Rolling Thunder
July 1965 - December 1966

HQ PACAF
Directorate, Tactical Evaluation
CHECO Division

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The counterinsurgency and unconventional warfare environment of Southeast Asia has resulted in USAF airpower being employed to meet a multitude of requirements. These varied applications have involved the full spectrum of USAF aerospace vehicles, support equipment, and manpower. As a result, operational data and experiences have accumulated which should be collected, documented, and analyzed for current and future impact upon USAF policies, concepts, and doctrine.

Fortunately, the value of collecting and documenting our SEA experiences was recognized at an early date. In 1962, Hq USAF directed CINCPACAF to establish an activity which would provide timely and analytical studies of USAF combat operations in SEA and would be primarily responsive to Air Staff requirements and direction.

Project CHECO, an acronym for Contemporary Historical Examination of Current Operations, was established to meet the Air Staff directive. Based on the policy guidance of the Office of Air Force History and managed by Hq PACAF, with elements in Southeast Asia, Project CHECO provides a scholarly "on-going" historical examination, documentation, and reporting on USAF policies, concepts, and doctrine in PACOM. This CHECO report is part of the overall documentation and examination which is being accomplished. It is an authentic source for an assessment of the effectiveness of USAF airpower in PACOM when used in proper context. The reader must view the study in relation to the events and circumstances at the time of its preparation—recognizing that it was prepared on a contemporary basis which restricted perspective and that the author’s research was limited to records available within his local headquarters area.

Robert E. Hiller
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FOREWORD

This study of air operations against North Vietnam - ROLLING THUNDER - is concerned primarily with the policies and plans governing the program. Emphasis has been placed on the Air Force role although vital contributions made by other services also must be recorded in order to achieve a well-balanced picture. It is hoped that this report, when read in conjunction with other CHECO studies dealing with different facets of ROLLING THUNDER, will contribute toward a better understanding of this program.

A definitive study and evaluation of ROLLING THUNDER remains in the future since the program is still in progress. For the present, it can be said that air operations have not stopped the flow of men and material from the North into South Vietnam, but they have forced Hanoi to pay a heavy price for its continued support of the insurgency. They have not brought Hanoi to the point of negotiating peace terms nor caused a complete demoralization of the North Vietnamese. However, air strikes have caused serious economic dislocations in the North and dramatically illustrated U.S. power and determination - as well as restraint. The cumulative effect of the selective bombing of North Vietnam targets cannot be currently assessed, but it will probably have considerable impact on communist plans for the future conduct of the war. The ROLLING THUNDER program unquestionably has had a salutary effect on the morale of our South Vietnamese allies.

These accomplishments are especially noteworthy when viewed against
the numerous political restraints which have hindered the effective employment of air power. The unique experience gained from the ROLLING THUNDER program is expected to make a valuable contribution to U.S. strategic air plans and policies.
INTRODUCTION

Planning for air strikes against North Vietnam began in June 1964 when the JCS asked CINCPAC to prepare targets in North Vietnam for air strikes. Following attacks on two Seventh Fleet destroyers in the Gulf of Tonkin, in August 1964, U.S. Navy aircraft attacked five naval bases in North Vietnam. Following this incident, a sizable deployment of air units to Southeast Asia and other Pacific bases was carried out. No retaliatory strikes were made subsequent to the mortar shelling of Bien Hoa in November or the Brink BOQ bombing of December 1964 but, by that time, planning for NVN strikes was quite advanced, with units earmarked and readied for such strikes. The Viet Cong attacks against American installations at Pleiku and an enlisted men's billet in Qui Nhon in February 1965 resulted in U.S. retaliatory strikes against the North. The FLAMING DART reprisal strikes were followed by a program of systematic attacks on North Vietnamese targets. Known as ROLLING THUNDER, these strikes began in March and details of the operations for the first half of 1965 are contained in CHECO Report, "ROLLING THUNDER; March–June 1965."
During the first week of July, air strikes pushed further north as the targets remaining below 20° were being struck. Armed reconnaissance missions were being directed against lines of communication. Although attention was drawn to the increasing numbers of AA sites, which had succeeded in bringing down two F-105's and damaging six other aircraft, there was a continuing interest in the enemy SA-2 activities. Five of these SAM sites had been discovered, although none were occupied. With the steadily dwindling number of profitable targets outside heavily defended areas, the enemy was redeploying and concentrating AA weapons around the remaining targets. 1/

The USAF and USN were each flying some 1200 sorties per week, while the VNAF averaged about 130. Navy efforts were being directed more and more to armed reconnaissance while USAF operations were, primarily, toward fixed targets. USAF strikes were being flown against inland targets, while the Navy operated in the better-weather coastal area favoring armed reconnaissance. 2/

Hostile Air Action

It was at this time that hostile air action was encountered. Although Navy aircraft had met MIG aircraft a few days previously, the USAF "first" occurred on 10 July, when an F4C downed a MIG-17.

By mid-July, of the 117 JCS targets below 20° North, 91 had been
attacked, with all POL storage areas and airfields damaged, 23-24 key bridges destroyed or severely damaged, and 1,151 buildings destroyed. Only 18 of 132 JCS targets above 20° North had been attacked as of 18 July, with strikes against two airfields, one supply depot, one POL storage area, one radar site, two bridges, six ammo depots and five barracks areas. Included were targets 40nm south of the Chicom/NVN border.

**SAM Defenses**

On 23 July, an RB-66 ELINT (electronic intelligence) aircraft intercepted FAN SONG radar signals, a type employed in the SA-2 guidance system. The location was estimated 23 nautical miles west of Hanoi where there were no previously identified SA-2 installations. Although five of these sites had been located earlier in July, there had been no previous evidence that any were operational.

Pilots preparing for strikes against NVN the following day, 24 July, were briefed on the SA-2 envelope around Hanoi and the signals which had been picked up the previous day. Two flights of four F4C's each (from Ubon) were in the target area flying "high cover" when, at 0850Z, an accompanying RB-66 intercepted FAN SONG signals and flashed a warning. The SA-2 site was estimated as being approximately 20 nautical miles west of Hanoi. Shortly thereafter, a pilot in Leopard Flight observed a missile climbing at an estimated speed of Mach 1, with a climb angle between 65 and 85 degrees. Within seconds it detonated and struck an F4C of the flight. The aircraft disintegrated in a brown-colored fireball, but one
of the other pilots was reasonably sure he had seen two seats eject. Two other missiles were observed to detonate behind the flight; the three remaining pilots took violent evasive action and recovered safely at their bases.

On 28 July, a 54-aircraft strike force was readied for attacks on SAM Sites 6 and 7 (JCS designation), the two suspected of shooting down the F4C. Other targets scheduled for this strike included the Cam Doi and Phu Nieu Barracks, believed to be supporting the SAM sites. Aircraft had been prepared for another mission but were downloaded and refitted with napalm and CBU weapons just prior to take-off. At 0700Z, the planes were over the target. At an altitude of 50 to 100 feet, the aircraft flew, four abreast, through heavy ground fire to deliver CBU's and napalm on the two SAM sites. Six of the 54 aircraft flying the strikes were downed, with one pilot being recovered. The mission commander later reported that the short (two and one-half hours) prior notice had precluded target study. Subsequently, one of the SAM sites was identified as a dummy - possibly intended as a trap; the other (Site 7) was unoccupied, but there was no damage to revetments or associated structures.

According to PACAF Intelligence, the July air strikes created a major transportation problem in parts of NVN. Damage to the Hanoi/Lao Cai rail link left that line inoperative in the Dong Khai area and affected resupply from China. Supplies, however, continued to pour into NVN via the northeast rail line, which had not been struck, and the Port of Haiphong, which was not authorized for air strike.
While the increasing number of air strikes against NVN was believed by PACAF Intelligence to be inflicting extensive damage below 20° and gradually cutting Hanoi off from the rest of the country, a buildup of NVN defenses against air attack continued. With many major routes being interdicted, the enemy was forced into wide detours and the use of fords, ferries, truck shuttles, human porters, animal pack trains, transshipments and considerable reconstruction. By the end of August, however, 18 confirmed SA-2 sites and 18 suspected SAM areas were reported in NVN, principally around the Hanoi/Haiphong complex. The enemy possessed a total of 4,170 medium and light AW and 6,249 prepared positions. At Phuc Yen Airfield, the NVN had 66 Fagot/Fresco fighters and eight Beagle light bombers. The enemy fighters had not been committed to attacks on U.S. strike aircraft since the 10 July encounter.

The trend for the USAF, during August, was away from strikes against fixed targets and inclined toward armed reconnaissance missions, with operations continuing to expand northward. Of the 131 JCS targets above 20° North, 28 had been attacked by the end of August. Targets struck in the northern area included: two airfields, two SAM sites, a supply depot, one POL storage site, an island radar site, seven bridges, eight ammo depots, five barracks areas and one thermal power plant. Operations continued outside the Hanoi/Haiphong prohibited area and well away from the Chicom/NVN border.

Of the 22 JCS targeted bridges south of 20°, 21 had at least one span collapsed. The Thanh Hoa Bridge (JCS #14) still stood, although it was reportedly severely damaged by strikes during each of seven ROLLING THUNDER
Fig. 2

ROLLING THUNDER OPERATIONS
July, 1965

O - Sam Sites

Hanoi/Lao Kay Rail Line
Northeast Rail Line
cycles. Struck with 3,000-pound bombs during ROLLING THUNDER 24, 25 and 28, PACAF reported "it is now considered 95% destroyed and unserviceable except for pedestrian traffic." However, if true, this was only a temporary condition. Other strikes during the period resulted in the successful interdiction of the northwest rail line to Kunming. However, this was only a temporary condition. Other strikes during the period resulted in the successful interdiction of the northwest rail line to Kunming.

As a result of the SAM threat, a ground-alert posture was established, under the code name of IRON HAND, to respond to ELINT or other reconnaissance information indicating an active SA-2 site. A decrease in effective sorties was noted on 12, 14 and 15 August when this alert force was not launched. Commencing 15 August, however, the alert aircraft struck hard targets and flew armed reconnaissance missions. Little success was experienced with IRON HAND alert aircraft during August. Concern for the SA-2 threat was evidenced by PACAF, who considered it a restraining factor in mission planning and execution, inasmuch as the threat dictated ground-alert posture, ordnance loads, and tactics (low- versus high-altitude) and affected attrition factors. Based on positive intelligence, the mobility tactics in SA-2 deployment were considered the primary reason for lack of success in attacking new sites.

On 9 August, an attack was made by USAF aircraft on SAM Site #9, with tactics differing from those used during the strike of 27 July. Although the site was later determined to be unoccupied, the new tactics were effective in terms of survival against ground fire and in the ability to deliver an effective weight of ordnance. The basic method consisted of three flights of F-105's (two aircraft per flight) armed with napalm and
CBU's, and attacking at minimum altitude and high speed from widely divergent approach headings, followed by six F-105's delivering 750-pound bombs from a low-altitude "pop-up" attack. The initial low-altitude attacks being concentrated on the missiles and launchers. Attacking forces were backed by MIGCAP, ECM, ELINT and SAR and, despite intense ground fire, only one aircraft received damage.

Three days later (12 August), the Navy lost an A-4 to an SA-2 missile. An intensive effort was made to locate and destroy the site, but without success. Difficulty in acquiring occupied SAM sites hampered efforts of the IRON HAND alert aircraft which continued to fly armed reconnaissance missions.

Despite addition of 3,000-pound bombs to the USAF inventory, strike planes were carrying more and more CBU and napalm to be used against SA-2 targets. With prospects of a shortage of 750-pound bombs, aircraft were carrying less ordnance. Both factors contributed to the drop in munitions tonnage delivered.

Losses were relatively high during August, with 19 aircraft downed during the last three weeks of the month; nine USAF and 10 Navy. BIG EYE sorties continued in support of attacking aircraft.

During ROLLING THUNDER 30 and 31 (3-16 September) the USAF struck two JCS hard targets and provided the major effort against three other barracks targets assigned the VNAF. Sorties against these targets, plus 610 armed reconnaissance sorties flown in the two-week period, raised the USAF strike
sortie level to 1,027, the highest achieved during any previous two-week cycle. Efforts to locate and destroy SA-2 sites continued to be a major portion of the effort. On 16 September, two F-105's of a strike force of six seeking an SA-2 site, were lost. The USAF returned to night operations during this period, using the B-57 as a strike aircraft and the C-130 as the navigation and flare ship. The B-57's carried 260-pound fragmentation bombs - 21 per aircraft. Tonnage dropped by USAF aircraft during the period rose 70 percent due to the increased strike effort.

During ROLLING THUNDER 32 and 33 (17-30 September) the USAF struck three JCS-targeted ammunition depots at Yen Son, Tai Xouan, and Ban Nuoc Chieu, and made the primary effort against two JCS barracks areas at Hoan Lao and Vinh Linh. The U.S. Navy hit four JCS targets during this cycle. Each being authorized 600 armed reconnaissance sorties, the USAF flew 666 and the Navy 575. The VNAF effort was dropping off, with the Vietnamese flying only 10 of the 2,675 sorties flown during the two-week period.

In the four-week period of 2-30 September, 21 aircraft were lost (11 USAF, eight Navy and two VNAF) but none to SA-2 missiles. On 20 September, a U.S. Navy force of 12 A4's, six A6's, and four F4's were attacked by SA-2 missiles near Kep Airfield. Three missiles were fired at the F4's, which executed a split-S maneuver and evaded. Four more missile contrails were observed by the strike group and they initiated a split-S and hit the deck as the missiles detonated overhead. Later, as the A4's prepared to attack, the strike leader saw two contrails followed by detonations at 1,500-2,000 feet AGL. Two additional contrails were later observed, but no
detonations were noted due to the evasive action taken. After the attack, two contrails were observed and one missile was seen detonating at about 1,500-2,000 feet AGL. In all, 13 SA-2 missiles were fired, with no hits; one detonating at altitude, the remainder around 800 to 2,000 feet AGL. The estimated "miss" distance from aircraft varied from 1,000 to 5,000 feet, slant range.

By the end of September, it was estimated that 91 percent of the 93 JCS targets south of 20° latitude had been damaged, as were 24 percent of the 125 JCS targets north of 20°. Except for damage to five thermal power plants, no industrial targets had been struck. PACAF believed that judicious selection of a few industrial targets outside the Hanoi/Haiphong complex (such as the Viet Tri Chemical Plant and the Thai Nguyen steel facility), for token attacks, would have beneficial and punitive effects. Intelligence reports from neutral sources in Hanoi indicated the North Vietnamese feared such attacks.

**Attacks on Hanoi/Chicom Supply Routes**

Planning for ROLLING THUNDER 34 and 35 emphasized not only pressure on NVN but also the long-sought opportunity for cutting vital supply routes between Hanoi and Red China. The USAF had two JCS targets: the Lang Met Highway Bridge and the Lang Het Ammunition Depot. The USN was given the Xom Phuong Highway Bridge and the Vu Chua Railroad Bridge. The USAF targets were attacked on 5 October, with 18 F-105's striking the Lang Met Highway Bridge, knocking the north end down and rendering the bridge unserviceable.
ROLLING THUNDER OPERATIONS
September, 1965

Fig. 4

TOP SECRET NOFORD
BORING THUNDER OPERATIONS
October, 1965

Fig. 5
Two F-105's were lost during this attack. Eight F4C's struck the Lang Het Ammunition Depot - in the face of heavy ground fire - causing one secondary explosion. An F4C was downed, both pilots ejecting safely but rescue efforts failed. The Navy damaged the southern approach to the Kep Highway Bridge and destroyed the northern half of the Vu Chua Bridge. These targets were located on the northeast rail line connecting Hanoi with Yungning in Red China.

During the ROLLING THUNDER 34 and 35 cycle (1-14 October) the USAF flew 698 armed reconnaissance sorties; Navy 594. Each was authorized 600, but the USAF requested and was assigned an additional 100 for the 10-14 October period. During the latter cycle, 20 USAF aircraft were hit with five lost; Navy received 19 hits, losing three aircraft. The VNAF flew only 10 II3 sorties; experiencing no hits, no losses and no aborts.

Strikes during the cycle were concentrated against JCS targets located above 20° North latitude, with the attacks against the northeast rail line being conducted less than 30nm from the Chicom border. The destruction of 32 JCS targeted bridges, plus over 500 secondary bridges during armed reconnaissance flights, was believed to have seriously disrupted all road traffic south and west of Hanoi, particularly during the rainy season. During the dry season, when streams could be forded, many LOC interdiction points could be bypassed. PACAF believed there was a decrease in the flow of supplies to enemy units in Laos and the RVN, reducing the enemy capability of massing units to launch large scale offensives.

In the period 15-28 October, ROLLING THUNDER 36 and 37 continued
emphasis on the armed reconnaissance program and interdiction of the Hanoi/Red China supply routes. The USAF was assigned the Bac Can Highway Bridge and the Choi Moi Highway Bridge, plus the Phu Van Army Barracks originally assigned the VNAF. Navy was authorized strikes against the Thai Nguyen and Lang Luong Highway Bridges. The USAF attack on the Bac Can Highway Bridge was made 17 October, in coordination with Navy strikes on their targets. Sixteen F-105's dropped 32 3,000-pound bombs, cratering the south approach and putting two large holes in the bridge deck. While the USAF lost no aircraft, the Navy lost three. The Choi Moi Highway Bridge was struck on 20 October. Fifteen F-105's and 11 flak suppression aircraft flew the mission, dropping two spans. No aircraft were lost or damaged.

In addition to strikes against the JCS targets, the USAF flew 603 armed reconnaissance missions (Navy, 584) during the 15-28 October period. The total of 1,380 sorties represented a slight drop from the 1,454 of the previous cycle.

ROLLING THUNDER 38 and 39, in the period 29 October-11 November, authorized six strikes against JCS targets. The USAF was assigned the Phu Ly RR Bridge and the Dong Em SAM Support Facility; the Navy was given the Hai Duong RR/Highway Bridge, Me Xa Highway Bridge and the Lang Luong Highway Bridge, with the Kep Highway Bridge as an alternate. A VNAF-assigned target, Vinh Linh Barracks was not struck as the damage level from previous strikes was considered adequate. The USAF struck both its targets on 7 November, dropping two spans of the Phu Ly RR Bridge and damaging 22 buildings of the Dong Em SAM Support Facility. Navy struck the Kep Highway Bridge on 31
Of 233 JCS targets in North Vietnam, 127 had been struck by the end of November, 1965.
October, with all spans reported off their piers and in the water. On
5 November the Hai Duong Highway Bridge was struck by Navy with damage
reported to the east span. On 8 November, moderate damage was inflicted on
the Me Xa Highway Bridge.

The USAF also flew 635 armed reconnaissance missions during the two-
week period, as compared to 576 for Navy. Sixteen IRON HAND strikes were
flown; another 145 IRON HAND sorties being diverted to armed reconnaissance
or cancelled. The USAF lost two F-105's; one to AA, one to SA-2. During
rescue efforts for the aircraft lost to the SA-2, two USAF A-1E's, one USAF
CH-3C and a Navy SH-3 were shot down. The USAF also lost an RF-101 during
the period. Navy lost four aircraft; two against JCS targets, one on
armed reconnaissance and one while attacking a bridge in NVN upon returning
to the carrier from a STEEL TIGER mission.

Successful attacks were made against SAM sites during November. On
the 7th, four F4C's struck SAM Site C18 at 203215N 1055446E. Sixteen 750-
pound bombs were dropped in the revetted area of the site and the radar was
believed destroyed. The same day, four other F4C's struck SAM Site B22 at
204555N 1053800E, dive-bombing against medium to heavy flak and dropping 22
750-pound bombs on target. It was uncertain as to whether the site was
occupied but no missiles were launched.

On 5 November, F-105's in the vicinity of 2025N 10553E observed missiles
fired toward them, one detonating at 13,000 feet, the other at 7,000. An-
other flight of F-105's (Oak Flight) reported a missile detonating within
50 feet of Oak-1, with two others detonating 3,000 to 12,000 feet away. Oak-1 was reported down shortly thereafter.

On 31 October, a Navy strike force sighted a total of 13 SA-2 missiles in flight between 0230Z and 0240Z. No aircraft were hit although 24 of them were within SAM range. This was attributed to the immediate evasive action taken following alert warnings from ELINT aircraft or as a result of visual sighting by other pilots. During the 31 October strike against the Kep Highway Bridge, Navy pilots were attacked by seven SA-2 missiles but were successful in evading. One missile tracked an aircraft flying at 700-800 feet; the aircraft turned 90 degrees to the missile, which turned directly toward the aircraft. The aircraft turned again, putting a karst ridge between itself and the missile site. The missile impacted the ground less than a mile from the aircraft.

Navy A4E aircraft, on 5 November, scored direct hits on a missile launcher near 205230N 1062330E. Secondary flaming-explosions and extensive brown smoke were observed in the launcher area. Two SAM's were launched during this mission, detonating at about 18,000 feet and five miles from a flight of F-8E's. On 8 November, Navy A4E's struck a new SAM installation at 205600N 1065030E, reporting two strings of bombs crossing the middle of the installation, with rockets hitting missiles on launchers. Another A4E struck Haiphong SAM Site B01, which was occupied.

For ROLLING THUNDER 40 and 41 (12-25 November) the USAF was assigned two targets: the Cao Nung Railroad Bridge and the Lang Luong Highway Bridge.
Sixteen F-105's struck the Lang Luong Bridge on 16 November, cratering the west approach and ford, but failed to drop a span. Twenty F-105's damaged the southwest end of the Cao Nung Bridge but the bridge was left serviceable. The Navy struck the Hai Duong RR/Highway Bridge, cutting the rail line and causing structural damage to the east span, rendering the bridge unserviceable. On 25 November, Navy aircraft struck the Me Xa Highway Bridge, again, with numerous hits on the east end of the bridge and approach. MIG's attacked the strike aircraft and were engaged by A4's. One Navy aircraft was damaged. No AA fire was observed in the target area during the MIG attack, indicating the NVN ability to coordinate air defense efforts. It also revealed a low-altitude engagement tactic which rendered BIG EYE hi-cover radar ineffective.

On 22 November, USAF launched two successful IRON HAND strikes. On one, four F-105's (using terrain masking at minimum altitude), in line-abreast formation, "popped-up" 10 miles from the targets, selected one of two sites visible and struck with rockets at 5,500 feet and 450 knots. No flak was encountered on the run-in and the site was left burning as the result of a large secondary explosion. In the other attack, three of four F-105's (one aborted) used "pop-up" tactics and again achieved surprise - encountering flak only when leaving the target area. One F-105 was lost during the period 12-25 November to a SAM missile.

Increased MIG activity was noted. On 15 November, two RF-101's northwest of Hanoi were attacked by two MIG-type aircraft. Both successfully eluded the enemy planes. The following day, two RF-101's on a BDA mission
sighted two MIG's northeast of Hanoi and dropped into clouds to evade them.

During the two-week cycle, USAF flew 108 night strike sorties (15 percent of strike effort), while Navy flew 214 (33 percent of effort). The total U.S. effort during the period declined slightly, due principally to problems in moving Navy carriers during bad weather. A total of 1,280 combat sorties were flown; 176 cancelled due to weather. Of the 157 JCS targets outside restricted areas, all but 33 were attacked as of 25 November. PACAF recommendations for strikes against the Thai Nguyen Iron and Steel Combine (JCS #76), Kep Airfield (JCS #9.1), and Kep Ha Airfield (JCS #9.11), had not been approved, nor had additional strikes against dams and locks been programmed. Airfields at Vinh, Dong Hoi, Na San and Dien Bien Phu were kept neutralized, with enemy AOB remaining intact at major airfields near Hanoi and Haiphong.

On 23 November, JCS issued an execute order pertaining to ROLLING THUNDER 42 and 43. The period of this order covered 26 November-9 December and listed a number of targets for attack; it also defined the U.S. armed reconnaissance area for the cycle. The order stated that the objective of armed reconnaissance was to sustain, for maximum feasible periods, day and night interdiction of LOC's, through surveillance and destruction of military targets encountered. The JCS authorized recipients of the order to include attacks on pre-briefed, small military targets, followed by route recce. JCS targets, within the armed recce area and previously assigned to ROLLING THUNDER strikes (excluding locks, dams and that portion of JCS #52 which was formerly JCS #38) were authorized targets. Strikes on such targets
to be identified and reported daily (to include number of attacking sorties, objectives of coastal armed recce including destruction of recognized NVN or other aircraft and/or surface craft which fire upon our aircraft along the NVN coast, in estuaries and mooring areas, and in the vicinity of coastal islands). The planned number of strike sorties were limited to a maximum of 1,200 for the 14-day period. CINCPAC was authorized to launch special sorties beyond this limit, if necessary to destroy SAM installations, trucks, rail rolling stock or NVN naval craft, and beyond the capabilities of planned armed reconnaissance sorties.

Recognized military targets of opportunity in vicinity of target areas, and crafts or units which fired upon aircraft en route to or from missions, would be destroyed. However, targets of opportunity situated outside the armed recce area were not to be struck if within 25nm of the China border, 30nm of the center of Hanoi or 10nm of the center of Haiphong. Aircraft (including BARREL ROLL and STEEL TIGER aircraft overflying NVN) returning from missions could attack previously struck JCS targets (except locks, dams, and that portion of JCS #52 which was formerly #38) which lay in the armed recce area and which were suitable as jettison areas. Returning aircraft overflying Laos were authorized to attack RLAF targeted road segments in Laos.

The JCS defined damage objectives as that amount of damage which neutralizes or renders the target ineffective and/or unable to perform its function. This damage objective in the case of those targets selected for U.S. strikes was, for each target, to be achieved in a single, coordinated
strike effort, although the targets need not be struck simultaneously. The JCS also authorized pre-strike, concurrent and post-strike reconnaissance. Commanders were told to avoid striking populated areas in attack of any targets, including those developed by armed route recce. MIGCAP and screen aircraft, and other appropriate elements of the forces were directed to engage in combat, including SAM-suppression when required to protect the strike forces. When engaged in immediate pursuit, in connection with protection for strike forces, U.S. forces were not authorized to attack NVN air bases from which attacking aircraft were operating.

The JCS directed CINCPAC to plan strikes and armed recce missions so that flight paths of U.S. aircraft did not approach closer than 20 nautical miles of the China border.

In conclusion, CINCPAC was authorized to assign alternate missions to BARREL ROLL and STEEL TIGER in the ROLLING THUNDER area, as appropriate.

For ROLLING THUNDER 42 and 43, the USAF was authorized to strike Dong Em SAM Support Facility, Cao Nung Railroad Bridge (JCS 18.24), and the Lang Luong Highway Bridge (JCS 18.62). The Dong Em target was struck on 27 November with one hundred and fourteen 750-pound bombs and eight 3,000-pound bombs, damaging four buildings and destroying eight, raising the damage level on this target by 15 percent. The Cao Nung Railroad Bridge was struck on 1 December and all three spans of the bridge were dropped, although one F-105 was lost due to intense flak and three SAM missiles were sighted during the attack. The Lang Luong Highway Bridge was scheduled for attack on five separate days, with 20 aircraft ready each day; however, weather forced
The Navy struck the Ha Chanh Bridge (JCS 18.76) on 28 November, using Bullpups and 1,000- and 2,000-pound bombs. The center span was dropped and the southern span damaged. No enemy reaction was experienced. On 1 December, the Navy hit the Hai Duong RR and Highway Bridge (JCS 18.25) damaging the bridge with one Bullpup. Pilots reported the western truss of the bridge to be spread and distorted. AA fire was heavy and SAM's were fired.

The VNAF, on 3 December, struck the Giap Rong, Barracks (JCS 39.47) with seven aircraft, reporting all bombs on target but no available BDA.

Against a quota of 600 armed recce sorties, the USAF flew 601; the Navy flew 433 of its quota of 600. Poor weather, which affected target areas and resulted in high seas hampering launch and recovery from carriers, was responsible for the Navy underflying its quota.

One F-105 was lost by the Air Force in the attack on the Cao Nung Railroad Bridge, another on armed reconnaissance. A third was lost when the aircraft flamed-out after take-off.

In the final two weeks of 1965, before the bombing pause on 24 December, pressure was maintained against North Vietnam through destruction of targets of military significance and continuing interdiction of LOC's. The objective was to continue to increase the cost and difficulties to the NVN in supporting its insurgencies in Southeast Asia. In addition to four strikes against bridges (as part of ROLLING THUNDER 44 and 45), the JCS authorized strikes against Uong Bi Thermal Power Plant, which was planned for the previous
cycle but cancelled due to weather.

The Uong Bi Thermal Power Plant was one of the largest plants in NVN, producing about 14 percent of the nation's total capacity of 176,000 kilo-

watts. The bulk of its power production went to Hanoi and Haiphong (supply-
ing one-fourth of Hanoi's power consumption and one-third of Haiphong's) and had been scheduled for expansion at the end of 1965. Strikes were scheduled by the Air Force on five consecutive days. Finally, on the fifth day (15 December), seven of 28 strike and flak suppression aircraft struck the plant. Although transmission lines were cut, the plant was not put out of operation. One F-105 was lost on the mission.

The USAF also struck the Bac Can Highway Bridge (JCS 18.61), on 19 December, after scheduling attacks for four consecutive days. Fifty-four 750-pound bombs were dropped on the bridge. Pilots reported two spans down, with extensive damage to the remainder of the bridge and adjacent areas. One aircraft was disabled by a SAM on the strike, but both pilots ejected and were rescued. Two missiles were fired.

Another JCS target strike against the Vu Chua Railroad Bridge (JCS 18.74) was flown on 20 December but reports indicated the bridge serviceable. On this mission, one F-105, one F-100 Wild Weasel aircraft, and one F4C were shot down. The F4C was hit by a SAM; both pilots ejected and were picked up. The other two aircraft were downed by AA fire.

The Navy made a night strike on the Uong Bi Thermal Power Plant on 20 December. Six A6A's dropped 2,000-pound bombs by radar, but no additional
Of 234 JCS targets in North Vietnam, 134 had been struck by the end of December, 1965.
damage was reported. On 22 December, the Navy struck again with three waves of aircraft (44 A4's, 11 F4's, and ten F8's) this time damaging the boiler house and rendering the plant unserviceable. Two A4's were shot down. Navy also hit the Hai Duong Railroad Bridge (JCS 11) on 22 December, with minor damage inflicted, in conjunction with the attack on the Uong Bi Plant. In this strike an A6A and RA-5 were lost to SAM's. On 23 December, the Navy struck the bridge again, this time leaving it unserviceable.

The Air Force flew 584 of its authorized 600 armed recce sorties while the Navy flew 414 sorties of their 600 quota. A USAF F-105 was lost on an armed recce mission. On an IRON HAND mission, flown on the 22d of December, an SA-2 site was located and attacked with excellent results. MIG activity was stepped up during this period with F-105's and F4's making visual sightings and noting indications of intended attacks against BIG EYE aircraft.

Only one day of strike operations was conducted during the ROLLING THUNDER 46 and 47 period (24 December 1965 through 6 January 1966). Following 91 USAF/USN strike sorties on 24 December, the "bombing pause" was initiated. Reconnaissance of NVN was continued throughout the period.

The Bombing "Pause"

When the "bombing pause" was begun on 24 December, CINCPAC reported that all major LOC's were open and being used extensively by truck traffic. The rail line from Hanoi to Lao Cai was also open. CINCPAC was concerned
that, despite 1,200 armed recce sorties flown each ROLLING THUNDER period, the LOC's remained usable. There were indications that 80 percent of enemy movement was by night. CINCPAC desired a maximum effort to identify and strike the most vulnerable points of the LOC's. However, there was a need for extensive photographic coverage of southern NVN (from Vinh to the DMZ) to locate secondary routes and bypasses for major routes. As this could best be accomplished by mosaic photography, 2AD was requested to examine the feasibility of acquiring such photography by using RF-4C's equipped with KA-55 cameras. There was also a requirement for better night coverage along the LOC's to identify traffic bottlenecks which could be exploited.

CINCPACAF realized that weather and other factors affected armed reconnaissance operations but said it was imperative a capability be developed to locate and concentrate efforts on the most vulnerable areas along LOC's. "You may expect continuing high level concern with this problem from here on out," CINCPACAF advised the 2AD Commander on 25 December.

Summary

At the end of the year, after some eleven months of ROLLING THUNDER operations, it was evident the program had not achieved its objective of pressuring Hanoi into halting support of insurgency in South Vietnam and Laos. It did, however, affect the economy of North Vietnam with indications of weakening the economic base.

Indications pointed to a prolonged struggle, since Hanoi's attitude did not change as a result of ROLLING THUNDER nor was the NVN morale
CINCPAC, in evaluating the overall effectiveness of ROLLING THUNDER, stated there had been significant disruptions on which the US/FWMAF could capitalize, if operations were to be resumed after the stand-down. NVN had been forced to expend great efforts to repair roads and bridges and to prepare defenses of urban areas against possible attack. Necessary internal operations had been severely disrupted and military support for the Viet Cong/Pathet Lao had been slowed, but not significantly. Reconstruction of communications links was designated as a primary strategic problem and numerous NVN citizens were organized into repair gangs. The NVA had been given supervision of reconstruction in damaged areas, which no doubt detracted from military duties. As a reflection of those pressures, the NVN news agency in Hanoi increased the tempo of propaganda relating to U.S. air strikes. These facts and others indicated that Hanoi felt the pressure and that US/RVN were aware the NVN government was faced with growing internal problems.

In light of the limited objectives of the air campaign over NVN, CINCPAC continued, ROLLING THUNDER had done quite well. On the other hand, ROLLING THUNDER operations had not been conducted in a manner sufficient to increase the pressure on Hanoi in late 1965. Targets vital to effective military operations had not been struck in significant numbers. Enemy military and civilian activities had accommodated to limited operations. In fact, the psychological pressure had decreased but, regardless of how ROLLING
THUNDER had been conducted, the important fact was that the nature of the war had changed since the NVN air campaign began. ROLLING THUNDER had not forced Hanoi to the decision the U.S. had sought. There was now every indication that Ho Chi Minh intended to continue support of the Viet Cong until denied the capability to do so. He had the political-economic support of the Chicoms which increased his obligation to that regime. This, with pressure from that direction to continue support, probably left him little alternative. This resolve had caused a significant change in the complexion of NVN support to the Viet Cong. With this final conclusion, CINCPAC recommended resumption of the program.

In late December, CINCPAC recommended that RT 48/49, during the period 7 January-20 January, place gradual but systematic pressure on NVN, by beginning the closure of the seaward supply LOC, selected attacks against other high value targets (such as POL and power) and shrinkage of the prohibited areas around Hanoi and Haiphong. He recommended that the prohibited areas around Hanoi be reduced to 25nm, and Haiphong 8nm, and that the armed recce boundary run south from the Chicom buffer zone, tangent to the southern edge of the Haiphong circle. He noted that this action would open up several key LOC targets to armed recce surveillance and attack. Additionally the NE LOC's, on which only occasional Alpha strikes had been accomplished, were recommended by him for armed recce surveillance between the CHICOM buffer zone and the Hanoi/Haiphong prohibited areas in order to maintain the damage levels and interdiction initially achieved. Relating to recent additional authority granted against NVN naval craft, he recommended...
### ROLLING THUNDER RESULTS
North Vietnam, 1965

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Fig. 9
that attacks be authorized to within 20nm of the Chicom border in order to include naval craft operating out of Port Wallut.

USAF/USN pilots were responsible for the great majority of combat sorties flown during 1965, including strikes, flak suppression, armed reconnaissance, combat air patrol and rescue activities. As of 23 December 1965, just prior to the "pause", the record was as follows:

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<th>Total Sorties</th>
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The ROLLING THUNDER program had been expanded to cover most of North Vietnam, but at the end of the year there was still no approval to carry out COMUSMACV's recommendations that B-52's be used to strike remote areas and that Haiphong Harbor be mined; nor was permission given to strike the air bases in the Hanoi/Haiphong complex harboring jet aircraft.

Prior to the 24 December-30 January stand-down of air operations against North Vietnam, CINCPAC had advised the JCS that without increasing pressure in the ROLLING THUNDER program beyond the 1965 level, the program would not accomplish its purpose. He voiced concern over the pause in air strikes and completely concurred with COMUSMACV's comment that "from a military standpoint, no advantages accrued whatsoever in a cease-fire affecting RVN." COMUSMACV recommended immediate resumption of offensive air operations.
CHAPTER II - OPERATIONS, JANUARY-JUNE 1966

Concept of Operations

A concept for the conduct of air attacks against North Vietnam, under the ROLLING THUNDER program was developed at the Honolulu Conference, held 17-31 January 1966. At that time, it was felt that the objectives could be achieved with available forces, providing those forces were utilized in accordance with that concept.

The overall objective of the air campaign was to reduce, to the maximum extent feasible, NVN's capability to support and direct the insurgency in SEA. The attainment of this objective required the expenditure of combat air sorties at a controlled weight of effort in the performance of three tasks:

a. Reduce/restrict NVN assistance from external sources.

b. Destroy in depth those resources already in NVN contributing most to the support of aggression; destroy or deny use of all known permanent military facilities; and harass and disrupt dispersed military operations.

c. Harass, disrupt and impede movement of men and materials through southern NVN into Laos and SVN.

The operational concept involved application of a relatively constant number of strike sorties against selective and sensitive target systems - the weight of effort to be applied to the three basic tasks, carefully balanced, to achieve the most effective results from the sorties expended.
The sortie generation rates were based on USAF tactical fighter squadrons, with 18 aircraft per squadron flying at the rate of .8 sorties/day/aircraft. This rate provided for 432 combat sorties per month for each squadron, including: strike, armed reconnaissance, flak suppression, combat air patrol and rescue combat air patrol sorties.

The three tasks were interrelated and had to be accomplished simultaneously for maximum effective results. While it was recognized that certain operations would be more productive than others, concentration on any one at the expense of the others would reduce the overall effectiveness of air operations.

It was felt that the greatest impact on NVN would be the reduction of support from external sources and destruction of in-country, hi-value resources. Armed reconnaissance, while less productive destruction-wise, was essential to keeping the lines of supply constantly disrupted and harassed to impede movement. The large land mass and extensive network of the LOC's would require considerable sortie expenditure to cover all elements of the LOC system which the enemy was using. However, by concentrating available armed reconnaissance against selected elements of the enemy LOC system and his dispersed and hidden support facilities, it was believed increasingly effective results could be expected.

The reduction of external support would require interdiction of water and land LOC's used to receive, distribute and transport war-making material from external sources. The interdiction effort would be a combination
of attacks against the major port facilities and key bridges and the northern LOC's, combined with armed reconnaissance to disrupt, harass, and impede enemy movement. In addition, armed reconnaissance along these LOC's would destroy dispersed and hidden support facilities, such as POL and military supply.

The harbors and ports of Haiphong, Hon Gay, and Cam Pha were the primary water LOC's. Reducing the flow of external support through these ports (67 percent of the total) could be accomplished by the destruction of the port handling facilities, mining the approaches, or a combination of both.

In the northern area there were two primary rail lines which provided additional external support - Lang Son to Hanoi and Lao Kay to Hanoi. These could be cut effectively by attacks on the key bridges. There were also eight LOC's -- Routes 2, 3, 1A, 1B, 13B, 18, and 5 and a rail line parallel to Route 5 -- which connected Haiphong and Hanoi. There were 15 key bridges that had to be kept in an unserviceable state to cut all of these LOC's. An initial effort averaging 25 strike sorties per bridge would probably accomplish the desired destruction. It was thought this level of effort would be required on a monthly basis in order to destroy new construction and prevent use of new routes. Six armed recce sorties per day on eight of the northern LOC's would be needed to harass reconstruction, destroy traffic bottle-necked by the cuts, and seek out and destroy traffic moving along bypass routes. The initial strikes on a monthly basis and the daily armed recce would provide an 85 percent probability of keeping at least two bridges interdicted on each route. The overall monthly average would be
UNCLASSIFIED

Fig. 10

UNCLASSIFIED