify them as aircraft commanders. A shortage of flight engineers in January required that four engineers qualified in C/AC-119s be sent to the theater on a TDY basis until assigned engineers could complete their check-out programs.

Major equipment problem areas were propellor and engine malfunctions. One modification was made to the firing components of the aircraft. The actual installation of the advanced analog computers was delayed due to insufficient test equipment and technical data. The first aircraft with the AYK-9 computer installed was delivered to Nakhon Phanom on about 1 February.

EFFECTIVENESS

In addition to the measures of effectiveness given in Chapter III, one other measure of performance was of interest.

Trucks Struck Per Truck Observed

Figure C-6 shows the ratio of trucks struck to trucks observed. This measure was monitored for indications of possible gunship force saturation. If the enemy were able to put more trucks on the road than the gunships could strike, this ratio would decline. Since sensor-detected truck movements were highest when the moon was full, the ratio

TRUCKS STRUCK PER TRUCK OBSERVED BY GUNSHIPS

3-DAY AVERAGES

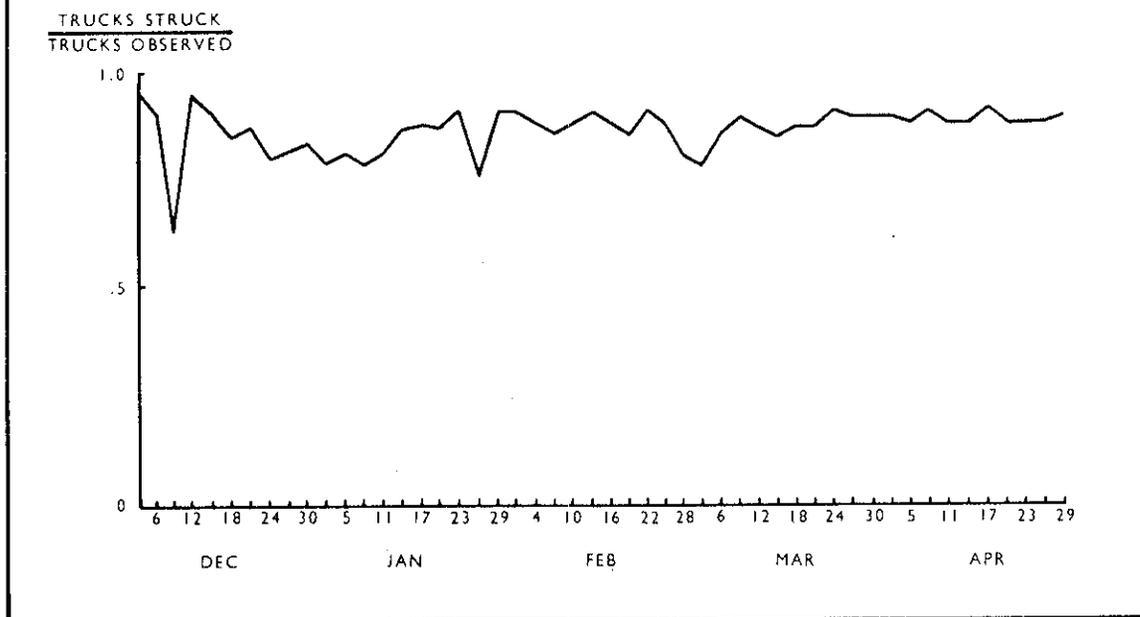


FIGURE C-6

would have declined during periods when the moon was full if the force were saturated. There was no evidence of any such pattern. The gunships were able to strike about 90 percent of all targets observed from January on.

Comparison of AC-130 Models

Table C-3 shows the relative performance of Surprise Package, Pave Pronto, and Update aircraft. In two of three measures of performance the Pave Pronto aircraft was the most effective. Trucks destroyed or damaged (D or D) per sortie was about the same for the Pave Pronto and Surprise Package aircraft. There were several reasons for this. Both the Surprise Package and the Pave Pronto aircraft had superior sensor capability with the LLLTV as opposed to the NOD in the Update aircraft. The Pave Pronto was recognized as the most probable producer of truck damage due to both quantity of aircraft and quality of systems. As a result they were given preferential maintenance as well as being given the most lucrative areas and target times. Finally, the Pave Pronto aircraft flew more sorties than the other two models combined and crew proficiency was higher with this system.

[REDACTED]

COMPARISON OF THE THREE MODELS OF AC-130

10 OCT - 30 APR

<u>STEEL TIGER</u>	<u>TRUCK SORTIES</u>	<u>TRUCKS STRUCK</u>	<u>TRUCKS D OR D</u>	<u>D OR D PER SORTIE</u>	<u>D OR D PER STRUCK</u>
ALL AC-130S	1311	14992	12741	9.72	.85
SURPRISE PACKAGE	139	1889	1593	11.46	.86
PAVE PRONTO	695	8695	7657	11.01	.90
UPDATE	477	4408	3491	7.31	.81

TABLE C-3

Comparison of the Effectiveness of AC-130 Sensor Systems

Of the various sensor systems available, some were used primarily for acquisition of targets and others for attack. Table C-4 shows the utilization of sensor systems.

TROOP SUPPORT MISSIONS

Though most of the improvements in gunship systems since the time of the AC-47 were directed toward the conversion of the aircraft into night truck-killers, they retained and even improved their capability to support ground troops. The emphasis placed on this capability was demonstrated by the fact that even though both aircraft were weight-limited, in most cases they still carried flare launchers, miniguns, and the APQ 133 Beacon Tracking Radars which were troop-support equipment. In those cases where this equipment was removed, rapid reinstallation capability was retained.

This proved to be indispensable during this campaign. Though the ground war in the Republic slowed, there were numerous campaigns in Laos where close support missions were required on a continuing basis. Supporting ground operations on the Bolovens Plateau, AC-119Ks flew 24 missions, striking 15 times in support of TICs, attacking 11 known and 3 suspected enemy locations (KELs, SELs), and reporting 12 fires and secondary explosions. The AC-130s flew two missions and supported two TICs with results not observed.

The gunships also supported the resistance of General Vang Pao to

AC-130 SENSOR EFFECTIVENESS

SURPRISE PACKAGE AND PAVE PRONTO

	<u>DETECTIONS</u>	<u>ATTACKS</u>	<u>TRUCKS D OR D</u>	<u>TRUCKS D OR D PER ATTACK</u>
BC	7230	159	93	.54
FLIR	3556	6287	5365	.85
LLTV	1067	4138	3792	.92
<u>UPDATE</u>				
BC	2991	88	49	.56
FLIR	1427	3280	2591	.79
NOD	830	1040	851	.82

TABLE C-4

the Communist threat in Barrel Roll. The majority of the missions flown by the AC-119Ks from Nakhon Phanom were in support of this campaign. The AC-119Ks flew a total of 303 missions, struck 168 times in support of TICs, attacked 93 SELs and 90 KELs, and recorded 318 fires and secondary explosions and 102 enemy KBA. The AC-130s flew two missions in Barrel Roll in support of troops and struck seven times in support of TICs resulting in one secondary explosion and one mortar destroyed.

Another major effort was flown in support of Lam Son 719. The AC-119Ks flew 65 sorties which expended in support of TICs and were credited with 42 troops KBA, 11 tanks destroyed or damaged, and 88 fires and secondary explosions. In addition, during the time of the operation, 17 LOC reconnaissance missions struck in the Lam Son 719 operating area and reported 40 trucks destroyed or damaged and 35 fires and secondary explosions. The AC-130s flew 25 missions striking in support of TICs with a reported 408 KBA, 18 tanks destroyed or damaged, and 190 fires and secondary explosions. In addition, from 8 February through 24 March a total of 136 armed reconnaissance sorties struck in the Lam Son area, reporting 1657 trucks destroyed or damaged.

INNOVATIONS IN GUNSHIP TECHNOLOGY

Technological innovations continued to make important contributions

[REDACTED]

to AC-130 and AC-119 gunship effectiveness during Commando Hunt V. The equipment involved is listed below, along with brief discussions of the technology.

Laser Designator (All AC-130)

The laser designator provided the capability to mark targets for laser-guided bombs.

Forward-Looking Infrared System (All AC-130 and AC-119K)

The forward-looking infrared (FLIR) system consisted of a mechanical and optical scanner. This instrument provided the aircraft with a viewing capability that was not endangered by intense light as some LLLTV sensing elements were. Hot objects such as truck motors, fires, and vehicle surface heat could be detected, although the detection range varied with humidity and foliage and with the size and temperature differential of the target and its background. The AAD-4 FLIR was installed in the Update AC-130s and AC-119Ks. The AAD-6 FLIR installed in the AC-130 Pave Pronto had improved detectors for a sharper display. It also had improved tracking features such as a drift-stabilized reticle and an improved gimbal control which incorporated a variable-sensitivity feature. The AAD-4 modification on Surprise Package was the prototype for the AAD-6 and combined the improved tracking features with the AAD-4.

Illuminator (All AC-130)

The illuminator provided the gunships with the capability to illuminate a target area when ambient illumination was not sufficient. The AC-130s used the small 2-kw illuminator for use with the NOD/LLLTV in the infrared (IR) mode. This light source was slaved to the sensor head and tracked with the sensor as the sensor performed either area search or tracked a specific target. This IR light was essential for the use of either the NOD or LLLTV when the moon illumination was less than 50 percent.

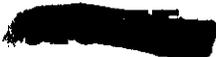
Helmet Sight Assembly (AC-130 Surprise Package)

The helmet sight assembly allowed the scanner to fix the locations of AAA positions with accuracy. A basic AFH-1 helmet was modified by the addition of a special magnetic receptacle on the top of the helmet and a retractable reflex sight unit to the visor cover above the right eye. An arm mounted on a moving carriage rode on two rails attached to the aircraft. Two resolvers provided the electrical signal required to compute the azimuth and elevation angles of the helmet with respect to the aircraft axes. The front end of the arm had an iron disc which was held to the helmet by a magnet. A hand control contained a switch for obtaining control of the system and another for designating targets.

[REDACTED]

The scanner took control by activating the control switch, at which time the reticle lit up. When he saw a target, he placed the reticle on it and depressed the designate switch. The inertial system took the data, computed, and read out the coordinates of the target.

The inertial system could then put the aircraft in firing geometry around the point as any other sensor would. The target could be laser-illuminated for LGB attack or the coordinates used for LORAN attack by escorts. Six photo-reconnaissance-confirmed gun-sites whose coordinates were generated by the helmet sight were destroyed by day Paveway operations.


APPENDIX D

INTRODUCTION OF THE B-57G

BACKGROUND

A multicommand General Officer Shedlight Program review was held at Aeronautical Systems Division, Air Force Systems Command, on 28 and 29 September 1967. At that meeting it was agreed that using commands would establish requirements for an interim high-performance, self-contained, adverse-weather or night-attack (SCANA) weapon system. Specifications were developed to modify the B-57B to provide an interim SCANA weapon system. On 15 July 1968, AFSC let a contract to the Westinghouse Aerospace Division, Baltimore, Maryland, for sixteen B-57G configured aircraft. AFSC and the contractor performed Category I tests. Category II and III tests were accomplished at Eglin AFB, Florida, and completed in July 1970. In September 1970, the 13th Bombardment Squadron, Tactical, deployed to Ubon RTAFB, Thailand, with 11 B-57G aircraft.

DESCRIPTION

The B-57G was a midwing, twin-turbojet, light bomber with special equipment to perform low-level attack missions. Major modifications included a new nose section incorporating a radome and chin fairing with forward- and downward-looking optical windows; two J65-W-50 engines, each providing 7650 pounds of thrust at military power; armor for the crew and fuel and flight systems; self-sealing fuel bladders; and rocket ejection seats.

B-57G TECHNOLOGY

Specific attack systems and brief descriptions of their design features are provided below.

Weapon Delivery and Navigation Computer

The primary function of the computer was solving bomb delivery equations, including providing steering information to the pilot and initiating release pulses to the preselected stores stations for automatic munitions release. A second important function was providing navigation information in the form of present position and azimuth steering commands. The computer processed information from a self-contained navigation group (the heading system, Doppler, TACAN, VOR/ILS, and radar altimeter), the system operator's controls, and the sensors (radar, LLLTV, FLIR, laser, and ancillary equipment) and produced steering and weapon release signals. The computer

[REDACTED]

provided initial attack and reattack information to the pilot. If the laser failed during a weapons delivery run, the computer would automatically switch from laser range to angle/angle rate ranges. This computer provided the capability for the crew to select any of a variety of munitions and make an automatic release of weapons at varying altitudes and ground speeds against fixed or moving targets.

Forward-Looking Radar

The AN/APQ 139 forward-looking radar had several modes of operation including ground mapping, terrain following, terrain avoidance, ground-moving-target indicator (GMTI), and air-to-ground ranging. The ground-mapping mode provided information for determining geographic position. The terrain-avoidance mode provided illuminated display of terrain height for a distance of 10 miles ahead of the aircraft. In the terrain-following mode, the pilot could adjust pitch attitude to fly a contour pattern along a desired course. The GMTI mode, used to detect moving targets, had a range of 10 miles. When the systems operator placed the cross hairs on the target the optical sensors, LLLTV and FLIR, and the laser were automatically slewed to the target. Continuing to keep the cross hairs on the target allowed the pilot to steer to the target by following steering information presented on the horizontal situation indicator (HSI). When the target was within range of optical sensors, target identification and attack were accomplished using these optical sensors. The air-to-ground ranging mode provided slant range information to the computer with direct readout at the crew station. This mode provided a radar-bombing capability as a backup to the primary bombing mode using the optical sensors.

Forward-Looking Infrared (FLIR)

This unit employed an IR detector unit, mounted on the right chin, to detect the radiation from truck engines, exhaust pipes, and other hot objects. FLIR effectiveness depended on target size, temperature contrast between the target and the background, foliage screening, and atmospheric conditions. Detection ranges varied from 6000 to 12,000 feet slant-range and were presented on an optical display in the rear cockpit. FLIR was a primary attack sensor and was not subject to burn spots from bright lights nor was it affected by ambient light levels. Azimuth and elevation information was provided to the computer.

Low-Light-Level Television (LLLTV)

The LLLTV vidicon tube was mounted in the left chin of the aircraft and could be used to view terrain and targets under light conditions varying from sunlight to low ambient light levels encountered at night. LLLTV information was presented on an optical display in the rear cockpit. The primary purpose of the LLLTV was to

[REDACTED]

detect and track a target during an attack by providing azimuth and elevation information to the computer. The effectiveness of this unit was dependent on target contrast and ambient light levels. It was subject to burn spots if sudden flashes of light were observed during darkness. During the campaign, a new burn-resistant tube was being developed for installation in the B-57G.

Electronic Countermeasures (ECM)

The B-57G carried both passive and active electronic devices for crew protection. The passive radar homing and warning (RHAW) equipment consisted of an AN/APR 37 receiver, an AN/APN 36 threat analyzer, and a display scope in both cockpits. The scope displayed azimuth of the threat source to warn the crew when the aircraft was under electronic surveillance. Active equipment included two ALT-28 transmitters with two operator-selected modes. It had to be set up on the ground by selecting a mean frequency and range about that frequency for barrage jamming. The aircraft could also carry two ALR-78 QRC pods on the inboard rocket stations, powered by the aircraft electrical system. These units were also used for jamming.

Laser Ranger

The laser ranger was a 100 mw unit with rate frequencies of 2 and 10 pulses per second, selectable by the operator. The primary use of the laser was to provide the computer with accurate slant-range information between the aircraft and the target. The laser was boresighted to the optical sensors and was the primary source of range information with the angle/angle rate of the rotatable sensor mirrors providing secondary range information. The laser had a secondary use as a designator in the high-pulse-recurrence frequency mode. This capability provided both slant range to the target and illuminated the target during delivery of the MK-82 laser-guided bombs. This unit was limited in look-back angle to approximately 94 degrees from the horizontal plane of the aircraft.

B-57G Weapons

20 mm Gun. The B-57G had the capability to carry four 20 mm guns, two mounted in each wing root. These guns were planned for air-to-ground operations but were removed to save weight.

General-Purpose Bombs. The B-57G could carry up to eight general-purpose bombs, four externally and four in the bomb bay. Types of bombs carried were M-117 750-pound bombs and MK-82 500-pound bombs, both in low- or high-drag configuration.

Napalm (BLU-27). The B-57G could carry four 750-pound BLU-27s. This munition had to hit the target precisely to insure destruction and therefore was not well-suited for attacking moving trucks.

[REDACTED]

Fire Bomb (M-36). The B-57G could carry four M-36E1 bombs internally. This bomb dispensed small incendiary bomblets and was well-suited for attacking trucks. It was used extensively in the B-57G operations during Commando Hunt V.

Laser-Guided Bomb. The B-57G could carry four MK-82 500-pound laser-guided bombs externally. The aircraft tracked the target with the laser set at 10 pulses per second and when the aircraft entered the bombing envelope the selected bomb was released automatically. The crew had to execute a climb-dive maneuver to ensure target designation through bomb impact because of the limitation in look-back angle. This munition was ideal against moving targets because of its high accuracy.

Hayes Bomb Dispenser. This modular bomb dispenser was installed on the bomb bay door. The unit consisted of 22 cells designed to carry CBU-27 rectangular canisters. Individual canisters varied in weight from 140 to 180 pounds, depending on the type of bomblets loaded in the canister. The aluminum canisters had a mechanical timer with settings from 1 to 90 seconds and were preset on the ground to ensure optimum height after release. The primary munition used in the canister was the BLU-26/B fragmentation bomblet weighing about one pound. Each canister contained 177 bomblets. The bombs were an area munition and described an elliptical pattern on the ground with a hole in the center. To ensure total area coverage, the canisters were released at prescribed intervals to fall in a line, thus overlapping the patterns to fill the center hole left by the previous canister.

Typical Munitions Load. The most common load carried during Commando Hunt V consisted of four M-36E1s and two MK-82 LGBs. This less-than-maximum load was necessary because of the runway length at Ubon AB, Thailand. With this common load, average takeoff weight of the B-57G was 55,470 lbs, requiring 7600 feet for takeoff roll. Early-evening flights carried only three M-36E1s internally and two MK-82 bombs externally to compensate for higher runway temperature.

COMBAT EVALUATION AND RESULTS

Purpose

The B-57G SEA combat evaluation was conducted for 90 days beginning with the first flight on 18 October 1970. The objectives were:

1. evaluate the effectiveness of the B-57G, Tropic Moon III system, in detecting, tracking, and destroying traffic along enemy LOCs;

[REDACTED]

2. verify that the aircrew ratio, maintenance requirements, and tactics which had been developed were correct;

3. record deficiencies and recommend corrective action;

4. determine the reliability of each subsystem; and

5. make recommendation as to future night attack systems.

Conclusions

Conclusions reached by the Combat Evaluation Group were:

1. The B-57G was effective in a night interdiction role in the environment in which it was evaluated.

2. Performance of the ground map mode of the APQ 139 was marginal. The GMTI mode was ineffective.

3. Although the performance of the navigation system was, for the most part, within design specifications, its degree of precision was inadequate to be used independently for rapidly determining aircraft and target position to guarantee compliance with the rules of engagement.

4. The M-36E1 and MK-82 laser-guided bombs were effective against trucks and other vehicular targets.

5. Aircrew and specialized maintenance manning was adequate to support the B-57G weapon system as operated by the 13th Bombardment Squadron, Tactical.

6. Tactics employed were sound.

7. Many of the specialized systems exhibited low-mean-time-between-failure and high-mean-time-between-repair rates.

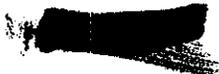
Recommendations

Recommendations for near-term considerations were that:

1. the B-57G be retained in SEA as long as required by PACAF;

2. concerted efforts be continued to improve the overall performance of the AN/APQ 139 radar and to provide an operational GMTI; and

3. action be taken to provide for automatic cut-off of the LLLTV at some point after release of the MK-82 (LGB).



EMPLOYMENT OF THE B-57G

During Commando Hunt V the B-57G was employed exclusively in a truck-killing role. Early in the 90-day combat evaluation, it was scheduled into relatively low-threat areas of Steel Tiger, VR Sectors 3, 5, 10, 11, 12, and 13. In early February, the B-57G was allowed to operate in the western portion of VR Sectors 4 and 6 and during March and April 71 it was scheduled into VR Sectors 3, 4, 5, and 6. Area and time of coverage were major considerations in scheduling gunships and B-57Gs. The more effective AC-130 and AC-119 aircraft were scheduled into the more lucrative areas and at prime times. The B-57G was used to fill any gaps in gunship coverage. Since the B-57G was on station for about one hour, carried only 6 bombs, and was more affected by weather than were the gunships, it was scheduled in 3rd priority, after the AC-130s and AC119s.

Tactics

As envisioned by the designers, initial target acquisition was to be made using the MTI feature of the APQ 139 radar at 5 to 10 mile range. This would allow the systems operator time to transition to IR or LLLTV for a one-pass attack. During Commando Hunt V, the APQ 139 radar, and hence the GMTI feature, was ineffective. Initial acquisition was made on the shorter-range IR or LLLTV sensors. Frequently, positive identification of the target could not be made in time for a first-pass attack and a second pass was required. Both sensors were forward-looking, requiring flight along the route rather than allowing random cuts as in the case of gunships. Thus a long straight stretch of road was desirable. When a truck was identified and tracked with either sensor, an automatic bomb release was made. The laser target designator was slaved to the sensors, but the look-back angle was limited to 94 degrees from the horizontal. Since the impact of the LGB was behind the aircraft, the crew executed a climb upon release and then pushed over into a shallow dive, allowing the laser to remain on the target until bomb impact. Impact of the MK-82 LGB was observed on IR. For attacks using the M-36E1, the crew circled back to observe the target and determine bomb damage. Damage was assessed according to the criteria in Table D-1.

Effectiveness of the B-57G in Commando Hunt V

A summary of B-57G sortie and effectiveness data is provided in Table D-2.

Because of the accuracy of the LGB, hits within 10 feet were common, and, using the criteria for assessing BDA by M-36E1, nearly all truck BDA was in the destroyed category. Table D-3 contains a sample of truck BDA by type bomb used in Commando Hunt V.

B-57G VEHICLE BDA CRITERIA

<u>BDA</u>	<u>WEAPON</u>	<u>CRITERIA</u>
DESTROYED	M-36E1	VEHICLE VISUALLY OBSERVED ON FIRE.
	MK-82 LGB	DIRECT HIT OR HIT WITHIN 15 FEET, OBSERVED ON IR SENSOR.
DAMAGED	M-36E1	IF THE VEHICLE WAS NOT OBSERVED ON FIRE, NO DAMAGE WAS CLAIMED.
	M-82 LGB	A HIT WITHIN 30 FEET, OBSERVED ON IR SENSOR.

B-57G EFFECTIVENESS

TRUCKS

	<u>TRUCK SORTIES</u>	<u>OBSERVED</u>	<u>STRUCK</u>	<u>D OR D</u>	<u>D OR D PER STRUCK</u>	<u>D OR D PER SORTIE</u>
10-31						
OCT	6	11	7	2	.29	.33
NOV	48	137	110	37	.34	.77
DEC	110	351	310	185	.60	1.68
JAN	190	695	578	409	.71	2.15
FEB	170	613	525	392	.75	2.31
MAR	197	885	812	599	.74	3.04
APR	143	567	467	307	.66	2.15
TOTAL	864	3267	2809	1931	.69	2.23

TABLES D-1/D-2

[REDACTED]

TRUCK BDA BY BOMB TYPE

<u>WEAPONS DELIVERED</u>	<u>NUMBER OF WEAPONS</u>		<u>TRUCKS</u>	
	<u>M-36E1</u>	<u>MK-82 LGB</u>	<u>DESTROYED</u>	<u>DAMAGED</u>
M-36E1	2073	-	1218	39
MK-82 LGB	-	425	301	7
MK-36E1 AND MK-82 LGB	247	162	225	4
TOTAL	2320	578	1744	50

TABLE D-3

Problems

The APQ 139 radar ground map mode was marginal and the GMTI mode was ineffective.

For the most part, performance of the navigation system was within design specifications. However, its degree of precision was inadequate to be used by itself for determining aircraft and target position to guarantee compliance with the rules of engagement.

Many of the specialized systems exhibited low-mean-time-between-failure and high-mean-time-between-repair rates.

During Commando Hunt V, CBU-27 canisters hung up in the Hayes dispenser on two occasions. Since these hung canisters could have ruptured fuel and hydraulic lines when the bomb bay was rotated, the use of the Hayes dispenser was discontinued until a positive safety feature could be incorporated.

[REDACTED]

APPENDIX E

WEATHER

One of the most important factors in the conduct of war in SEA is weather. During the northeast monsoon, decreasing rainfall in Laos allows roads throughout the Ho Chi Minh trail network to dry out. With drying of the roads, sections which were impassable during the rainy season become motorable, and the enemy logistics effort gains momentum. At the same time, low cloud ceilings begin to lift and better flying weather permits the air interdiction campaign to enter full-scale operation. Even though flying conditions over Laos and bordering provinces of RVN and Cambodia improve to a great extent during the northeast monsoon, they are still far from ideal, and weather continues to be a critical item in conduct of an air interdiction campaign.

TRANSITION TO THE NORTHEAST MONSOON

During the last half of October, the northeast monsoon gradually replaces the autumn transition season over all SEA, except for the southernmost regions. The autumn transition period is the shortest of the four seasons as the Intertropical Convergence Zone moves southward with little variance or regression. The airstreams of the northeast monsoon originate in the cold Siberian high-pressure areas of the northern hemisphere. The air moves south to the South China Sea, merges with the warmer air flowing from the western Pacific, and arrives over the east coast of SEA with modified temperatures and moisture content. Cloud coverage as a rule decreases over all of SEA. The exceptions to this condition occur along the southeast coast of NVN and the east coast of RVN. There is a sharp increase in cloudiness in these areas as they come under the influence of the northeast flow. Visibilities are for the most part good except for early morning fog in the northern valleys and during periods of widespread fog and drizzle. These extended periods of fog and drizzle are caused by moist easterly flow over the South China Sea and affect the Delta region of NVN and the coast of RVN, sometimes as far south as 12°N. During these times, ceilings are as a rule less than 1500 feet and visibilities less than two miles. Except along these coastal areas, light precipitation is normal throughout SEA during the first half of October. As the northeast monsoon becomes established, precipitation amounts increase along the coastal regions of Vietnam, while most days are rain-free in the areas west of the Annam Mountains.

NORTHEAST MONSOON WEATHER PATTERN

The first surge of the transition to the northeast monsoon was

[REDACTED]

felt along the northern portion of MR 1 of RVN in late September. On 30 September 1970, 6 to 10 inches of rain fell on this area. The rains set the stage for the strong northeasterly flow which prevailed over most of SEA north of 15°N. However, the southern portions were still dominated by light to moderate easterly flow until near the end of the month. The transition was somewhat slower than the one which occurred during October 1969. In general, the 1969 northeast monsoon was established from the DMZ area northward through NVN at the beginning of the month, and by 10 October, all of SEA was under its influence.

Several periods of extensive low cloudiness and rain occurred in October 1970 as four tropical disturbances passed through the South China Sea and two strong polar fronts moved into the area. In contrast, no tropical disturbances had affected SEA during the 1969 northeast monsoon. Two tropical storms entered RVN. Typhoon Kate went inland just south of Da Nang on 25 October, and Tropical Storm Louise made landfall southwest of Phan Rang on 28 October. The strong northeasterly flow and tropical disturbances caused southern NVN, most of eastern Laos, and northern RVN to have predominately cloudy skies and, at times, very heavy rains during the month. Because of the strong wind flow, the cloudiness spilled across the Annam Range into eastern Laos for an average of 20 to 30 miles. Marginal to poor flying conditions continued to dominate that area with low broken clouds occurring on about three-fourths of the days during the month. (Note: Flying weather is classified here as: (1) Poor - ceiling and visibility equal to or less than 3000 feet and 2 miles, (2) Marginal - ceiling and visibility between 3000 feet and 2 miles and 5000 feet and 5 miles, (3) Favorable - ceiling and visibility equal to or greater than 5000 feet and 5 miles.)

The very limited data available for the transition season for Cambodia indicate that cloudiness continued to decrease as expected under normal conditions. Middle and high clouds were dominant conditions over all areas throughout the month. Morning stratus and fog sometimes formed along the Mekong and other major rivers during the early morning hours, but often dissipated by mid-morning.

Rain occurred almost daily during the last half of the month over Vietnam between 15°N and 18°N. During the last week of the month, rainfall amounts on some days exceeded three inches over the northern portion of RVN due to the tropical storm and frontal weather activity. Some stations reported 24-hour rainfall amounts ranging from 6 to 18 inches. It is probable that even greater amounts of rain fell in areas where observations were not available. The result was widespread flooding.

By November, the northeast monsoon was well established, and all of SEA was under its influence. Strong northeasterly flow continued and produced considerable cloudiness over the eastern sections with the spillover into eastern Laos along the Annam Mountains averaging 5 to 15 miles. This strong flow caused poor flying

[REDACTED]

conditions over eastern Laos and Vietnam north of 13°N. The weather conditions over the western sections were typical for the month with a great deal of low scattered cloudiness and isolated rainshower activity. The strong flow was interrupted for brief periods by three tropical disturbances which passed through the South China Sea. As these storms approached the coast, flow over northern portions of Southeast Asia became northerly and allowed clearing over northern sections of Laos. The remains of two tropical storms, Marge on the 7th, and Patsy on the 21st, entered the central coast. As these storms moved inland, extensive cloudiness and rain prevailed over the coastal regions of Vietnam and extended over into southern Laos. Southern NVN, eastern portions of southern Laos, and the northern portion of RVN had poor conditions over 50 percent of the time, while northern Laos had near equal periods of poor, marginal, and favorable flying weather. The rest of SEA experienced favorable weather throughout the month.

The existing strong easterly to northeasterly flow continued to prevail over all of SEA during the first half of December. There was extensive cloudiness and rain over and east of the Annam Range with spillover along the ridge averaging 25 to 30 miles into eastern Laos. Increasing seasonal clearing was evident elsewhere. On the 16th, the flow became northerly, and clearing occurred over the entire area. This condition lasted for five days, and then easterly flow returned for the remainder of the month. Eastern Laos remained favorable until the 25th when significant spillover again returned. Western Laos and Cambodia continued to experience favorable flying conditions. Rainfall in these areas was in general less than one inch for the month.

During the month of January, light to moderate east-northeasterly through easterly flow prevailed over SEA. Except for occasional surges of the monsoon winds, spillover into Laos decreased to a large degree from that which occurred in December. During most of the month, extreme eastern Laos was at least marginally workable due to the decrease in spillover. The flying weather in MR 1 of RVN was poor to marginal most of the month, and there were very few days with favorable flying conditions. The flying weather in MR 2 was near seasonal expectations, while in the remainder of RVN and all of Cambodia it was quite good all month.

During the first ten days of February, all of SEA was under the influence of light east to northeasterly flow. Weather conditions during this time were typical of that expected for the month, and the poorest overall weather throughout the theater occurred during this time. Except for a short period of northeast monsoon weather following a surge on the 14th, the rest of the month had southeast to southerly flow which resulted in better weather than would be expected during February. Spillover into Laos was minimal after the 10th, and rainshowers and thunderstorms were reported in Steel Tiger

[REDACTED]

late in the month. Operationally, eastern Steel Tiger was favorable 50 percent of the time, while morning fog and stratus often occurred over eastern Barrel Roll. The predominate weather conditions of southern NVN and the northern portions of RVN remained poor to marginal. Flying weather in the southern half of RVN and all of Cambodia was favorable all month.

During the first half of March, the prevailing wind flow was from the east over SEA. After the 18th, the strength of the flow became lighter and the direction more southeasterly to southerly. Spillover into Laos was slight except during the period of the 7th through the 15th when surges caused low cloudiness to extend up to 30 miles into Laos. Haze often restricted visibilities near sunrise and sunset, over Laos, and morning fog was operationally significant over northeastern Barrel Roll during the first half of the month. MR 1 of RVN had quite poor flying conditions due to the abundance of low cloudiness, drizzle, and fog so common to this area during the north-east monsoon season.

During the first half of April, SEA was under the influence of south-southeasterly to easterly wind flow with occasional southerly flow over interior areas. Flying weather over Laos was in most cases favorable. However, conditions were sometimes marginal with haze and smoke, some patchy stratus and fog, and a few daytime thunderstorms over Barrel Roll. Afternoon and nighttime thundershowers were responsible for marginal conditions over Steel Tiger. Flying weather was quite good over the rest of the peninsula except for northern MR 1 in RVN and in Cambodia east of the Mekong. In MR 1, low stratus, drizzle, and fog contributed to occasional marginal conditions there, especially in the mountains. In eastern Cambodia, low visibilities produced by haze and smoke were the primary cause of marginal conditions; however, isolated rainshower and thundershower activity contributed somewhat to the problem. Even though April is in general considered to be a transition season month in SEA, overall rainfall for this period was below normal, in spite of some thundershower activity reported.

Table E-1 shows the number of days of favorable flying weather experienced during Commando Hunt V.

NUMBER OF DAYS WITH FAVORABLE FLYING WEATHER

	BARREL ROLL		STEEL TIGER		CAMBODIA		RVN (MR)				
	WEST	EAST	WEST	EAST	WEST	EAST	1	2	3	4	
<u>OCT</u>											
1970	23	4	19	3	22	25	6	12	26	30	
NORMAL	16	9	11	6	26	26	14	11	22	25	
<u>NOV</u>											
1970	27	9	16	5	29	27	4	8	21	26	
NORMAL	20	5	12	5	23	23	8	14	23	22	
<u>DEC</u>											
1970	23	6	26	6	31	29	4	5	29	30	
NORMAL	15	6	17	7	28	27	9	15	27	26	
<u>JAN</u>											
1971	27	15	28	8	31	31	3	11	29	31	
NORMAL	15	8	15	5	27	29	9	12	23	25	
<u>FEB</u>											
1971	23	6	27	14	27	26	4	11	27	28	
NORMAL	15	9	14	5	24	24	7	17	23	21	
<u>MAR</u>											
1971	29	9	31	21	30	25	4	16	31	31	
NORMAL	13	10	14	6	25	26	12	19	25	25	
<u>1-15 APR</u>											
1971	15	4	15	11	12	12	8	13	15	15	
NORMAL	7	5	8	4	8	9	6	7	7	9	

NOTE: BARREL ROLL WEST CONTAINS MR I AND THE WESTERN HALF OF MR V. BARREL ROLL EAST CONTAINS MR II, THE EASTERN HALF OF MR V, AND THE NORTHERN PORTION OF MR III.

STEEL TIGER WEST IS THE PORTION OF SOUTHERN LAOS WEST OF THE VR SECTORS. STEEL TIGER EAST IS MADE UP OF THE 14 VR SECTORS.

THE MEKONG DIVIDES CAMBODIA INTO EAST AND WEST AREAS.

TABLE E-1



APPENDIX F

USAF LOGISTICS IN SEA

The employment during Commando Hunt V of a wide spectrum of complex weapon systems required a continuous flow of supplies, equipment, munitions, fuels, and skilled personnel. In April 1971, the assigned personnel in 7AF totaled 26,136 with 13,205 engaged in materiel and support functions. Manpower authorizations were based on a 60-hour work week, but direct support and maintenance personnel averaged 85 hours per week.

The logistics support of RVN-based weapon systems was the responsibility of the 7AF Commander, while Thailand units were supported by the Commander, 13AF, with headquarters at Clark Air Base, Philippines. In Thailand, the Deputy Commander, 7/13AF, received his operational guidance from the Commander, 7AF, and his logistics support policies and resources from the Commander, 13AF. This split in logistics administration worked very well as long as the Commander, 7AF, was provided with the daily status of total weapon systems posture.

Extraordinary measures were required to support aircraft requirements. These measures included the increased use of cannibalization of equipment, drawdown of serviceable stocks, expedited lateral support, increased use of War Readiness Spares Kits, increased priority requisitioning, and heavy reliance upon airlift. These measures are detailed herein in terms of the functional areas of materiel, i.e., Transportation, Maintenance, Munitions, and Supply.

TRANSPORTATION SUPPORT.

Logistics were maintained through the direct support provided by the 834th Air Division Air Lines of Communication (ALOC), in conjunction with the operation of aerial ports. During the period 1 November 1970 through 30 April 1971, the 834th AD flew 146,301 sorties with four different types of aircraft (Table F-1). These missions supported operations such as Commando Vault and Lam Son 719, as well as continuing Bladder Bird support.

Combat-Essential Support

During Commando Hunt V, combat-essential (CE) resources took priority and were delivered to line troops with minimum delay. Cargo for CE missions consisted of 82 tons of aircraft engines, 2495 tons of bombs and rockets, 148 tons of ground support equipment, one O-2A aircraft, 83 maintenance support passengers, and eight K-9 dogs. Bombs and rockets for direct support of combat operations occupied 92 percent of the total combat-essential materials moved (Table F-2).

TOTAL AIRLIFT SORTIES

<u>AIRCRAFT TYPE</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
C-130	5839	6714	6432	6853	8025	6315	40178
C-123	5984	5898	5648	4887	5437	4039	31893
C-7	11009	11539	11431	10647	11857	11389	67872
C-7 (RAAF)	946	1095	1039	953	1061	994	6088
TOTAL	23778	25246	24550	23340	26380	22737	146031
DAILY AVERAGE	793	814	792	834	851	758	806

TABLE F-1

**COMBAT ESSENTIALS MOVED
(TONS)**

	<u>BOMBS AND ROCKETS</u>	<u>GROUND SUPT. EQUIP</u>	<u>AIRCRAFT ENGINES</u>	<u>TOTAL</u>
NOV	11.0	.5	8.0	19.5
DEC	667.5	12.0	4.5	684.0
JAN	878.5	18.5	14.0	911.0
FEB	104.0	34.0	12.0	150.0
MAR	701.0	80.5	36.5	818.0
APR	133.0	2.0	7.5	142.5
TOTAL	2495.0	147.5	82.5	2725.0

TABLE F-2

[REDACTED]

In addition to regular support operations, the 834 AD conducted Commando Vault operations. These operations were designed to clear helicopter landing zones. A total of one hundred and sixteen 15,000-pound BLU-82 high-explosive bombs were dropped during the campaign, and 72 of these were dropped in RVN.

Aerial Delivery

Through its aerial delivery and mobility sections, aerial port personnel maintained the capability to provide mobile cargo and passenger processing teams at many forward operating locations. Aerial port mobile teams, consisting of four personnel each, handled an average of 400 passengers, 400 tons of cargo, and 100 aircraft sorties per month.

The aerial ports also deployed other teams where needed. In support of Lam Son 719, three six-man teams deployed to Dong Ha. The programmed workload indicated a need for three teams because of multiple operations, possibility of a 24-hour operation, and extended deployment to other locations. Two of these teams later deployed to Khe Sanh. During this operation, these mobility teams handled 10,887 tons of cargo and 21,693 passengers.

All told, 3500 missions moving 30,000 tons of cargo and 40,000 passengers supported Lam Son 719.

AIRMUNITIONS SUPPORT

The primary munitions objective for Commando Hunt V was to provide undisputed munitions support to sustain tactical forces. From July to November 1970, when the munitions were being programmed for Commando Hunt V, emphasis was placed on reduction of SEA munitions stocks. Despite this emphasis, a build-up of munitions in relation to storage capacity was experienced due to reduction in storage facilities and under-expenditure of anticipated requirements. The chief cause of under-expenditures was the prolonged wet season and the resultant reduction in targets due to marginal flying conditions. As a result of the growing stock levels, munitions programming was adjusted downward starting in July 1970. Through the many efforts initiated to adjust munitions stockage and the increased expenditures during the campaign, 7AF stock reduction objectives were achieved. On-hand munitions reached 75 days of supply level by the end of January and munitions storage was in a favorable condition by the close of Commando Hunt V (60,000 tons). Programming accomplished during the campaign was designed to restore critical munitions levels and to preclude a recurrence of stock build-up during the first half of FY 72.

[REDACTED]

During the Commando Hunt V campaign, USAF units in SEA expended 152,755 tons of airmunitions valued at \$414 million. A summary of the expenditures of major munitions elements is listed in Table F-3.

AIRMUNITIONS EXPENDITURES								
	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
MK-82 GPB	37617	46100	44474	44845	38893	54647	41659	308235
KMU-388 KITS	0	0	64	119	98	208	185	674
MK-84 GPB	318	213	416	444	962	1237	1474	5064
KMU-351 KITS	82	120	55	247	556	586	729	2375
M-118 LGB	0	0	49	137	20	50	38	294
CBU-24	2474	4507	7592	9214	6402	8638	6938	45765
CBU-25	1866	2105	2499	2034	2206	1677	1328	13715
CBU-49	410	663	1360	1546	2693	1346	986	9004
FIRE BOMBS	4136	2450	4954	5194	7647	11631	6212	42224
BLU-82	8	8	21	10	6	35	28	116
MK-24 FLARES	10422	10241	10561	10897	19359	23898	14604	99982
40 MM ROUNDS	300	3656	26667	78641	90400	130700	135500	465864
2.75" ROCKETS	33453	26090	27054	28582	34481	35233	41300	226193
TOTAL TONS	14766	17537	20922	25065	21445	29027	23993	152755
DOLLAR VALUE	\$30M	\$42M	\$45M	\$85M	\$69M	\$78M	\$65M	\$414M

TABLE F-3

MAINTENANCE SUPPORT

Aircraft Maintenance Capability

During Commando Hunt V, units of 7AF and 7/13AF were tasked at an ever-increasing sortie rate each month through March. This sustained

[REDACTED]

high level of activity had an adverse effect on aircraft and equipment. In January, the Operational Ready (OR) rate for USAF tactical strike aircraft in SEA went below the DOD standard and remained there, however, there was a levelling effect in March caused in part by an even greater effort on the part of the maintenance personnel involved. The OR rate reached a high 73 percent and a low of 68 percent. The DOD standard was 71 percent. As the number of sorties increased and the OR rate decreased, more aircraft were required to fly multiple sorties in a given day, allowing less maintenance to be performed between each sortie. Table F-4 shows USAF sorties, flying hours, and maintenance manhours per sortie by month through March.

STRIKE AIRCRAFT SORTIES, FLYING HOURS, AND MANHOURS PER SORTIE (NOVEMBER - MARCH)			
	<u>SORTIES FLOWN</u>	<u>HOURS FLOWN</u>	<u>MANHOURS PER SORTIE</u>
NOV	8700	16700	74
DEC	9500	19000	78
JAN	10300	21000	68
FEB	10400	19600	63
MAR	12800	23800	64

TABLE F-4

AC-119 Maintenance Manhours

During the campaign, it became more and more difficult for the 14th Special Operations Wing to operate one main support base and three forward operating locations. The standard manning factor for the AC-119G was 18 manhours per flying hour and 21 manhours for the AC-119K. These manning factors did not yield sufficient manpower to maintain the dispersed gunships seven days a week, 24 hours a day. An authorization of an additional 128 maintenance personnel was requested. PACAF forwarded to CSAF a recommendation that 128 spaces be added and that the manhours per flying hour be changed to 26 for both aircraft. To provide immediate relief, PACAF also requested and received 140 TDY maintenance personnel for 120 days.

[REDACTED]

Unique Avionics System Support

A number of unique avionics systems were installed on certain types of strike aircraft. These systems enhanced the aircraft capabilities to seek out and destroy enemy targets.

Late in 1970, an operational requirement existed for an accurate sensor system for medium-altitude photography. The KA-82 sensor system installed in the RF-4C fulfilled this requirement and reduced the risk to aircrews operating in high threat areas. Until installation of the KA-82 in the RF-4C, it was used only in RB-57 aircraft which operated in low-threat areas. Seventh Air Force received permission from CSAF to install KA-82 sensors in the RF-4C from available assets and to buy some additional systems. With the KA-82 sensor system, the RF-4Cs operated in nonpermissive areas and reduced the time aircrews were exposed to enemy AAA and SAM defense system. The KA-82 superior imagery, large area cover, and high speed capability eliminated the need for multiple passes over the target area.

Because of the high failure rate of the attitude director indicator (ADI) in the F/RF-4 aircraft, AFLC initiated two programs: Pacer Roll--replacement of the unreliable primary ADI with reconditioned components, and Pacer Crown--installation of a self-contained two-inch standby attitude indicator. A depot team visited 7AF F/RF-4 units and instructed assigned personnel in the installation of the aircraft wing wiring.

Seek Silence was the name of a program which provided secure ultra-high frequency (UHF) radio communication. This program required modification of aircraft wiring and UHF radios, and installation of a coding or scrambling device (KY-8/28). The KY-8/28 was a security-controlled item and was only carried when an operational requirement existed. This system permitted forward air controllers to transmit intelligence information necessary for tactical operations without divulging it to the enemy.

Igloo White prime mission equipment (PME) was installed in the QU-22 aircraft for the purpose of relaying intelligence data between implanted sensors and the sensor control monitoring station. This equipment was operated in the QU-22 aircraft; however, due to aircraft engine performance problems in the QU-22, the feasibility of installing this equipment in the Airborne Battlefield Command and Control Center (ABCCC) C-130 aircraft was examined. An evaluation of this was authorized by PACAF and was being conducted when the campaign ended.

Aircraft and Engine Deficiencies Affecting Combat Capability

Recurring engine problems hampered the QU-22 aircraft. An Aeronautical Systems Division team completed detailed tests in aircraft at NKP on 4 April. The team recommended providing contractor

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maintenance support, revising of technical orders, improving of parts quality control, and continuing of the existing time compliance technical order program. The team estimated the problems would be solved by September 1971.

The R3350-89B engine had been a major problem since the introduction of the AC-119G/K aircraft into SEA. As one weak area was strengthened, additional problems were identified. Problems which developed in November and December resulted in the design of a new exhaust valve to prevent ovalization. Installation of -93 nose case assemblies on all gunship engines was accomplished to stop propeller shaft cracking. A SAAMA team performed the nose case change during the third quarter of FY 71. In addition the development of a new R3350-95W engine promised further improvement in engine reliability. The first R3350-95W engines were received in March and all future replacement R3350 engines were to be -95Ws. This particular engine was a composite of the -89B and -93 engines. A complete swap-out of -89B for the -95W engines was anticipated by mid-September 1971.

On 29 January and 13 February, B-57G main gear retread tires failed, and an emergency unsatisfactory materiel report was submitted, requesting immediate replacement of retreads with new tires. At this time, the depot advised that 150 new tires were available to support the 8 TFW and that 30 new tires would be sent at once. A total swap-out of new tires for retreads was completed on 7 March, and the Commander of AFLC directed only new tires for B-57G aircraft be furnished PACAF.

SUPPLY SUPPORT

To provide supplies and equipment necessary to support a variety of weapons systems in RVN, the 7AF supply system maintained 350,000 line items valued at \$300 million. From November through April a total of 563,400 demands were placed on the supply system in support of mission requirements. Of these demands, 277,100 were priority requests (Table F-5). Dollar value obligations for the same period totaled \$18,914,000.

The best single measure of aircraft supply support was non-operationally ready, supply (NORS) rate. This measure reflected the percentage of aircraft which were not mission capable for lack of parts. The 7AF NORS rate remained below the Department of Defense standard of 5 percent except during February (Table F-5). The failure to meet the 5 percent standard in February was attributed to the impact of Lam Son 719.

Consumption of aviation fuels from October through April totaled 403 million gallons (Table F-6). Four million gallons per month were consumed in direct support of Lam Son 719. Four C-130 and two C-123 bulk-aerial-refueling delivery system aircraft flew 262 sorties and

SUPPLY ACTIONS

	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOTAL</u>
REQUESTS	84400	93700	111800	96500	89000	88000	563400
PRIORITIES	43400	44200	53700	45600	45200	45000	277100
PRIORITY REQ.	35300	33100	49300	45900	53200	51000	267800
OBLIGATIONS	\$3.223M	\$1.997M	\$2.778M	\$3.301M	\$3.790M	\$3.825M	\$18.914M
NORS RATE	3.6%	4.8%	4.4%	5.1%	4.7%	4.6%	

TABLE F-5

AVIATION FUELS USAGE

(MILLIONS OF GALLONS)

	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>TOT</u>
JP-4	49	51	53	52	55	49	47	356
115/145	6	7	7	7	7	6	7	47
TOTAL	55	58	60	59	62	55	54	403

TABLE F-6

airlifted 890,000 gallons of fuel in support of Lam Son 719.

During Lam Son 719, supply of spare parts was not a serious problem, however, there was a definite drawdown of serviceable stocks. Had the surge continued for a protracted period, extra ordinary resupply measures would have been required. AGE and vehicle support was not as responsive as aircraft spares support. Items such as bomb lifts received heavy use and suffered high out-of-commission rates.

Commando Hunt V was made possible through the efforts of a large number of dedicated, mission-oriented people from many disparate agencies. Its success reflected a superb combination of skilled aviators and experts in the field of logistics.



APPENDIX G

DATA BASES

Analysis of day-to-day SEA air activities, compilation of operational reports, and the historical documentation of the Commando Hunt V campaign were dependent upon the accurate collection, processing, and storage of large amounts of data. To assist in this task, information relating to SEA air activities was processed by computers and stored on tapes and discs where it was available for future retrieval and analysis. This appendix describes those data bases within 7AF that provided information utilized in the preparation of the Commando Hunt V campaign report. These data sources were the Mission Summary file (MISSA), the Infiltration Surveillance file (IGTFA), the AAA Reactions file (FLAKA), the Southeast Asia Data Base (SEADAB), the Aircraft Destroyed and Damaged file (DAD), the FAC Activity Report (FACACT), and the Arc Light file (ARKLA).

MISSION SUMMARY FILE

The Mission Summary File (MISSA) contained the bomb damage assessment history for the air war in Cambodia, Laos, and NVN, and was the official source for data relating to BDA. The primary sources of information entered into MISSA were the Operations Report-4 (OPREP-4) from tactical units and the Daily Intelligence Summaries (DISUMs) submitted by FAC units. The Directorate of Targets updated these data through interpretation of reconnaissance photos and other intelligence sources and surveyed all reports to eliminate duplication of BDA in the file. One item of major interest was the result of tactical air strikes against the enemy transportation and supply system. Extensive documentation of air strikes against trucks was entered in the file, and included visual truck observations (by FAC and tactical aircrews), trucks struck, trucks destroyed, trucks damaged, and truck-associated fires and secondary explosions. Information contained in the MISSA file included:

- Mission date
- Mission number
- Call sign
- Time of ordnance drop
- Day/night
- Unit
- Type mission
- Mode target sighted (visual, radar, etc.)
- Map coordinates
- Route package (Steel Tiger East, Barrel Roll West, etc.)
- Project indicator (Barrel Roll, Steel Tiger, etc.)
- Tiger number (target identifier)

[REDACTED]

- FAC call sign
- Strike mode
- Reason why target was not struck
- Reason why no strike results
- BDA
- Characteristic movement (southbound, parked, etc.)

INFILTRATION SURVEILLANCE FILE

The Infiltration Surveillance file (IGTFA) contained a history of sensor-detected activity (wheeled and tracked vehicles). This activity was first picked up by sensors implanted along the enemy lines of communication and transmitted to QU-22Bs and EC-121s orbiting over the area. These data were relayed to the Infiltration Surveillance Center (ISC) at Task Force Alpha where the information was entered in the ISC file (implemented in October 1970) and transmitted daily to 7AF Data Division, Directorate of Targets (INTD), and MACV via AUTODIN. The IGTFA file contained the following information:

- ISC sequence number
- Date
- Target type
- Number of targets
- Direction of travel
- Speed
- Time of initial detection
- Initial tracking module, string, and member number
- Location of initial detection
- Time of final detection
- Final tracking module, string, and member number
- Location of final detection
- Route segment
- Operational area
- Time transmitted to 7AF

AAA REACTIONS FILE

The AAA Reactions (FLAKA) file contained a history of enemy defensive reactions against US aircraft. The Directorate of Operational Intelligence (INO) coded the following data from OPREP-4s and DISUMs and entered them into the file:

- Type of aircraft
- Target
- Location
- Time of incident
- Type of weapon
- Accuracy
- Intensity
- Number of rounds of AAA fire
- Aircraft altitude

[REDACTED]

SOUTHEAST ASIA DATA BASE

The Southeast Asia Data Base (SEADAB) contained data relating to missions scheduled and flown by Air Force (excluding Arc Light), Navy, Marine, VNAF, RLAF, and Royal Australian Air Force (RAAF) aircraft in RVN, Cambodia, Laos, and NVN. This information was extracted from fragmentary orders, OPREP-4s, and OPREP-8s (telephonic reports from FAC units) and entered into the file on a daily basis. The following data were in the file:

- Day and year
- Mission number
- Unit
- Launch base
- Mission call sign
- Aircraft type and series
- Day/night indicator
- Flight following code
- Fragged/flown data
 - Service
 - Number fragged/flown
 - Mission function
 - Route package
 - Time over target/last time on target
 - Flying time
- FAC controlling mission
- FAC flying time
- Primary/alternate target
- Special operations
- Reason for deviation from frag information
- Flying time of aborted mission
- Ordnance carried
- Ordnance expended/jettisoned/returned
- Ordnance delivery mode
- Operation supported
- Reconnaissance results (successful/unsuccessful)
- Target type
- Target coordinates
- Tiger target number
- Province
- BDA
- Aircraft loss/damage data
 - Aircraft type and serial number
 - Service
 - Base
 - Unit
 - Cause
 - Tactic
 - Altitude
 - Mission function

[REDACTED]

Location where hit
Location where downed
Crew status

The Directorate of Automated Systems (DOY) maintained a file of 79 computer retrievals for extraction of air operational data from the SEADAB file. One of the primary inputs to the Commando Hunt V campaign report from SEADAB was information on tactical air sorties by target type. On a majority of missions flown by tactical aircraft, ordnance was released on more than one target complex, and each strike was recorded by target type. Certain SEADAB retrievals classified sorties by target type based on the first target struck; therefore, a fighter sortie which struck a truck park on its first strike and later made a strike against trucks was classified as a truck park sortie. This allowed for a complete sortie count without duplication. Other retrievals classified sorties by target type based on whether they struck a certain type target at any time during the sortie. These retrievals allowed calculation of aircraft effectiveness against specific target types. However, combining sortie totals from two or more target types could result in double counting of some sorties. In addition to being the primary source for tactical air sortie count, the SEADAB file was the official record of bomb damage assessed in RVN.

AIRCRAFT DESTROYED AND DAMAGED FILE

The Aircraft Destroyed and Damaged (DAD) file was maintained by the Directorate of Tactical Analysis (DOA) and contained information concerning battle damage and losses sustained by US aircraft. Data were entered into the DAD file from three sources. DOA received information on aircraft damage on AF Form 40s from all USAF units. This was supplemented by data on aircraft losses extracted from SEADAB and additional damage reports on USAF, Navy, and Marine aircraft recorded in the Aircraft Combat Loss and Damage File (HISTA) maintained by INTD. The HISTA file was based on information from unit-submitted OPREP-4s. The information in the DAD file included:

Date of incident
Type aircraft
Tail number, squadron, and base
Sortie function
Type target
Day/night
Route package where hit
Airspeed and altitude
Number of passes at same target
Type defense

FAC ACTIVITY REPORT

The FAC Activity Report (FACACT) file, maintained by DOA, was

[REDACTED]

compiled from data extracted from the Moonbeam and Hillsboro 7ACCS FAC worksheets submitted daily by the Airborne Battlefield Command and Control Center (ABCCC). This file was used as a source for FAC activity reported in the weekly OPREP-5. This file included:

Total sorties by aircraft type by VR sector
Total time flown by aircraft type by VR sector

ARC LIGHT FILE

The Arc Light file (ARKLA) contained a historical summary of B-52 strike missions in SEA. The file was updated weekly by the Arc Light branch (INTTT) from OPREP-4s submitted by the SAC units and contained only crew-observed BDA. The file contained the following data:

Date of strike
Time on target
Target type
Special Arc Light operating area
Route segment
Center coordinate of strike box
Country
BDA (number and size of fires and secondary explosions)
Number of A/C reporting BDA, no BDA, and RNO
Number of A/C diverted to alternate target and reason

ACCURACY OF THE DATA COLLECTION PROCESS

The data collection process in support of air operations in SEA was a large and complex operation and involved reporting, transmitting, and interpreting of a very large number of items of information on a daily basis. As in any manual information-gathering process of this size, it is recognized that there was opportunity for human error. The data passed through several channels before being recorded in the various data bases. The complexity of this collection effort can be seen by examining the procedures for reporting the results of a tactical air strike. A pilot returning from a strike mission was debriefed by intelligence personnel and the results of the mission reported by the unit via the OPREP-4 to 7AF. This information was then coded and entered into both the SEADAB and MISSA files through use of the 2260 cathode ray tube and IBM cards. Further updates of the bomb damage assessment, reported by FACs via DISUMs, were also entered into the MISSA file. Incomplete or inaccurate data could be entered into the system through errors in reporting by the aircrews, mistakes in completing and transmitting of the OPREP-4s and DISUMs, and improper coding or keypunching at the computer centers. While these and other opportunities for errors did exist, an effort was made to maintain quality control of these data bases.

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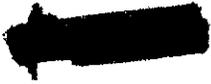
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