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DEPARTMENT OF THE AIR FORCE
AIR FORCE HISTORICAL RESEARCH AGENCY
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30 September 2009

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John Greenewald
[REDACTED]

Dear Mr. Greenewald,

I am writing in response to your FOIA request, which we received on 17 September 2009. We have assigned this request AFHRA inquiries reference number 909. Since your request was made under provisions of the Freedom of Information Act it has been designated FOIA number 2009-3963F. Enclosed is a copy of the requested document, "Pathfinder Operations in the Khmer Republic," IRIS number 1001195, Call number K740.306-16. If you have any other questions, please let us know.

Thank you for your request.

Sincerely,

Kevin Burge
Archivist
AFHRA/RSA

Attachments:

1. "Pathfinder Operations in the Khmer Republic," IRIS number 1001195, Call number K740.306-16

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SEA Declassification & Review Team
Date: 02 July 92 Initials: RMM

AIR OPERATIONS REPORT

ATSIRO
MANUEL SAVIN

RETURN TO

**PATHFINDER OPERATIONS
IN THE
KHMER REPUBLIC**
2 MAY - 15 AUG 1973

700492

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TACTICAL ANALYSIS

DIVISION

HEADQUARTERS, 7TH AIR FORCE

30 SEPT 1974

Distribution No.
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SEA Declassification & Review Team

HEADQUARTERS USSAG/7AF, THAILAND
TACTICAL ANALYSIS DIVISION

AIR OPERATIONS REPORT

PATHFINDER OPERATIONS IN THE KHMER REPUBLIC
2 MAY - 15 AUGUST 1973

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CHAPTER 1

INTRODUCTION

PURPOSE AND SCOPE

(S) The Pathfinder concept was developed as one method of increasing the all-weather strike capability of the tactical forces. It consists of utilizing the equipment of a Pathfinder aircraft to acquire a target and direct the release of ordnance from other aircraft (Pathfinder follower) on the target. The follower aircraft generally did not possess the target acquisition and strike equipment. This concept was used extensively during the last months of the war in Southeast Asia (SEA) for TACAIR strikes and was extended to include B-52s.

(S) Table 1.1 shows the configuration of Pathfinder lead and follower aircraft and the mode of target acquisition and strike that were used.

Table 1.1

Pathfinder Configuration

<u>Pathfinder</u>	<u>Follower</u>	<u>Mode</u>
F-4	F-4	LORAN
	A-7	LORAN
	B-52	LORAN
F-111	F-4	BEACON/RADAR OFFSET
	A-7	BEACON/RADAR OFFSET
B-52	B-52	LORAN

(C) The purpose of this report is to document the Pathfinder efforts of the United States Air Force (USAF) in SEA from May 1973 to the bombing halt in the Khmer Republic on August 15, 1973. No attempt is made to compare the effectiveness of the Pathfinder led air strikes with the strikes using conventional means. This is because of a lack of Bomb Damage Assessment (BDA) for many of the Pathfinder missions - a development that is not surprising, since these missions did not require a Forward Air Controller (FAC) and were frequently conducted in inclement weather. Primary emphasis in the report is given to describing the B-52 and TACAIR* Pathfinder operations and documenting the weight of the bombing effort in the Khmer Republic (KR) conducted by Pathfinder led missions.

*TACAIR in this report refers to tactical fighter aircraft conducting Interdiction, Strike, Close Air Support, or Armed Reconnaissance missions.

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(U) Chapter 2 presents background information on the Pathfinder concept and detailed operating procedures for the various Pathfinder and follower configurations. The remainder of the report is primarily a presentation of data to document the magnitude of the Pathfinding effort.

(U) Chapter 3 contains data on TACAIR and B-52 Pathfinder operations for the week 27 June - 3 July 1973. Data is presented for each day of this week to show detailed variations in the Pathfinder operations. This particular week was selected from the 15 weeks included in the period of this report (2 May - 15 August) because a change in procedures for fragging the TACAIR Pathfinder missions occurred during the week which produced interesting results.

(U) A weekly presentation of the data is contained in Chapter 4. Data pertaining to TACAIR operations for the period 2 May - 15 August and data for B-52 operations from 23 March to 15 August are given.

(U) The concept of using a Pathfinder to enhance the all-weather capability of the force applies only to TACAIR. The Pathfinders were used with B-52s primarily because of the gap in Ground Directed Bombing (GDB) coverage and the lack of radar significant geographic features in the southern Khmer Republic. Weather affected the TACAIR sorties by prohibiting visual target acquisition which was the only available mode of delivery for much of the TACAIR force. Appendix A contains a description of weather conditions in the Phnom Penh area for the daylight hours for the time period 2 May - 15 August. A brief sketch of the events surrounding the last eight months of US air activity in SEA is included to put the study in historical perspective.

HISTORICAL PERSPECTIVE

(C) The last year of active US involvement in the conflict in SEA began with the same high level of air activity that had marked the final months of 1972. In January 1973, the US flew over 18,000 strike* sorties into North and South Vietnam, Laos and the Khmer Republic (see Figure 1-1). Over 12,000 of the strikes were flown in North and South Vietnam.

* A strike sortie as used here includes B-52, gunship and TACAIR sorties.

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UNITED STATES STRIKE SORTIES FLOWN IN SEA
1 JAN - 15 AUG 1973

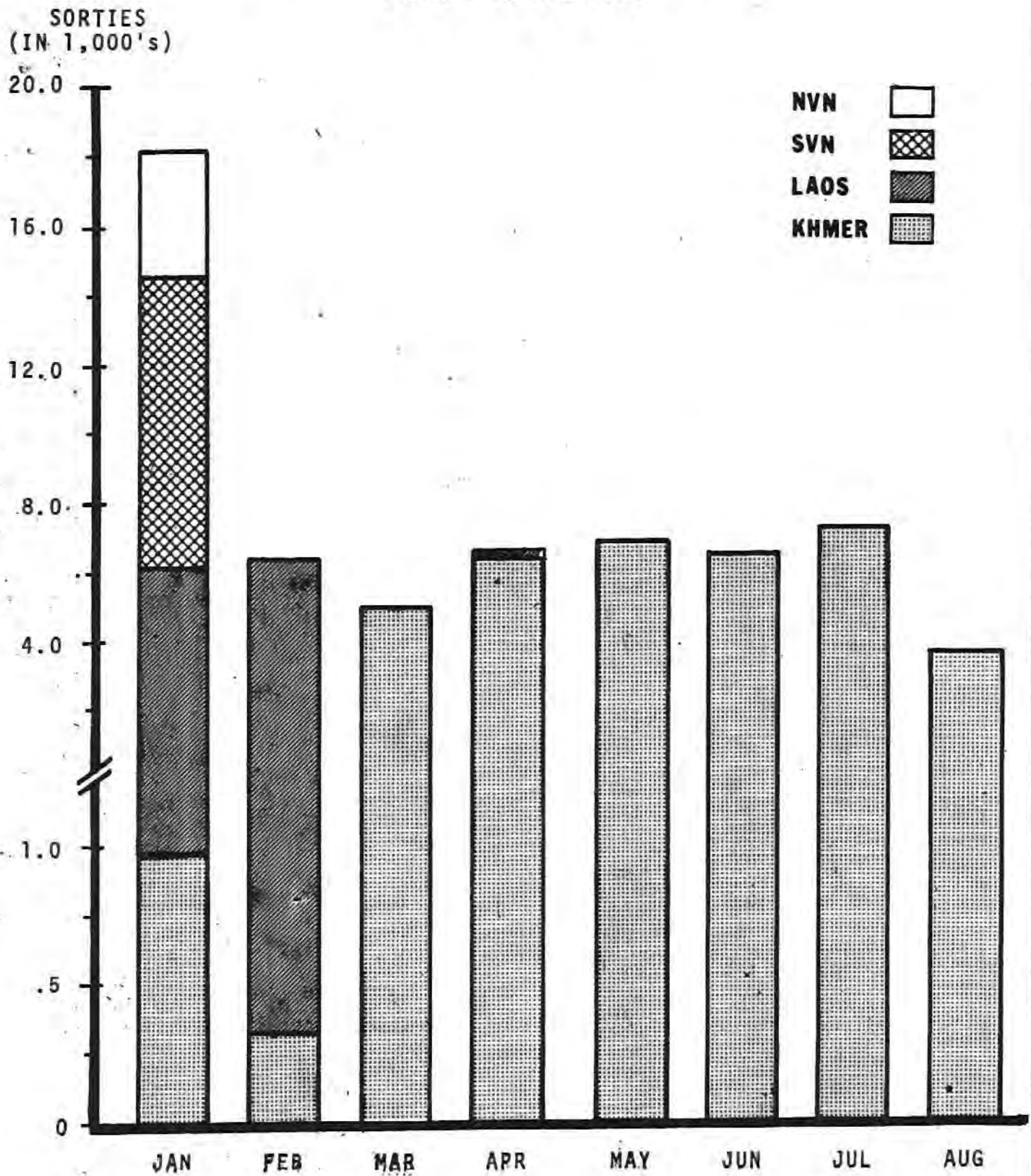


FIGURE 1-1

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The 3,830 sorties in North Vietnam, restricted to targets below the 20th Parallel, were flown in the first 12 days of the month. Another 8,500 strike sorties were flown in South Vietnam in an effort to stem land-grabbing efforts by the North prior to the pending cease fire. The strikes in South Vietnam terminated with the Vietnamese cease fire on 28 January.

(C) The other major effort by US air in SEA in the first month of 1973 was in Laos. Over 5000 strike sorties were flown in the annual battle with the Pathet Lao for the control of the Plaine Des Jarres. The sortie rate increased to over 7500 in February as the fighting intensified because of attempts to gain control of land areas prior to the Laotian cease fire, which went into effect on 22 February 1973.

(C) Expectations for a general peace in SEA were shattered, however, by a surge of enemy activity in the KR. The Khmer insurgents initially attempted to capture the capital, Phnom Penh, by cutting off all supply routes to the city. The US had been flying between 500 and 1000 strike sorties per month into the KR in an Air Interdiction (AI) role. During January and February, these sorties were directed against lines of communication (LOC) in the Freedom Deal area (eastern KR). In March the US flew 5000 strike sorties into the KR. The sortie rate increased to approximately 6500 in the month of April and remained near that level until the bombing halt on 15 August.

(C) Air strikes in the KR in March were primarily flown in an Air Interdiction role. This role gradually changed in response to the ground situation. April saw the beginning of a flight pattern that lasted through 15 August. Slow and fast Forward Air Controllers (FAC) directed air strikes against logistic channels in Freedom Deal, and against troops in contact (TIC) throughout the Khmer. Continuous air cover was provided for Mekong River and Route 4 convoys by FAC and TACAIR. F-111s flew around the clock, providing a 24 hour response to requests from friendly ground commanders. AC-130 aircraft flew some AI missions, but were used primarily to support TIC and Attacks by Fire (ABF). B-52s struck targets throughout the Khmer. The weight of effort for each strike pattern changed with the tactical situation and modifications were made as the conflict progressed.

(U) Early in the conflict, the insurgent forces aimed most

of their efforts against the provincial capitals and major LOC throughout the KR. This emphasis shifted in May, and the insurgents applied pressure to the Mekong River corridor and other LOC leading to the capital. The attempt to cause the fall of Phnom Penh by cutting off all means of resupply had begun.

(C) Air strikes were increased along the LOC, especially along the Mekong, to insure the safe passage of supply convoys. B-52s struck enemy concentrations and choke points along the river the night before a scheduled convoy, and F-111s struck between one and two hours prior to convoy passage. FAC directed TACAIR and gunships flew with the convoy and provided an immediate strike capability in response to enemy attacks.

(S) When it became apparent that Phnom Penh could be resupplied by convoy the enemy's tactics changed and, they attempted to take the city by force. Our response to this enemy maneuver was a change from Air Interdiction to Close Air Support (CAS) for the threatened friendly positions. The CAS was difficult to manage primarily because of the Cooper-Church restrictions. The use of the Airborne Battle Field Command and Control Centers (ABCCC) and Forward Air Guides (FAG) provided the capability to clear and direct close air strikes. There were, however, not enough FAGs to cover every strike, and they could not be used to direct strikes during inclement weather.

(S) An additional problem arose with the Vietnamese cease fire and the deactivation of the GDB radar at Bien Hoa. Alternate means had to be found to guide aircraft to known enemy locations (KEL) and supply concentrations. Two methods that were used in the Khmer were the F-111/beacon combination and F-4/B-52 LORAN Pathfinders. Both of these systems demonstrated their usefulness in the defense of Takeo in May.

(C) TACAIR and B-52 strikes continued in the KR with the heaviest strikes directed at enemy positions around Phnom Penh until the bombing halt on 15 August. The US flew approximately 210 TACAIR, gunship, and ARC LIGHT sorties a day for the last two months of the war. The majority of these strikes were flown in support of the defense of Phnom Penh and to keep the Mekong River and major highways open for convoys.

(S) When it became apparent that the US would halt all bombing on 15 August, a campaign was begun to clear the enemy from the west bank of the Mekong and thus enable the Forces Armees Nationales Khmer (FANK) to keep this important supply line open. This campaign began on 4 August. B-52s and F-111s were targeted against KEL along Route 1. The F-111s also struck in front of advancing friendly forces. By 10 August the FANK had gained control of the strategic west bank of the Mekong, and thus denied the enemy firing positions on the east banks.

(S) An earlier major campaign had begun in June. The main emphasis of the enemy's thrust was toward the southwest of Phnom Penh, mainly along Routes 2 and 3. By the end of June the enemy controlled all but the east and west ends of Route 201 and the Prek Thanot River line. The initial enemy success against the capital city led them to press the attack at the expense of the campaign against the provincial capitals and LOC. The enemy, massed for attack, became targets for US air strikes and by the end of June B-52s began hitting base camp areas and TACAIR responded to TIC and ABF in the immediate battle area.

(C) It took until early August to stop the enemy drive and begin counteroffensives. By this time, however, the enemy had suffered substantial losses and the FANK slowly began to regain lost ground. The success of the US air strikes is clear; the enemy offense was halted and the enemy had, in fact, withdrawn from the immediate Phnom Penh area by 15 August.

(U) The air activity in the Khmer Republic occurred during a period of inclement weather which encouraged the use of TACAIR Pathfinders. The summer monsoons and their associated cloud cover increased; TACAIR sorties led by Pathfinders became a valuable air asset used to strike difficult targets. The weather, one of the driving forces behind Pathfinder scheduling, is discussed in Appendix A of this report.

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CHAPTER 2

CONCEPT OF OPERATION

F-4 as Pathfinder for TACAIR

(C) Long range navigation (LORAN) equipped F-4 aircraft are called Pave Phantoms and were used as Pathfinders for other F-4 and A-7 aircraft. LORAN is a precision navigation system which measures time differences from three ground stations to determine aircraft position. This system can be used to provide an accurate all-weather bombing capability when the actual values of the LORAN coordinates at a target are known. These values were accurately determined by SENTINEL LOCK at 7AF Headquarters prior to fragging the targets.

(S) A candidate list of targets for the Pathfinder missions was established by the USSAG targets panel, usually 48 hours prior to conducting the strikes. Actual targets were then selected from this list and approved by COMUSSAG. The approved targets were arranged in order of priority and published in the fragmentary orders. Rules of Engagement (ROE) restricted the LORAN strikes by F-4 led TACAIR to a distance no closer than 3000 meters to friendly positions or other restricted areas, although some strikes closer to friendly positions were approved by 7AF on a case by case basis.

(C) A problem associated with the Pave Phantom Pathfinder was its susceptibility to electrical disturbances. Its all-weather capability was severely degraded when thunderstorms were in the target area, because thunderstorms frequently caused the onboard LORAN receiver to break lock. Affected missions were usually diverted to other lower priority Pathfinder targets outside the thunderstorm area, or were changed to strikes under FAC control.

(C) USAF TACAIR resources were limited in support of Pathfinder missions because only LORAN equipped F-4s could be used as Pathfinders. Some RF-4 aircraft were equipped with LORAN, but possessed no bombing computer. They were used in their primary mission, reconnaissance, instead of as support for the Pathfinder missions. During the period of this report there was an average of 35 Pave Phantom aircraft in SEA, about 20 percent of the F-4 resources. A lesser constraint on Pave Phantom scheduling was crew

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availability. Pathfinder crew personnel were required to be certified for the missions by the Wing Director of Operations, and all crews in the wing were not certified.

(S) Operational procedures to be followed by the Pave Phantom and the TACAIR follower aircraft were described in 7AFM 55-1. Excerpts from the manual dated 25 May 1973 follow: (U)

"(a) (S) For preplanned Pathfinder missions, the 7AF fragmentary order will designate call signs, target coordinates (latitude/longitude, UTM, and LORAN corrected UTM), TOT, and ordnance. The Pathfinder Tactical Unit Operations Center (TUOC) will relay the rendezvous point, altitude, time, and rendezvous frequency to the strike flight TUOC by message or secure voice a minimum of four hours prior to TOT. Takeoff time will be computed by the strike wing to meet the rendezvous time.

(b) (S) Weather minimums for LORAN bombing in confirmed SAM/MIG threat area. Weather conditions should permit operations within the following criteria:

1. 8000 feet above an undercast.
2. 3000 feet below an overcast.

(c) (S) In-flight Mission Briefing. Strike aircraft will pass to the Pathfinder the mission number, type and quantity of ordnance, fuzing (ordnance fuzed with MK-344 fuze will not be expended on Pathfinder missions), and number of aircraft in the flight. The Pathfinder will brief the strike flight on the target (including latitude/longitude), IP, run-in heading, altitude, airspeed, radio terminology, and intervalometer setting.

(d) (S) Rendezvous Procedures:

1. The rendezvous point is planned so as to avoid route conflict with other missions.

2. If necessary, the Pathfinder will hold at the rendezvous point at a preplanned altitude which does not conflict with other Pathfinder missions in the

area. Holding will normally be left hand orbit at 300 KIAS in VMC.

3. Rendezvous will be accomplished by use of aircraft nav/radar systems or GCI when available.

4. Altimeter setting will be 29.92.

5. The strike flight will join on the Pathfinder, maintaining 2000 feet vertical separation until visual contact is established. Elements of the strike flight may join on opposite wings of the Pathfinder. If multiple flights are employed, the Pathfinder will direct each strike flight leader as to the wing he will join on.

6. After joinup, the Pathfinder will assume the lead. Pathfinder call sign will be used to preface all radio transmissions. Strike flights will retain their original call signs when acknowledging calls. When multiple flights are joined on the Pathfinder, the flight(s) on the left wing will acknowledge radio calls first.

(e) (S) Formation. Missions in a low threat area will normally consist of no more than eight strike aircraft during daylight hours or four strike aircraft at night. Missions in a high threat area will normally consist of four strike aircraft during daylight hours and two strike aircraft at night. However, tactical considerations may dictate greater numbers of strike aircraft to meet mission requirements.

1. Low Threat Areas:

a. Enroute to target. Maintain two to four shipwidth spacing.

b. At one minute to go. Close to maintain close formation.

c. After weapons release. Maintain two shipwidth spacing for ordnance check, or re-attack if authorized, prior to flight break-up.

d. Flight break-up will be called for by the Pathfinder. GCI will be used when available. VMC break-ups will be coordinated by the strike flight leader. IMC break-ups will be maximum of two aircraft at a time spaced 30 seconds apart by turning away and descending or climbing as necessary.

2. High Threat Areas:

- a. Enroute to target. Specific pod formation will be flown IAW unit tactics manuals.
- b. At one minute to go. Close to two shipwidth spacing.
- c. After weapons release. Strike formations will exit the area IAW briefed tactics for highest survivability.
- d. When all aircraft exit the area in formation the flight break-up will be the same as for low threat areas.

(f) (S) Standard lost wingman procedures as stated in 55 series manuals will be used. If wingman is lost during bomb run in IMC, re-attack will not be attempted unless a VMC rejoin can be made. Lost wingman will obtain clearance from his leader to RTB. If an alternate target is chosen, a new rendezvous point may be designated.

(g) (S) Delivery Parameter:

1. If target defense permits, the IP will be a minimum of 30NM from the target.
2. Except for special ordnance, deliveries will normally be made in level flight. Bomb run will be made at 8000 feet to 20,000 feet AGL and 400 to 500 KTAS depending on type of aircraft.
3. After departing the IP the Pathfinder will cross-check central air data computer (CADC) and internal navigation system (INS) input to the LORAN with known altitude, airspeed, heading, vertical velocity, and winds prior to entering the weapons release mode.
4. Weapons may be released by either voice command and/or observed ordnance release from other aircraft in the flight.

(h) (S) Radio calls. The following commands will be transmitted by the Pathfinder. All calls will be prefaced by the Pathfinder's call sign.

1. Air Strike Warning. Five minutes prior to TOT. "Attention all aircraft. Avoid by 10NM (UTM) on the (RAD/DME) from channel _____ until _____ Z" (Time will be TOT plus ten minutes).

2. "IP/Inbound" - Approximately three minutes to go.

3. "Alpha Check" - Designated aircraft will respond only if significant difference in range and bearing to the target is noted.

4. "Two Minutes, Arm Them Up". Strike aircraft master armament switch(s) will be off/safe until this call.

5. "One Minute". (Close to prescribed formation).

6. "Ten Seconds".

7. "Ready,.....Pickle".

(i) (S) Radio out procedures. If a strike aircraft loses voice contact subsequent to the in-flight Pathfinder briefing, he is cleared to drop. The signal to "Arm Them Up" will be when other aircraft close to weapon release spacing. Command of execution for release is the release of ordnance from other aircraft. If a strike aircraft loses voice contact prior to the in-flight briefing he is not cleared to drop except under emergency circumstances."

F-111 as Pathfinder for TACAIR

(C) Procedures were developed in January 1973 to utilize the all-weather bombing capability of the F-111 to conduct Pathfinder operations for F-4 and A-7 aircraft against targets in Laos. In May 1973, these Pathfinder operations were instituted in the Khmer Republic. The Khmer F-111 Pathfinder operations differed from the Laotian ones in the respect that the Pathfinder fraged missions in the KR did not normally divert to visual ordnance delivery when visual meteorological conditions existed in the target area, as had been done in Laos.

(S) F-111s were initially employed in the Khmer Republic using medium altitude, radar synchronous deliveries. This method of employment involved a lengthy process of radar prediction of the target area by wing intelligence personnel and extensive target study by the aircrews. Additionally, the scarcity of radar significant cultural and terrain features in many parts of the KR severely limited the usefulness of synchronous bombing.

(S) Radar beacons were installed at designated sites in the KR to reduce the time involved in the target planning cycle and provide a means of accurate all-weather bomb delivery in these areas. The AN/PPN-18 radar beacons which were installed had proven their utility in Laos. These beacons are small, battery powered, J-band transponders which furnish the F-111 with an easily identifiable radar aiming point. When properly tuned for beacon reception, the F-111 radar set displays the coded pulse transmitted by a beacon and permits the crew to strike targets within the off-set range capability (99,990 feet) of the bombing system. Because the beacons dispensed with the need for prior target study they enabled immediate F-111 response to requests for bombing high priority targets, and were used by the F-111 Pathfinder aircraft in the KR.

(S) Table 2.1 shows the location and date first used for each beacon site in the KR.

TABLE 2.1

<u>Beacon Number</u>	<u>Location</u>	<u>Date First Used</u>
11	Takeo	19 Mar 73
12	Kampong Thom	18 Mar 73
13	Phnom Penh	2 Apr 73
14	Neak Luong	5 Apr 73
15	Kampot	19 Apr 73
16	Kampong Chhnang	1 May 73
17	Kampong Spoe	7 May 73
18	Odong	21 May 73
19	Kampong Cham	1 Jun 73
20	Pursat	31 May 73

Figure 2-1 shows the locations of the beacon sites and their effectiveness ranges in the Khmer Republic.

(S) Targets for the Pathfinder missions were fragged at 7AF Headquarters by the Current Operations Division (DOO). The USSAG targets panel compiled a candidate list of targets which had to be within range of a beacon or have significant radar aim points nearby. The targets were fragged daily by DOO based on the estimated target value, the availability of Pathfinder resources and strike timing constraints. The fragmentary order was approved by COMUSSAG and the strikes were subsequently executed.

(S) Resource availability for the missions were primarily limited by crew availability, since all crews of the 474TFW were not Pathfinder qualified. A basic requirement for Pathfinder crew qualification was a special knowledge of ROE, and the crews had to be certified by the wing operations officer. The ROE permitted strikes led by F-111 Pathfinders to be conducted within 1000 meters of friendly positions. Bombing accuracy with the F-111/beacon combination was such that when the ground situation became critical in June and July around Phnom Penh, 7AF approved strikes on a case by case basis which were as close as 200 meters to friendly positions.

(S) The operating procedures used by the F-111 Pathfinder and its TACAIR followers were described in a 474TFW Message (S) 151040Z May 1973. Excerpts from the message follow: (U)

"(S) The basic concept for the Pathfinder mission is to use the F-111 radar bombing system to lead other aircraft to an ordnance release point. Normally this will be accomplished in level flight, and at medium altitude. The following procedures will apply when an F-111 is utilized as a Pathfinder for strike aircraft on a pre-planned basis.

(S) The DOO or Pathfinder/flight leader will coordinate prior to the flight briefings. Information on call signs, rendezvous points, weapon loads, etc., will be discussed. Takeoff times will be computed by the parent wing to meet rendezvous time.

(S) Weather minimums for Pathfinder operations in confirmed SAM/MIG areas are: (1) 8,000 feet above an undercast, (2) 3,000 feet below an overcast, and (3) five nautical miles inflight visibility.

KHMER REPUBLIC

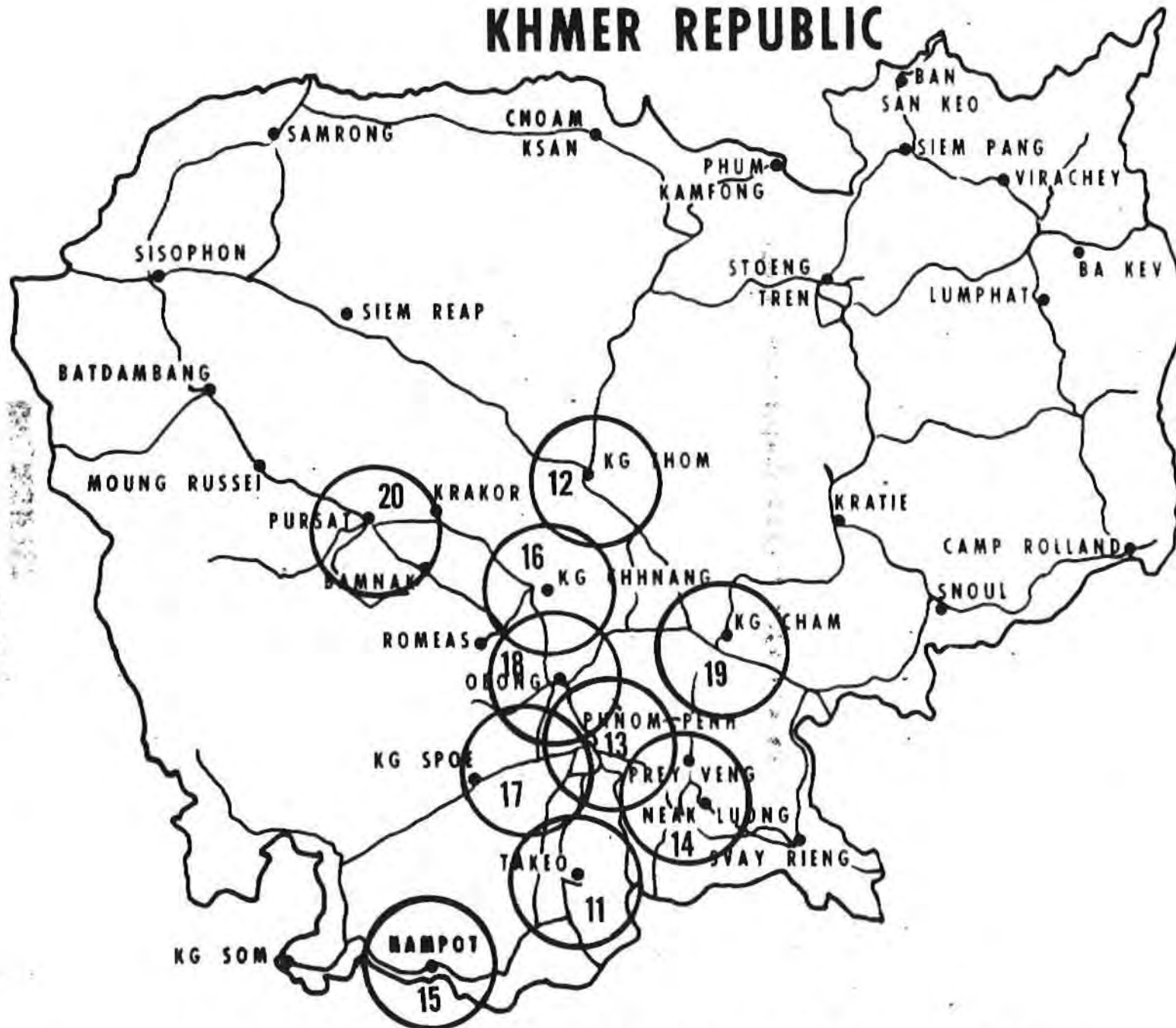


Figure 2-1
15

F-111 BEACON LOCATIONS IN KHMER REPUBLIC

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(S) The following rendezvous points will apply. Altitudes and rendezvous points may be changed dependent upon weather and target location. The rendezvous and joinup will be accomplished on frequency 269.9:

A. Point Alpha - 210 degrees/126NM, CH 93, 1326N/10346E.

B. Point Bravo - 180 degrees/100NM, CH 93, 1335N/10452E.

C. Point Charlie - 352 degrees/43NM, CH 85, 1215N/10445E.

D. Any preplanned Beta or Charlie points.

(S) If necessary, F-111 Pathfinders will hold at the predetermined joinup point at FL 150 or above, 300 KIAS, VMC in a left orbit.

A. Rendezvous may be under radar control of Lion/Disco, A/A TACAN, A/A radar, etc.

B. Altimeter setting will be 29.92.

C. The joining aircraft will maintain 2,000 feet vertical separation until visual contact.

D. The F-111 will assume the lead on visual contact and the entire flight will assume the leader's call sign.

E. Delivery aircraft may maintain 2,000 feet above the Pathfinder for enroute cruise VMC.

F. Delivery aircraft elements may joinup on opposite wings of the F-111.

(S) Formations used while Pathfinding will vary according to the threat and time of day.

A. Low Threat: The formation will be a Pathfinder aircraft plus a maximum of eight delivery aircraft in daylight and Pathfinder aircraft plus four delivery aircraft at night. Prior to one minute to release, the delivery aircraft will maintain two to four shipwidth spacing. At one minute to go, all aircraft will close on the leader to maintain one shipwidth spacing.

B. High Threat: In high threat areas the maximum formation size will be limited to the Pathfinder plus four delivery aircraft in daylight and two delivery aircraft at night.

C. Specific Pod formation (if required) will be as briefed and in accordance with unit tactics manuals until the one minute call; the two shipwidths will be maintained until release. Pod formation will be resumed after release and maintained throughout egress from the high threat area.

(S) After joinup the F-111 Pathfinder will brief the flight (on discrete frequency) on procedures to be used. This briefing will consist of the following (items that have been previously coordinated and remain unchanged need not be briefed):

A. The delivery aircraft will brief the Pathfinder on:

- (1) The mission number
- (2) Number and type of ordnance
- (3) Fusing

(4) Safe separation time (minimum of 8 seconds -
NOTE: MK-344 fuzes not allowed)

- (5) Ballistics, time of fall and range

B. The Pathfinder will brief:

- (1) Target description
- (2) Geographic coordinates of IP and target
- (3) Run-in heading
- (4) Altitude and airspeed. Altitude will be a minimum of 10,000 feet and a maximum of 15,000 feet. Airspeed limits will be a minimum of 400 TAS and a maximum of 480 TAS (recommend 440 TAS).
- (5) Number of bombs to drop
- (6) Intervalometer setting in MS

(7) Formation, including evasive maneuvers

(8) Radio failure procedures. NOTE: Day visual signals will be cocked pistol signal for setting up switches and a nod of the head for weapons release. Night visual signals will be exterior lights momentarily bright/flash for setting up armament switches and Pathfinder's white cockpit lights (thunderstorm lights) full bright for weapons release. Should a delivery aircraft radio become inoperative after the weapons delivery information has been briefed, he is cleared to drop ordnance. The execution signal in this instance will be the delivery of ordnance by the other delivery aircraft, not the Pathfinder. Should a delivery aircraft radio become inoperative before the weapons delivery information is verified, he is not cleared to drop ordnance.

(9) Radio Calls. Required calls are:

(a) IP inbound (3 to 5 minutes from target)

(b) "Alpha Check" - The Pathfinder will designate the lead delivery aircraft AF "Alpha" - His duty will be to crosscheck the Pathfinder's progress to insure that the correct target is being struck. When the Pathfinder calls "IP inbound, Alpha Check", delivery lead will acknowledge the call. If he disagrees significantly on the target data "Alpha" will so state.

(c) Two minutes - arm them up.

(d) One minute to drop

(e) Ten seconds

(f) ReadyPickle. "Ready" is the preparatory command and "Pickle" is the command of execution for bomb release.

C. All calls will be prefixed by the Pathfinder's call sign. WARNING: Delivery aircraft must understand that due to a possible inadvertent release from the F-111 at the arming point, the delivery aircraft will not release without a visual or verbal signal from the Pathfinder.

(S) Compatible ordnance loads will be fraggd for all simultaneously fraggd deliveries.

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(S) The Pathfinder/delivery aircraft intervalometer settings will be adjusted to insure all bombs impact within the F-111 stick. The F-111 Weapons Systems Operator will determine the intervalometer settings in MS for the delivery aircraft from the ballistics information given to the Pathfinder by the delivery aircraft.

(S) Strict formation discipline must be adhered to at all times. Deviation from briefed procedures will be allowed only in an emergency.

(S) Upon completion of ordnance delivery the Pathfinder will release the delivery aircraft - after an ordnance check. Reattack is authorized if hung ordnance is involved.

(S) Flight breakup is accomplished by the delivery aircraft turning away from the F-111. The F-111 will accelerate and climb straight ahead. Breakup will be planned so that separation is insured. CRP/CRC will be used to obtain separation in IMC.

(S) Delivery aircraft will assume their original call sign. The F-111 Pathfinder will pass target information to ABCCC for all delivery aircraft.

(S) If the delivery aircraft reach Bingo fuel prior to weapons release the F-111 Pathfinder may elect to proceed with his delivery or request AAR. If the latter occurs the flight will remain intact utilizing normal AAR procedures with the F-111 leading.

(S) Delivery aircraft should be aware that if the F-111 is carrying ordnance the maximum cruise altitude will be FL 200.

(S) Lost wingman procedures are standard for the second element of a four-ship formation for the delivery aircraft. If a lost wingman occurs during bomb run in IMC, reattack will not be attempted unless a VMC rejoin can be accomplished. Lost wingman will obtain clearance from Pathfinder lead to RTB. If alternate target is chosen a new rendezvous point in VMC will be designated."

(S) An F-111 Pathfinder conference was held at 7AF Headquarters on 8 June 1973 with representatives from all F-4 and A-7 wings. Some new procedures for the F-111 Pathfinder missions were developed and subsequently

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approved by COMUSSAG. Changes to the procedures described above which were implemented are quoted below:

" A. The 474TFW aircrews will insure that routes of flight and TOTs with other Pathfinder/F-111 bombing missions do not conflict. Altitude separations will be used as a primary planning factor in this effort.

B. Normally no more than four strike aircraft during daylight hours or two at night will be scheduled for Pathfinder missions; however, tactical considerations may dictate a greater number of strike aircraft to satisfy mission requirements.

C. The rendezvous point and time will be determined by the 474TFW and forwarded to the strike flight.

D. The F-111 call sign will be used by the Pathfinder when passing instructions/information concerning the Pathfinder missions. Strike flights will retain the original call signs and will acknowledge Pathfinder calls with the same. When more than one strike flight is joined on the Pathfinder, the flight(s) on the left wing will acknowledge radio calls first.

E. The following items are eliminated from the in-flight briefings: fuzing; armed delay; ballistics for MK-84, MK-82 and CBU; target description; and bomb run heading, altitude and airspeed.

F. Day radio out procedures no longer require visual signals from the F-111. The side by side arrangement of the F-111 cockpit and poor visibility from positions two and four in the strike flight necessitated this change.

G. Night radio out procedures are eliminated. A-7 and F-4 aircrews are not familiar with F-111 cockpit lighting. There is a high probability of a short round resulting from a strike aircraft misinterpreting normal F-111 cockpit lighting and crew activity. No other positive visual signals are available.

H. Restrictions were added to the paragraph which stated F-111 Pathfinding will be accomplished on a pre-planned, pre-briefed basis (prior to takeoff) unless required in conjunction with or to preclude an emergency situation. Also, F-111s were not permitted to join up to compensate for systems malfunctions. Aircraft unable to

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complete a mission on its own systems would RTB. "

F-4 and B-52 as Pathfinder for B-52

(C) Pathfinder led B-52 bombing began on 20 February 1973 when the first non-OT&E bombing mission utilizing B-52s led by a B-52 Pathfinder (Pave Buff) was conducted. Prior to this mission, a test to demonstrate the feasibility of using the LORAN system to bomb with B-52s had been conducted at the Eglin Test Range and a tactical evaluation was performed under combat conditions in SEA.

(C) The primary objective of the CONUS test was to evaluate and demonstrate high altitude delivery accuracy of the B-52D aircraft equipped with a modified PAVE PHANTOM LORAN bombing system. To accomplish this, one B-52D was modified at McCoy AFB, Florida, by 306 Bomb Wg, maintenance personnel under contractor (Lear Siegler, Inc) supervision. One combat ready crew and a squadron instructor pilot of the 306 Bomb Wing were trained in equipment operation. Six productive sorties were staged from McCoy AFB on the Eglin Test Range. Of these sorties, two were utilized to assess repeatable position accuracy and four to establish a bombing accuracy standard. A total of forty inert MK-82 bombs were released from 35,000 feet at 470 KTAS (35 single releases plus one string of five). The 36 single releases scored (the mid bomb of the string of five was scored as a single release) established a CEP of 362 feet. The test was suspended on 10 May 1972 due to a requirement to utilize the aircraft in direct support of the SEA conflict. All primary high altitude objectives were accomplished prior to test suspension. Although the CONUS test was somewhat limited in scope, it was concluded that the concept of B-52D LORAN bombing warranted further investigation. Hq SAC requested and received Air Staff approval to conduct a combat evaluation in SEA.

(C) From 1 August through 7 December 1972, the SEA Pave Buff test was staged from U-Tapao Airfield, Thailand. CONUS testing provided a base of experienced personnel for the design of checklists, aircrew procedures, and an aircrew training program. Initial flights were accomplished utilizing the flight crew trained during CONUS testing. Three additional crews were trained at U-Tapao. Prior to actual bombing, dry runs were accomplished on three separate missions. During these missions initial formation tactics, safety procedures, checklists, and

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scoring procedures were developed. On 27 August 1972, the first B-52D LORAN bombing mission was accomplished in SEA. A total of 57 LORAN strikes were conducted during the test in the northern regions of RVN. Missions were flown utilizing standard three ship B-52 cell procedures with minor modifications. The test B-52 aircraft led the formation in a Pathfinder role on all missions.

(S) With the close of the Bien Hoa GDB site on 21 March 1973, the southern portion of Cambodia was without GDB radar coverage. Considering the lack of suitable airborne radar offset aim points and the possession of only two LORAN equipped B-52s in theater, ARC LIGHT operations would have been significantly curtailed in this area. To support and augment these operations, 7AF provided LORAN equipped (Pave Phantom) F-4s as Pathfinders for B-52s. Seventh AF tasked the 8th TFW to develop procedures for testing and conducting operations. These operations were called Pave Phantom Lead.

(U) On 17 March 1973, 8TFW project officers, representing 7AF, met with 8AF personnel at Andersen AFB, Guam, to establish these procedures. Test flights were conducted on 19 and 20 March utilizing the Ubon MSQ site to score the simulated drops. The first live drop occurred on 23 March.

(S) The Pathfinder bombing procedures as described in 8AFM 55-2 (1 Nov 73) are as follows: (U)

" 4-7 (S) LORAN Bombing Procedures. The LORAN bombing tactic is accomplished by using airborne LORAN positioning data to direct delivery aircraft to a weapons release point. The positioning data is derived from LORAN time delay signals transmitted from ground based LORAN stations. The LORAN equipped aircraft can effect its own release, direct follow cells to a release point or both. Bomber and Pathfinder crews will crosscheck time delays as soon as possible after rendezvous.

a. (S) Communications: All communications will be on UHF. The Pave Buff aircraft will use his discrete call sign found on the ARC LIGHT Code Word Sheet. Pave Phantom will use fraggd call sign. Pave Buff will use the bomber cell's C/R plan frequency for rendezvous and

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interplane frequency. Pave Phantom will use fragged frequency for rendezvous and interplane.

b. (S) (U) Rendezvous Procedures. If the Pathfinder aircraft does not take off with the bomber cell, the bomber cell will rendezvous with the Pathfinder aircraft using the following procedures.

(1) (S) Pave Buff Rendezvous. The cell will depart the timing box in order to make good the fragged rendezvous control point time. Pave Buff will adjust its orbit on the latest ETA from the cell for the RCP. Pave Buff will approach the rendezvous point 1000 feet below the fragged B-52 cell base altitude. Point parallel rendezvous procedures will be used as written in the flight manual for B-52/KC-135 air refueling (including range calls and offset) except for the following:

(a) Pave Buff will remain 1000 feet below the B-52 cell base altitude.

(b) Airspeed for Pave Buff and the cell is 440 KTAS.

(c) Beacon codes and interplane frequencies are for the cells C/R Plan.

(2) (S) After the rendezvous and when cleared by the Pave Buff aircraft, the cell will descend to 500 feet above the Pave Buff altitude. Spacing will be 2NM between the Pave Buff and cell lead and 1NM intra-cell. Pave Buff assumes cell lead responsibility at the point where he clears the cell to descend from enroute altitude to cell altitude and retains the lead responsibility until his route of flight departs the cell route.

(3) (U) Pave Phantom Rendezvous. Pave Phantom will be in orbit at the PIP ten minutes prior to the fragged arrival of the B-52 cell at the rendezvous control point, located 80NM prior to the PIP. Twenty five (25) NM prior to the RCP, the B-52 cell will accelerate to 470 KTAS and establish their formation - 500 feet between aircraft and 1NM intra-cell separation. The cell base altitude is 2500 ft above the Pave Phantom altitude. When the B-52 cell announces crossing the control point the Pave Phantom will proceed inbound to the B-52 cell using his fire control radar to accomplish a point parallel

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rendezvous rolling out 2NM ahead of the lead B-52.

(4) (S) After the Pathfinder cell has rendezvoused they will adjust to a formation with 2NM between directing aircraft and cell leader, with 1NM separation between cell members using briefed differential airspeed. After the formation is closed the bomber cell will, upon command of cell lead, descend to briefed bombing altitude stacked up 500 feet from the Pathfinder's base altitude.

c. (S) Pathfinder Bombing Formation. The bomber cell will, upon command of bomber cell lead, assume the Pathfinder bombing formation prior to the IP. Bomber cell lead will fly a station keeping position 2NM behind the Pathfinder. Bomber #2 will fly briefed DASK position 3NM behind and to the right of the Pathfinder. Bomber #3 will fly briefed DASK position 4NM behind and to the left of Pathfinder. All range and azimuth computations will be measured from the Pathfinder aircraft.

d. (S) Pathfinder Directions. The Pathfinder will begin directing the cell after joinup and only after coordination with the bomber cell lead. The Pathfinder will direct all heading, altitude and airspeed changes and the bomber cell will acknowledge. The LORAN bomb run calls will be 240 seconds, 180 seconds, 120 seconds and 30 seconds. Final countdown will be as follows:

Standby for countdown, 5,4,3,2,1, HACK. Following aircraft release on timing from the directing aircraft's HACK using station keeping, DASK or (if directing aircraft is a Pave Buff) bonus deal procedures.

NOTE: (S) Pave Phantom directed cell are not authorized to use Bonus Deal procedures. "

(S) A more detailed description of Pave Phantom lead procedures as described in 7AFM 55-1 (25 May 73) is as follows: (U)

"(S)(1) F-4/B-52 Pathfinding (Pave Phantom Lead):

(a) Pre-mission planning information concerning control point (CP) time for the B-52 cell, pre-identification point (PIP), IP, TGT, and the B-52 cell call sign will be included in the fragmentary order.

(b) In-flight Mission Briefing. The F-4 will make radio contact with the B-52 cell when established in orbit at the PIP 10 minutes prior to the scheduled B-52 arrival time at the CP. Confirm the type ordnance being carried (for mixed MK-82/M117 loads, use MK-82 weapons ID settings for release).

(c) Rendezvous. The F-4 will hold at the PIP in a left hand orbit with inbound leg on the course from the CP to PIP. F-4 orbit and intercept will be 500-540 KTAS at FL 305. When the B-52 cell calls at the CP, Phantom lead will proceed up-stream parallel to the bomber course to the PIP. A standard 180 degree turn intercept will be performed on the lead B-52 as the range decreases to 26-28 miles. As the F-4 moves out in front of the lead B-52 and on course, the B-52 leader will call ranges of 6000', 10,000', 11,000', and 12,000'. At 12,000' the Phantom lead will stabilize at 470 KTAS. The B-52 will advise the F-4 of the KCAS the cell is using to achieve 470 KTAS. When stabilized the F-4 will assume the lead and inform the B-52 leader that he has station keeping responsibility. The B-52 cell will descend to 500' above the Phantom lead.

(d) All turns for the bombing run will be made using a maximum of 15 degrees of bank and will be called to the B-52 cell, i.e., "Red, left turn to 360 degrees." Temporary heading changes of two degrees or less will not be called. The B-52 cell leader will acknowledge all calls except for heading changes after the one minute warning. After the one minute warning, the turn calls will be abbreviated i.e., "Red, 124 degrees."

(e) The B-52 cell lead will transmit the ASW 10 minutes prior to TOT. ABCCC will transmit the five (5) minute ASW. Format follows:

"Attention all aircraft: Avoid by 10NM (UTM) on the _____ (RAD/DME) from channel _____ until _____ Z (time will be TOT plus 10 minutes).

(f) Radio calls on the final run-in. All calls will be prefaced with the B-52 cell call sign.

1. "...Two Minutes" (approx 20 miles to go)
2. "...One Minute" (approx 10 miles to go)

3. "....10 Seconds"

4. "....Ready, 5,4,3,2,1, Hack"

(g) If the Pave Phantom lead is a two ship flight, the wingman will normally fly on the right wing, line abreast with one ship width spacing. He should be prepared to assume the lead at any point up to 4NM prior to the "Hack". If the F-4 leader experiences a malfunction or is not in weapon release mode at 11.9NM to go he will call "Lead Sour". The wingman will acknowledge and assume the lead.

(h) The Pave Phantom leader can withhold by not completing the count down to "Hack" or by transmitting "withhold", "do not drop", or words to that effect. If the run is being monitored by a GDB site, the site can "withhold" the bombers if their attack is more than 3000 feet from centerline or the course is diverging at 20 seconds from release.

(i) Reattack. If a reattack is required the F-4 flight will maintain final heading for 50 seconds from "Hack". The B-52 cell will continue to station keep and a second run will be accomplished using the following procedures:

1. When the proper time has elapsed after "hack" point the F-4 will turn 90° using 30° of bank and hold heading for three (3) minutes (direction of turn will be specified in frag order).

2. Using 15° of bank turn to reciprocal of bomb track and hold for seven (7) minutes.

3. Using 15° of bank turn 90° to reciprocal bomb track; intercept original attack heading and proceed with bomb run. (Turn at 470 KTAS, 15° bank angle is approximately 14NM).

(j) If no reattack is authorized the F-4 will hold attack heading a minimum of 50 seconds. After LORAN freeze out data is recorded, the F-4 leader will turn to egress heading and descend 2000' below the run-in altitude. The B-52 cell leader should be advised of the direction the F-4 is turning off target.

(k) Emergency Procedures:

1. If necessary to abandon the bomb run for safety of flight, the F-4(s) will turn away and descend.
2. Hazardous weather will be avoided. Deviations from fragged attack heading on the final run-in to avoid weather will only be performed if the final track can be regained in sufficient time to make a normal attack.
3. If for any reason the joint formation is discontinued in favor of independent cell navigation, the formation may be re-established provided respective altitudes have not changed, sufficient pre-TOT remains, the F-4 is within station keeping range, and both the F-4 and B-52 leaders concur.

(1) Airborne Target Change (ATC) TOT Extension:

1. An ATC, if required will be transmitted to the F-4 aircrew NLT 45 minutes prior to TOT. Use the same PIP and IP, and LORAN validated UTMs must be given to enable the F-4 aircrew to crosscheck TGT data. The B-52 cell must also copy the change. Each respective leader (F-4 or B-52) will confirm the change with the other.
2. TOT extensions will not be made later than the F-4 takeoff time or departure from the tanker, whichever is applicable.
3. Format for passing ATC's will be as follows:
 - (1) Replace TGT Designator_____.
 - (2) New TGT Designator_____.
 - (3) TOT_____plus briefed.
 - (4) TDA_____.
 - (5) TDB_____.
 - (6) TGT UTM_____.
 - GEOGRAPHIC Coord_____.

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- (7) PIP to IP _____.
- (8) IP _____ GEOGRAPHIC Coord.
- (9) HDG/DIST _____ IP to TGT.
- (10) TGT Elevation _____.
- (11) Second run _____ yes/no, right/left."

(S) Initial tests were conducted at 440 KTAS, FL 330. This low airspeed/high altitude combination, however, proved to be untenable for the F-4s. Initial spacing between the Pave Phantom and the cell was 1NM, but was later changed to 2NM, the same as the Pave Buff. The UBON GDB scored 14 "live" Pave Phantom directed ARC LIGHT strikes between 23 March 1973 and 31 March 1973. Scores ranged from 388 feet to 2050 feet for a circular error probable of 1187 feet and a circular error average of 1112 feet. Photo interpretation of Pave Phantom directed strikes outside of GDB coverage appeared to substantiate these results. This led to the restriction on Pave Phantom directed ARC LIGHT strikes to be set at 3 kilometers from the Vietnamese border.

(S) The Pave Phantom F-4s were fraggd in flights of two, and sometimes in flights of three, and additional F-4s were fraggd as ground alert backups. This redundant system resulted in a low mission abort rate for F-4 aircraft. Thunderstorms along the run-in route, however would cause mission aborts because no variance in heading, altitude or airspeed could be tolerated from the IP to the Target. Thunderstorms also caused the LORAN to lose positive contact and break lock, causing additional mission aborts.

(S) The heavy bombers were flown from U-Tapao (B-52D) and Andersen AFB, Guam (B-52G). The B-52 resumed bombing on 6 March 1973 (Many of the B-52 sorties were dual-targeted during the period covered by this report; therefore, data for B-52s is presented in terms of lines and targets. A line is one aircraft strike against one target. For dual-target B-52 sorties, each sortie accounted for 2 lines.) Dual targeting was utilized during the week of 7 - 13 March, resumed again on 28 May, and continued until the cessation of bombing on 15 August. Seven cells of D-models were dual targeted on each day during the 28 May - 15 August period.

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(S) The B-52s struck area targets in the shape of rectangular boxes. The boundaries of the target boxes could be no closer than 1000 meters to friendly positions or non-combatants. B-52 target candidates were presented to a target selection panel which then passed selected targets through SAC ADVON to 8AF, where resource allocations were made. If the SAC planners determined that Pave Phantom support was required, they would notify Hq USSAG, who would then frag the tactical units.

(S) The GDB tracking radar at Ubon RTAFB, Thailand, provided radar coverage of the northern half of the Khmer Republic (Figure 2-2). For targets within its area of coverage, the weapon controllers at the GDB site would direct the cell into the target and provide a "hack" for bomb release. This highly reliable all-weather bombing method was the preferred B-52 strike mode. However, the FANK's greatest support requirements were in the southern half of the Khmer Republic.

(S) The B-52s could employ the capabilities of their onboard radar navigation system for strikes when radar significant geographic references were available; however, these references were not available throughout most of southern and eastern KR. To circumvent this problem, x-band radar beacons were located in the south and the south central portion of the Khmer Republic, around Phnom Penh and along the Mekong convoy route during May 1973. Beacon bombing started at the end of May. The geographic radar significant references are located in the southwest and northeast regions of the Khmer Republic. The 400 square kilometer area around Phnom Penh, however, was where the strikes were required. Therefore, most of the synchronous bombing used the nine beacons located as shown in Figure 2-2. The Pathfinder mode of delivery was preferred, however, to beacon bombing as it was more accurate and had a lower probability of a short round occurring. Thus beacon bombing was not used extensively.

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KHMER REPUBLIC

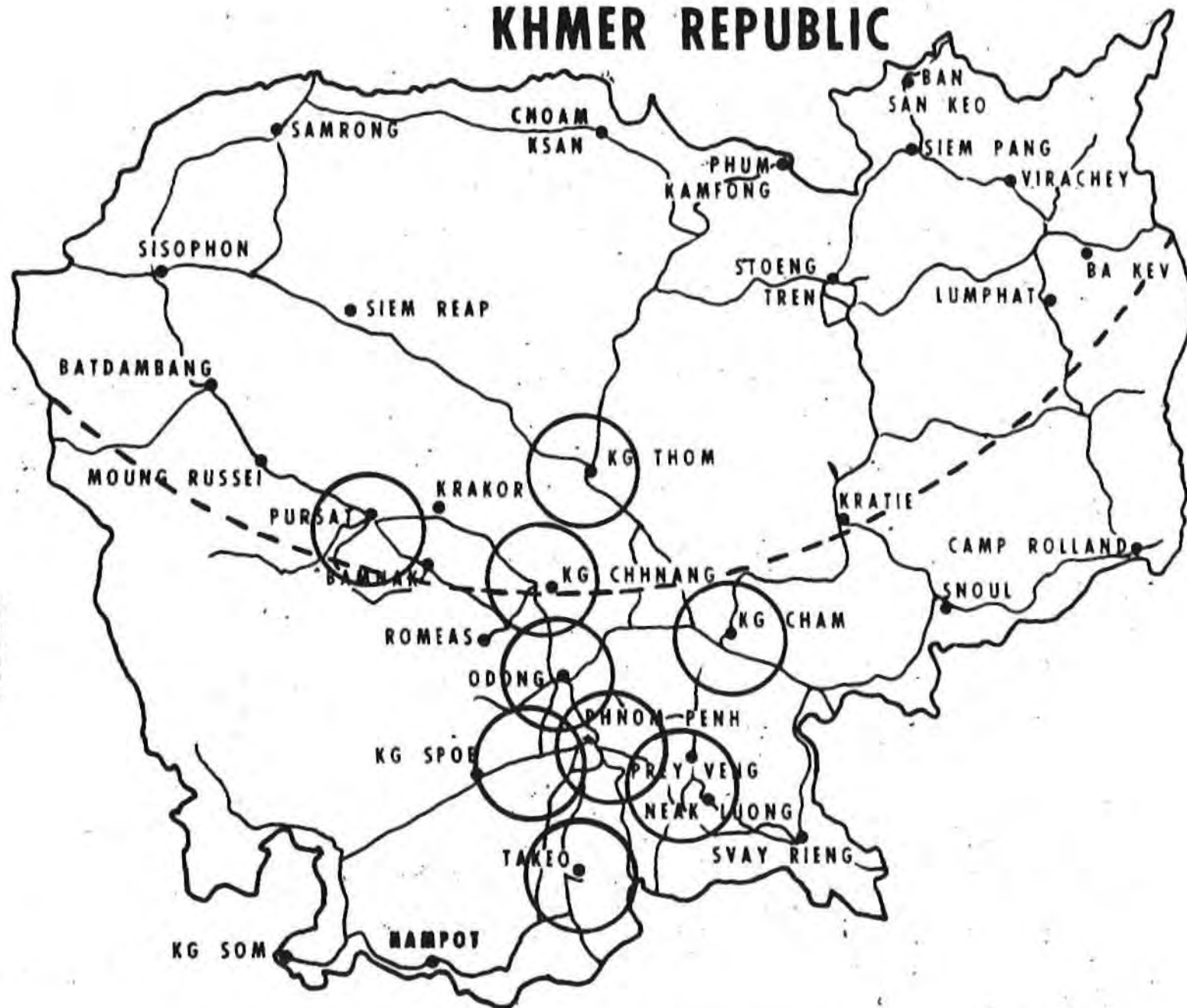


Figure 2-2
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B-52 BEACON LOCATIONS IN KHMER REPUBLIC

CHAPTER 3

PATHFINDER OPERATIONS - 27 JUNE - 3 JULY 1973

(U) This chapter presents data on TACAIR and B-52 Pathfinder operations for the week 27 June - 3 July 1973. Its primary purpose is to document in detail the amount of TACAIR and B-52 bombing effort in the Khmer Republic devoted to Pathfinder missions, and portray the daily variations in this effort.

(S) Prior to 30 June, F-4 Pathfinders and TACAIR follower aircraft were generally not mated in the frag. Pave Phantom Pathfinders were fragged to carry ordnance and were further instructed: "If unable to conduct Pathfinder activities, contact ABCCC for FAC assignment. Check out with ABCCC for possible Pathfinder activity for other aircraft." The F-111 Pathfinders were fragged to lead flight of four aircraft. For example, the frag for 27 June called for nine F-4 Pathfinders, one F-111 Pathfinder and seven F-4 follower aircraft. Seven Pathfinders had no specific followers assigned. Beginning on 30 June a policy was implemented to hit the enemy during the first 1 1/2 hours of daylight in the morning and the last 1 1/2 hours of daylight in the evening with Pathfinder led strikes, regardless of weather conditions. Normal procedures called for an F-111 or Pave Phantom Pathfinder to expend its ordnance on a target, pick up a flight of four F-4s or A-7s and lead them in on an additional pre-planned target, then pick up a second flight of four F-4s or A-7s and lead them in on still a different target. For example, on 1 July, four F-4s and four F-111 Pathfinders were fragged to lead in two flights of four TACAIR followers each as shown in Table 3.1.

(S) Pave Phantom used to lead in B-52s were generally fragged to operate in flights of two or three aircraft. A flight of Pave Phantoms generally led the B-52s for strikes on two separate targets. (Pathfinders led a far greater portion of the B-52 effort than of the TACAIR effort.) Almost 75% of the B-52 targets fragged during the week under consideration were to be struck by Pathfinder led missions.

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TABLE 3.1

PATHFINDER FRAG FOR 1 JULY 1973

(Source: USSAG History July - August 1973)

<u>Pathfinder</u>	<u>TACAIR FOLLOWERS</u>	
F-111/PAL	F-4/JOY HOP	(4)
	F-4/RANCHO	(4)
F-111/LAW	F-4/TINT	(4)
	F-4/HUT	(4)
F-111/JACKEL	F-4/CONE	(4)
	F-4/LARIET	(4)
F-111/IRIS	F-4/ETHER	(4)
	F-4/LIST	(4)
TOTAL: F-111 (4) F-4 (32)		
F-4/CASH	F-4/HOFFER	(4)
	A-7/MADAM	(4)
F-4/CONFINE	F-4/JAZZ	(4)
	A-7/RAM	(4)
F-4/ASHCAN	F-4/REDTOP	(4)
	A-7/WORMY	(4)
F-4/BASJET	F-4/CARPUS	(4)
	A-7/MAGNET	(4)
TOTAL: F-4 (4) A-7 (16) F-4 (16)		

Summary: 8 Pathfinders Fraggd: 4 F-111s and 4 F-4s.
64 Strike Followers Fraggd: 48 F-4s and
16 A-7s.

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FIGURE 3-1

FRAGGED AND FLOWN PATHFINDER SORTIES (TACAIR)
27 June - 3 July 1973

(Source of Data; USSAG/7AF Fragmentary Orders and SEADAB)

DISCUSSION: There were 68 Pathfinder sorties fragged during the week and 36 sorties flown. This yields a daily average of 9.7 sorties fragged and 5.1 sorties flown. Weather in the Phnom Penh area (See Appendix A) was mostly favorable during the week and consequently many of the scheduled TACAIR followers made visual strikes. This accounts for the large difference in fragged and flown sorties during the first three days of the week. The close correspondence between fragged and flown sorties during the last four days of the week reflects implementation of the previously discussed policy concerning Pathfinder missions. There was little difference in the flight time for an F-4 or F-111 Pathfinder sortie; the average sortie length of a Pathfinder for the week was 4.04 hours. Three F-4s were scrambled for add-on sorties and there were 35 deviations from the frag. Most of the deviations as recorded in the SEADAB are given in Table 3.2.

TABLE 3.2

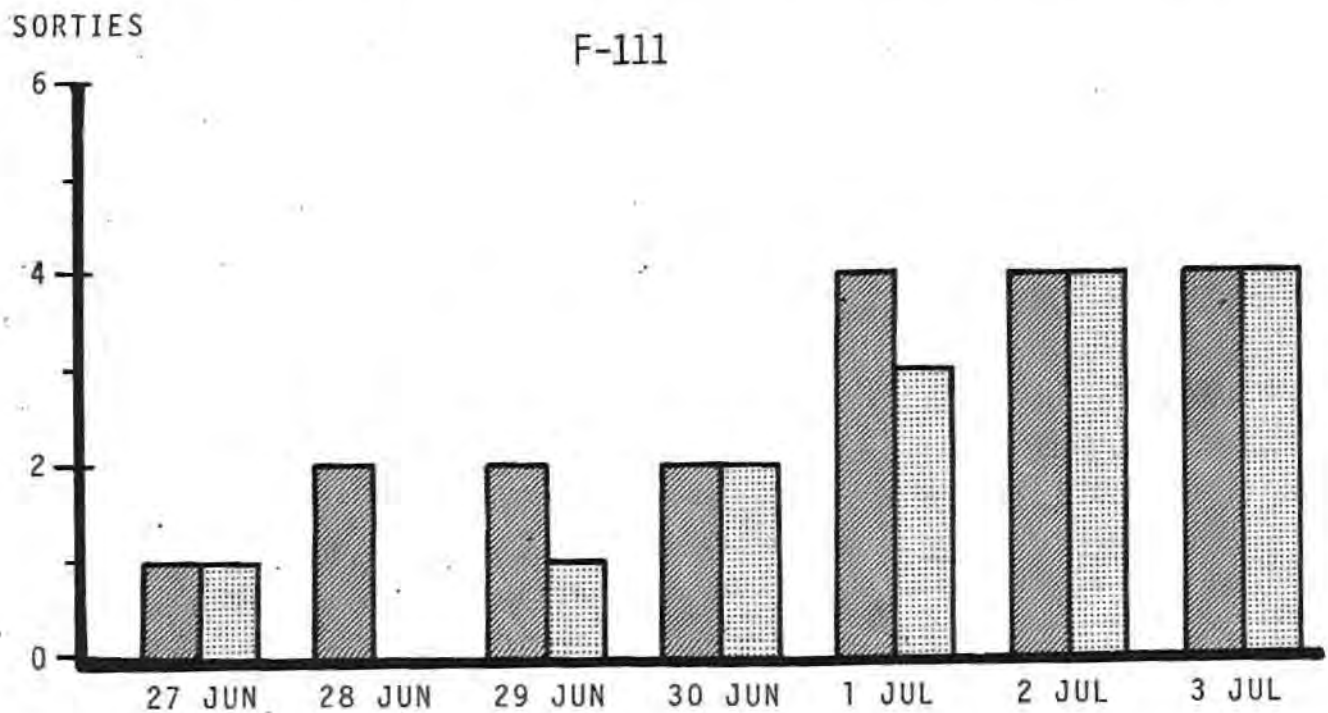
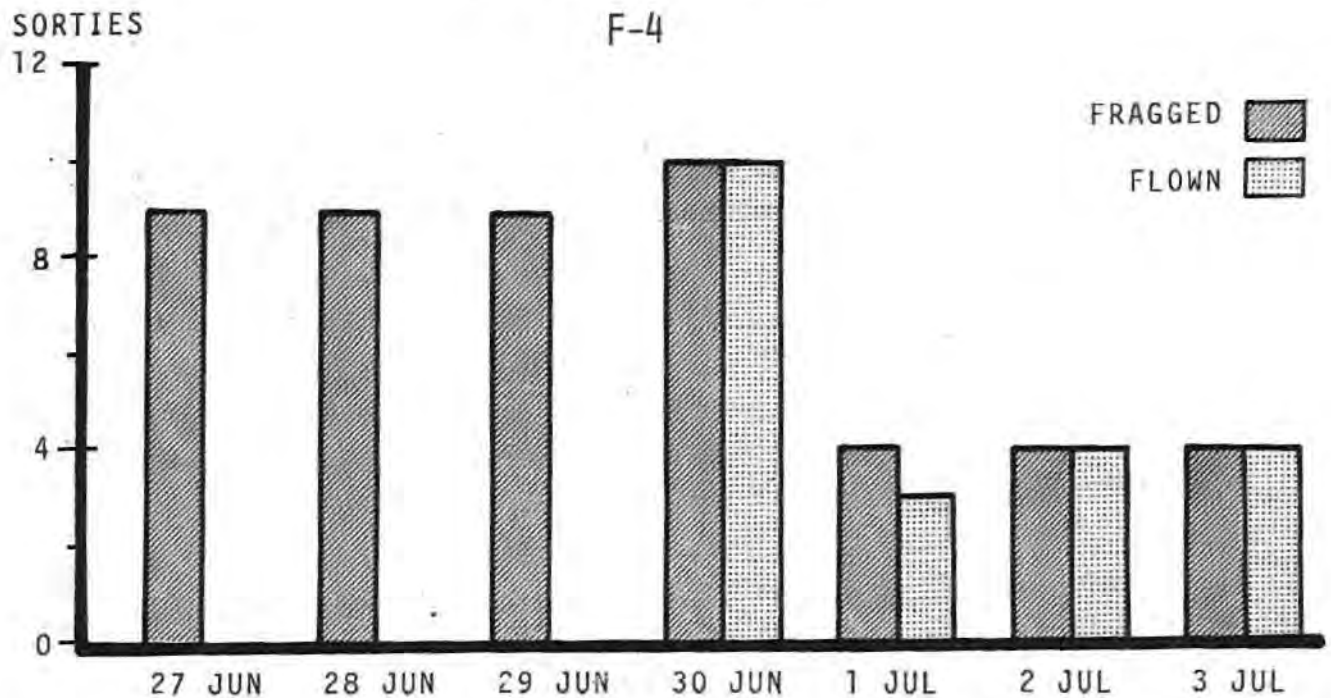
PATHFINDER DEVIATIONS FROM FRAG

<u>F-4</u>	<u>F-111</u>	<u>Reason for Deviation</u>
26	0	Change Mission/More Lucrative Target
0	1	Change Mission/No Requirement
0	2	Change Mission/No Reason Given
1	0	Ground Abort/Aircraft Malfunction
1	1	Air Abort/Aircraft Malfunction
2	0	Air Abort/Weather At Target
1	0	Cancellation/Spare Not Needed

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FRAGGED AND FLOWN PATHFINDER SORTIES (TACAIR) 27 JUN - 3 JUL 1973



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FIGURE 3-2

FRAGGED AND FLOWN PATHFINDER FOLLOWER SORTIES (TACAIR)
27 June - 3 July 1973

(Source of Data: USSAG/7AF Fragmentary Orders and SEADAB)

DISCUSSION: There were no Pathfinder led TACAIR sorties flown during the first two days of the week. There were 286 sorties fragged for the week and 203 flown; the flown sorties occurred primarily during the last four days of the week. Of the flown sorties, 166 were flown by F-4s and 37 were flown by A-7s. The average duration for a sortie was 2.04 hours for the A-7 and 2.52 hours for the F-4. Eighty-three deviations from the frag were recorded for the week; 56 for the F-4 and 27 for the A-7. Reasons for the deviations are given in Table 3.3.

TABLE 3.3

PATHFINDER FOLLOWER DEVIATIONS FROM FRAG

<u>F-4</u>	<u>A-7</u>	<u>Reason for Deviation</u>
10	4	Change Mission/More Lucrative Target
15	3	Change Mission/No Reason Given
12	4	Change Mission/Pathfinder Air Abort
4	3	Ground Abort/Aircraft Malfunction
3	5	Air Abort/Aircraft Malfunction
3	4	Air Abort/No Reason Given
1	0	Air Abort/Sympathetic
6	0	Air Abort/Fuel Depletion
2	0	Air Abort/No Target
2	0	Air Abort/Weather At Target

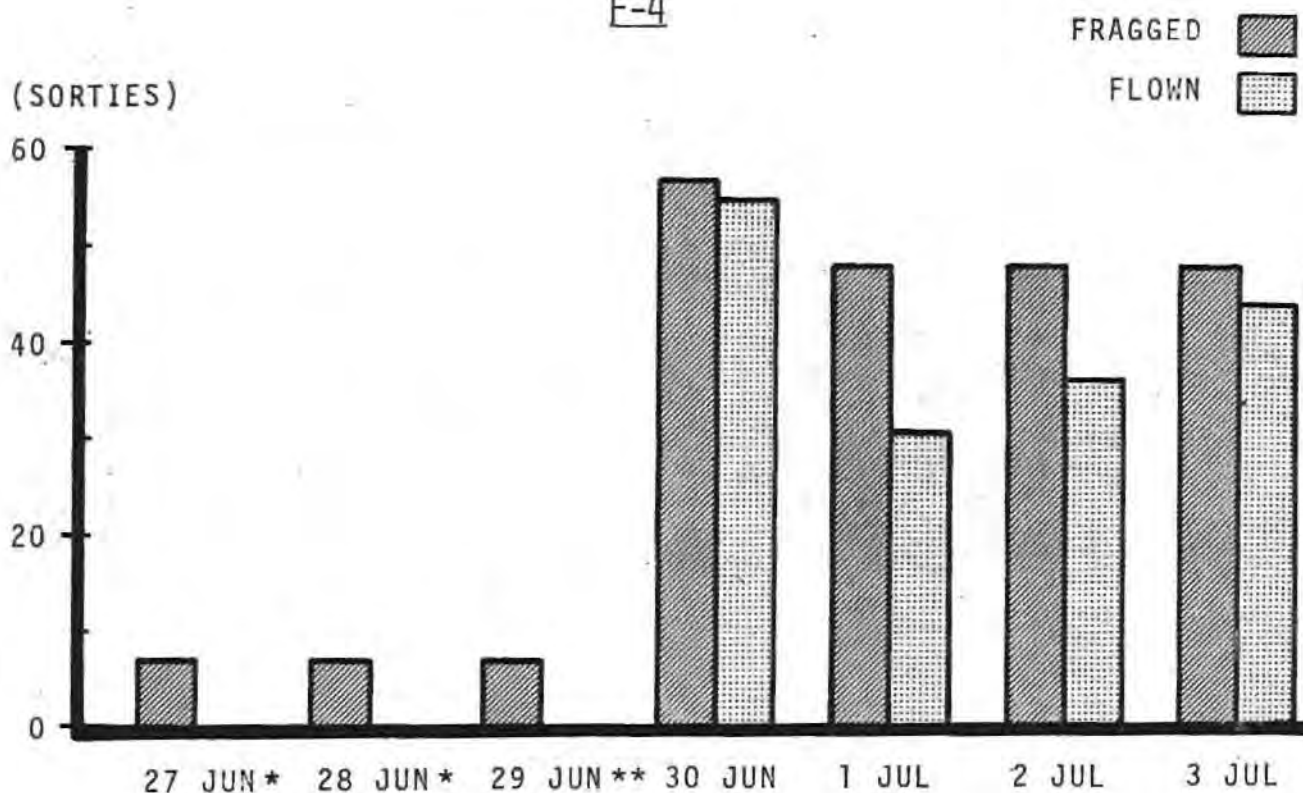
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TACAIR

FRAGGED AND FLOWN PATHFINDER FOLLOWER SORTIES

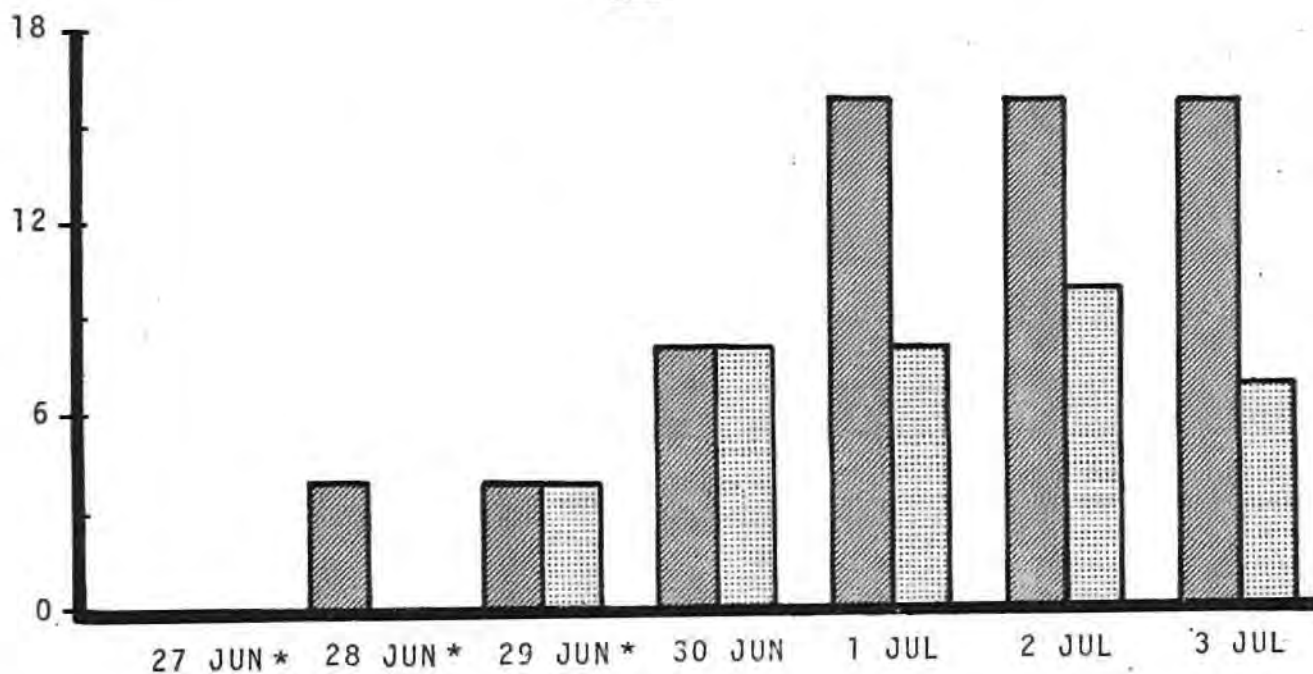
27 JUN - 3 JUL 1973

F-4



(SORTIES)

A-7



* NO PATHFINDER LED SORTIES FLOWN
** NO F-4 PATHFINDER LED SORTIES FLOWN

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FIGURE 3-3

TACAIR EFFORT FRAGGED TO BE PATHFINDER LED
27 June - 3 July 1973

(Source of Data: USSAG/7AF Fragmentary Orders)

DISCUSSION: The weight of TACAIR effort for the week which was fragged to be led in by Pathfinders is depicted in the figure. TACAIR as used here refers to an F-4, F-111 or A-7 sortie fragged to conduct a Strike, Interdiction, Armed Reconnaissance or Close Air Support Mission. There were 1437 TACAIR sorties fragged for the week, of which 286 were to be led by a Pathfinder. Thus, a substantial 20 percent of the TACAIR effort for the week was fragged to be led in by Pathfinders. This percentage increases to 24 when only the fragged F-4 and A-7 sorties are considered. Only 30 of the Pathfinder led sorties were fragged during the first 3 days of the week. A constant 64 sorties per day were fragged for the rest of the week reflecting the newly instituted policy of striking more targets with Pathfinder missions.

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TACAIR EFFORT FRAGGED TO BE PATHFINDER LED

27 JUN - 3 JUL 1973

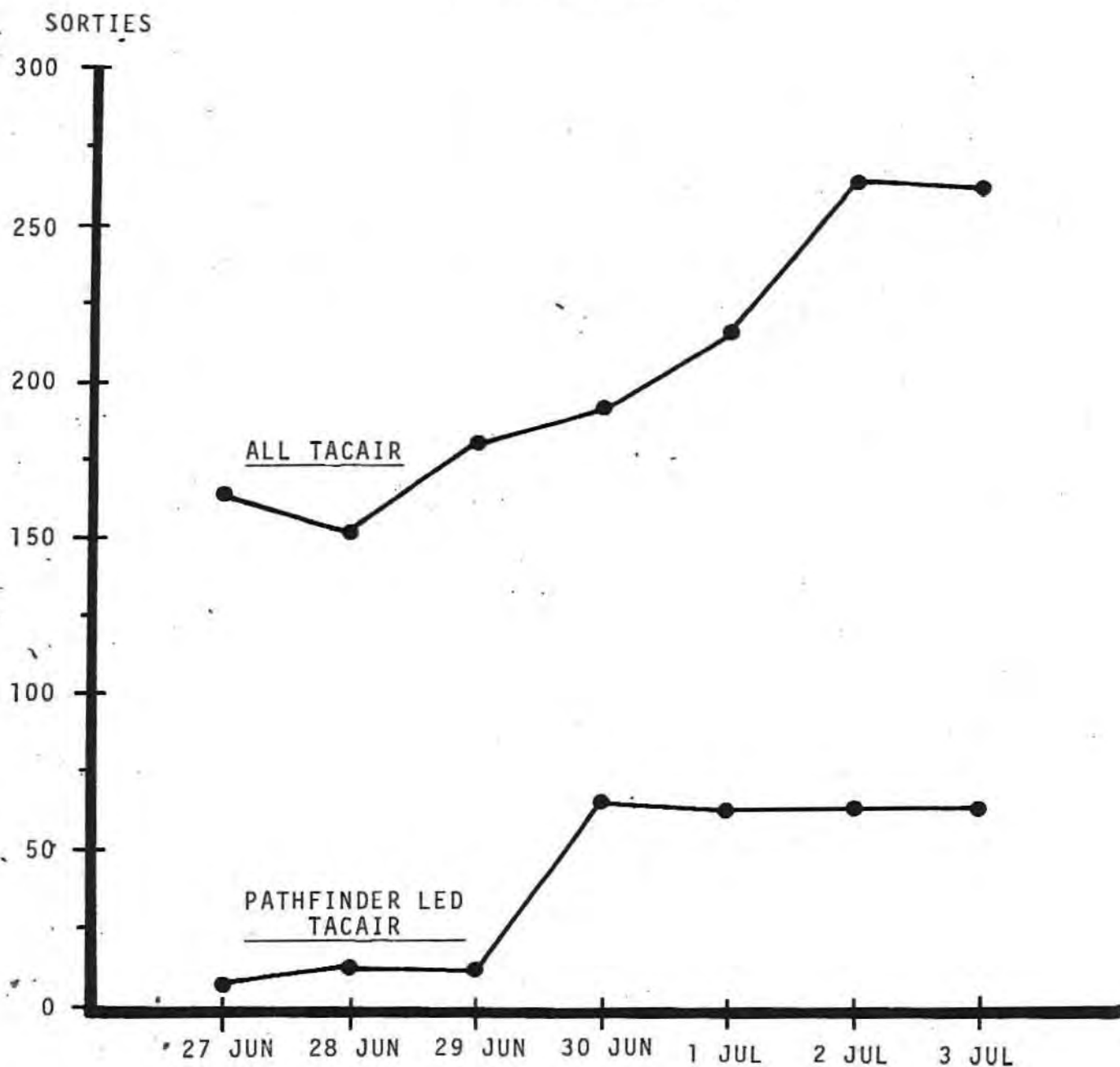


FIGURE 3-3

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FIGURE 3-4

RATIO OF FLOWN FOLLOWER TO PATHFINDER SORTIES
27 June - 3 July 1973

(Source of Data: SEADAB)

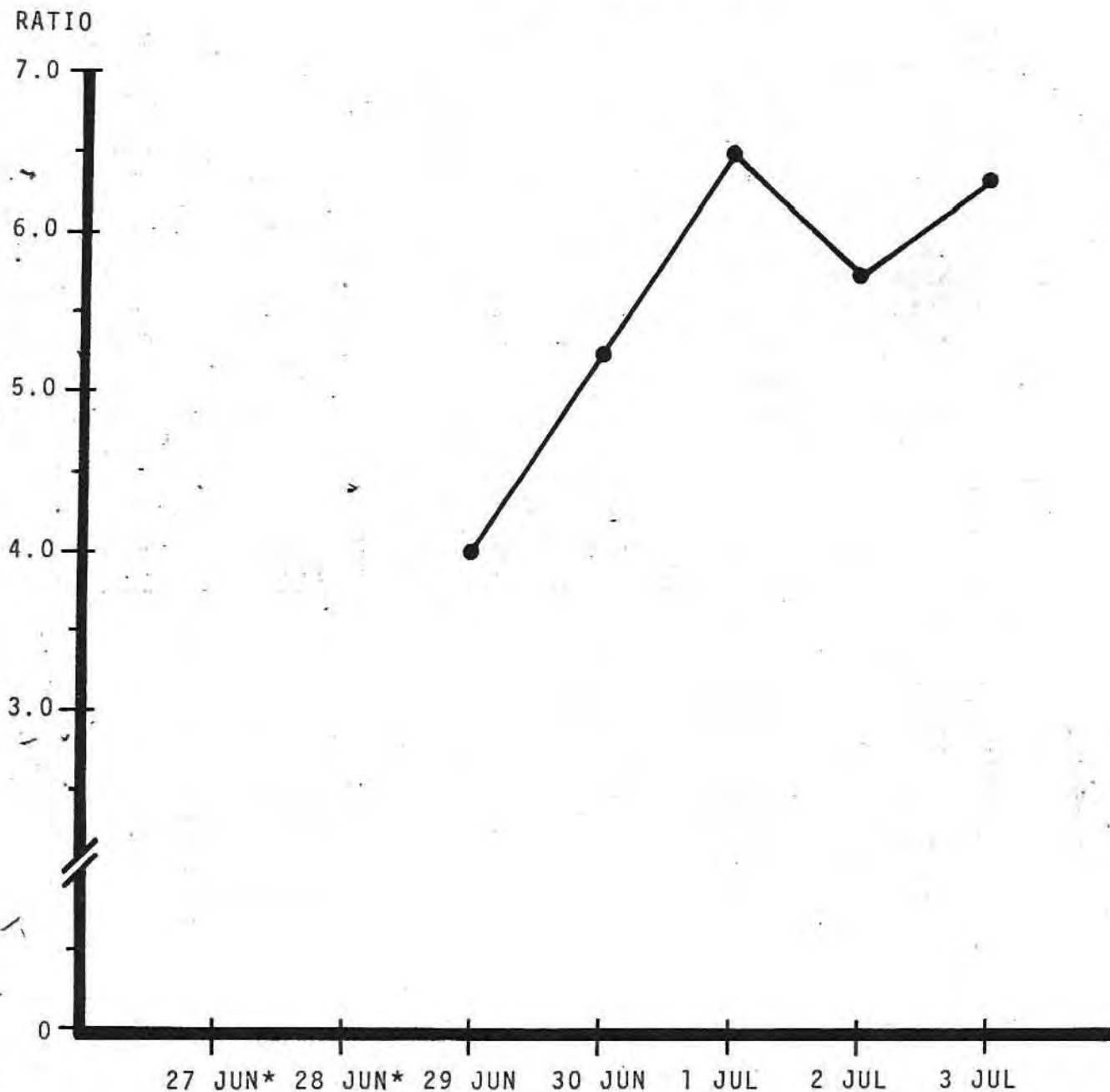
DISCUSSION: This figure illustrates the average number of TACAIR sorties led in by a single Pathfinder by showing the daily ratio of flown follower to Pathfinder sorties. No follower sorties were flown during the first two days of the week. During the last 4 days of the week each Pathfinder was fragged to lead in 2 flights (8 aircraft). The average for these days, however, is less than 8 due to deviations for the various reasons already given. This ratio decreased in later weeks when fewer multiple flights were fragged to be led in by a Pathfinder.

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RATIO OF FLOWN FOLLOWER TO PATHFINDER SORTIES

27 JUN - 3 JUL 1973



*NO PATHFINDER-LED STRIKES WERE ACCOMPLISHED. ONE PATHFINDER FLEW ON 27 JUNE AND NONE ON 28 JUNE

FIGURE 3-4

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FIGURE 3-5
TARGETS FRAGGED TO BE STRUCK BY PAVE PHANTOM LED B-52s
vs FRAGGED PAVE PHANTOM LEAD FLIGHTS

27 June - 3 July 1973

(Source of Data: USSAG/DOB ARC LIGHT Logs and SEADAB)

DISCUSSION: This figure shows the daily number of B-52 targets fragged to be struck by Pave Phantom led missions and the daily numbers of Pave Phantom flights which were fragged to lead the B-52s. The ratio of these two quantities is shown in the figure and represents the average number of targets fragged to be struck per flight of Pave Phantoms. The ratio is 2.07 for the entire week.

TABLE 3.4 below gives a more detailed look at the Pave Phantom Lead effort versus the B-52 effort led by Pave Phantom for the week of 27 June through 3 July 1973. Differences in the number of targets fragged and struck were always a result of aborts for LORAN or weather problems. Since there were 3 aircraft in each cell, each target deviation accounted for 3 line deviations. Line deviations that were above the three per target deviations were a result of B-52 ground or air abort.

TABLE 3.4

<u>DAY</u>	<u>B-52s Led by Pave Phantoms</u> <u>Lines/Targets</u>	<u>Pave Phantom Leads</u> <u>Sortie/Flights</u>
27 June	Fragged 21/7 Struck 18/6	Fragged 10/4 Flown 6/4
28 June	Fragged 42/14 Struck 33/11	Fragged 17/7 Flown 16/7
29 June	Fragged 48/16 Struck 28/10	Fragged 20/8 Flown 17/8
30 June	Fragged 60/20 Struck 45/15	Fragged 22/9 Flown 18/9
1 July	Fragged 36/12 Struck 35/12	Fragged 14/6 Flown 13/6
2 July	Fragged 30/10 Struck 20/7	Fragged 12/4 Flown 9/4
3 July	Fragged 48/16 Struck 29/10	Fragged 19/8 Flown 19/8

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TARGETS STRUCK BY PAVE PHANTOM LED
B-52s VS PAVE PHANTOM LEAD FLIGHTS

27 JUN - 3 JUL 1973

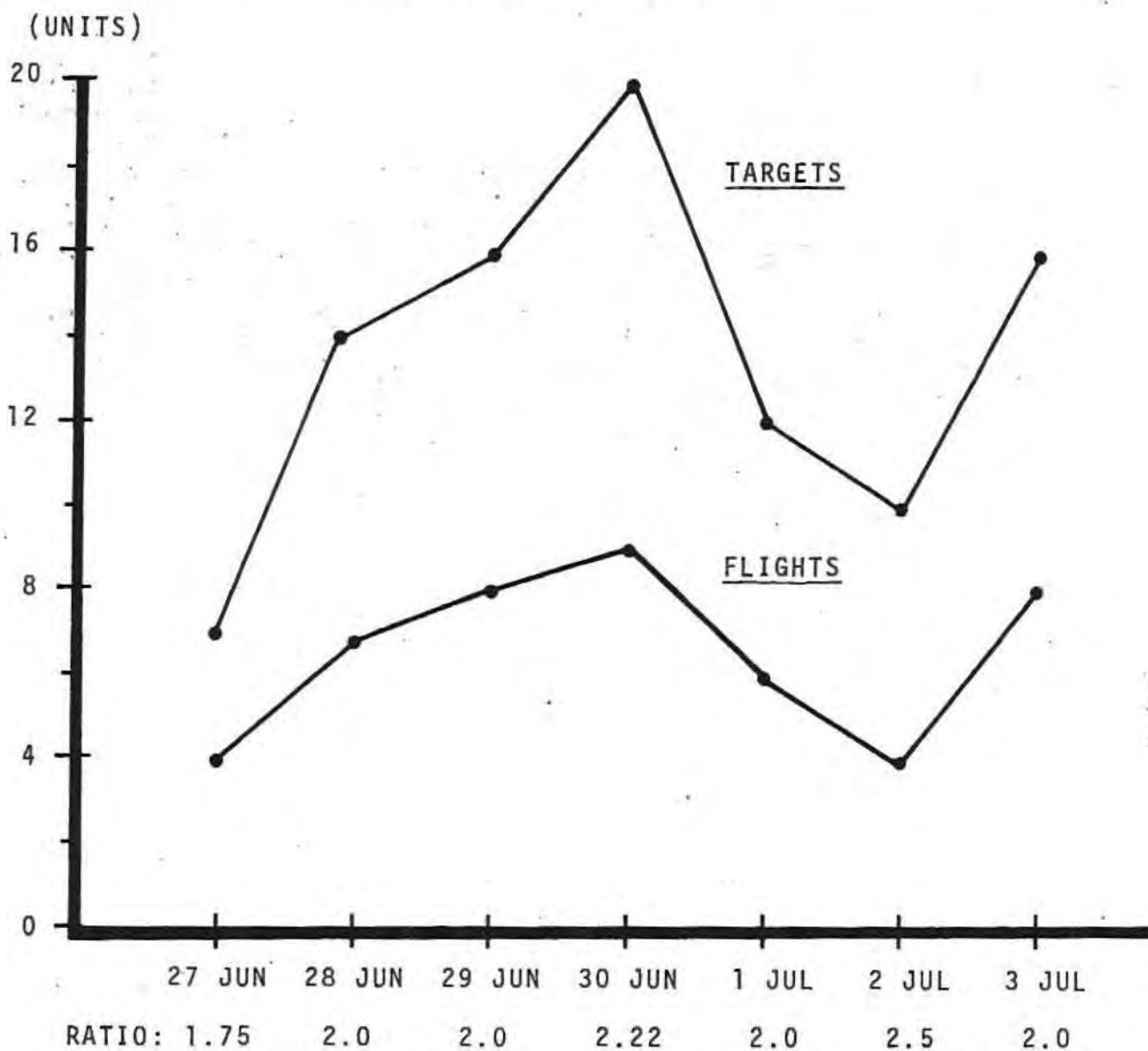


FIGURE 3-5
43

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FIGURE 3-6

B-52 PRIMARY TARGETS FRAGGED AND STRUCK BY MODE OF DELIVERY

27 June - 3 July 1973

(Source of Data: USSAG/DOB ARC LIGHT Logs)

DISCUSSION: This figure illustrates the amount of variation in the mode of delivery of B-52 ordnance. The method of delivery was highly dependent on target locations. All targets struck by GDB were in northern KR within range of the Ubon GDB site, while targets in southern KR were struck either by the Pathfinder method or in the synchronous (including beacon bombing) mode. The mode of delivery can therefore be used to indicate relative target locations. Refer to Fig 2-2, pg 31, for actual coverage of the Ubon GDB site and the beacon locations in the KR. During the week of 27 June 1973, 73.8% of the targets were fragged to be struck in the Pathfinder mode compared to 69.5% for the period 23 March - 15 August 1973. June 30th was the only day within the period of this report for which all targets were fragged to be Pave Phantom led.

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B-52 PRIMARY TARGETS FRAGGED AND STRUCK BY MODE OF DELIVERY

27 JUN - 3 JUL 1973

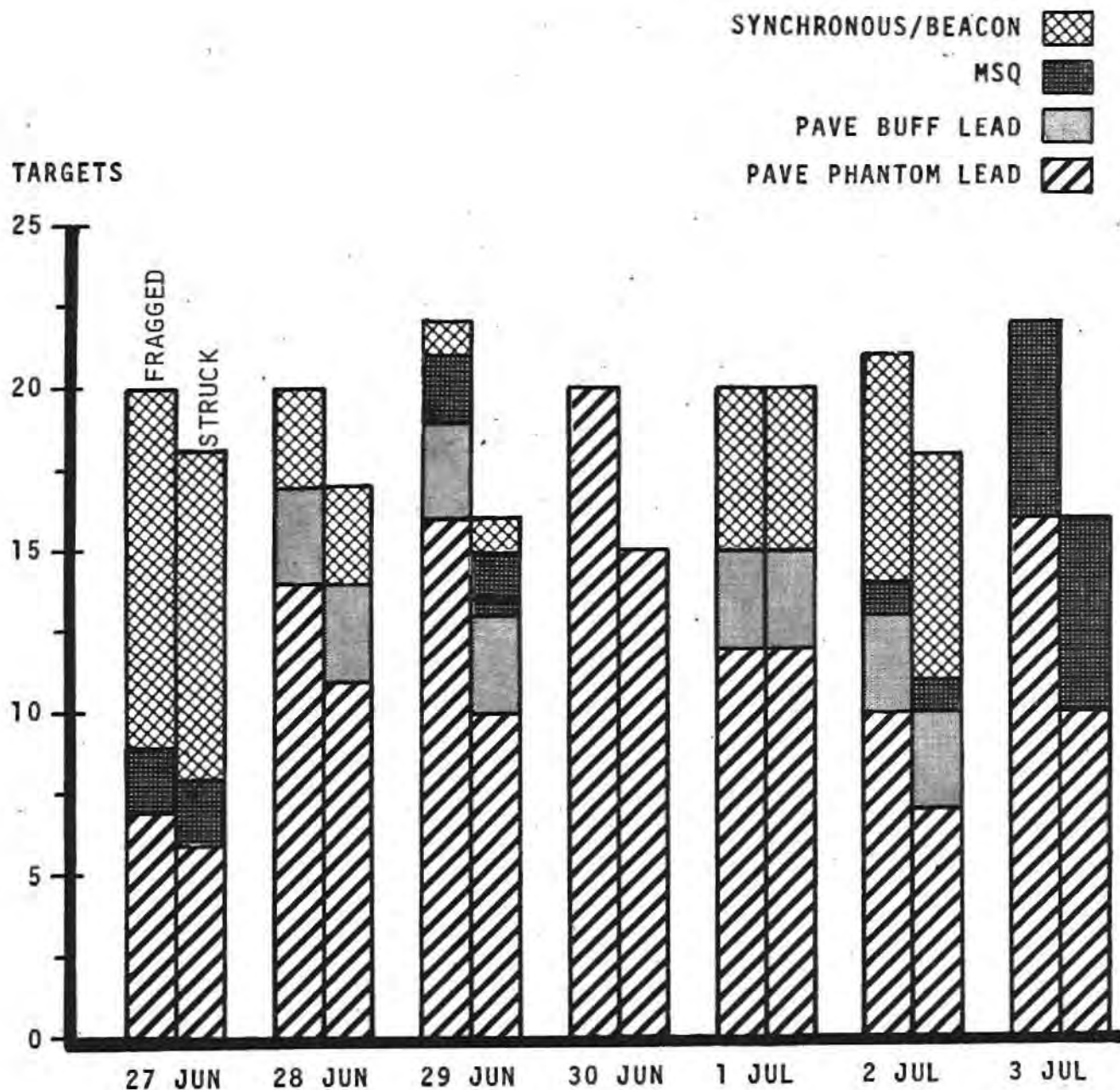


FIGURE 3-6

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CHAPTER 4

PATHFINDER OPERATIONS
2 May to 15 August 1973

(C) Although Pathfinders for TACAIR were fragged prior to 30 June, they were generally not used in the Pathfinder role when visual meteorological conditions existed in the target area. After 30 June, when the policy was initiated to conduct fragged Pathfinder missions regardless of weather conditions, the flown sorties generally exceeded the fragged ones and the level of activity increased. A portion of the increase in Pathfinder missions after 30 June is due to a general decline in the favorable weather conditions after that date. However, a large part of the increase is attributable to an increased requirement for TACAIR strikes to support the FANK.

(S) Immediately apparent in reviewing the activity for the last seven weeks of air strikes is a lull in Pathfinder activity in the last week in July. The tactical situation called for the use of aircraft normally used in the Pathfinder role to support higher priority strikes. F-111 Pathfinding was halted by 7AF for the period 23 July to 2 August. These F-111s were used to make interdiction strikes in advance of Mekong convoys and to strike B-52 targets not hit because of Pathfinder led B-52 aborted missions. Additionally, much of the F-4 and A-7 effort for the week 27 - 31 July was flown under FAC control in support of the "River Convoy Box" concept. The A-7s conducted strikes on both sides of the Mekong River within the box during convoy passage and F-4s provided continuous convoy coverage.

(U) Beginning on 23 March 1973 and continuing through 15 August 1973, there was a gradual increase in Pathfinder led B-52s in the Khmer Republic. Pathfinder led B-52s remained the primary means of B-52 ordnance delivery throughout the period.

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FIGURE 4-1

FRAGGED AND FLOWN PATHFINDER SORTIES (TACAIR)
2 May - 15 August 1973

Source of Data: SEADAB*

DISCUSSION: No F-111 Pathfinders were fragged or flown for five of the fifteen weeks. Overall, 593 sorties were fragged and 474 were flown during the time period, yielding an average of 40 sorties fragged and 32 sorties flown each week. The average length of a Pathfinder sortie for the 15 week period was 3.42 hours for the Pave Phantom and 3.36 hours for the F-111. There were 436 F-4 deviations and only 10 F-111 deviations during the 15 weeks. Table 4.1 gives general reasons for deviations as recorded in the SEADAB. Care should be exercised in using the data presented in this table, since often a given sortie had several deviations and, consequently, deviations do not correspond to sorties in a one-to-one fashion. Moreover, some of the deviations were add-on sorties and others merely changed the target to be struck by the Pathfinder mission.

TABLE 4-1

TACAIR PATHFINDER DEVIATIONS
2 May - 15 August 1973

<u>F-4</u>	<u>F-111</u>	<u>Reason for Deviation</u>
61	1	Air Abort
12	0	Ground Abort
52	0	Cancelled
173	1	Change Target
18	7	Change Mission
34	1	Aircraft Added
72	0	Immediate Request Scrambles
14	0	Return to Base Early

*Fragged data for the week 27 June - 3 July was taken directly from the frags.

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FRAGGED & FLOWN PATHFINDER SORTIES (TACAIR)

2 MAY - 15 AUGUST 1973

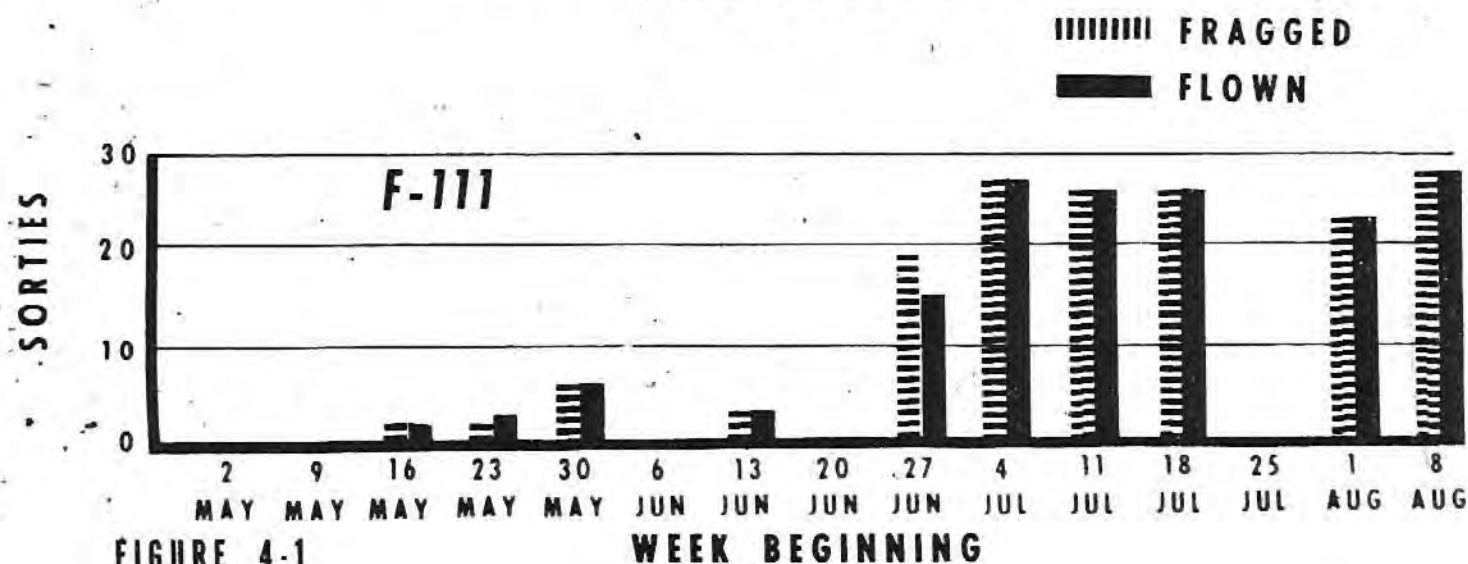
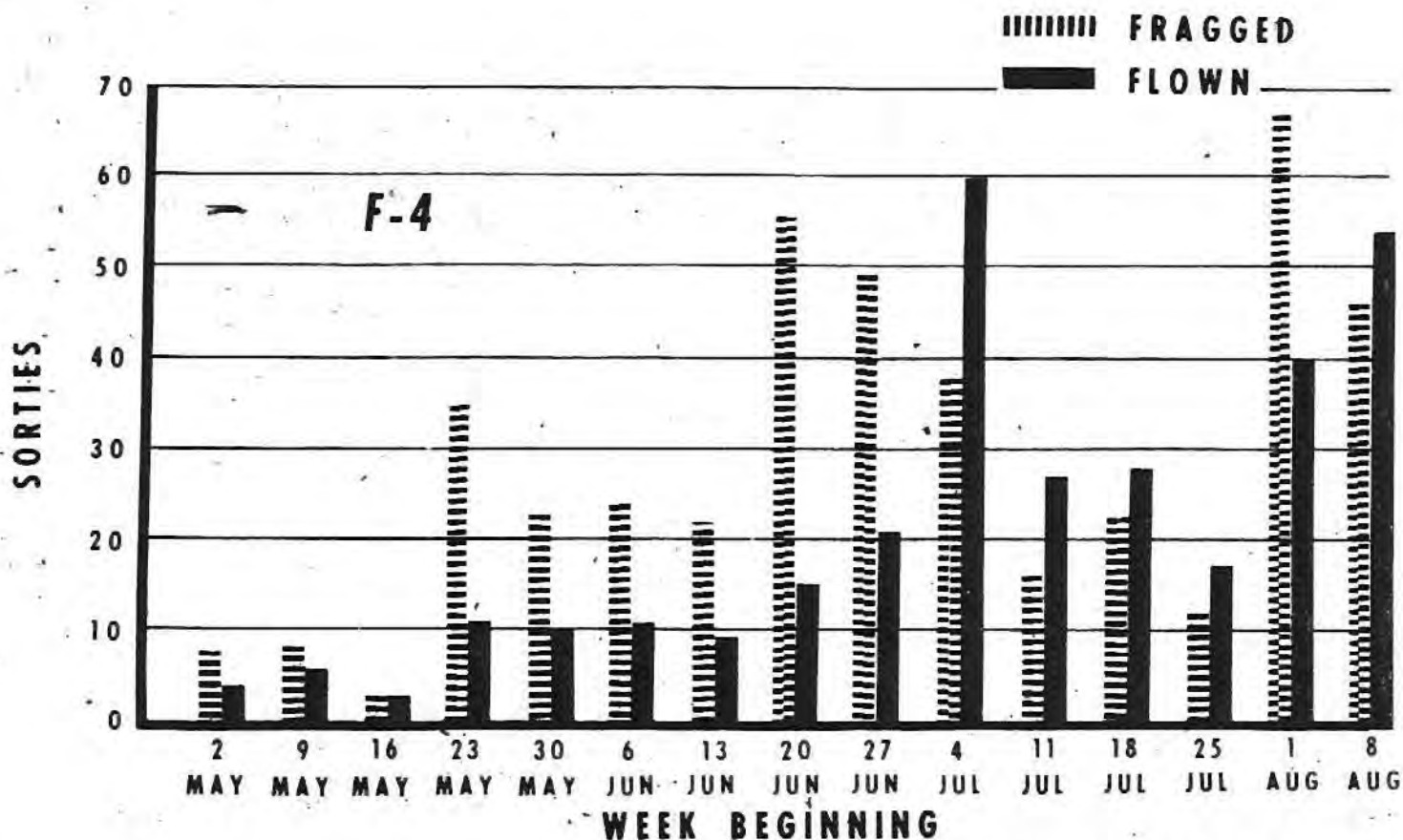


FIGURE 4-1

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FIGURE 4-2

FRAGGED AND FLOWN PATHFINDER FOLLOWER SORTIES (TACAIR)
2 May - 15 August 1973

Source of Data: SEADAB*

DISCUSSION: There were 1559 TACAIR sorties fragged to be led by Pathfinders during the period 2 May to 15 August and 1420 sorties flown during the period. The fragged/ flown sorties for F-4s and A-7s, respectively, were 1354/1247 and 205/173. An average of 95 sorties per week were flown during the period with a peak of 364 sorties for the week 4 - 10 July. The average length of a sortie for the time period is 2.7 hours for an F-4 and 2.2 hours for an A-7. SEADAB recorded deviations are presented in Table 4.2, and the comments regarding Table 4.1 are applicable here.

TABLE 4.2

TACAIR PATHFINDER FOLLOWER DEVIATIONS
2 May - 15 August 1973

<u>F-4</u>	<u>A-7</u>	<u>Reason for Deviation</u>
33	13	Air Abort
21	6	Ground Abort
19	2	Cancelled
597	69	Change Mission

There were 470 F-4 and 42 A-7 "Change Mission" deviations due to "More Lucrative Target". This indicates that a considerable amount of flexibility was available in the use of TACAIR led by Pathfinders.

*Fragged data for the week 27 June - 3 July was taken directly from the frags.

FRAGGED & FLOWN PATHFINDER FOLLOWER SORTIES (TACAIR)

2 MAY - 15 AUGUST 1973

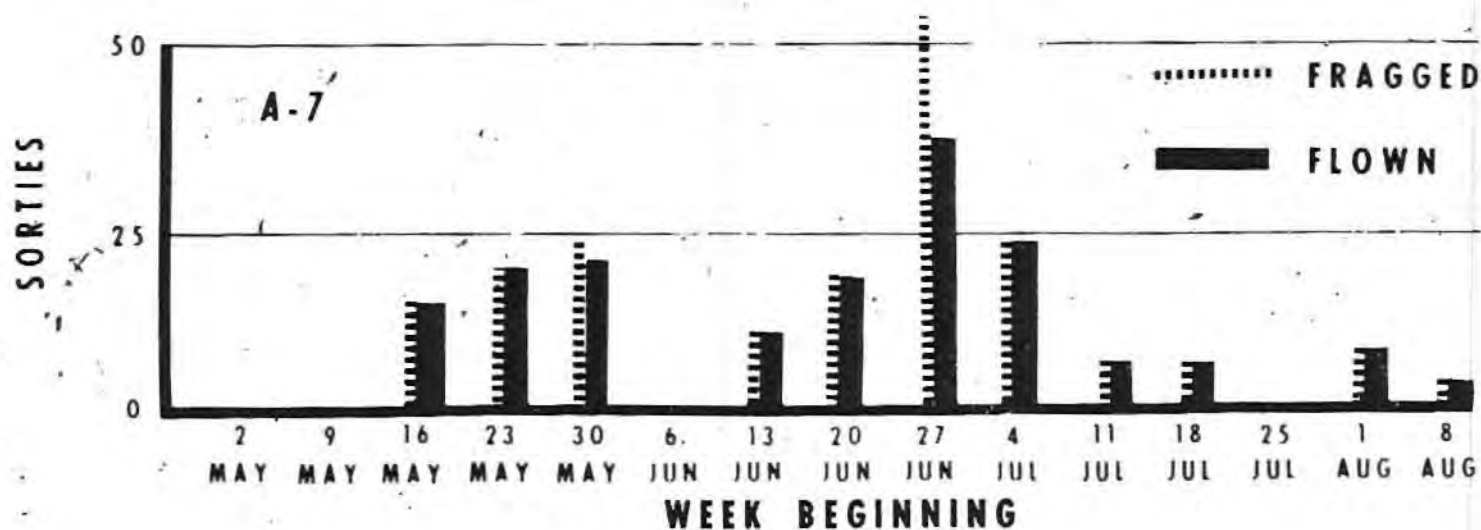
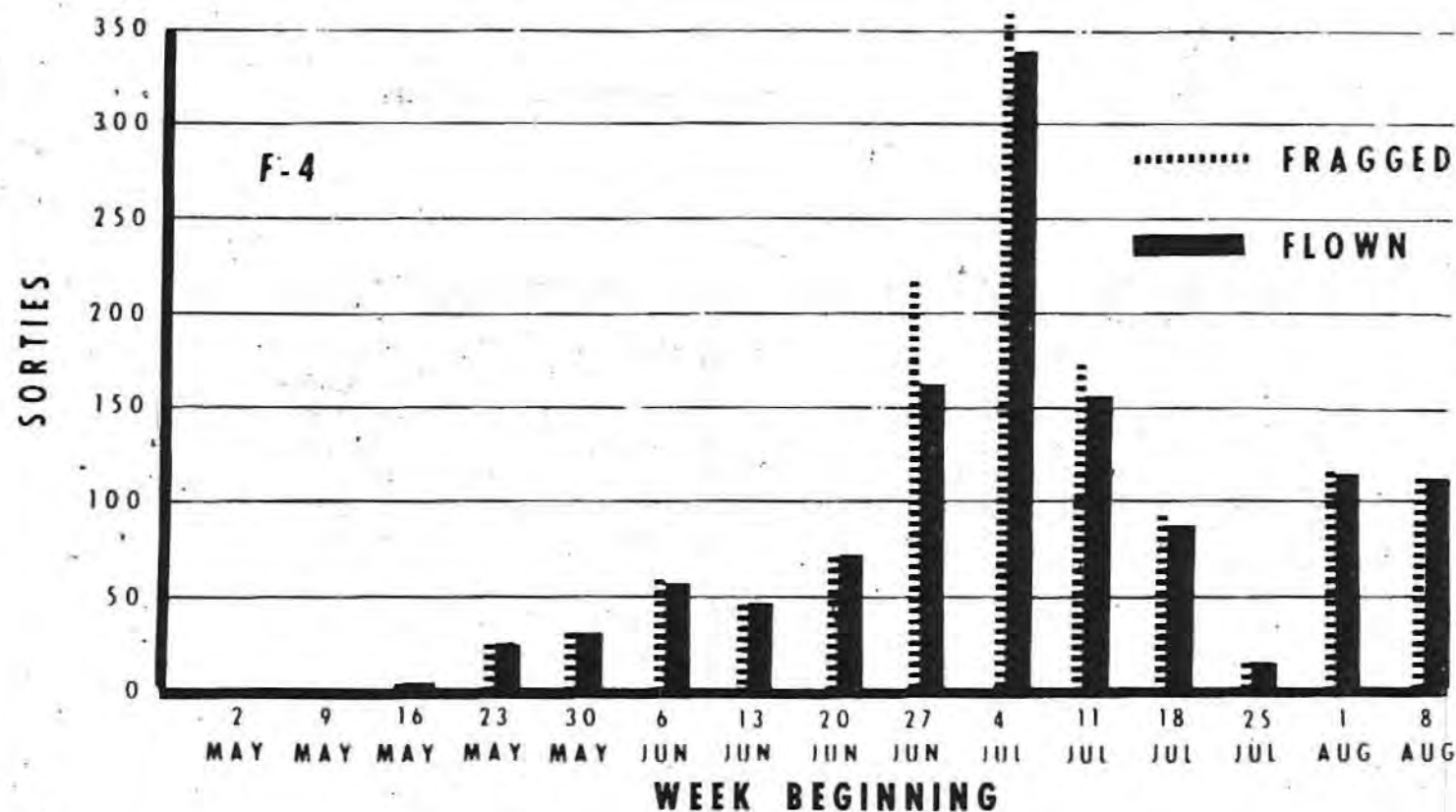


Figure 4-2

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FIGURE 4-3

USAF TACAIR SORTIES FLOWN IN KHMER REPUBLIC BY WEEK
2 May - 15 August 1973

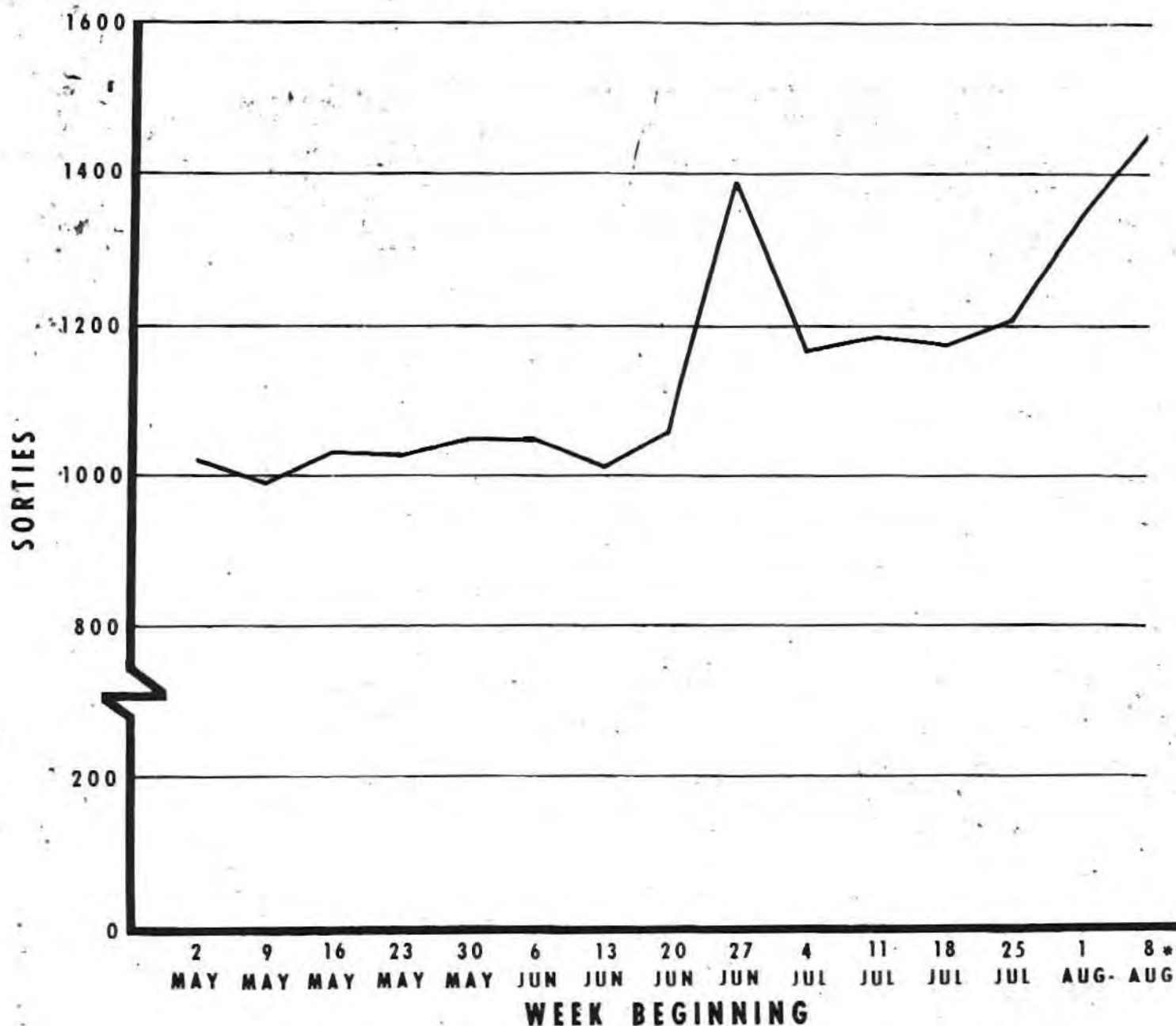
Source of Data: SEADAB

DISCUSSION: The TACAIR sorties shown here are F-4, F-111, and A-7 sorties flown as Strike, Close Air Support, Interdiction or Armed Reconnaissance missions flown in the Khmer Republic. A total of 17,181 TACAIR sorties were flown during the 15 weeks; 58 percent by F-4s, 19 percent by F-111s and 23 percent by A-7s. This yields an average of 1145 sorties flown per week. The largest deviations from this average occurred during the first two weeks of August and the week 27 June to 3 July when an average of 1395 sorties per week were flown.

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USAF TACAIR SORTIES FLOWN IN KHMER REPUBLIC BY WEEK

2MAY - 15 AUGUST 1973



* 8 DAYS

FIGURE 4-3

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FIGURE 4-4

PATHFINDER LED TACAIR SORTIES FLOWN
2 May - 15 August 1973

Source of Data: SEADAB

DISCUSSION: This figure shows the weekly TACAIR sorties that were Pathfinder led. Note that the follower sorties were predominately flown by F-4s. No Pathfinder led sorties were flown during the first two weeks and 1420 were flown during the next 13 weeks, 1247 by F-4s and 173 by A-7s. Thus, 88 percent of the TACAIR follower sorties were flown by F-4s during the time period.

PATHFINDER LED TACAIR SORTIES FLOWN 2 MAY - 15 AUGUST 1973

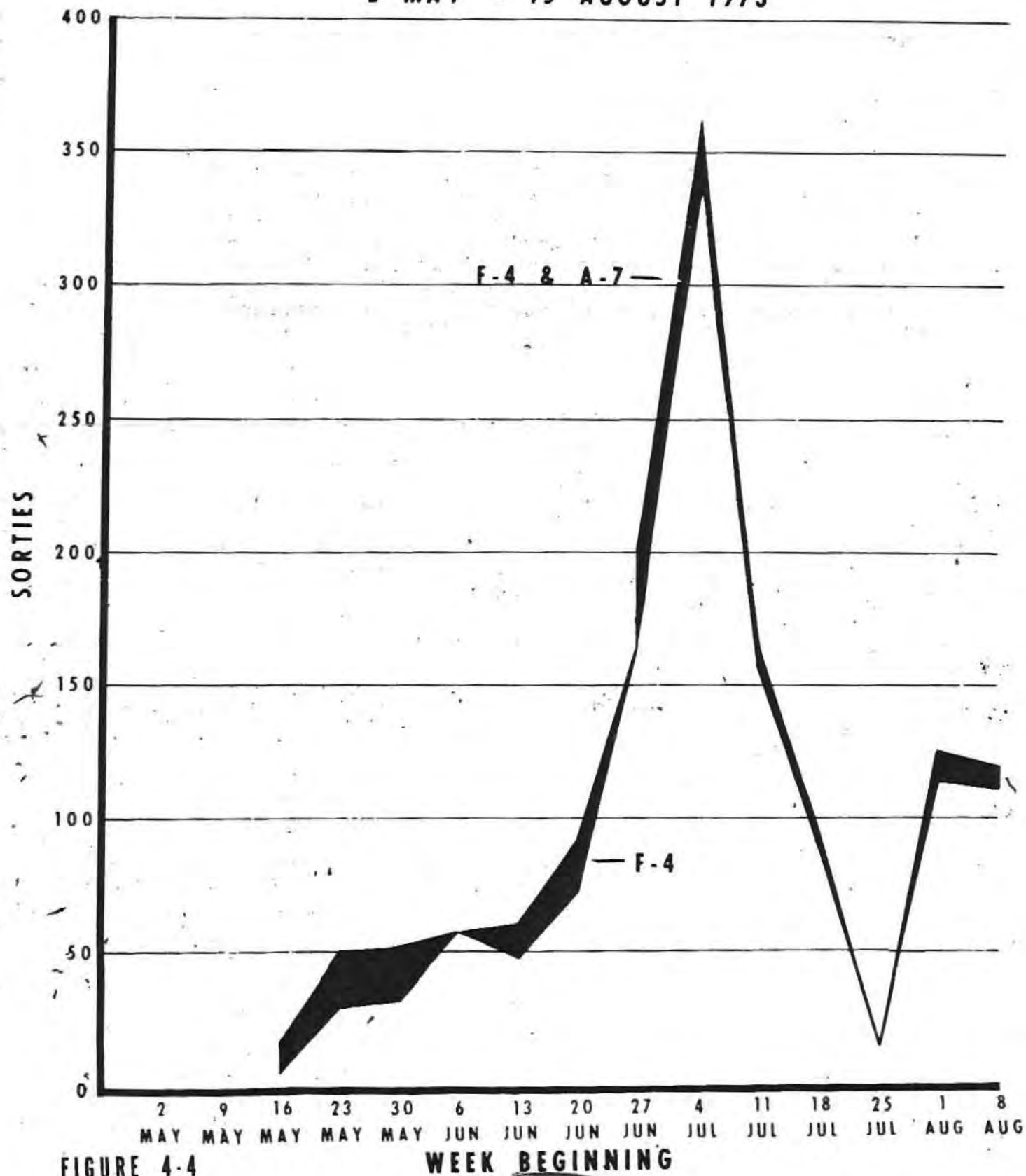


FIGURE 4-4

WEEK BEGINNING

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FIGURE 4-5

PERCENT OF FLOWN F-4 AND A-7 SORTIES PATHFINDER LED
2 May - 15 August 1973

Source of Data: SEADAB

DISCUSSION: This figure shows that the weight of TACAIR effort conducted by Pathfinder missions in the Khmer Republic was significant. During seven of the last eight weeks of TACAIR sorties more than ten percent of the A-7 and F-4 sorties flown were led by Pathfinders. The peak of TACAIR Pathfinding activity occurred during the week 4 - 10 July when 38 percent of the F-4 and A-7 sorties flown were Pathfinder led.

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**PERCENT OF FLOWN
F-4 AND A-7 SORTIES PATHFINDER LED
2 MAY - 15 AUGUST 1973**

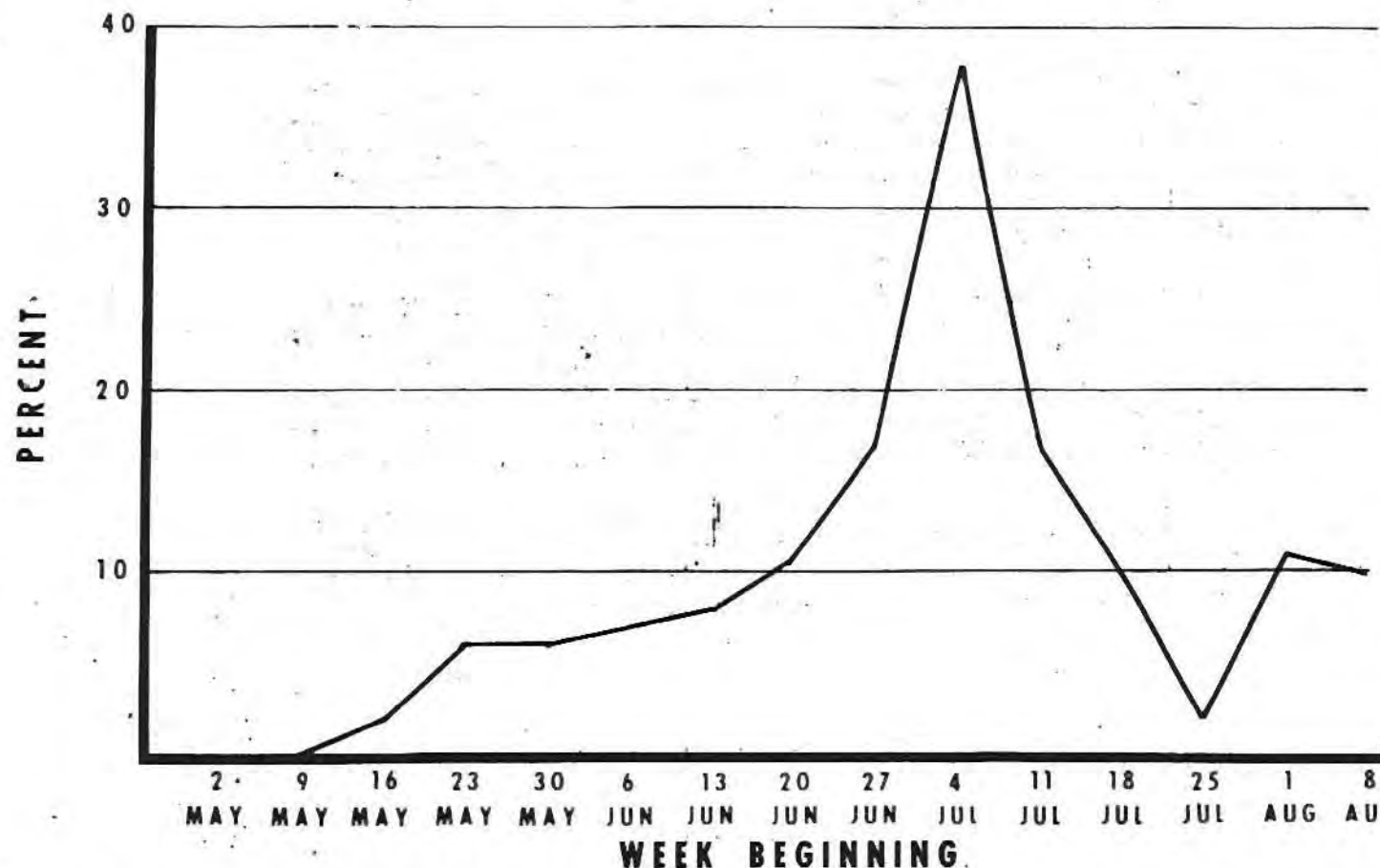


FIGURE 4-5

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FIGURE 4-6

B-52 PRIMARY TARGETS FRAGGED BY MODE OF DELIVERY

23 March - 15 August 1973

Source of Data: USSAG/DOB ARC LIGHT Logs

DISCUSSION: This figure illustrates the variations in the mode of delivery of B-52 ordnance. These variations were highly dependent on target locations. All targets struck by GDB were in northern Khmer Republic within range of the Ubon GDB while targets in southern Khmer Republic were struck by Pathfinder or synchronous (including beacon bombing) modes. Thus the mode of delivery indicates target locations. Refer to Figure 2-2, page 31, for actual Khmer coverage of the Ubon GDB site and beacon locations. During the period 2 May - 15 August 1973, 71.5 percent of the B-52 targets were fragged to be struck in the Pathfinder mode compared to 69.5 percent for the period 23 March - 15 August 1973.

The graph shows that a significant increase in the use of Pave Buff led B-52 bombing occurred during the period 8-15 August 1973, reflecting increased activity in southern Khmer Republic around Phnom Penh.

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B-52 FRAGGED TARGETS BY MODE OF DELIVERY

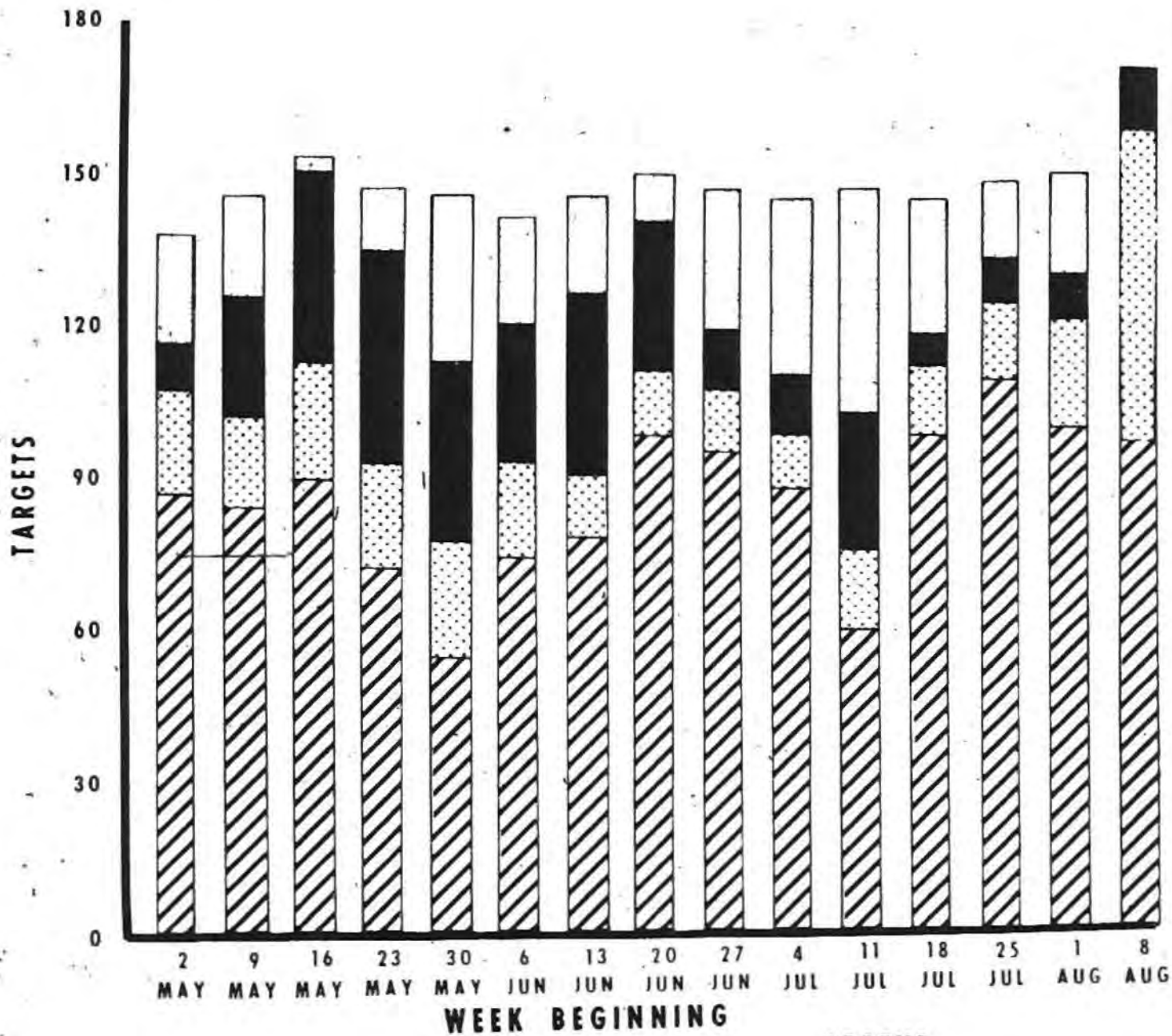
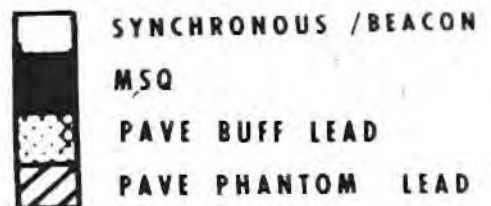


FIGURE 4-6

59

LEGEND



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FIGURE 4-7

PERCENT OF B-52 EFFORT BY MODE OF DELIVERY
23 March - 15 August 1973

Source of Data: USSAG/DOB ARC LIGHT Logs

DISCUSSION: This figure shows the percent of B-52 effort by mode of delivery in three ways. The first column for each period gives the percentage of primary targets fragged by mode of delivery. The second column gives the percent of primary targets struck by mode of delivery. The third column gives the percent of primary and secondary targets struck by mode of delivery. The figure indicates an increasing dependence on Pave Phantom Leads.

Table 4.3 gives the percent of B-52 effort by mode of delivery for the same cases as mentioned above.

TABLE 4.3

	<u>Percent of Primary Targets Fragged</u>	<u>Percent of Primary Targets Struck</u>	<u>Percent of Total Targets Struck</u>
Pave Phantom	54.6	52.3	47.5
Pave Buff	14.8	13.9	12.6
GDB	15.6	17.5	24.7
Synchronous	15	16.3	15.2

The increase in GDB percentage for total targets struck is due to the fact that 95.5 percent of all secondary targets were struck by GDB. [Synchronous] bombing was used for the remaining secondary targets.

During the period 23 March - 15 August 1973, Pathfinders were fragged for 69.4 percent of all primary targets and they struck 66.2 percent of the primary targets and 60.1 percent of all targets struck.

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PERCENT OF B-52 EFFORT BY MODE OF DELIVERY

23 MARCH - 15 AUGUST 1973

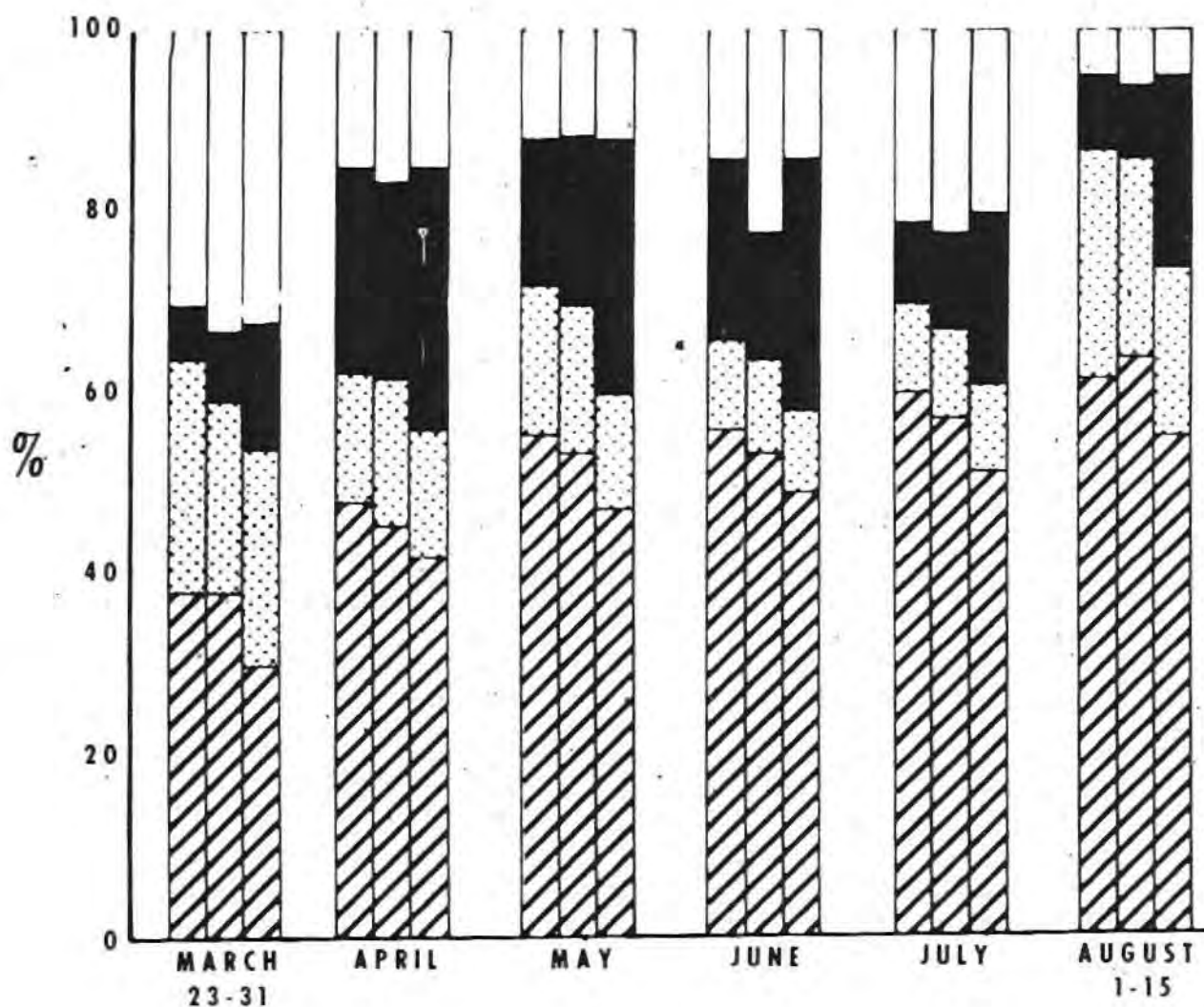


FIGURE 4-7
61

LEGEND



SYNCHRONOUS / BEACON
MSQ
PAVE BUFF LEAD
PAVE PHANTOM LEAD

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FIGURE 4-8

B-52 LINES AND TARGETS BY MODE OF DELIVERY
23 March - 15 August 1973
Source of Data: USSAG/DOB ARC LIGHT Logs

DISCUSSION: This figure gives primary B-52 lines and targets that were fragged and struck. Numbers in parentheses are secondary lines and targets that were struck.

Table 4.4 shows, by mode of delivery, the percentage of fragged primary targets for which bombs were successfully released.

TABLE 4.4

<u>Mode of Delivery</u>	<u>Percent</u>
Pave Phantom	81.5
Pave Buff	79.8
GDB	95.2
Synchronous	92.4

Table 4.5 shows, by mode of delivery, the percentage of fragged primary lines which released bombs successfully.

TABLE 4.5

<u>Mode of Delivery</u>	<u>Percent</u>
Pave Phantom	78.9
Pave Buff	78.1
GDB	93.1
Synchronous	89.6

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FIGURE 4-8

B-52 LINES AND TARGETS BY MODE OF DELIVERY

<u>MONTH</u>		<u>PAVE PHANTOM</u> <u>LINES/TARGETS</u>	<u>PAVE BUFF</u> <u>LINES/TARGETS</u>	<u>GDB</u> <u>LINES/TARGETS</u>	<u>SYNCHRONOUS*</u> <u>LINES/TARGETS</u>
MARCH	FRAGGED	207/69	138/46	36/12	162/54
23-31	STRUCK	189/65	114/38	36/12 (35/12)	156/54
APRIL	FRAGGED	939/313	294/98	408/140	291/97
	STRUCK	773/265	258/87	379/134 (110/42)	287/97
MAY	FRAGGED	1062/354	279/93	347/120	217/73
	STRUCK	811/284	224/77	305/109 (176/53)	174/61 (19/8)
JUNE	FRAGGED	1047/349	189/63	354/125	249/84
	STRUCK	824/284	156/52	341/121 (99/39)	222/78 (4/2)
JULY	FRAGGED	1164/388	201/67	163/60	382/132
	STRUCK	899/306	157/53	157/59 (130/59)	331/118
AUGUST	FRAGGED	585/195	252/84	56/21	52/18
1 - 15	STRUCK	454/155	158/53	52/20 (96/37)	40/14 (6/2)
23 MAR-	FRAGGED	5004/1668	1353/451	1365/478	1353/458
15 AUG	STRUCK	3950/1359	1057/360	1270/455 (646/252)	1212/423 (29/12)

*Includes Beacon Bombing

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FIGURE 4-9

TARGETS FRAGGED TO BE STRUCK BY PAVE PHANTOM LED B-52s
vs FRAGGED PAVE PHANTOM LEAD FLIGHTS
2 May - 15 August 1973

Source of Data: SEADAB and USSAG/DOB ARC LIGHT Logs

DISCUSSION: This figure shows the weekly number of B-52 targets fragged to be struck by Pave Phantom led cells and the weekly numbers of Pave Phantom flights which were fragged to lead in the B-52s. The ratio of these two quantities as shown in the figure represents the average number of targets fragged to be struck per flight of Pave Phantoms. The ratio is 2.12 for the period 2 May - 15 August 1973.

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TARGETS STRUCK BY PAVE PHANTOM LED B-52s Vs PAVE PHANTOM LEAD FLIGHTS

2 MAY - 15 AUGUST 1973

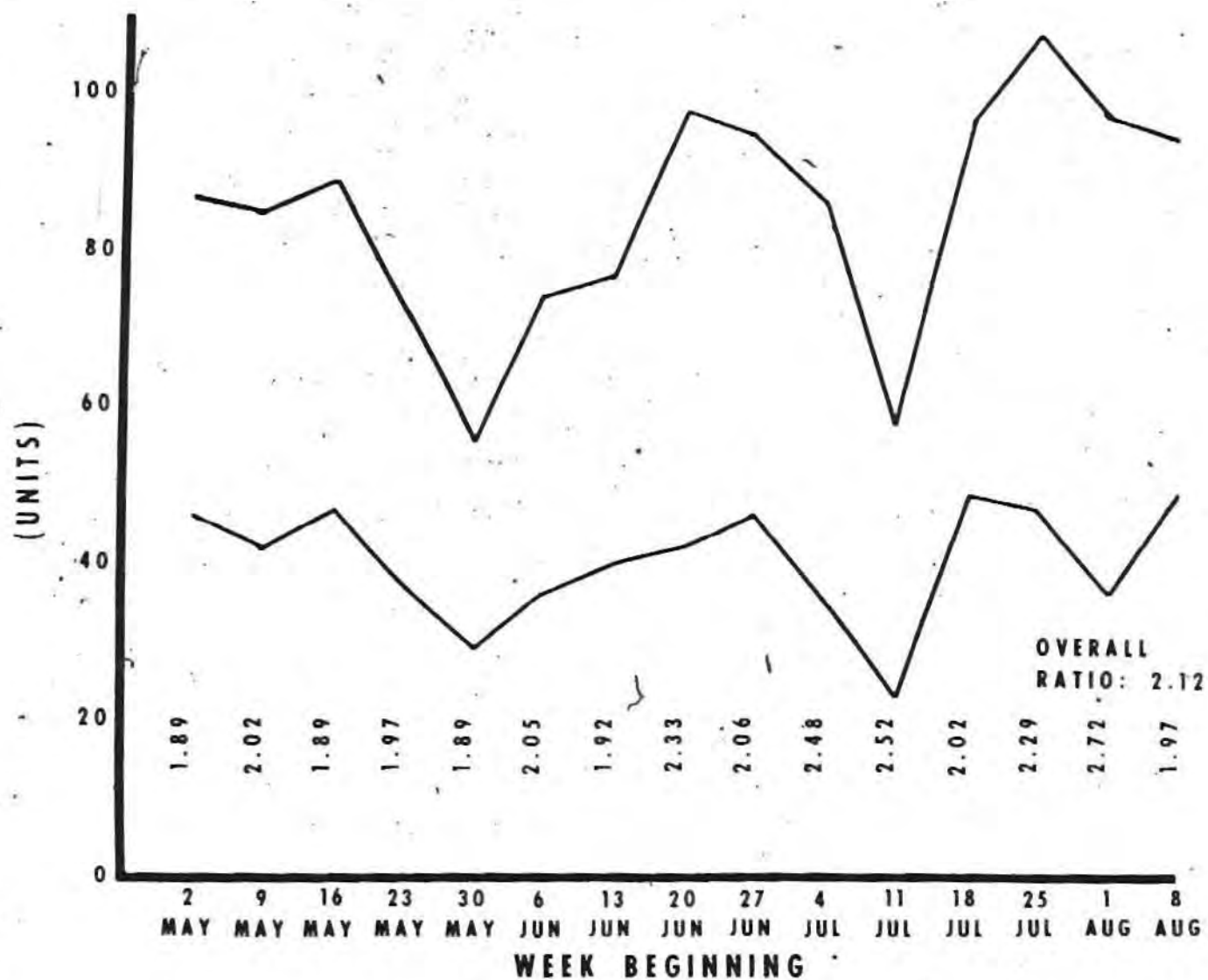


FIGURE 4-9

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FIGURE 4-10

PAVE PHANTOM LEAD EFFECTIVENESS
March - August 1973

Source of Data: USSAG Quarterly History
(1 Jul - 30 Sep 73) and USSAG/DOB ARC LIGHT Logs

DISCUSSION: Of the total 1668 Pave Phantom lines flown, 81 percent were effective. Weather accounted for the greatest percentage of noneffective lines, 63 percent. This percentage was fairly constant for each month. Airborne LORAN malfunctions accounted for 20 percent of the total malfunctions. Coordination accounted for the third largest percentage of noneffective lines, 8 percent. Coordination included such items as Blue Chip errors, pilot errors, ABCCC errors, etc. Of particular note is the reliability of the LORAN transmitting stations. Only one line out of 1668 was noneffective due to a LORAN transmitter being down.

As a comparison, the Pave Buffs were successful in 79.8% of the fragged lines. The Pave Phantom leads were fragged in flights of two or three, or in flights of two with a ground alert. Because there were only two Pave Buffs during this time period, the Pave Buffs never had a backup. It is therefore reasonable to expect a somewhat higher percentage of successful Pave Phantom Lead lines.

*Percent of fragged F-4 Pathfinder lines for which B-52 cells were able to release bombs.

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FIGURE 4-10

PAVE PHANTOM LEAD EFFECTIVENESS

March - August 1973

MONTH	LINES	EFF	NON-EFF	LORAN (R)	WX	COORD	CANX	MALFUNCTIONS		LORAN (T)	UNK
								FRIENDLIES IN BOX	F-4		
AUG	195	155	40	3	26	5	2	4			
%		79.5	20.5	7.5	65	12.5	5	10			
JUL	388	306	82	17	56	4	3		2		
%		78.9	21.1	21	68	5	4		2		
JUN	349	284	65	12	40	5		1	6		1
%		81.4	18.6	18	62	8		1.5	9		1.5
MAY	354	284	70	19	45	2		1	1	1	1
%		80.2	19.8	27	64	3		1.4	1.4	1.4	1.4
APR	313	265	48	10	26	8	1	1	1		1
%		84.7	15.3	21	54	17	2	2	2		2
MAR	69	65	4	2							2
%		94.2	5.8	50							50
TOTAL	1668	1539	309	63	193	24	6	7	10	1	5
%		81.5	18.5	20	63	8	2	2	3	0	2

NOTE: Percentages indicated under the malfunction categories are in relation to the figures in the noneffectiveness column.

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FIGURE 4-11

PAVE PHANTOM LEADS, FRAGGED AND FLOWN

Source of Data: SEADAB

DISCUSSION: This figure shows, by week, the number of LORAN equipped F-4 aircraft that were fragged and flown to Pathfind for B-52s.

The variation in the number of lead aircraft corresponds very closely to the number of Pave Phantom led B-52 targets as shown in Figure 4-9 on page 65.

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PAVE PHANTOM LEADS, FRAGGED AND FLOWN 2 MAY - 15 AUGUST 1973

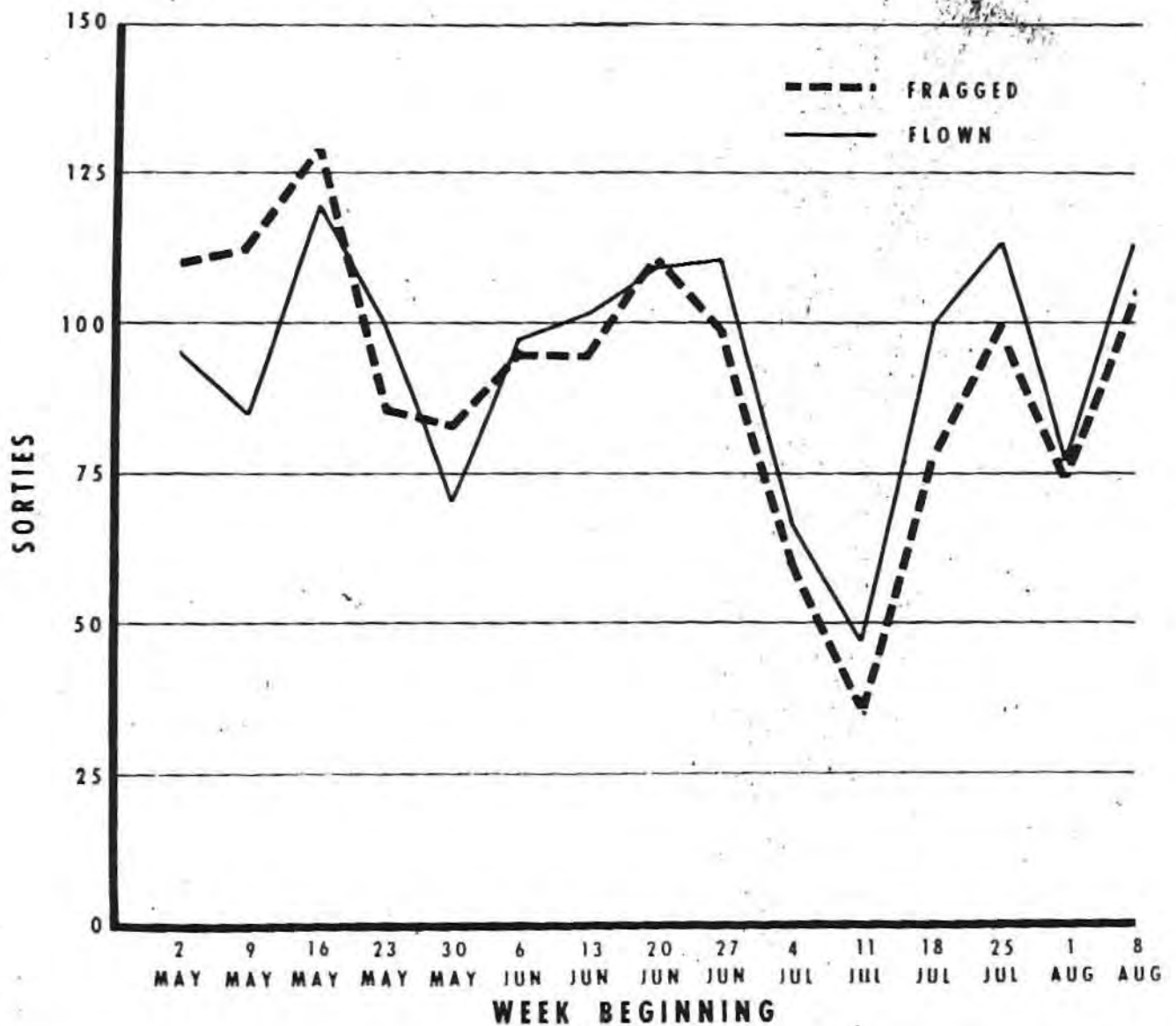


FIGURE 4-11

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FIGURES 4-12 to 4-17

B-52 STRIKES

Source of Data: USSAG/DOB ARC LIGHT Logs and HQ PACAF.
Air Operations Southeast Asia, Vol CIV - CIX, Mar - Aug 1973

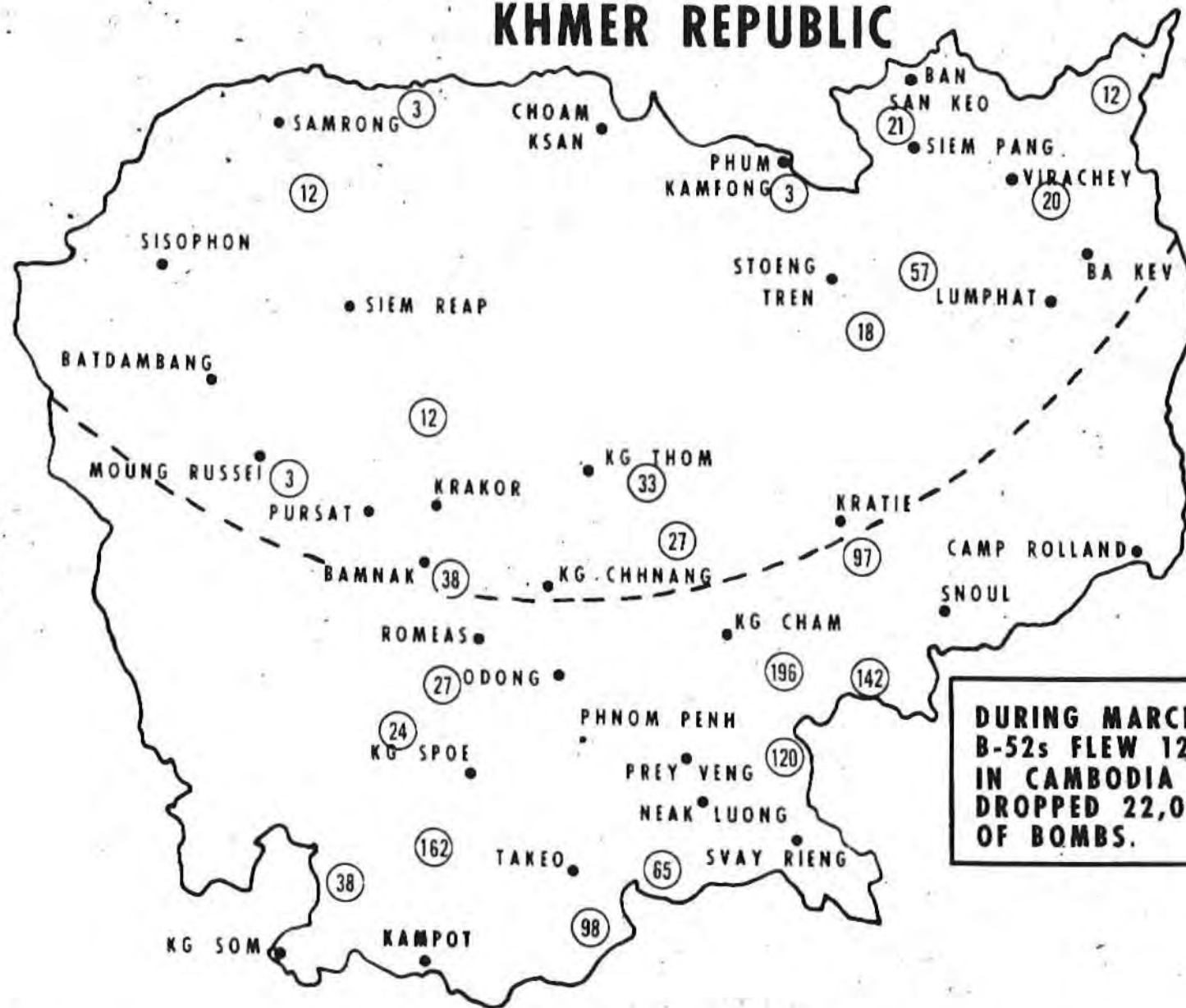
DISCUSSION: These figures show the location of B-52 sortie targets in the Khmer Republic, by month, for March through August 1973.

The range of GDB within the Khmer Republic is shown in each figure.

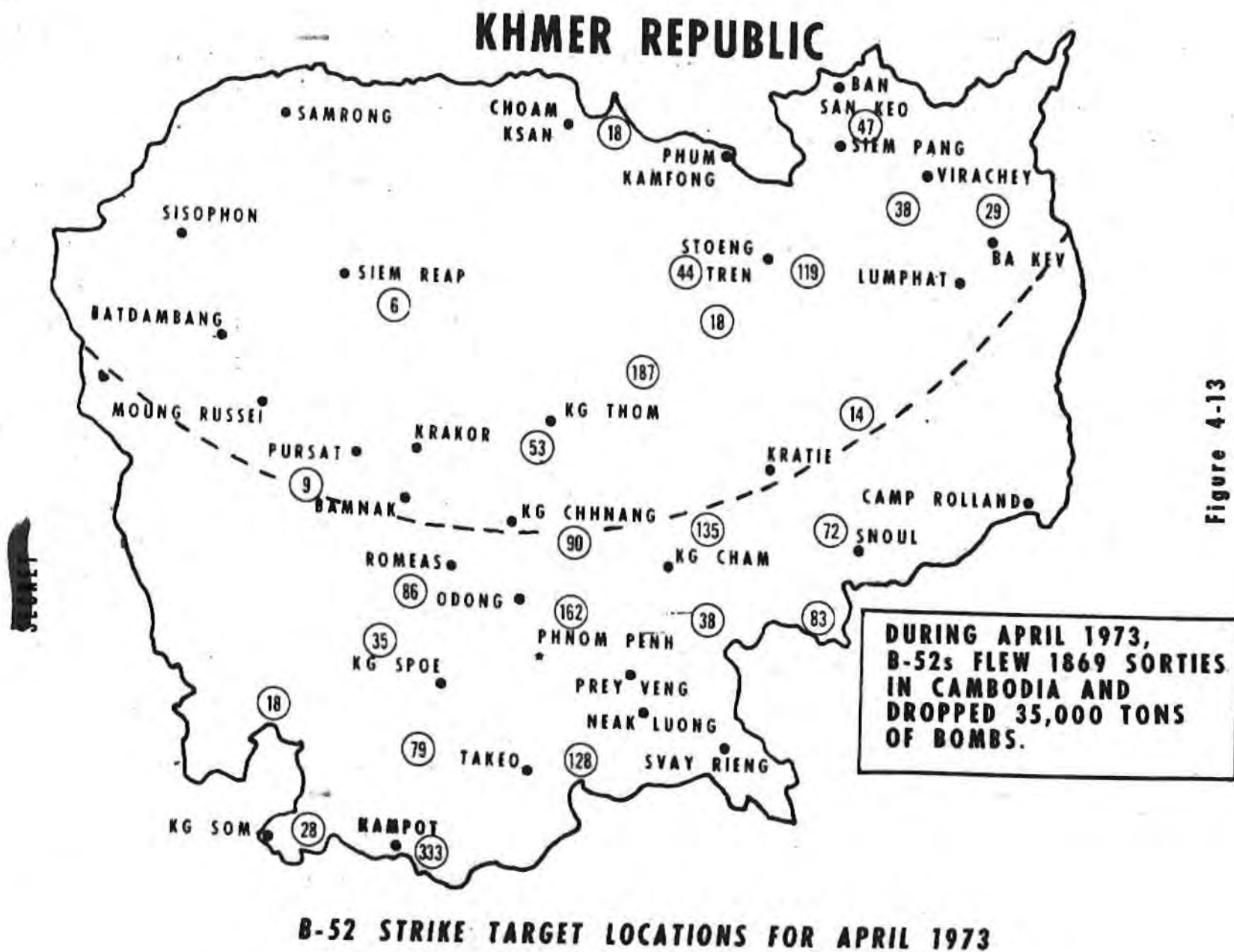
Most Pathfinder led bombing was in southern Khmer Republic outside the range of the Ubon GDB site. All bombing within range of the Ubon GDB site was done using the GDB method of delivery.

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KHMER REPUBLIC



B-52 STRIKE TARGET LOCATIONS FOR MARCH 1973



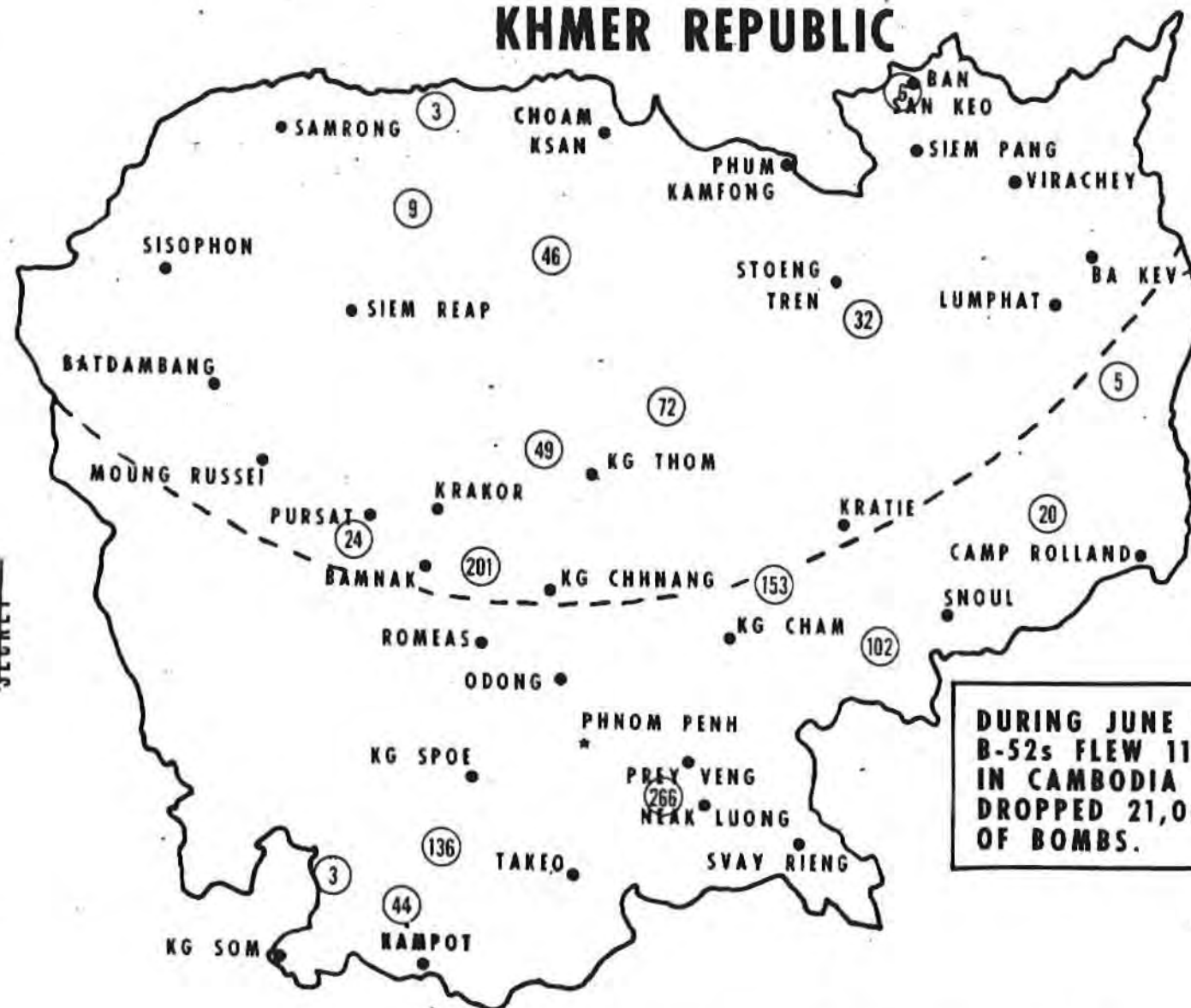
KHMER REPUBLIC



Figure 4-14
73

B-52 STRIKE TARGET LOCATIONS FOR MAY 1973

KHMER REPUBLIC



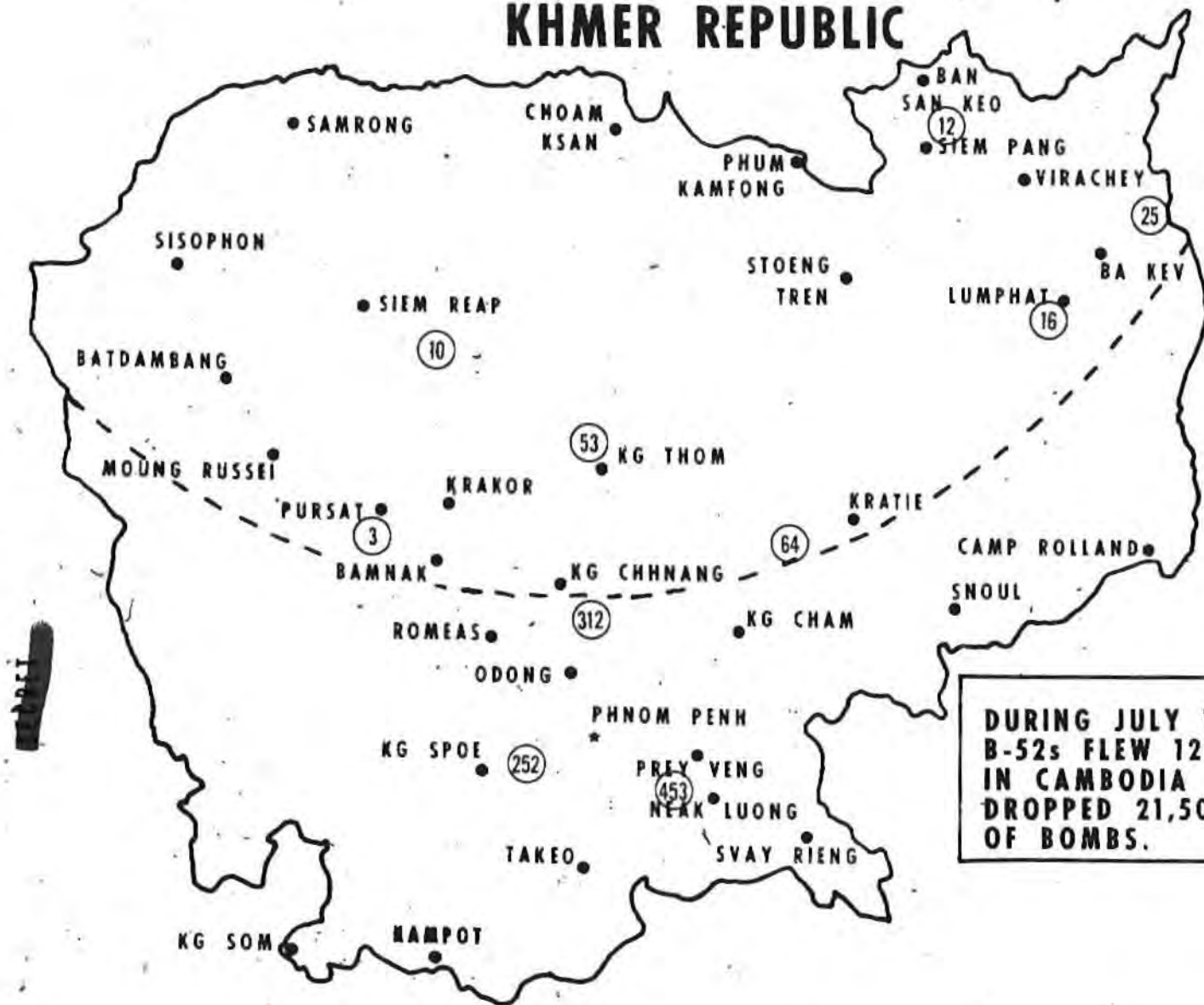
B-52 STRIKE TARGET LOCATIONS FOR JUNE 1973

Figure 4-15

74

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DURING JULY 1973,
B-52s FLEW 1200 SORTIES
IN CAMBODIA AND
DROPPED 21,500 TONS
OF BOMBS.

B-52 STRIKE TARGET LOCATIONS FOR JULY 1973

KHMER REPUBLIC

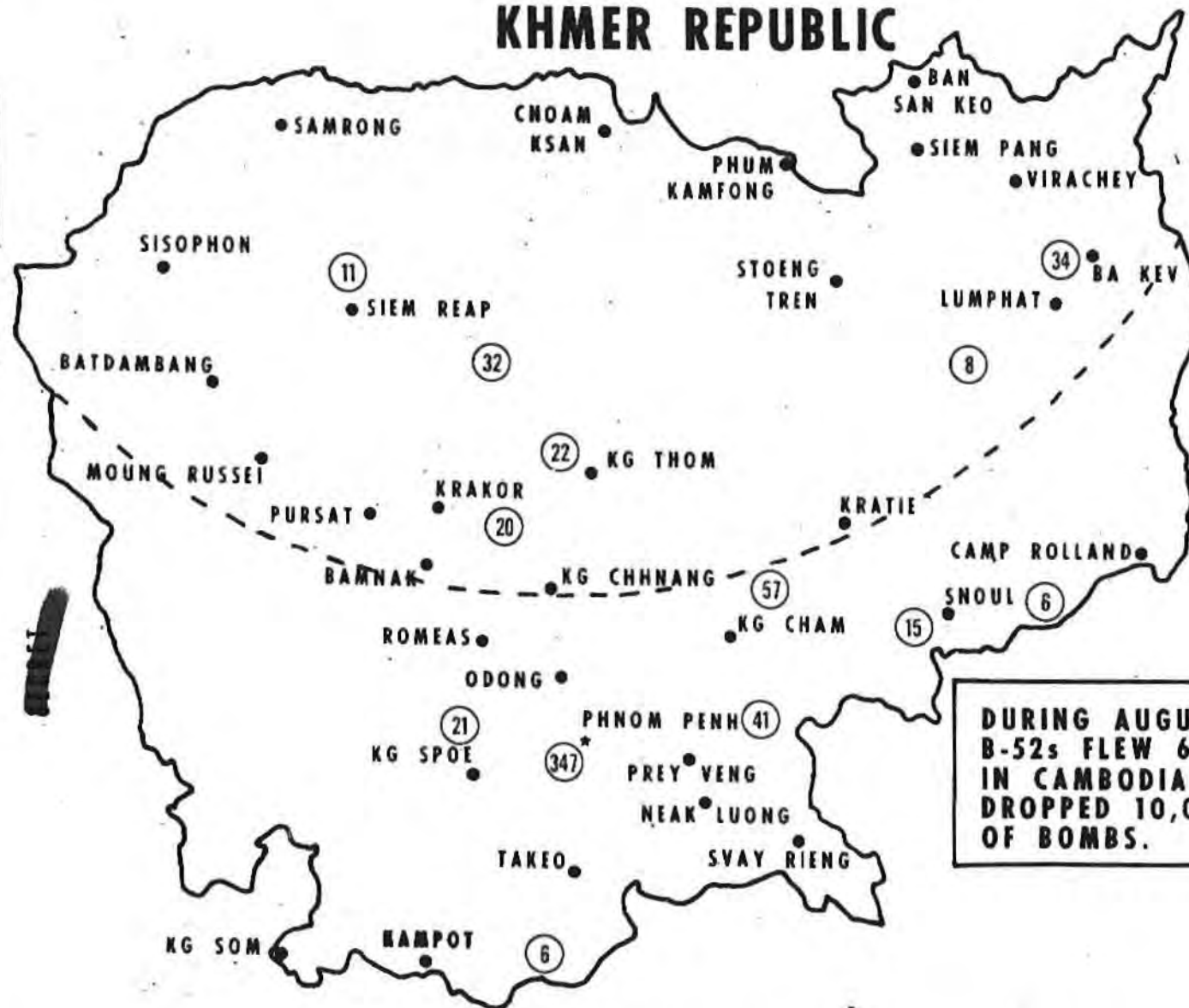


Figure 4-17
76

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B-52 STRIKE TARGET LOCATIONS FOR AUGUST 1973

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SUMMARY

(C) Pathfinder activity in the Khmer Republic during period 2 May - 15 August 1973 represented a substantial portion of the US air effort. Pathfinders were used to lead in TACAIR and B-52 strikes. The need for Pathfinders to be used with TACAIR was primarily a result of expected weather conditions during the monsoon season; whereas, Pathfinders for B-52s were necessary to permit strikes by the bombers on targets in southern Khmer Republic which were outside GDB coverage.

(C) Because of the large number of critical targets in the Phnom Penh area, outside the range of Ubon GDB site, 61.8 percent of the total B-52 targets struck during the time period were Pathfinder missions. Weather was more favorable than expected, thus decreasing the anticipated requirement for Pathfinder led TACAIR strikes. Nonetheless, the Pathfinders provided TACAIR with an all-weather capability when needed and Pathfinder led TACAIR strikes accounted for eight percent of the total TACAIR sorties during the 15 weeks.

(C) Two LORAN equipped B-52 aircraft were used to Pathfind for B-52s and the remainder of the Pathfinder activity was conducted by F-4s and F-111s. Consequently, a considerable amount of tactical aircraft resources were devoted to the Pathfinder effort. The LORAN equipped F-4 (Pave Phantom) accounted for the largest percentage of the job. There were 1845 Pave Phantom Pathfinder sorties flown between 2 May and 15 August; 1371 supporting B-52s and 474 supporting TACAIR. There were 159 F-111 Pathfinder sorties during the period of this report. These F-111s utilized airborne radar and ground beacons and were flown solely in support of TACAIR strikes. The B-52 Pathfinders (Pave Buff) flew only a small percentage of the total Pathfinder sorties. They flew a total of 231 lines all in support of B-52s as opposed to 1025 Pave Phantom Lead lines.

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APPENDIX A

Cloud cover in the KR is typically found at three levels: high cloud formations, those with bases greater than 12,000 feet above ground level (AGL); middle clouds, normally found between 8,000 and 10,000 feet AGL; and low clouds normally found between 3,000 and 4,500 feet AGL. The high cloud formations are above the normal base altitude for immediate TACAIR pre-bomb run activity and therefore were not used in the determination of favorable vs unfavorable weather. Cloud cover at the middle and low levels was measured periodically throughout the day to determine the extent of coverage. The observations were then reported as eighths of coverage for each layer in a predetermined area and were used to describe the weather conditions as favorable, unfavorable or marginal.

If the visibility* was greater than 3 nautical miles, the cloud cover at each level was $\frac{3}{8}$ or less, and the total cloud cover (the sum of the middle and low cloud cover) was $\frac{4}{8}$ or less, the weather was considered favorable.

If the visibility was less than 3 nautical miles, the cloud cover at either level was greater than $\frac{5}{8}$, or total cloud cover (again, the sum of the middle and low cloud cover) was greater than $\frac{7}{8}$, the weather was considered unfavorable. Marginal weather included all conditions between favorable and unfavorable, and therefore accounted for a large percentage of the reported weather during the rainy season.

Figure A-1 is a graphic presentation by week of the weather conditions in the Phnom Penh area from 2 May until 15 August 1973. It represents actual cloud cover over the Phnom Penh area, which is typical of the prevailing weather in central Khmer. Cloud cover measurements were recorded for the 12 hour period from 2300Z until 1100Z daily. A given day might have 2 hours of favorable, 6 hours of unfavorable and 4 hours of marginal weather recorded. The figure depicts these recordings for the 84 hours of observed cloud cover during a week. This weather data was obtained from Det 25, 10th Weather Squadron as provided to controllers at 7AF Tactical Air Control Center (Blue Chip).

*NOTE: Visibility relates to the weather associated with the cloud cover, not visibility in the actual cloud cover.

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Immediately evident is the fact that unfavorable weather was not prevalent. The effect of this unusually clear weather on the Pathfinder missions is difficult to establish, but the number of TACAIR Pathfinder sorties would have logically increased if the weather had been unfavorable throughout the period of this report. Three weeks in July were the only weeks that had marginal or unfavorable weather over 40% of the daylight hours. The majority of B-52 missions were during the period 1100Z - 2300Z and no weather data is available for this time period. Thunderstorms were the biggest deterrent to successful completion of the B-52 Pathfinder led missions due to the operational procedures followed and electrical interference with the LORAN receivers. Visual Meteorological Condition (VMC) exerted no influence on the conduct of B-52 missions led by Pathfinders.

The weather was favorable almost 50% of the daylight hours from 2 May until 15 August and unfavorable weather occurred less than 14% of the time. The marginal weather, which accounted for the remaining 36% of the total weather, could not be broken down to determine into which end of the weather spectrum the actual recordings fell. The total amount of unfavorable weather and the accompanying need for TACAIR Pathfinders, however, were not as great as had been envisioned prior to the monsoon season.

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PHNOM PENH WEATHER

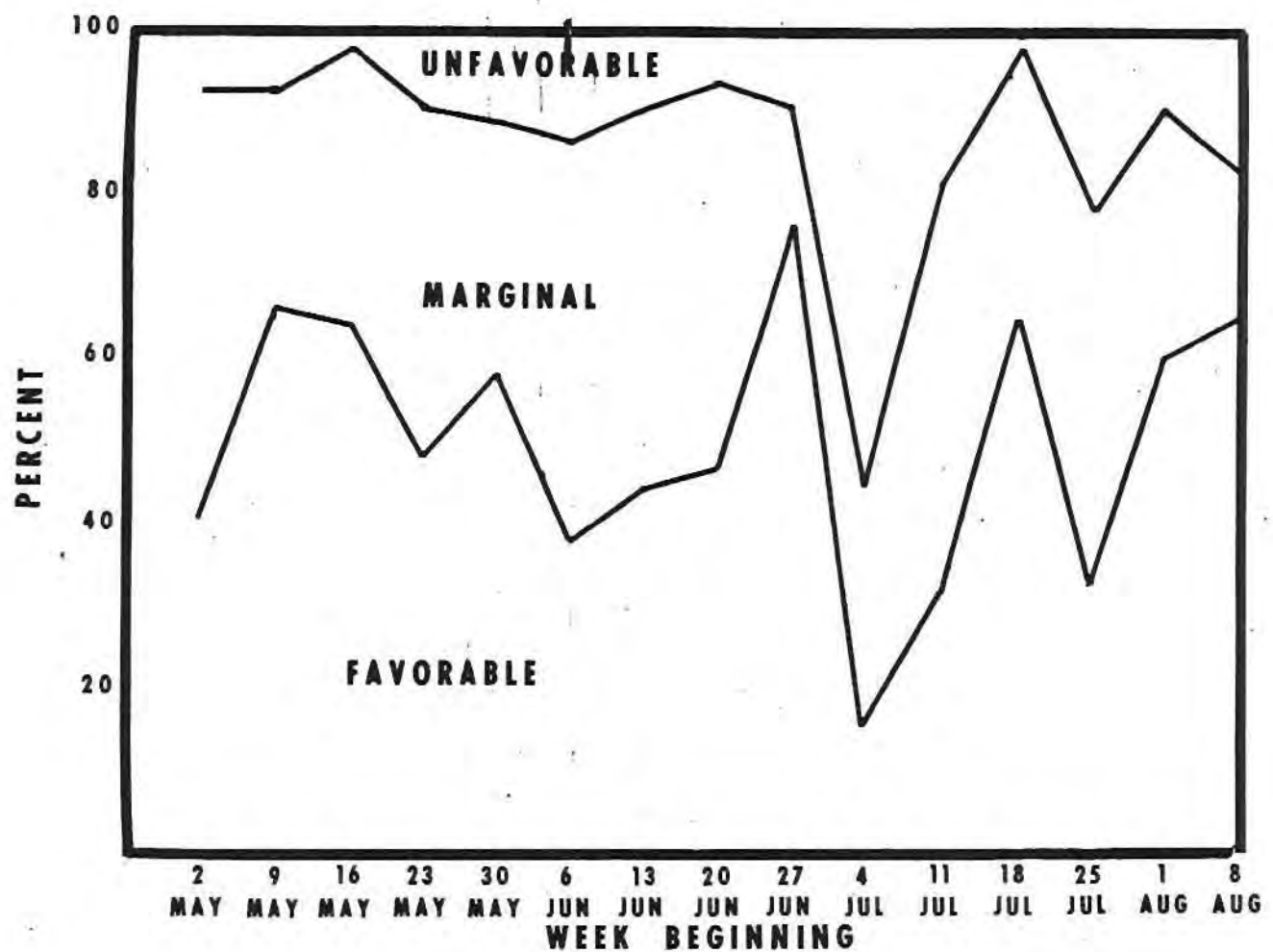


FIGURE A-1

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GLOSSARY

Alpha Check - A target crosscheck performed by the lead delivery aircraft

A/A - Air-to-Air

AAR - Air-to-Air Refueling

ABCCC - Airborne Battlefield Command and Control Center

ABF - Attack by Fire

AGL - Above Ground Level

AI - Air Interdiction

ARC LIGHT - B-52 Operations in SEA

ASW - Air Strike Warning

ATC - Airborne Target Change

BDA - Bomb Damage Assessment

CADC - Central Air Data Computer

CAS - Close Air Support

CBU - Cluster Bomb Unit

CEP - Circular Error Probable

COMUSSAG - Commander USSAG

CONUS - Continental United States

CP - Control Point

CRP/CRC - Control and Reporting Post/Control and Reporting Center

C/R - Communications Reporting

DASK - Drift Angle Station Keeping

DISCO - Call sign for Airborne Early Warning & Control Aircraft (EC-121)

DME - Distance Measuring Equipment

ETA - Estimated Time of Arrival

FAC - Forward Air Controller

FAG - Forward Air Guide

FANK - Forces Armees Nationales Khmer

GCI - Ground Control Intercept

GDB - Ground Directed Bombing (formerly, MSQ)

IAW - In Accordance With

IMC - Instrument Meteorological Conditions

INS - Inertial Navigation System

IP - Initial Point

KEL - Known Enemy Location

KR - Khmer Republic

KTAS - Knots True Air Speed

LION - The Control and Reporting Post of Ubon RTAFB, Thailand

LOC - Line(s) of Communication

LORAN - Long Range Airborne Navigation

OT&E - Operational Test and Evaluation

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POD Formation - A two or four ship fighter formation which was flown in such a manner that the ECM (Electronic Countermeasures) pods on each aircraft offered mutual ECM protection

PIP - Pre-Initial Point

RAD - Radial

RCP - Rendezvous Control Point

ROE - Rules of Engagement

RTB - Return to Base

RVN - Republic of Vietnam

SAC ADVON - Strategic Air Command Advanced Echelon

SAM - Surface-to-Air Missile

SEA - Southeast Asia

SEADAB - Southeast Asia Data Base

SENTINEL LOCK - A method of determining LORAN coordinates

TACAIR - Tactical Air

TACAN - Tactical Air Navigation (Radio air navigation system)

TIC - Troops in Contact

TGT - Target

TOT - Time Over Target

TUOC - Tactical Unit Operations Center

UHF - Ultra High Frequency

USSAG - United States Support Activities Group

UTM - Universal Transverse Mercator (Map projection)

VFR - Visual Flight Rules

VMC - Visual Meteorological Conditions

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ASD/RWR	1
ASD/RWS	1
ASD/RWD	1
AFAL/AVN	1
FTD/PDYE	1
ESD/XR	1

Pacific Air Force

CC	1
CV	1
DO	2
DOA	2
XP	1

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Tactical Air Command

DO	1
XPSY	1
DR	1
XP	1

US Air Forces Europe

DO	1
DM	1
DP	1

US Air Forces Southern Command

DO	1
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CINCSAC

DO	1
HO	1
XO	1
INT	1

Numbered Air Forces

(7th Air Force)

IN	2
DOO	2
DOOF	2
DOX	2
DOXW	1
DOY	1
ASD O/L	2
DOB	1

(13th Air Force)

DO	2
13th ADVON	2

(3rd Air Force)	2
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(5th Air Force)	2
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(8th Air Force)

INT	1
DOXL	1

(9th Air Force)..... 2

(12th Air Force)..... 2

(16th Air Force)..... 2

(17th Air Force)..... 2

(19th Air Force)..... 2

Wings/Units

347TFW	1
388TFW	1
432TRW	1
SAC ADVON	1
CHECO	1

Air University..... 2

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