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THE 1972 WAR IN THAILAND: RESULTS FROM A WARFARE SIMULATION PRO--ETC(U)
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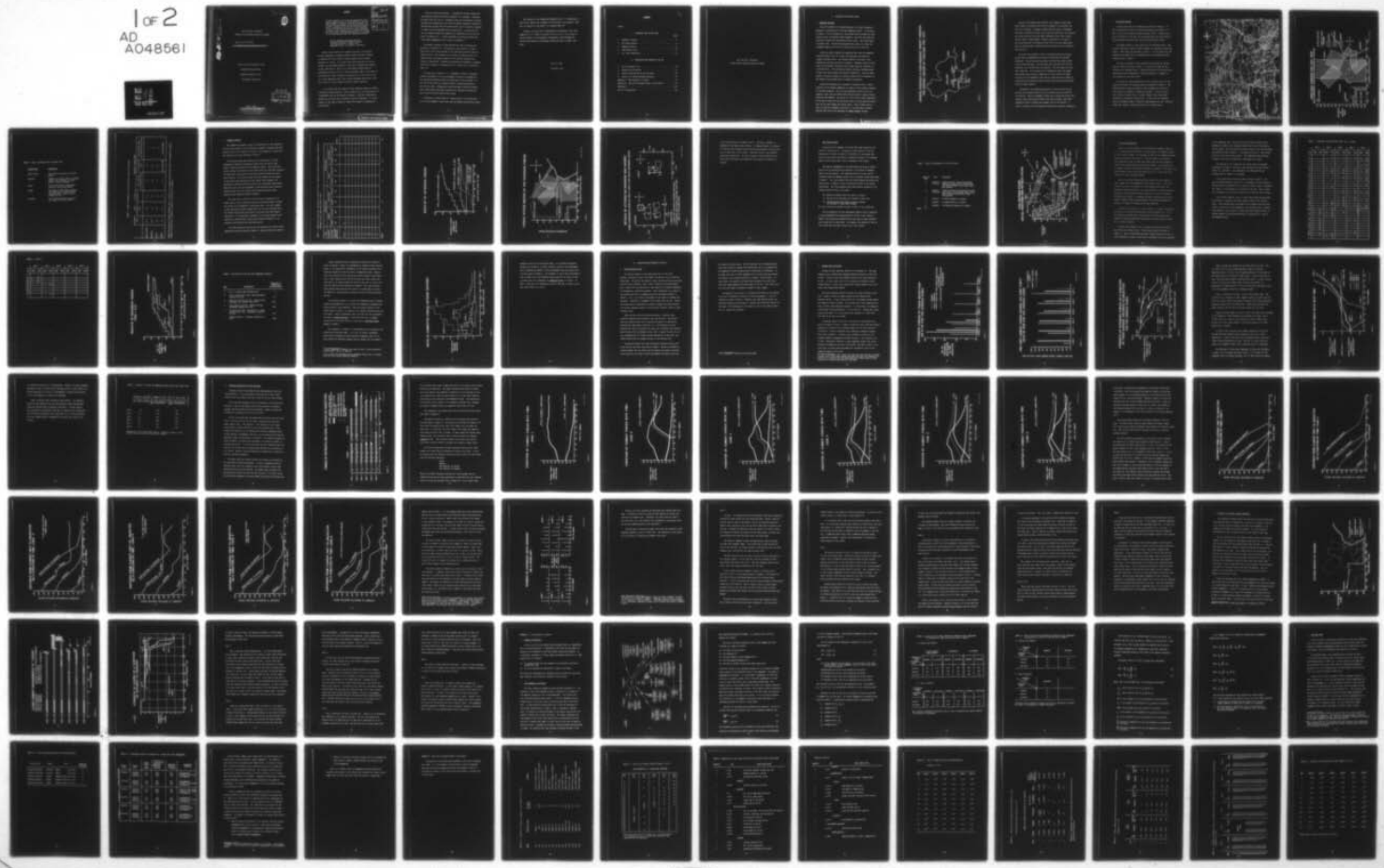

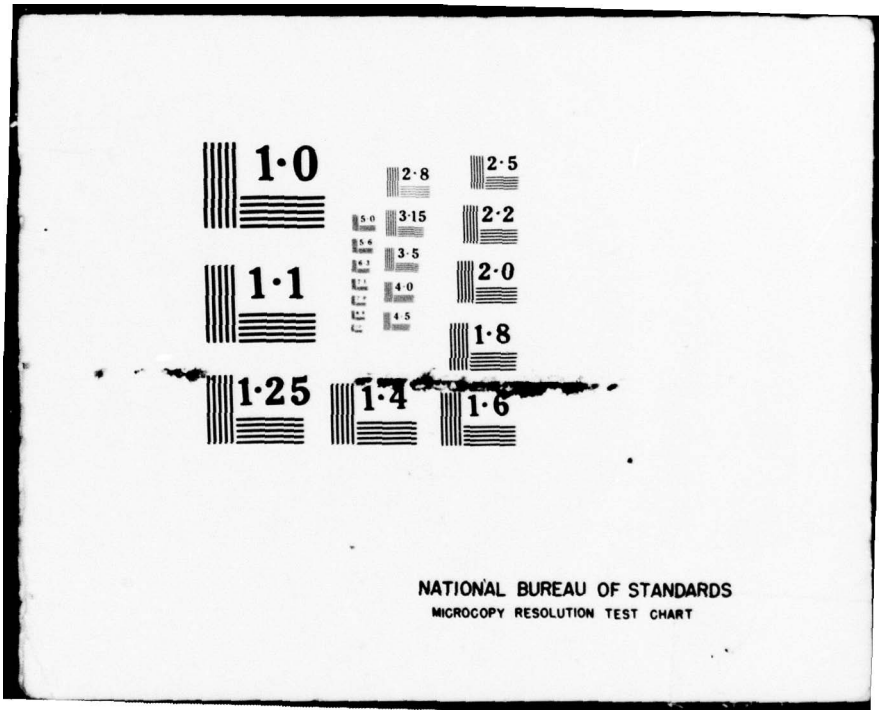
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MICROCOPY RESOLUTION TEST CHART

The 1972 War in Thailand:

Results from a Warfare Simulation Program

Report No. DAC-R-52951

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Douglas Aircraft Co., Inc.

Long Beach, California

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PREFACE

"Closely related to the size and composition of our general purpose forces is the capability of moving them promptly to wherever they may be needed. Obviously, the more rapidly we can introduce substantial U.S. ground and air forces into an area under attack, the smaller the total U.S. force commitment is likely to be. However, rapid deployment requires the use of fast, but expensive airlift. Our problem is to bring speed and cost into appropriate balance".

Paul R. Ignatius, Assistant Secretary
of Defense, DOD-NSIA Advanced Planning
Briefing Conference, 3 March 1965,
Ambassador Hotel, Los Angeles, California

Several months before this statement was made, the Aerospace Sciences Department of Douglas Aircraft started a project designed to study for the first time the actual military uses of rapidly deployed U.S. forces. It is clear that before speed and cost can be brought "into appropriate balance", there must be quantitative answers to such questions as: What is the relationship between speed of deployment and size of the U.S. forces required? What is the effect on the outcome of N days of combat of varying the U.S. force size or the U.S. force commitment time? With a given deployment mode, what is the size of the U.S. force needed to achieve a fixed objective?

It is evident that the nature of these questions permits no simple quantitative general answers. What is found true in one area and set of circumstances may not hold exactly elsewhere. Realistic quantitative answers can be given only for specific conflict situations. It is the purpose of this memo to report in detail the results of studying one such conflict.

The area chosen was Thailand. A hypothetical Chinese attack plan was postulated along with several plausible U.S. responses. Combining the attack plan with the U.S. responses within the environment of central Thailand was accomplished by the Tactical Warfare Simulation Program [1]. Hypothetical military units were moved toward their objectives, engaging in combat with the defending forces along the way. A description of how the computer handled the movement and interactions of the units is given in reference [1]. A short discussion of attrition factors and close combat engagements will be found in Appendix A.

The general outcomes of these hypothetical wars in Thailand are discussed in reference [2]. The purpose of this report is to take a much closer look at the progress of the individual conflicts than was possible there. Such subjects as the attack and defense plans, the combat terrain, and various aspects of the military situation are treated in some detail. Questions concerning the estimation of campaign costs and the methods of deploying the U.S. forces will be found elsewhere [2].

We would like to thank Dr. C. L. Zimmerman, Director of Aerospace Sciences Department, for his encouragement during the development of the program and guidance during its application to this problem. It was also he who wrote the original scenario, selecting Thailand as the conflict area. Although this choice was made as early as October 1964, recent events have amply justified the classing of Thailand as one of the Free World's most critical areas.

In addition, we would thank Col. Charles Carroll, who worked with us on the development of such input data as movement and attrition rates.

The question of air warfare was handled by Mr. D. L. Schilling, to whom we are indebted for estimates of the effects of air support. This work is reported in some detail in a separate memo [3].

Finally, we would like to acknowledge the assistance of Mr. Gary Hoggard, Mr. T. B. Payne, Mr. Robert Sullivan, and Mr. Cecil Wright in certain aspects of the deployment calculations, which, although not used here specifically, nevertheless formed the basis of some of the input.

Janice B. Fain

William W. Fain

CONTENTS

The 1972 War in Thailand:

Results from a Warfare Simulation Program

I. BACKGROUND AND PRE-WAR PLANS

1. Communist Strategy

With the intention of invading Thailand, the Chinese communists assembled a striking force on the Thai-Cambodian border. As indicated in Figure 1, their strategy was a four-pronged thrust through the lower central section of Thailand toward Bangkok in the south and toward the airfields of Khorat and Koke Kathiem further north. The attack began in February 1972. The military operation was carried out within the rectangle between 12° 40'N to 15° 30'N and 100° 2'W to 103° 5'W.

There are several reasons for supposing that, when the Communist timetable finally calls for a move into Thailand, this would be a credible military action. The central section is the heart of all economic and political activity in Thailand. Communist control of this region could probably be achieved only through physical occupation by a military force. The northern and eastern sections, although larger in area, have less economic and political importance. Once the center region is occupied, extension of Chinese control over the remainder of the country would probably meet no effective resistance.

Along with extending their influence in Southeast Asia, a major objective of the Chinese communists is control of the economic resources of the Thai peninsula. Here are found important sources of the tin, tungsten, lead, coal and rubber which they must have to support further industrial development. As long as U.S. naval forces retain superiority in the Gulf of Siam, the only practical route to the mineral-rich peninsula lies by land through the central basin. Even if Burma could be used as a base for Communist activities, it is practically isolated from the Thai side of the peninsula by rugged mountain terrain.

CHINESE STRATEGY: A FOUR-PRONGED THRUST THROUGH THE CENTRAL REGION OF THAILAND, FEB. 1972

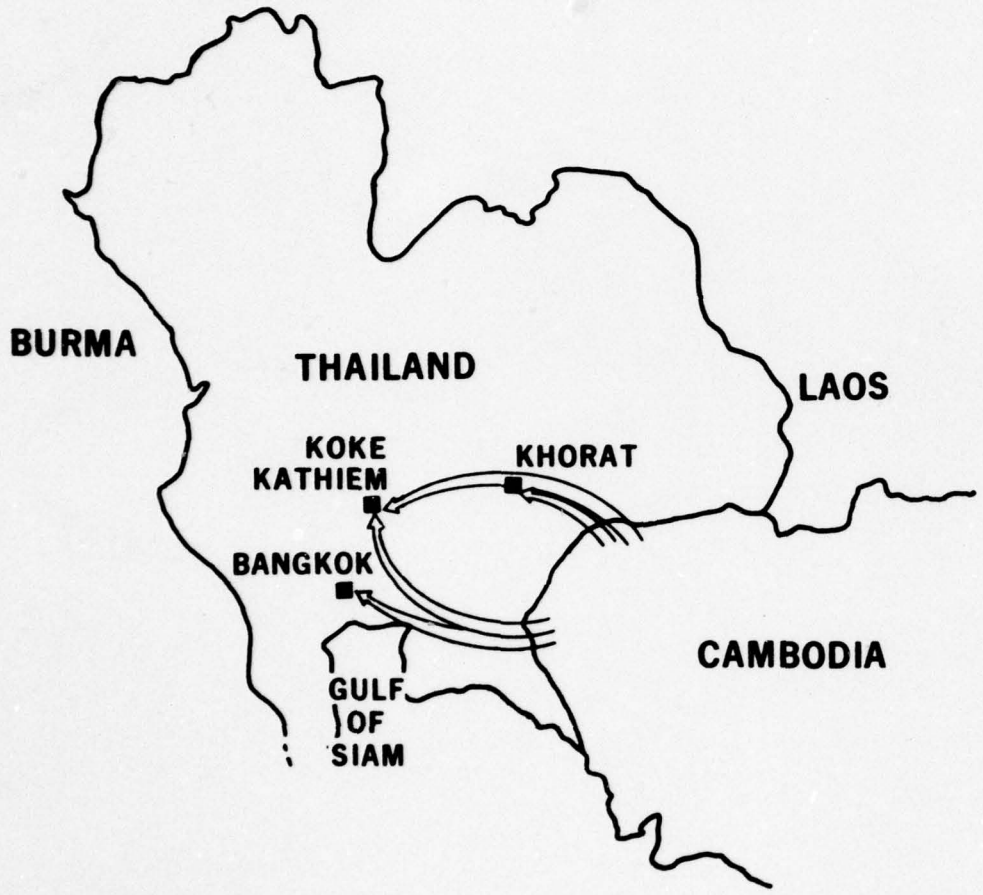

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FIGURE 1.

Finally, and perhaps most important, with Cambodia firmly under their control, the central basin route to Bangkok is the shortest one open to the invaders. Although a thrust from the north or northeast would meet, initially at least, little military opposition, the distances and terrain are such that even almost unopposed forces could require several weeks to reach Bangkok. Physical occupation of the area at this time would gain the Communists very little, but the several days' delay in reaching their objectives would allow more time for a Thai-U.S. force build-up.

The action was assumed to start in February because the weather at this time is considered to be the best of the year for military operations. The dry season which began in October has firmed up most of the inland road-ways. The north-east winds are dying out and temperatures in the central plain are moderate. The dry season will last until early May. If the attack can be completed by then, the summer rainy season would seriously hamper any U.S.-Thai efforts to regain the area, and the Communists could plan on having about five months to consolidate their political position before large scale ground military action is again feasible.

Incidentally, the February-June period is also the only part of the year when military action would not interfere seriously with the rice culture. Since the Communist intent was to occupy and control the country, rather than merely provide a military diversion, they would probably not want to destroy the economic life of the country. A hostile, starving civilian population would prove too great a liability.

2. The Combat Terrain

A larger scale map of the combat area is shown in Figure 2. It can be seen that the country is dotted by mountains with peaks up to 3000 ft. and criss-crossed by canals and small rivers. Although not so clearly indicated on this map, in the lowlands there are dense forests, with wide marshy areas near the coast and along the main rivers.

The combat terrain is, then, made up of the following types: open country, mountainous regions, forests, swamps, and waterways (canals and rivers). These types are described in Table 1. For the purpose of this simulation the combat area is approximated by the rectangular terrain features shown in Figure 3.

The rates of movement of the invading forces through the various types of terrain are given in Table 2. In the first column are the velocities for unopposed forces. Reduced velocities for units which are suffering artillery bombardment, crossing minefields, or engaged in close combat are also shown there.

The rivers and canals themselves are not introduced into the simulation, but rather, the crossing points as indicated in Figure 3. The offensive units' paths are planned so that waterways are crossed at these points if no delay in crossing is expected. If the unit must stop to build a bridge, then a "terrain feature" which drastically decreases its velocity is placed there. In this case the unopposed units are assumed to make a crossing in approximately an hour. Defensive action can, however, increase this delay up to eleven hours.

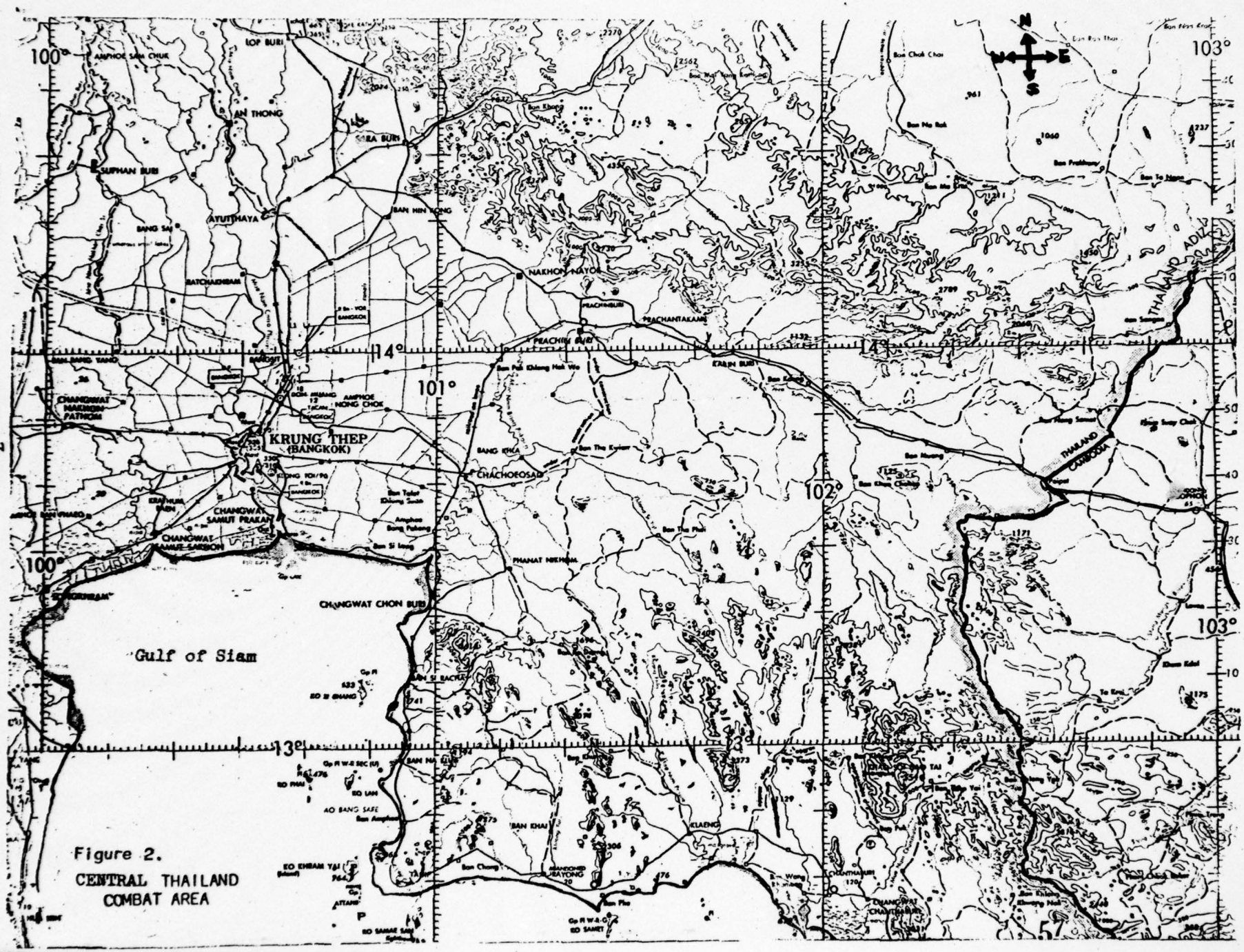

Figure 2.
CENTRAL THAILAND
COMBAT AREA

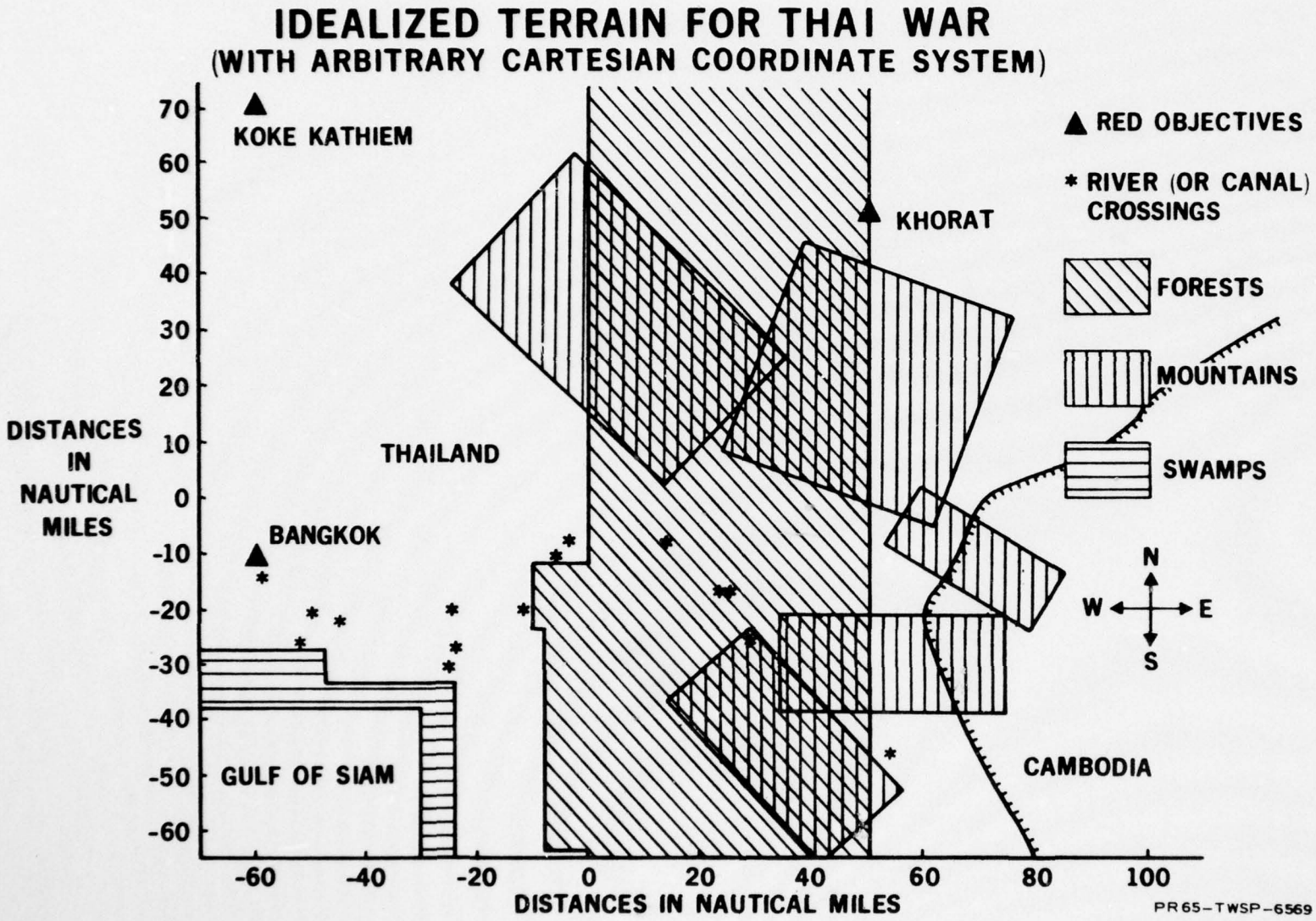
IDEALIZED TERRAIN FOR THAI WAR
(WITH ARBITRARY CARTESIAN COORDINATE SYSTEM)
KOKE KATHIEM
KHORAT
BANGKOK
THAILAND
GULF OF SIAM
CAMBODIA
RED OBJECTIVES
* RIVER (OR CANAL) CROSSINGS
FORESTS
MOUNTAINS
SWAMPS
N
W
E
S
DISTANCES IN NAUTICAL MILES
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-60
-40
-20
0
20
40
60
80
100
DISTANCES IN NAUTICAL MILES
PR65-TWSP-6569

FIGURE 3.

TABLE 1. Types of Terrain Found in Combat Area

Terrain Type	Description
Basic Terrain	Open country, generally flat solid ground.
Mountains	Rugged hill country, gentle to medium slopes, some 2000-3000 ft. peaks, medium to dense underbrush.
Forest	Low and flat; dense, heavy underbrush;wet during rainy season.
Swamps	Wide areas of soft ground, crossed by streams without solid bottoms; some quicksand. Passible only to infantry on foot.
Waterways	Can be crossed without delay only at bridges or crossing points.

TABLE 2. Rates of Movement for Offensive Units* (Nautical Miles/Day)

	Unopposed Units	Under Artillery Fire Only	Crossing Minefields	ENGAGED IN CLOSE COMBAT		
				With Infantry (or Artillery) Units	With Armored Units	With Infantry Units, And under Artillery Fire
Basic Terrain	15.0	4.5	10.0	1.5	3.0	.5
Mountains	10.0	3.0	6.7	1.0	2.0	.3
Forest	7.5	2.3	5.0	.8	1.5	.2
Swamps	7.0	2.1	4.7	.7	Not Applicable	Not Applicable

*These are basically infantry movement rates. However, it is assumed that artillery units are assigned to support infantry units and will, therefore, advance at the rates for infantry.

3. Communist Tactics

The Communists assigned a force of 85 battalions to this operation. This force was chosen to be of sufficient strength to overwhelm the Thai defenses when no U.S. forces are involved. The composition, objectives, and timing of this force are given in Table 3.

The initial attack was carried out by 43 battalions, with the remaining 42 battalions crossing the border over the next 24 days. Figure 4 shows the build-up of the offensive forces. The three lower curves indicate the build-up of the attack forces by individual objective; the upper curve is the sum of these three curves and shows the total force build-up. The initial attack force was divided into two groups: 25 battalions struck through the lower region toward Bangkok; the remaining 18 battalions started further north, advancing toward Khorat. Three days later, the units assigned to Koke Kathiem started along the northern route, with the southern force starting after six days. Typical attack routes are shown in Figure 5.

The first units to arrive in the vicinities of Bangkok and of Khorat took up "hold" positions outside the objectives proper to await the arrival of the remainder of the groups there. The final assault on each objective was thus delayed until all the units assigned there had either reached their hold points or had broken and been removed from action. It was possible, therefore, for the final assault on an objective to start earlier in the case of heavier defenses if some potential late-arrivers were destroyed earlier.

The fixed defensive positions and the offensive hold points around Bangkok and Khorat are shown in Figure 6. These positions are plotted

TABLE 3. Composition, Objectives, and Timing of Offensive Forces (Composition Expressed in Numbers of Battalions; Commitment Time in Days After Start of War).

ROUTE	SOUTHERN ROUTE				NORTHERN ROUTE				
OBJECTIVE	BANGKOK		KOKE KATHIEM		KHORAT		KOKE KATHIEM		
UNIT TYPE	INFANTRY	ARTILLERY	INFANTRY	ARTILLERY	INFANTRY	ARTILLERY	INFANTRY	ARTILLERY	
COMMITMENT TIME (DAYS)	BNS.	BNS.	BNS.	BNS.	BNS.	BNS.	BNS.	BNS.	TOTALS
0-1/2	24	1			15	3			43
3	4						3		7
6	3	1					2	1	7
9			4				3		7
12			3	1			2	1	7
13			1						1
14			1						1
15			1				2	1	4
18			1				2		3
21			1				2		3
24							2		2
TOTALS	31	2	12	1	15	3	18	3	85

BUILD-UP OF OFFENSIVE FORCES

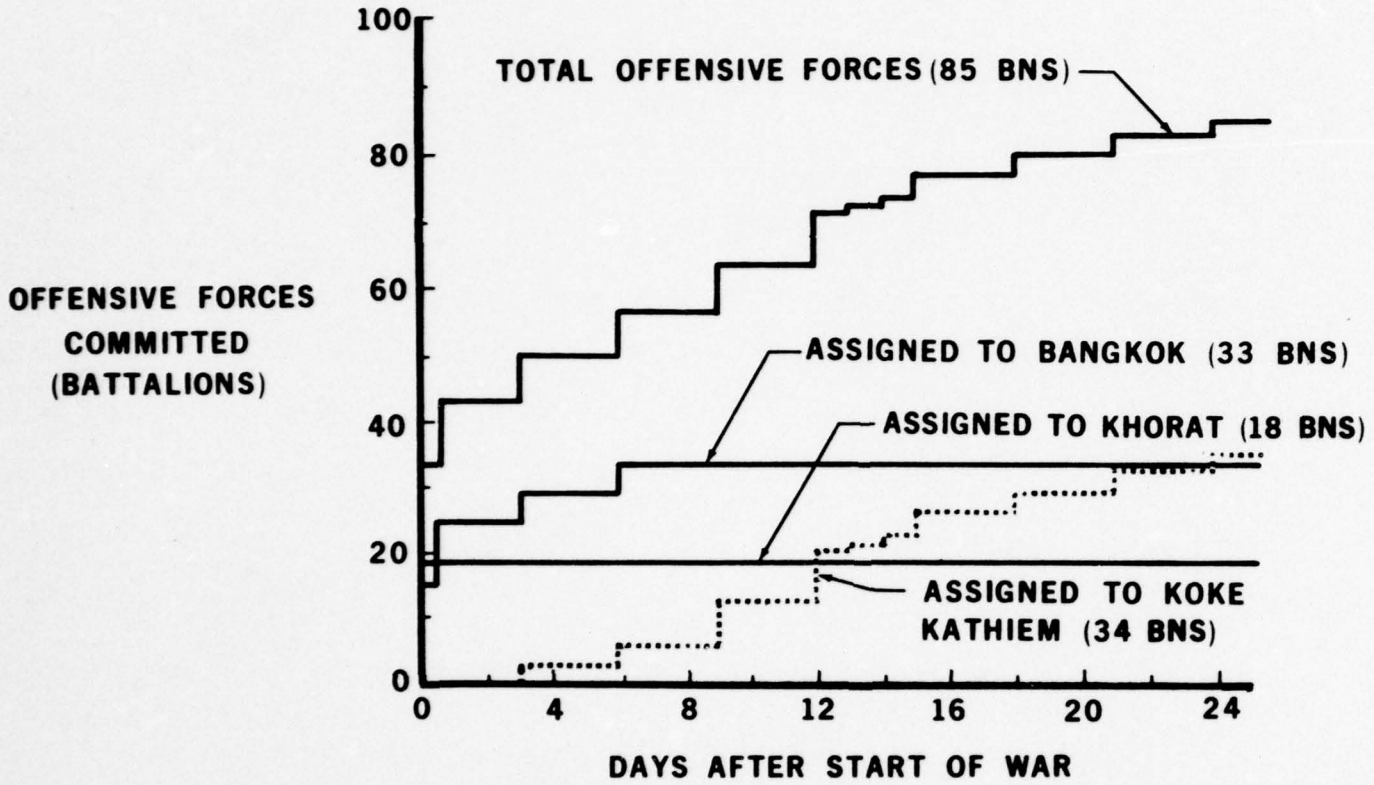

FIGURE 4.

TYPICAL ATTACK ROUTES OF THE OFFENSIVE FORCES

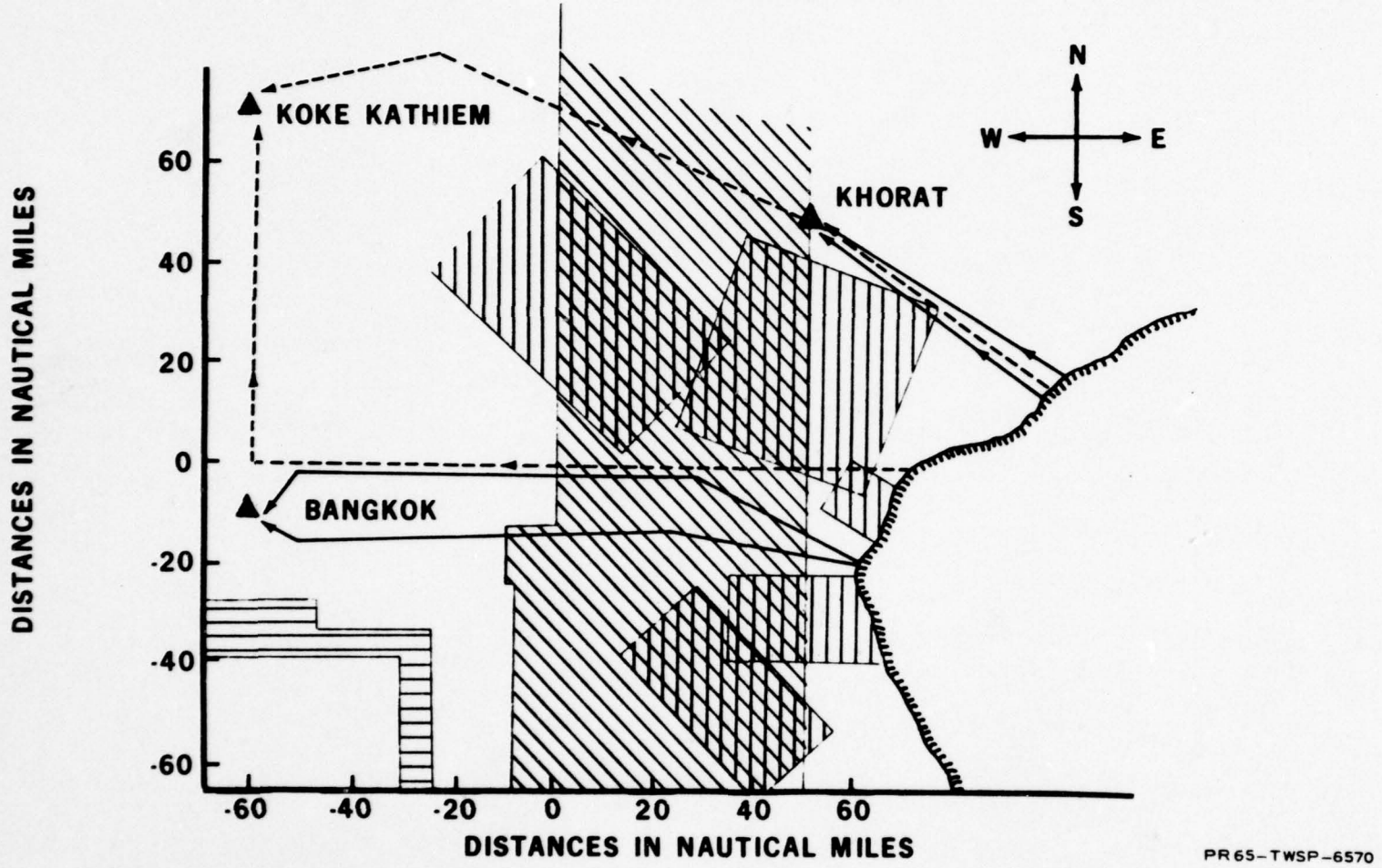

FIGURE 5.

DETAILS OF ATTACKS ON BANGKOK AND KHORAT

(SAME COORDINATE AXES AS FIGS 3 AND 5, BUT WITH EXPANDED SCALE)

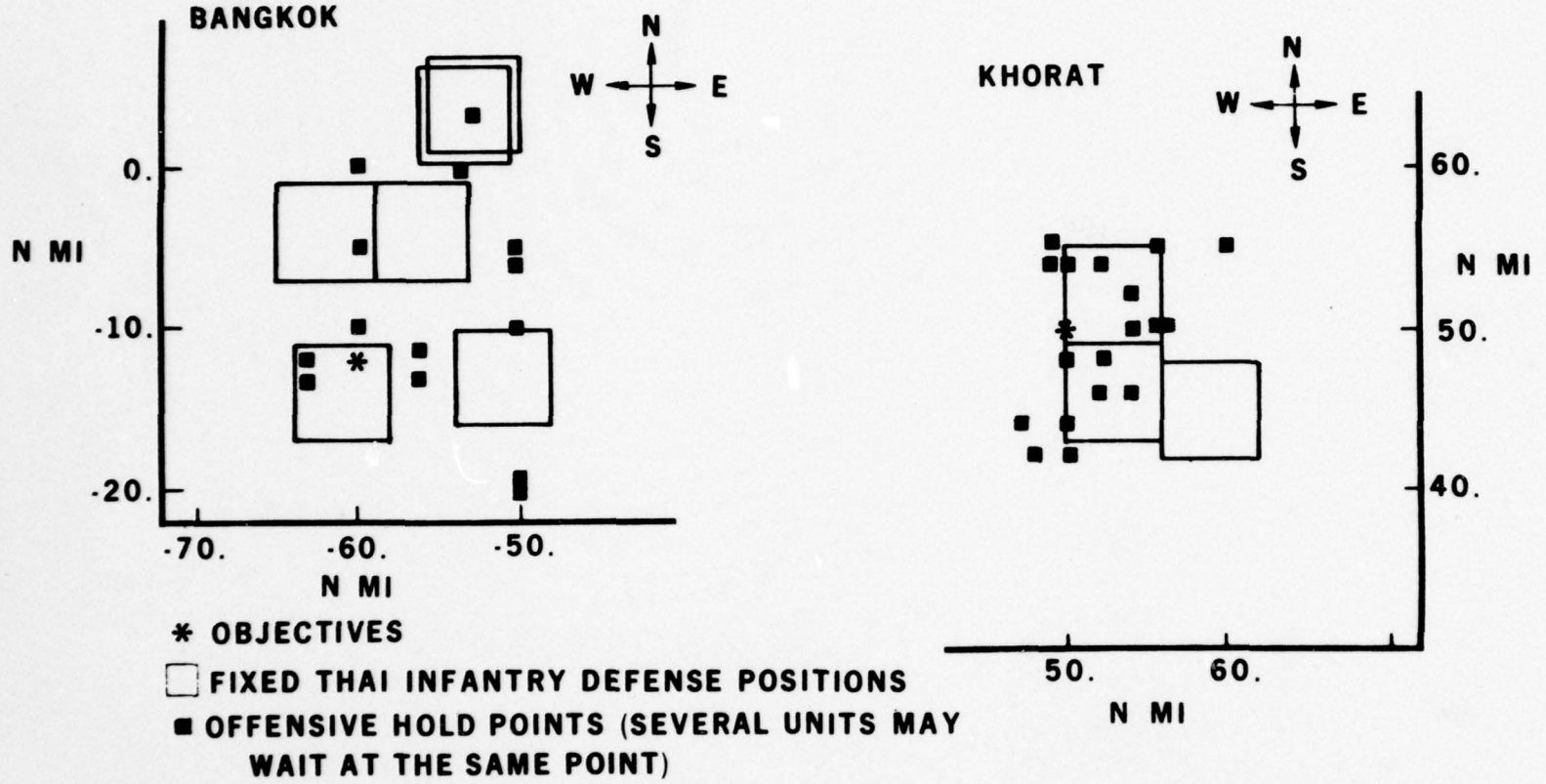

FIGURE 6.

on the coordinate axes of Figures 3 and 5. The scale, however, is expanded to show details more clearly. In studying Figure 6, it should be noted that the offensive units traveled approximately west and northwest to reach their "hold" points. From these points, they advanced toward their objectives. The units assigned to Koke Kathiem were not given "hold" positions, but advanced on the objective as rapidly as possible.

4. Thai Defense Plans

According to one estimate, the entire Thai army consists at the present of 50,000 men [4]. Allowing for some increase by 1972 and considering the length of border to be defended, it was judged that twenty-two battalions represented a reasonable estimate of the maximum number of Thai forces which could be assigned to this region.

The specific assignments of the Thai forces are given in Table 4. Some ten of the battalions were assigned to the defense of Bangkok, Khorat, and Koke Kathiem. The remaining twelve units were placed initially along the Cambodian border with the planned retreat paths shown in Figure 7. The fixed defense positions around Bangkok and Khorat were shown earlier in Figure 6, which pictured the details of the Chinese attack plans. The fixed defenses around Koke Kathiem consisted of one infantry battalion which is not shown.

The simulation program allows two types of retreats:

(1) Retreat by an individual unit because of heavy fire.

(2) General retreat by a group of units to prevent encirclement or enemy break-through.

For these studies only general retreats of type (2) were permitted.

This is referred to as the "determined defense" mode of operation. It was accomplished by pre-specifying the "retreat lines" shown in Figure 7 and pulling the defensive units back when an enemy offensive unit crossed one of these lines. For example, the defenses in Zone 1S were pulled back into Zone 2S when line A' was crossed.

TABLE 4. Specific Assignments of the Thai Forces

Quantity Bns.	Type	Assignment
6 2	Infantry Artillery	Placed initially along south-eastern Cambodian border; given retreat paths west toward Bangkok, then north toward Koke Kathiem.
3 1	Infantry Artillery	Placed initially along Cambodian border north-east of above group; given retreat paths northwest past Khorat toward Koke Kathiem.
6	Infantry	To defend Bangkok; no retreat.
3	Infantry	To defend Khorat; no retreat.
1	Infantry	To defend Koke Kathiem, no retreat.
TOTAL 22		

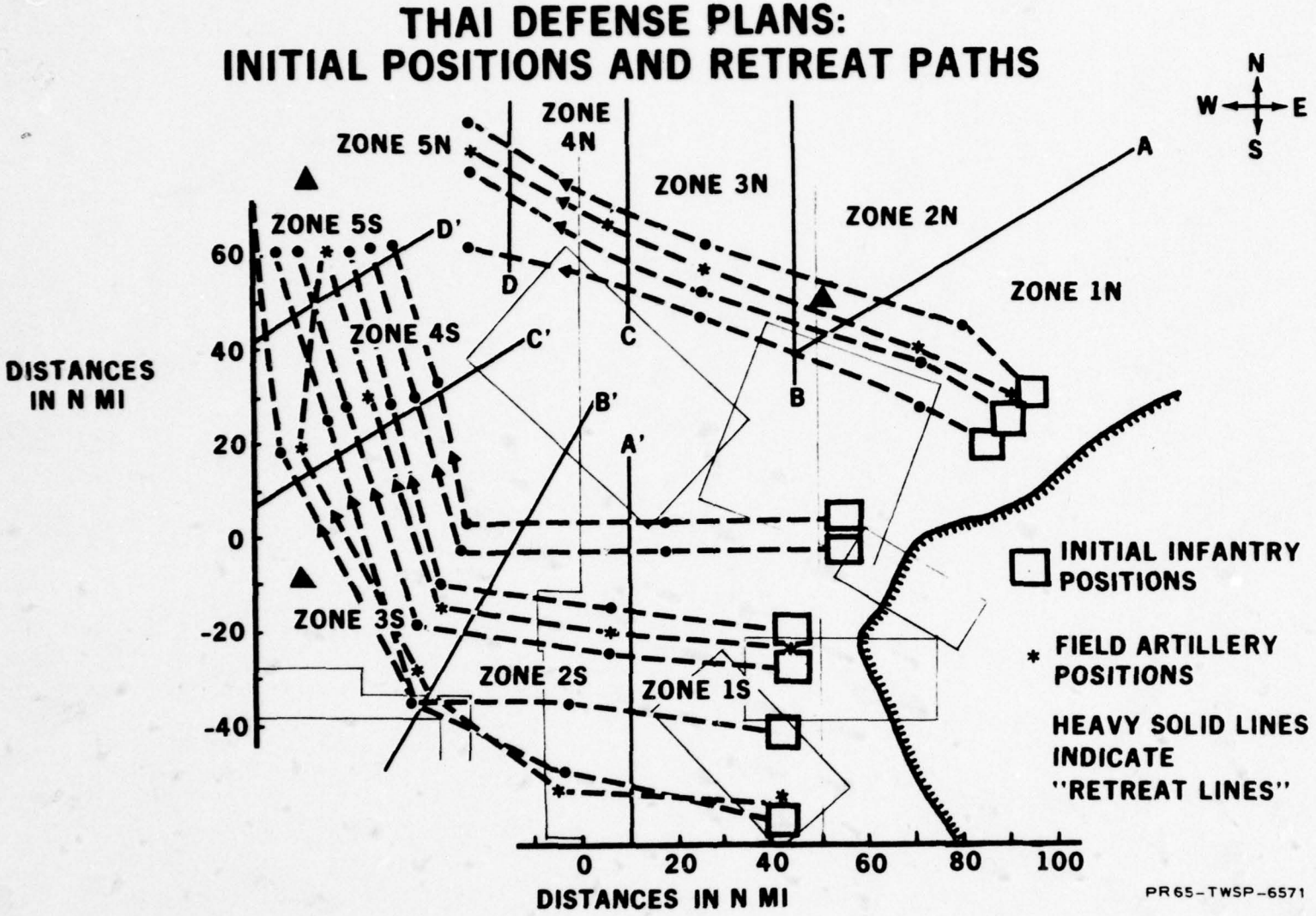
THAI DEFENSE PLANS:
INITIAL POSITIONS AND RETREAT PATHS
N
W
E
S
ZONE 5N
ZONE 4N
ZONE 3N
ZONE 2N
ZONE 1N
ZONE 5S
ZONE 4S
ZONE 3S
ZONE 2S
ZONE 1S
A
A'
B
B'
C
C'
D
D'
DISTANCES IN N MI
60
40
20
0
-20
-40
0
20
40
60
80
100
DISTANCES IN N MI
INITIAL INFANTRY POSITIONS
* FIELD ARTILLERY POSITIONS
HEAVY SOLID LINES INDICATE "RETREAT LINES"
PR65-TWSP-6571

FIGURE 7.

5. U.S. Force Disposition

The U.S. force was chosen to be of sufficient strength so that, if it is in position when the border is first crossed, the Communist attack will be clearly repelled. It consisted of three of the augmented infantry divisions referred to as "Force A". For the purpose of calculating force commitment times, the principal combat units and their immediate support were separated from the divisional support. The composition of the combat portion of one division is given in Appendix B. The units listed there represent about 40,000 tons gross weight, or a little less than one-half the total divisional weight.

Only the principal combat units were entered into the simulation. These combat units were aggregated on the battalion level. Thus, one division was taken to be made up of seven infantry battalions, two mechanized infantry battalions, two tank battalions, six field artillery battalions, and one armored cavalry battalion or a total of eighteen battalions per division. Including the combat capability of the direct support elements, there are approximately 18,000 combat personnel per division, or roughly an average of 1000 per battalion.

Details of the initial U.S. force locations, the means of transportation, and the deployment operations are given elsewhere [2]. In all, six cases are discussed here; five in which the three divisions were deployed by various transportation modes and a background case in which no U.S. forces were used.

Like the Thai defenses, the U.S. forces have planned positions in each of the ten defense zones. (These defense zones were shown in Figure 7). Which of these positions were occupied initially by the U.S. forces depended, of course, on how far the offensive forces had progressed

by the commitment time. The U.S. forces were always entered by the program into combat in the farthest eastern zone not yet controlled by the Red forces. The entry times and initial zones for the various deployment modes are shown in Table 5. A discussion of the U.S. force deployment will not be part of this report. The commitment times indicated in Table 5 are, for this discussion, considered to be inputs.

The build-up of U.S. forces for the various cases is indicated graphically in Figure 8. The solid lines represent the total defense forces (U.S. and Thai). For convenience, the offensive build-up (already shown in Figure 4) is repeated.

A short description of the six cases is given in Table 6. One way of characterising the scope of U.S. involvement is by the number of battalion-days of operations over a fixed time period, where a "battalion-day" refers to one battalion in the field for one day. Table 6 gives this information also for the six cases for the first 40 days of combat.

Like the Thai defenses, the U.S. forces have planned retreat paths which follow, in general, the routes shown in Figure 7 for the Thai units. These retreat paths are planned by the analyst before the simulation is run but with full knowledge of the offensive plans. However, which offensive units survive to advance and which defensive units, to retreat depends on the timing and details of combat and will vary in the different cases.

TABLE 5. Commitment Times and Entry Zones for U.S. Forces

	CASE 2		CASE 3		CASE 4		CASE 5		CASE 6	
DAY	#BNS	ZONE	#BNS	ZONE	#BNS	ZONE	#BNS	ZONE	#BNS	ZONE
1			3	1S	6	1S	6	1S	6	1S
									6	2N
2										
3									7	1S
4										
5			2	1S	4	2N	4	2N	3	2N
			1	2S	2	3N	2	3N	4	3N
6										
7					7	2S	7	2S	4	2S
									1	3S
8										
9					7	3N	7	3N	5	3N
10			6	3N						
11					4	2S	4	2S		
					1	3S	1	3S	6	2S
12										
13					3	3N	3	3N		
					2	4N	2	4N	8	2S
14			7	3S	6	2S				
15			7	4N	8	3S	6	3S	3	2S
									1	3S
16	3	3S	1	3S						
	3	4S	4	4S	4	3S				
17	6	5N	3	4N						
			2	5N						
18	3	3S					8	3S		
	4	4S								
19	4	5N								
20	5	4S								
	1	5N								
21							4	3S		
22	3	5N	5	4S						
			1	5S						

TABLE 5. (Cont'd)

	CASE 2		CASE 3		CASE 4		CASE 5		CASE 6	
DAY	#BNS	ZONE	#BNS	ZONE	#BNS	ZONE	#BNS	ZONE	#BNS	ZONE
23	5	4S								
24	5	4S								
25	4	5S								
26			7	4S						
27										
28										
29										
30			3	5S						

BUILD-UP OF DEFENSIVE FORCES
(THAI + U.S.)

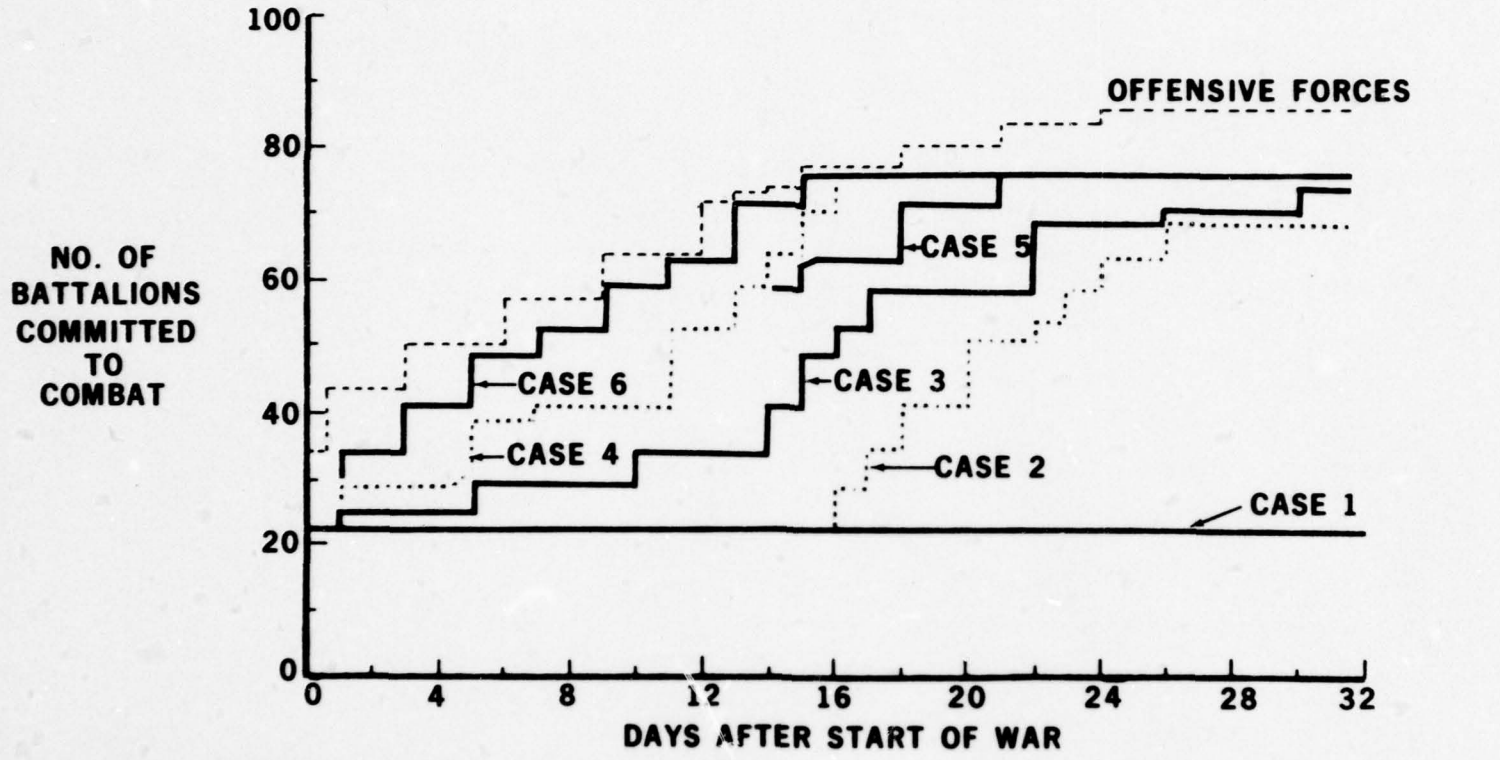

FIGURE 8.

TABLE 6. Description Of The Six Force Commitment Patterns

CASE	DESCRIPTION	SCOPE OF U.S. OPERATIONS (battalion-days)
1.	No U. S. Forces; Thai defenses only.	0
2.	No U.S. forces until D+16. Rapid deployment completed by D+26.	911
3.	First U.S. forces in at D+1. Slow build-up. Deployment not complete until D+30.	1047
4.	First forces in at D+1. Medium build-up. Deployment completed at D+16.	1622
5.	Identical with Case 3 through D+13. Slower build-up after then. Deployment completed by D+21.	1607
6.	Fastest Build-up. Deployment completed by D+15.	1782

A more interesting way of looking at the build-up of forces is shown in Figure 9. There, the information on offensive force build-up (Figure 4) is combined with information on the various defensive force build-ups (Figure 8)to give the ratio of committed forces. Figure 9 shows the variation of this ratio with time for several of the cases.† Case 1 (Thai defenses only) follows the curve for Case 2 until D+16. From then on, it would increase at about the same rate to 3.86 at D+24 when the offensive force build-up is complete. The curve for Case 2 drops rapidly after D+16 when the first U.S. forces begin to arrive. The faster U.S. force build-up in Cases 3-6 force the ratio down,even earlier.

In considering Figure 9, it should be remembered that all figures, tables and discussions up to this point are background information and provide inputs to the simulation. With the single exception of the "Entry Zones" in Table 5, no results of the warfare simulation have yet been shown. Figure 9 represents, then, only what its title indicates—the ratio of committed forces. It does not show what is commonly referred to as the "force ratio", or the ratio of surviving forces engaged in combat.*

The information in Figure 9 is an additional way of looking at the offensive and defensive plans. It is not, of course, information which would be possessed by either military commander alone, but it does provide the omniscient analyst with an insight into the probable

† In the interests of clarity, the curve for Case 5, which would fall between Cases 4 and 6, is omitted.

* If no units were destroyed and no personnel killed, then, of course, these two force ratios would be identical.

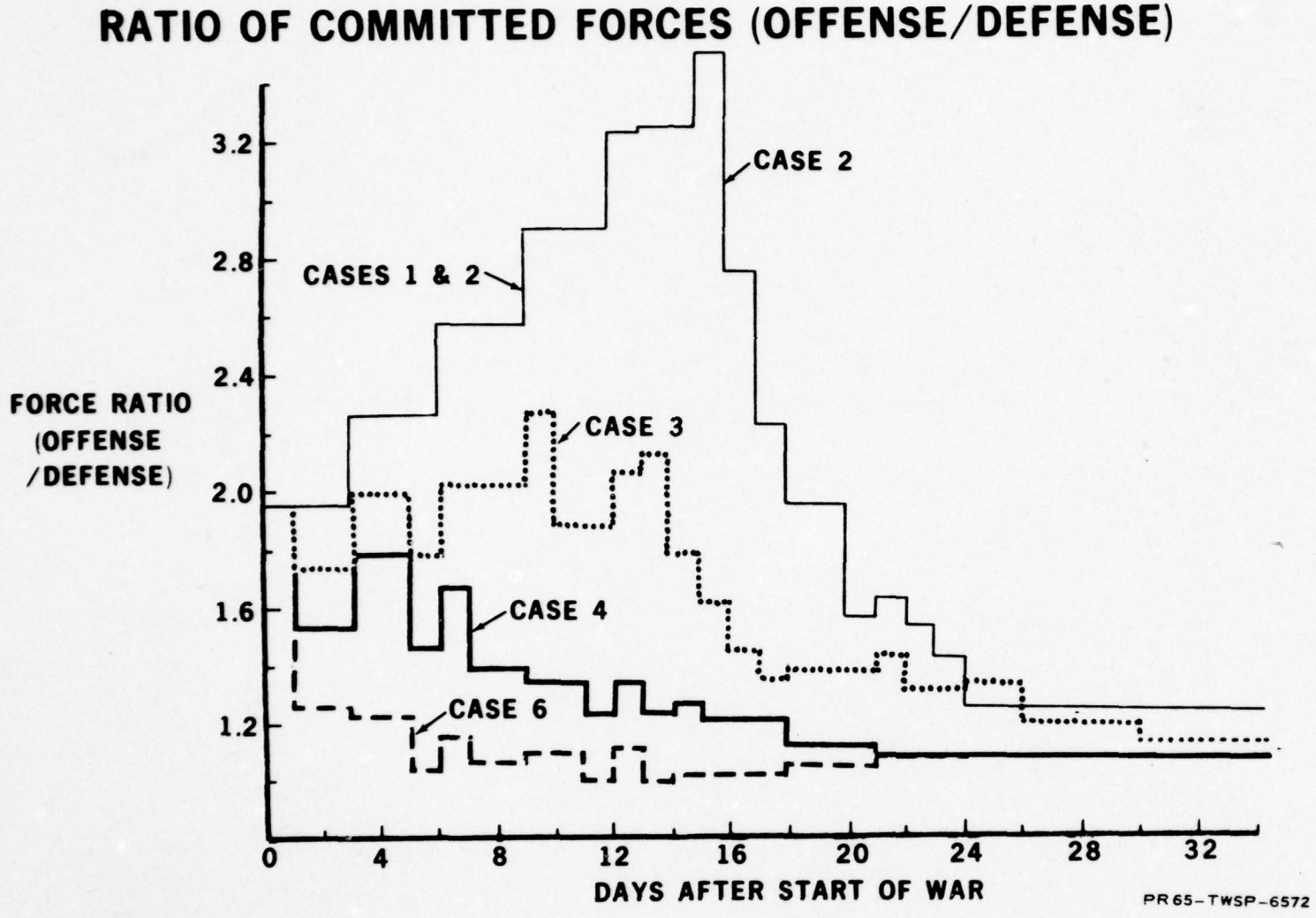
RATIO OF COMMITTED FORCES (OFFENSE/DEFENSE)
FORCE RATIO (OFFENSE /DEFENSE)
3.2
2.8
2.4
2.0
1.6
1.2
CASE 2
CASES 1 & 2
CASE 3
CASE 4
CASE 6
0
4
8
12
16
20
24
28
32
DAYS AFTER START OF WAR
PR65-TWSP-6572

FIGURE 9.

outcomes of the war in the various cases. If no warfare simulation program were available, it would, possibly, provide a more meaningful way of studying the effects of force deployments than the simple force build-up curves of Figure 8. For instance, it can be seen from Figure 9 that in Cases 1 and 2 the offensive forces have for the first 18 days a greater than a 2/1 advantage (in committed forces, of course). In Case 3, they have a 2/1 advantage for only 8 days and, in Cases 4 and 6, they never attain a 2/1 ratio.

II. DESCRIPTION AND RESULTS OF THE WAR

6. How To Describe a War

The obvious question to ask about these wars is "Who won?" Generally speaking, "to win a war" means "to achieve a set of political objectives". To say who won requires, then, that the political objectives of both sides be defined. This is both a difficult and controversial area. Rarely will the objectives in one theater be a package independent of simultaneous objectives elsewhere. What corresponds to a victory in one location and set of circumstances may be overwhelming defeat in another. It is, in no sense, the purpose of this paper to examine such questions. Therefore, no judgement will be made about who won. Rather, the results will be presented as a series of graphs and tables showing how the most important aspects of the military situation varied in these different cases.

There are four critical military variables: offensive force strength, defensive force strength, time, and position. The results which are presented here will be devoted principally to showing the relationships among these variables; i.e., the variations of force strength with time, of position with time, and of strength with position. These results will be arranged to show first a general picture of the war, proceeding then to a more detailed description of each case, and ending finally with the complete history of one military unit.

The general results will show the military situation during, and at the end of, the first forty days of combat. The war is followed no further because, for the terrain and the numbers and types of military units involved, forty days is about the maximum time period which can

be covered by pre-war plans. By this time most of the offensive units have either broken or reached their objectives, and it is necessary for the Communists to make decisions about reinforcing or withdrawing. At the same time, the U.S.-Thai commanders will be faced with such choices as holding in their present positions or making a counter-attack. In other words, the scenario and attack plans presented here cover only this first (approximately forty-day) phase of the war. This report will not cover what might be expected to happen in later stages.

The purpose of this study is to determine the effect on the outcome of the war in Thailand of various U.S. force deployments. It is not primarily a study of tactics. Therefore, the same Chinese attack, the same Thai defenses, and the same U.S. defense positions* were used in all six cases. The differences in the cases lie only in the times at which the U.S. forces were committed.

*i.e., geographic locations and retreat paths.

7. General View of the War

Perhaps the most important question to be answered is: "How many Communist units reached their assigned objectives within the forty day period?" Figure 10 shows the offensive forces at the three objectives on D+40. It can be seen that in all six cases some offensive forces reached Khorat; in three cases, some forces reached Bangkok; and in two cases, some reached Koke Kathiem.

The second important question concerns the losses suffered by each side. Figure 11 shows the combat losses for both offensive and defensive forces. It can be seen that as U.S. involvement became deeper, the Communist losses increased. On the other hand, while remaining very high, the Thai losses decreased slightly. On the average, the Communist losses ranged from approximately .5 to 2.5% per day. Average Thai losses dropped from about 2 to 1.5% per day, while average U.S. losses were less than 1% per day in all cases.

The general course of the war in each case is illustrated by the curves of Figures 12 and 13. Figure 12 shows the total surviving offensive strength as a function of the average distance of the units from their objectives.* A nearly horizontal line represents a Communist advance with little attrition. A vertical line represents a halting of the offensive advance accompanied by higher attrition. The horizontal line of Case 1 represents, therefore, a rapid Communist advance with little effective resistance on the part of the Thais. The Case 6 curve, on the other hand, is nearly vertical around D+30, indicating a halt in the Communist advance at this time.

*It will be recognized that, since "the total surviving offensive strength" includes (until D+24) some uncommitted forces and since the "distance-to-objective" is averaged over all three objectives, these curves by themselves give a rather gross picture of the wars.

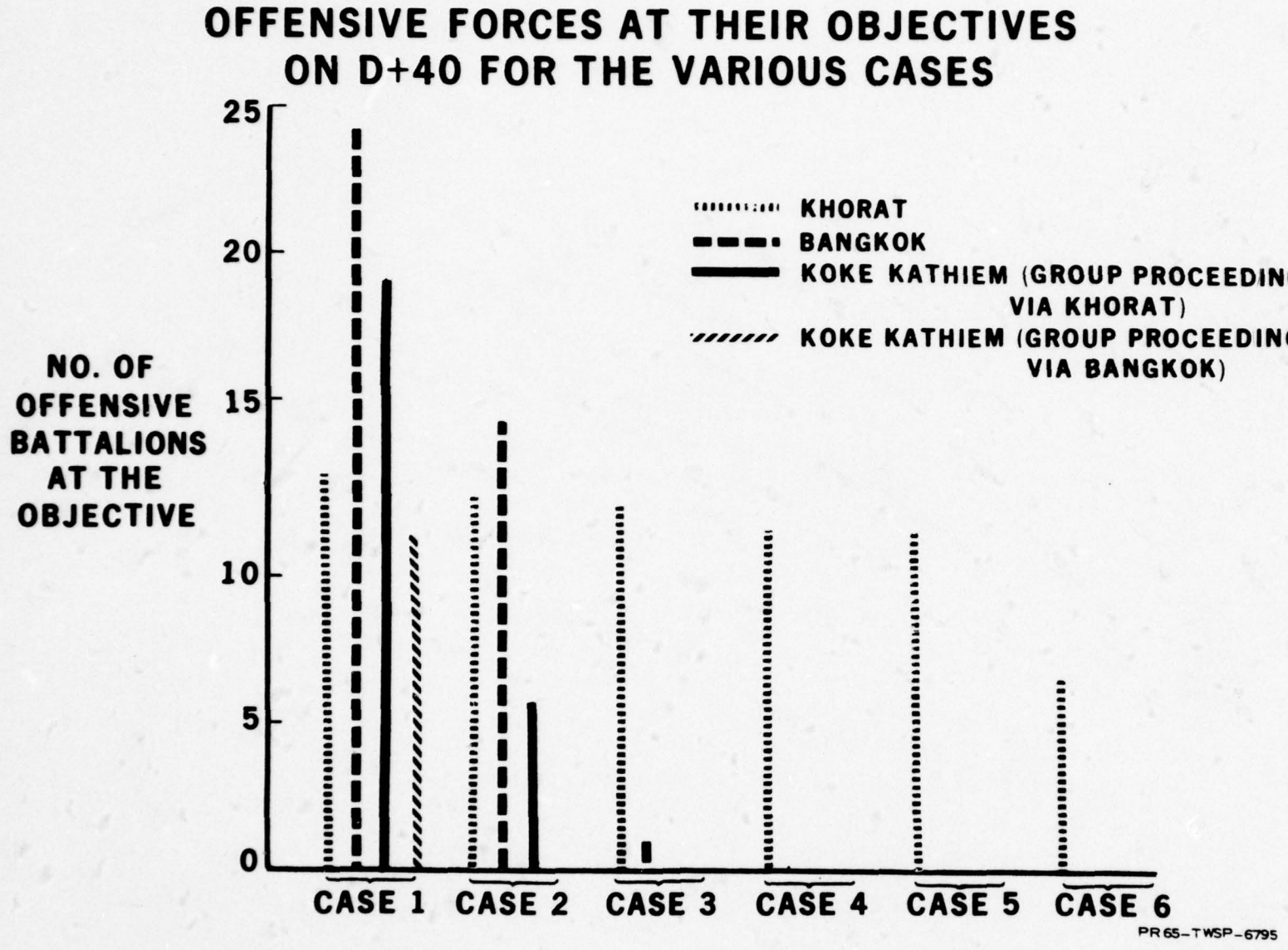
OFFENSIVE FORCES AT THEIR OBJECTIVES
ON D+40 FOR THE VARIOUS CASES
NO. OF OFFENSIVE BATTALIONS AT THE OBJECTIVE
25
20
15
10
5
0
KHORAT
BANGKOK
KOKE KATHIEM (GROUP PROCEEDING VIA KHORAT)
KOKE KATHIEM (GROUP PROCEEDING VIA BANGKOK)
CASE 1
CASE 2
CASE 3
CASE 4
CASE 5
CASE 6
PR65-TWSP-6795

FIGURE 10.

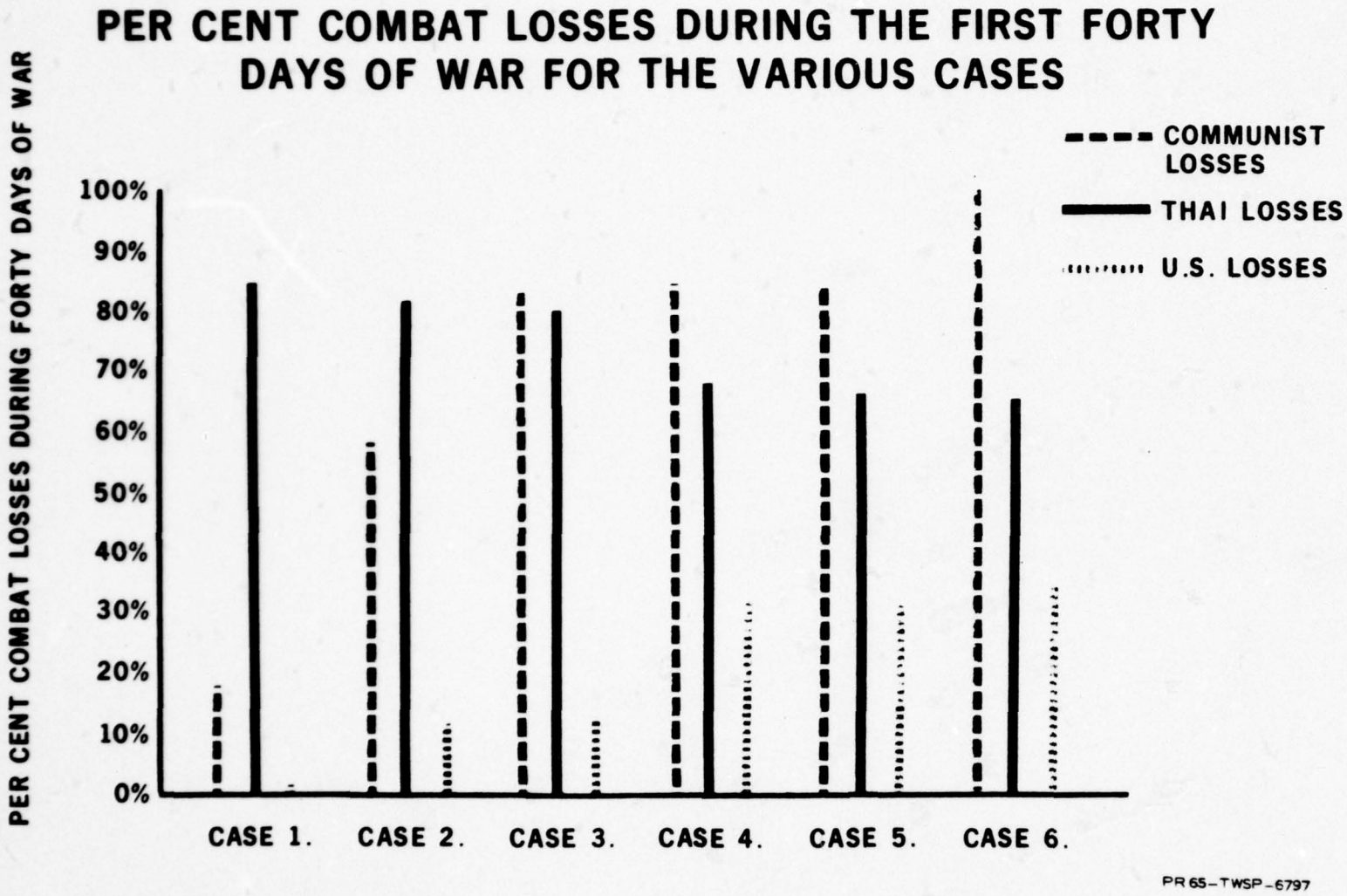
PER CENT COMBAT LOSSES DURING THE FIRST FORTY DAYS OF WAR FOR THE VARIOUS CASES
COMMUNIST LOSSES
THAI LOSSES
U.S. LOSSES
PER CENT COMBAT LOSSES DURING FORTY DAYS OF WAR
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
CASE 1.
CASE 2.
CASE 3.
CASE 4.
CASE 5.
CASE 6.
PR 65-TWSP-6797

FIGURE 11.

STRENGTH OF OFFENSIVE FORCES AS A FUNCTION OF THEIR AVERAGE DISTANCE-TO-OBJECTIVE FOR THE VARIOUS CASES

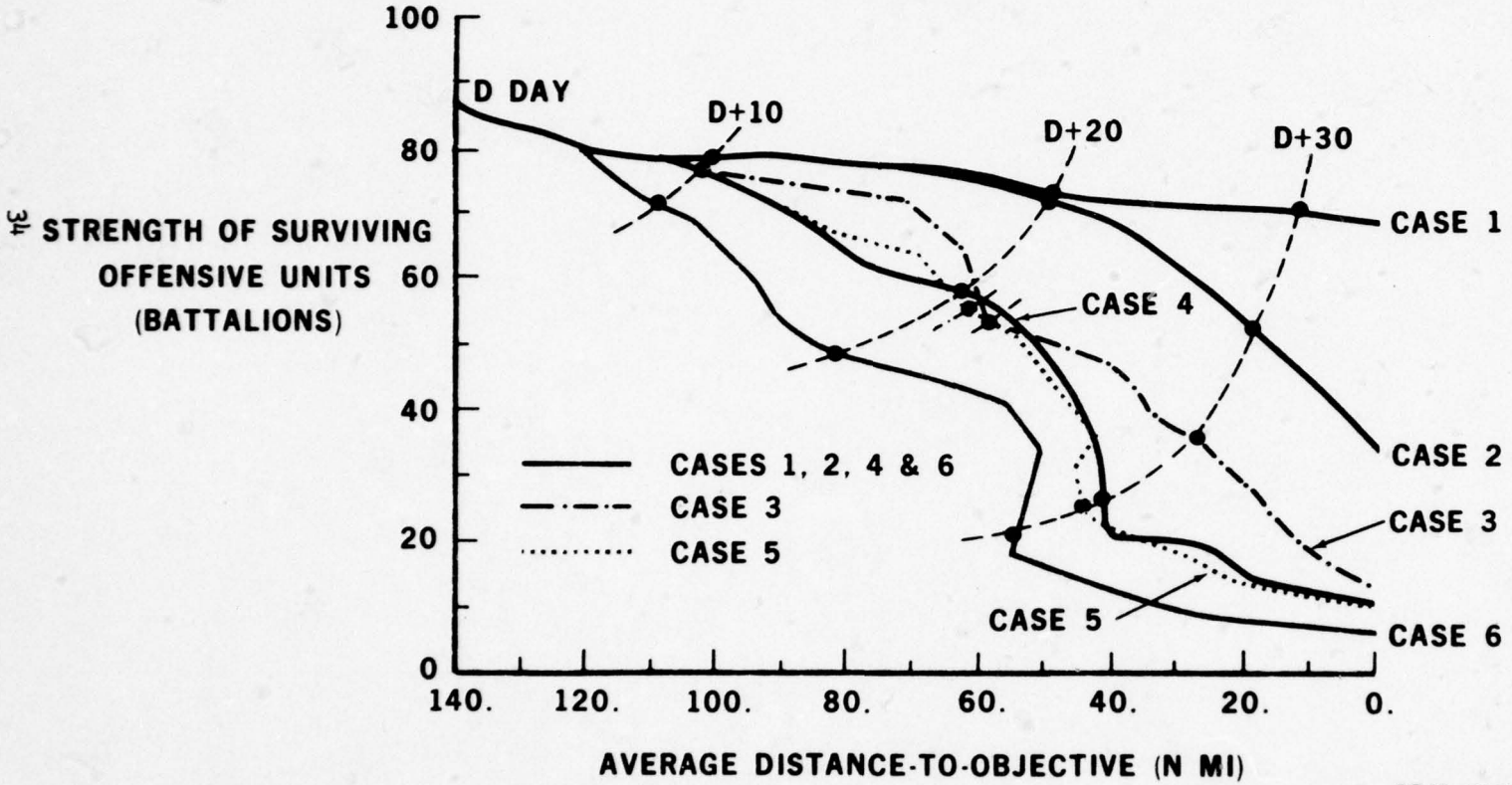

FIGURE 12.

Figure 13 shows the variation of the force ratio with time. Here the "force ratio" has the common meaning of "ratio of surviving committed forces". That is, the two opposing factors of force build-up and combat losses are included in these curves. It can be seen that in Case 1 the Thais never gained a favorable force ratio. In fact, the full extent of the military disaster which overtook them without U.S. assistance is illustrated here. By D+7 the force ratio was greater than 3/1 in the Communists' favor and increasing rapidly.

Case 2 is identical with Case 1 for the first sixteen days. The effects of U.S. assistance in Case 2 begins to show up on D+17, and the force ratio shows a rapid rise toward the region of U.S.-Thai superiority, passing the equal force line around D+26. Early losses have been too great, however, and the force ratio never reaches the 2/1 level.

During the early stages of the war in Case 3 the force ratio increases in the Communists' favor although not so rapidly as in Cases 1 and 2. On D+12, there is a break in the situation for the U.S.-Thai forces, and the force ratio trend reverses. By D+25 the region of U.S.-Thai superiority is reached.

In Cases 4 and 5 the force ratio remains constant for the first few days and then increases slowly toward the region of U.S.-Thai superiority. In Case 6, the force ratio increases rapidly toward this region from the beginning of the war. By D+12, U.S.-Thai forces are equal to the Communist forces, and by D+29 they have a 2/1 advantage.

The importance of early force commitment is shown most strikingly in Figure 13 in the region from D+32 to D+40. If, in Cases 3-6, the Communists have not already withdrawn, the U.S.-Thai forces are clearly

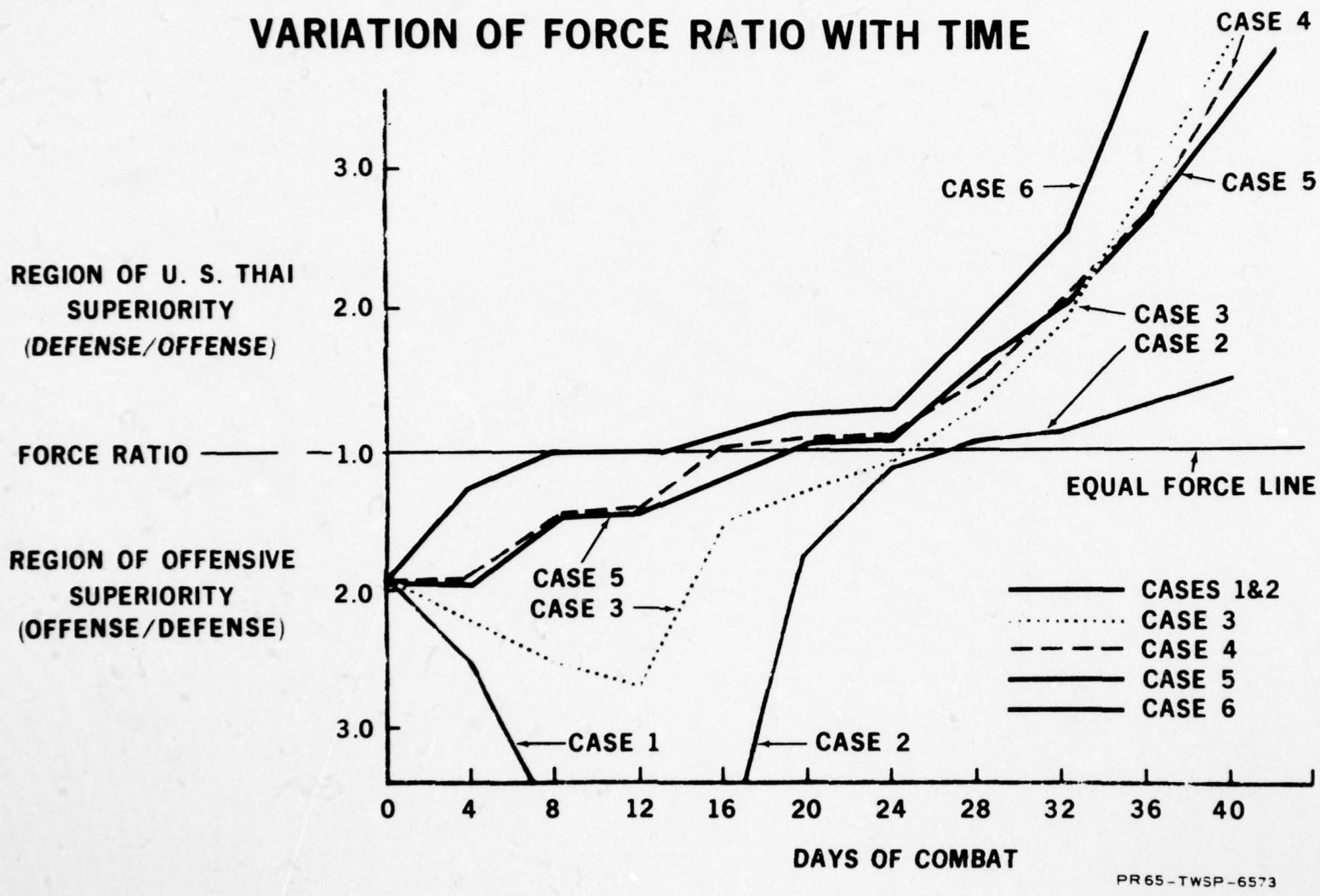
VARIATION OF FORCE RATIO WITH TIME
CASE 4
CASE 6
CASE 5
CASE 3
CASE 2
REGION OF U. S. THAI SUPERIORITY (DEFENSE/OFFENSE)
FORCE RATIO
REGION OF OFFENSIVE SUPERIORITY (OFFENSE/DEFENSE)
3.0
2.0
1.0
2.0
3.0
EQUAL FORCE LINE
CASE 5
CASE 3
CASES 1&2
CASE 3
CASE 4
CASE 5
CASE 6
CASE 1
CASE 2
0
4
8
12
16
20
24
28
32
36
40
DAYS OF COMBAT
PR65-TWSP-6573

FIGURE 13.

in a favorable position for a counterattack. However, the early Communist advantage in Case 2 is never really overcome by the U.S.-Thai forces, and without additional U.S. units, a counterattack to regain the objectives lost to the Communists is clearly not advisable.

Table 7 exhibits three interesting "war-indices": the offensive losses per unit defensive loss and the offensive losses and defensive losses per battalion-day of defensive operations. If these indices are interpreted as representing some kind of defense force "efficiency", then the obvious conclusion can be drawn that it is not very efficient to go into combat greatly outnumbered as the Thais were forced to do in Case 1.

TABLE 7. Relative U.S.-Thai and Communist Losses During Forty Days of War

	$\left[\frac{\text{Communist Losses}}{\text{U.S.-Thai Losses}}\right]$*	$\left[\frac{\text{Communist Losses}}{\text{U.S.-Thai Battalion-Day of Operations}}\right]$	$\left[\frac{\text{U.S.-Thai Losses}}{\text{U.S.-Thai Battalion Day of Operations}}\right]$
Case 1	.83	.018	.021
Case 2	2.1	.028	.013
Case 3	3.0	.037	.013
Case 4	2.3	.029	.013
Case 5	2.3	.029	.013
Case 6	2.4	.030	.012

*Rounded off to two significant figures. Therefore, Column 1 is not always exactly the ratio of the last two columns.

8. Detailed Descriptions of the Six Cases

A general picture of the Thai War has been presented in the preceeding section. It is the purpose of this section to take a much closer look at the course of the war in each of the six cases studied.

One of the most important pieces of information in describing the outcome of a war is the timing of such critical events as retreats, attacks, and first entries into the objectives. Figure 14 gives this information in graphical form for the six cases.

It will be recalled that the combat area is divided into ten zones, five in the north and five in the south. Separating the zones are eight retreat lines. (See Figure 7). The crossing of one of these lines signals a defense retreat into the next (western) zone. Four retreats are possible for the southern area (from the Cambodian border to Koke Kathiem, via Bangkok); and four, for the northern area (from the Cambodian border to Koke Kathiem, via Khorat). The southern retreats are shown in Figure 14 by small white triangles; the northern retreats, by the small black ones. It can be seen that the early retreats—those into zones 2N, 3N, and 2S—are not significantly affected by the presence of U.S. forces. However, the later retreats are delayed and, in Cases 4-6, some are prevented altogether.

The shaded and black regions indicate the timing of the attacks on the objectives of Khorat and Bangkok. It will be remembered that the offensive plans call for a massing of the attack groups outside these objectives before the final attacks. The shaded areas represent this waiting period between the first and last arrivals at the "hold" points. The black areas represent the period between the arrival of the last unit

TIMING OF RETREATS AND FINAL ATTACKS ON OBJECTIVES

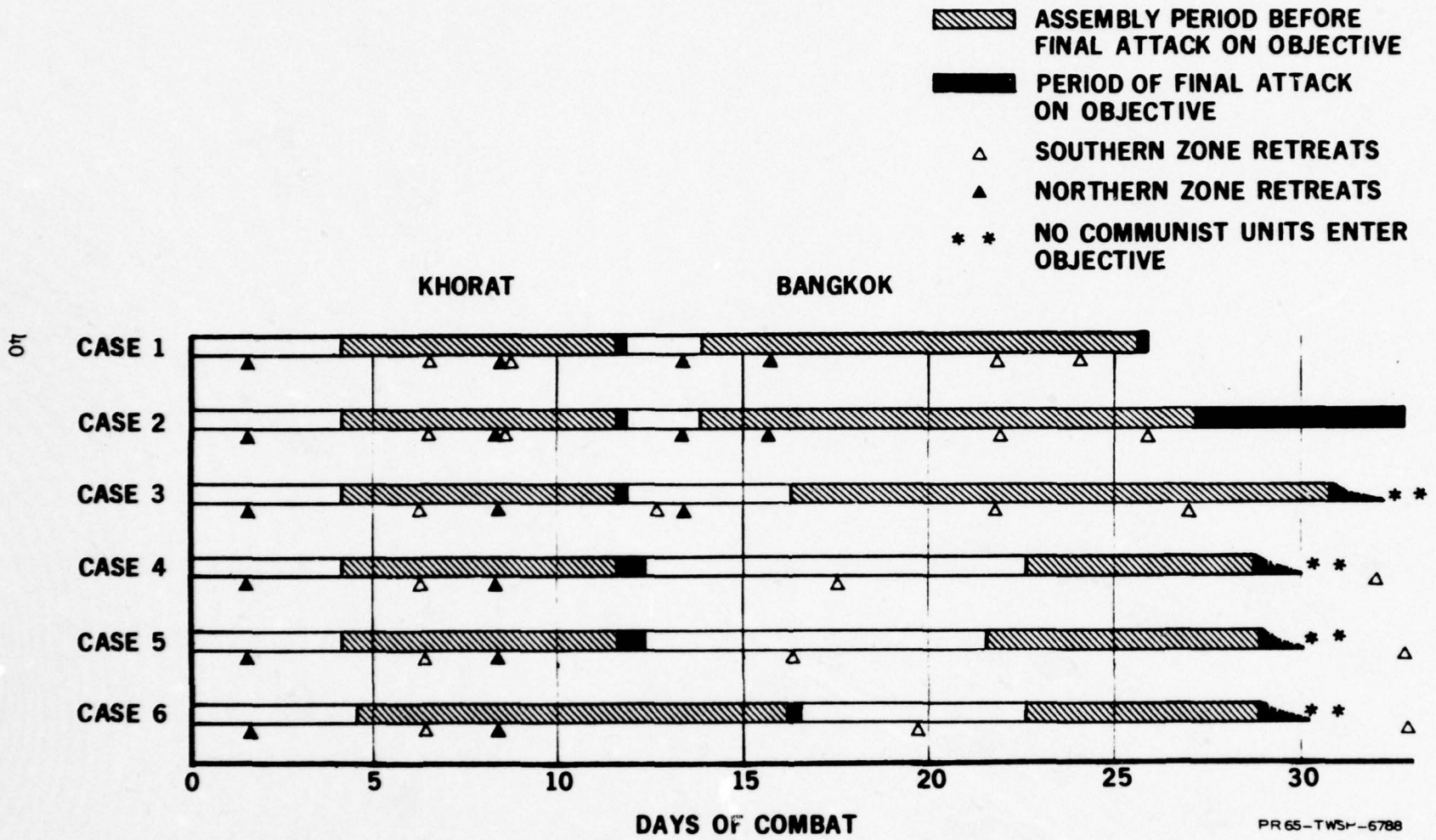

FIGURE 14.

of the attack group, which triggers the start of the attack, and the first entry into the objective. The combat continues after this, of course, but if the taking of an objective is defined to be the entering of even one offensive unit, then the sharp right end of a black area indicates the falling of the objective to the Communist forces. The trailing-off of the black areas in Cases 3-6 is intended to indicate that, although the attack on Bangkok starts, no Communist forces enter the city.

The strengths of the forces which enter the objectives have already been shown in Figure 10.

The general variation of offensive force strengths with position has been shown in Figure 12. More details are provided by Figures 15-20 which show the variation with time of the combat force strengths for both sides. As used here, the term "combat force" means the committed units minus the units lost in combat. To make comparisons between these figures easier, the top dotted curve in each one shows the offensive committed forces. The difference between this dotted curve and the solid curve labeled "offense" represents the offensive combat losses.

Of the four significant military variables listed earlier, there remains to be shown only the variation of position with time. It will be recalled that the offensive attack forces are divided into four groups with the following objectives:

Khorat
Bangkok
Koke Kathiem, via Khorat
Koke Kathiem, via Bangkok

Thus, the variable "distance-to-objective", when averaged over all offensive units and all three objectives is sufficient only for a general look at the over-all situation (as in Figure 12). For a closer study

VARIATION OF COMBAT FORCES WITH TIME:

CASE 1

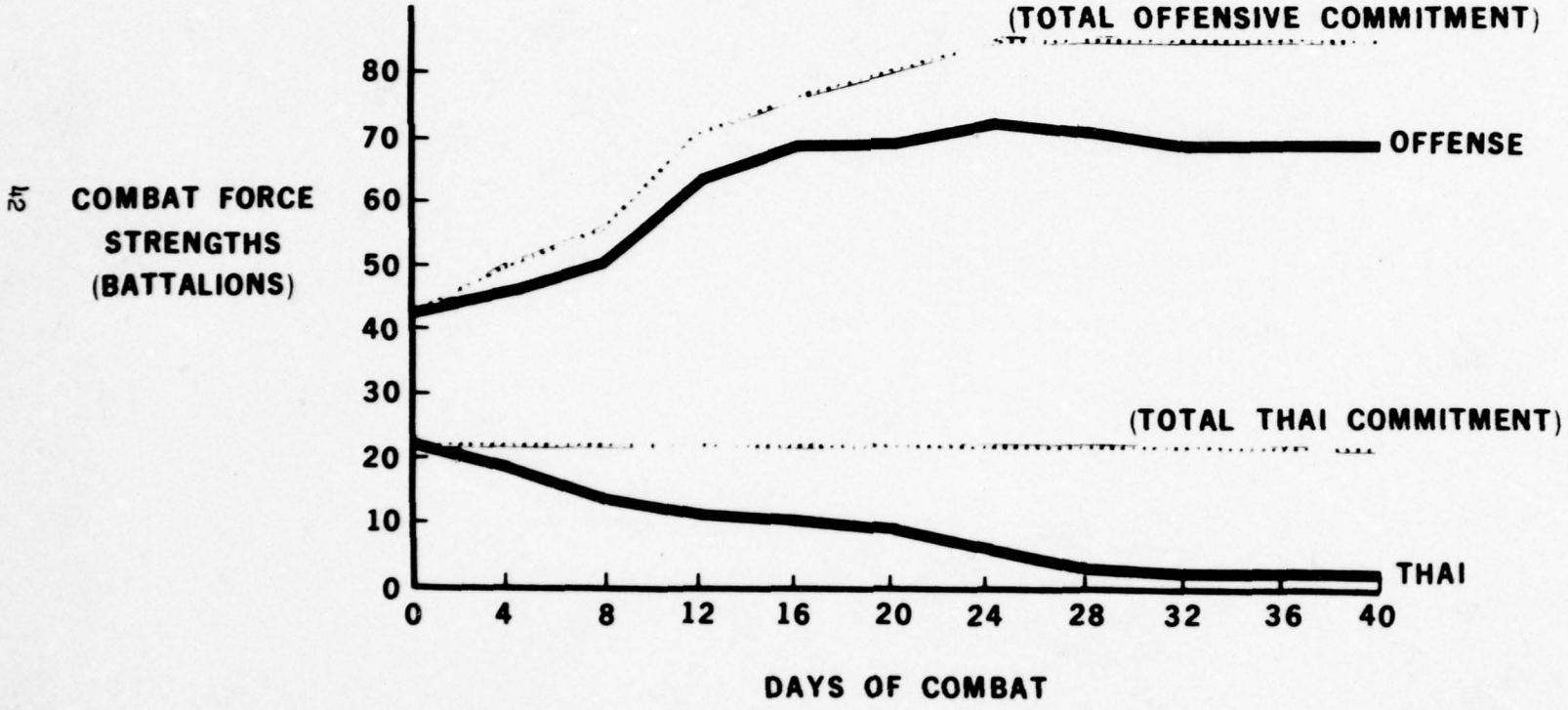

FIGURE 15.

VARIATION OF COMBAT FORCES WITH TIME:

CASE 2

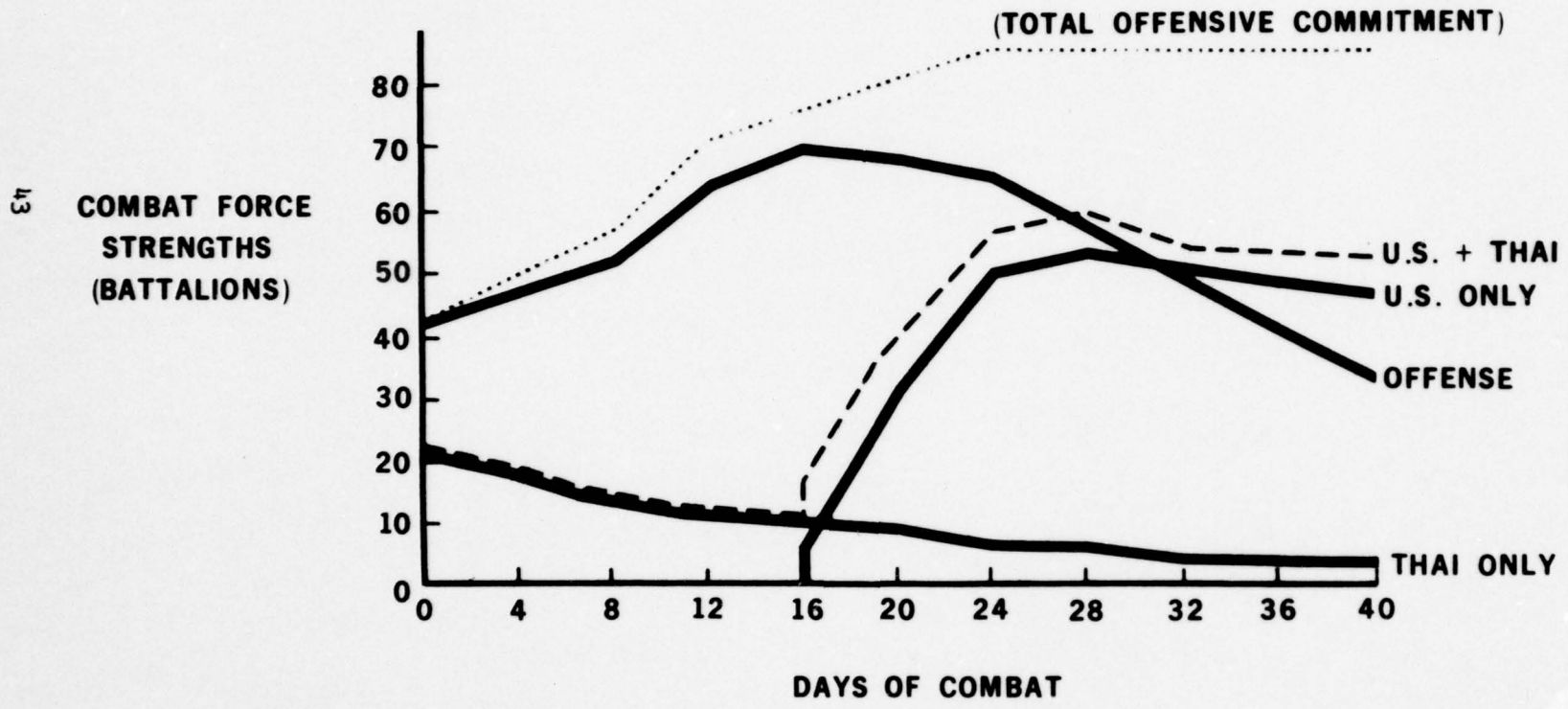

FIGURE 16.

VARIATION OF COMBAT FORCES WITH TIME:

CASE 3

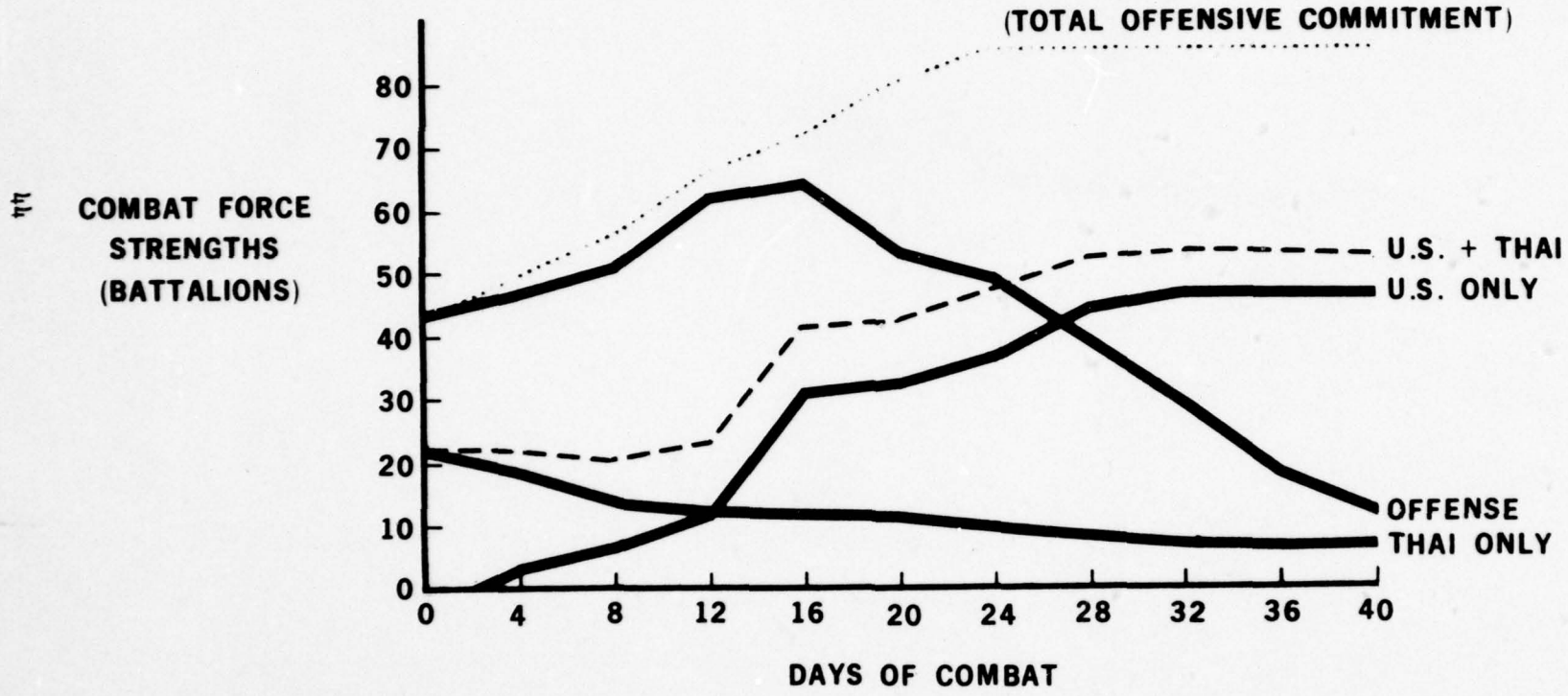

FIGURE 17.

VARIATION OF COMBAT FORCES WITH TIME:

CASE 4

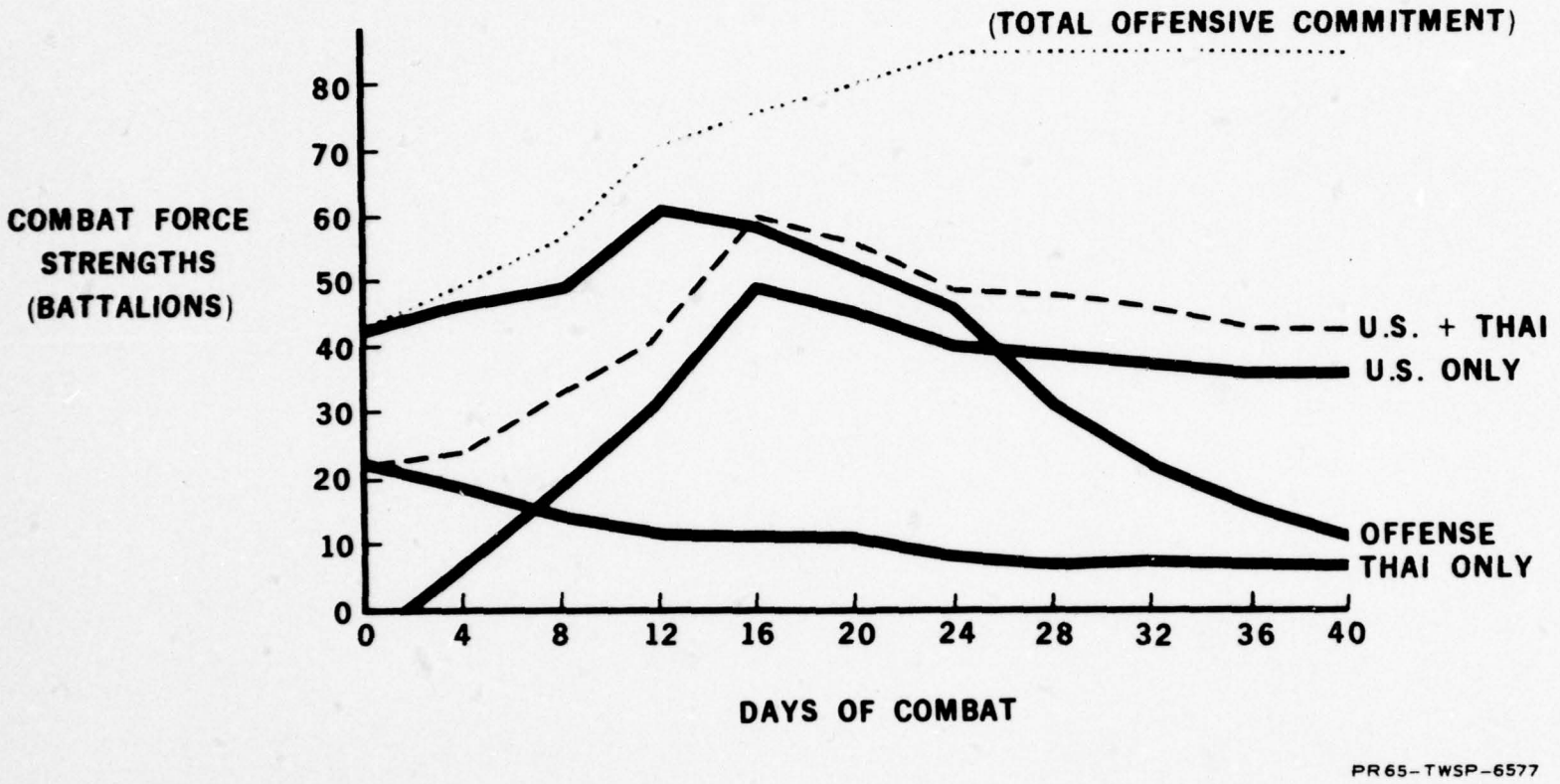

FIGURE 18.

VARIATION OF COMBAT FORCES WITH TIME:

CASE 5

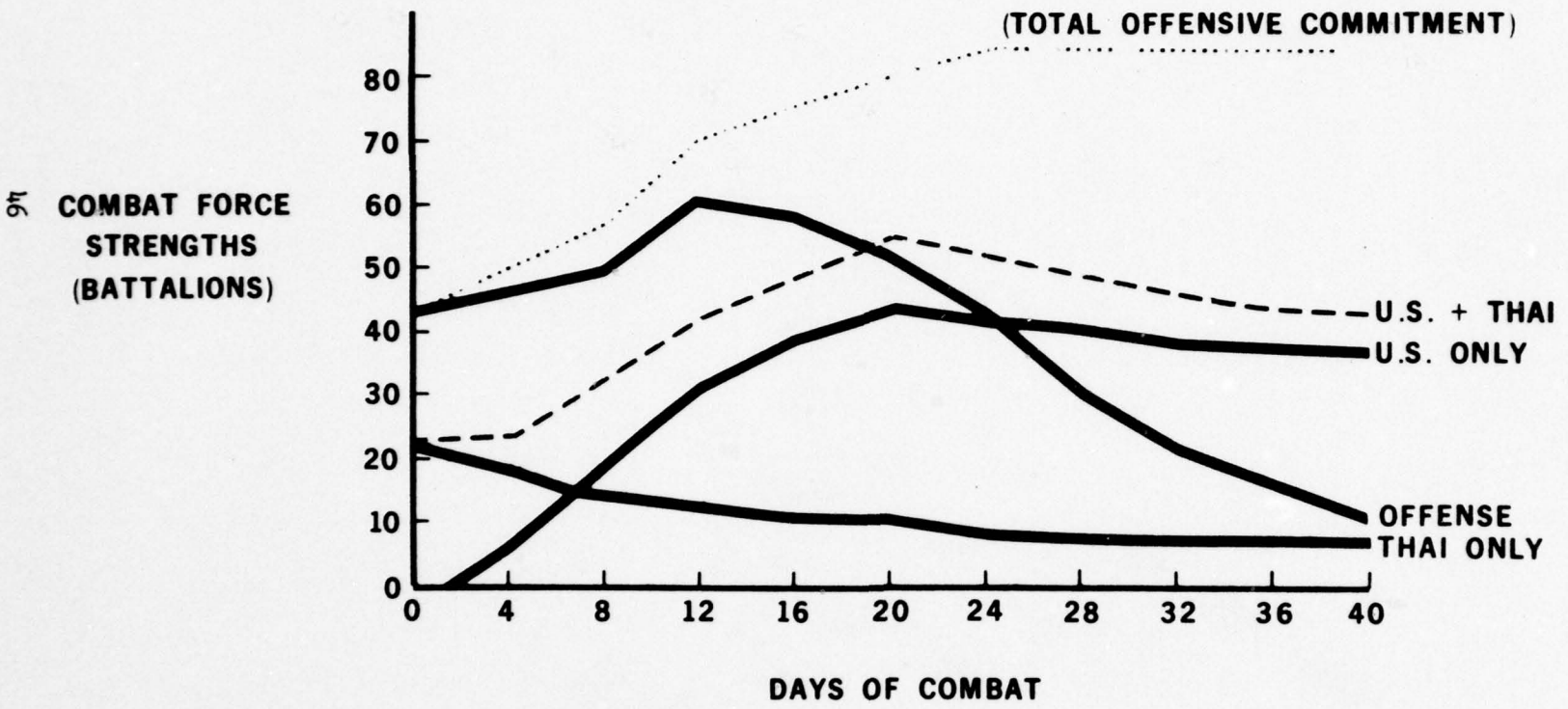

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FIGURE 19.

VARIATION OF COMBAT FORCES WITH TIME:

CASE 6

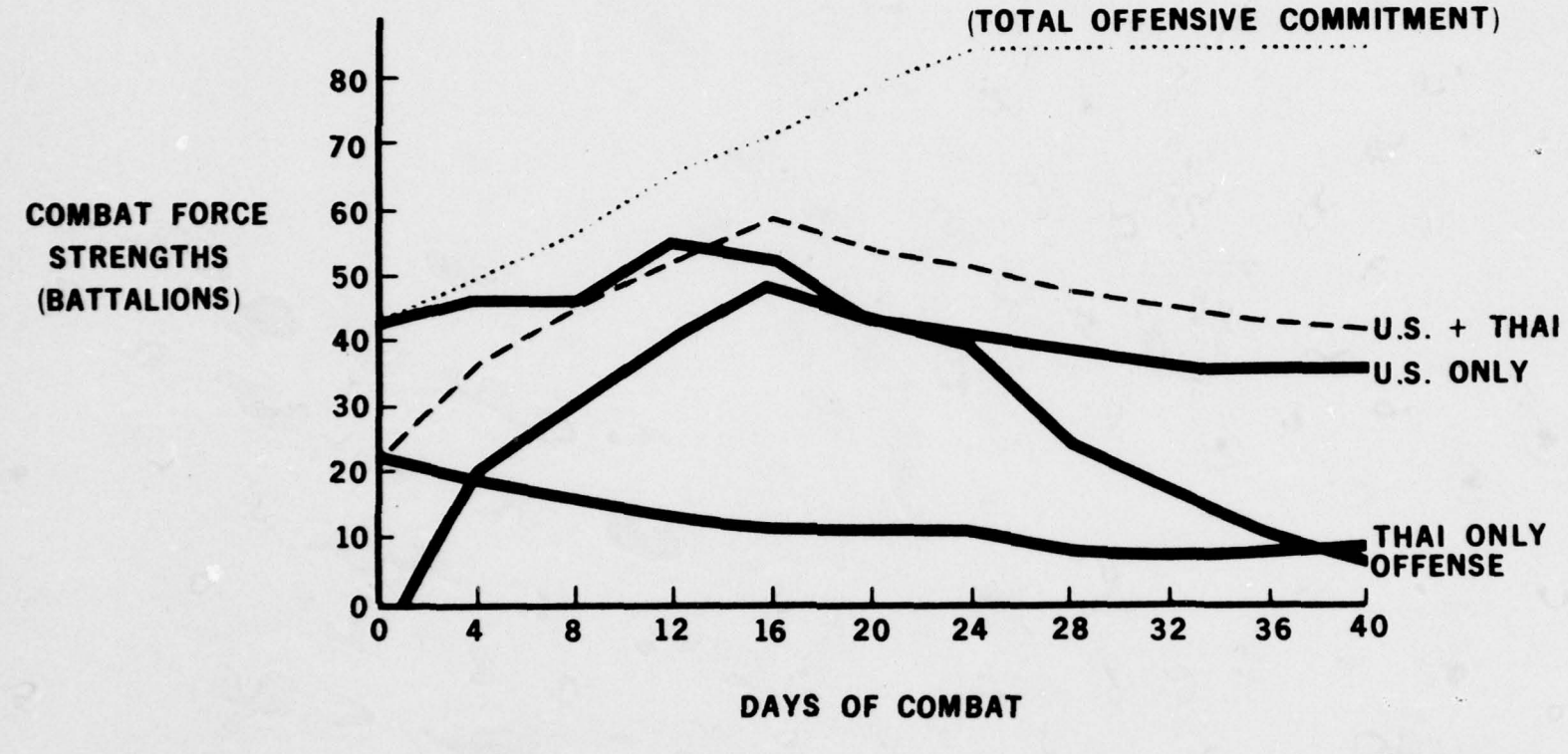


FIGURE 20.

of the wars a variable more responsive to the actions of each group is required. There are several which might be suitable, but the most useful appears to be the minimum distance to its objective of the most advanced unit in each attack group. Therefore, Figures 21-26 show the variation with time of this minimum distance-to-objective. Since the offensive units may advance or stop, but not retreat, the increase of this minimum distance with time (such as is found in Figure 24, for example) is a consequence of the loss in combat of the forward offensive units.

The advance toward Khorat was not greatly different in the six cases. The attack group starting toward Bangkok was delayed (Cases 2 and 3) and finally prevented altogether from reaching the objective (Cases 4-6). This is about what would be expected on the basis of results already presented.

The most interesting information in this group of curves concerns the advance of the attack groups assigned to Koke Katheim. In Case 1 the group going via Khorat arrived first. In Case 2 the timing of this group's advance was very little changed by the U.S. forces. To see why this should be so, it is necessary to turn back to Table 5. It will be seen that the first U.S. forces to reach the northern combat area entered zone 5N on D+17. However, by this time the Communist group had nearly reached Koke Kathiem. Although the rate of Communist advance was very little changed, it can be seen from Figure 10 that the strength of the group actually arriving in Koke Kathiem was cut down from 90% to less than 30%. The offensive group proceeding by Bangkok was delayed and finally destroyed without coming closer than about ten miles. However, in Case 3, when even a small U.S. force is available early, these

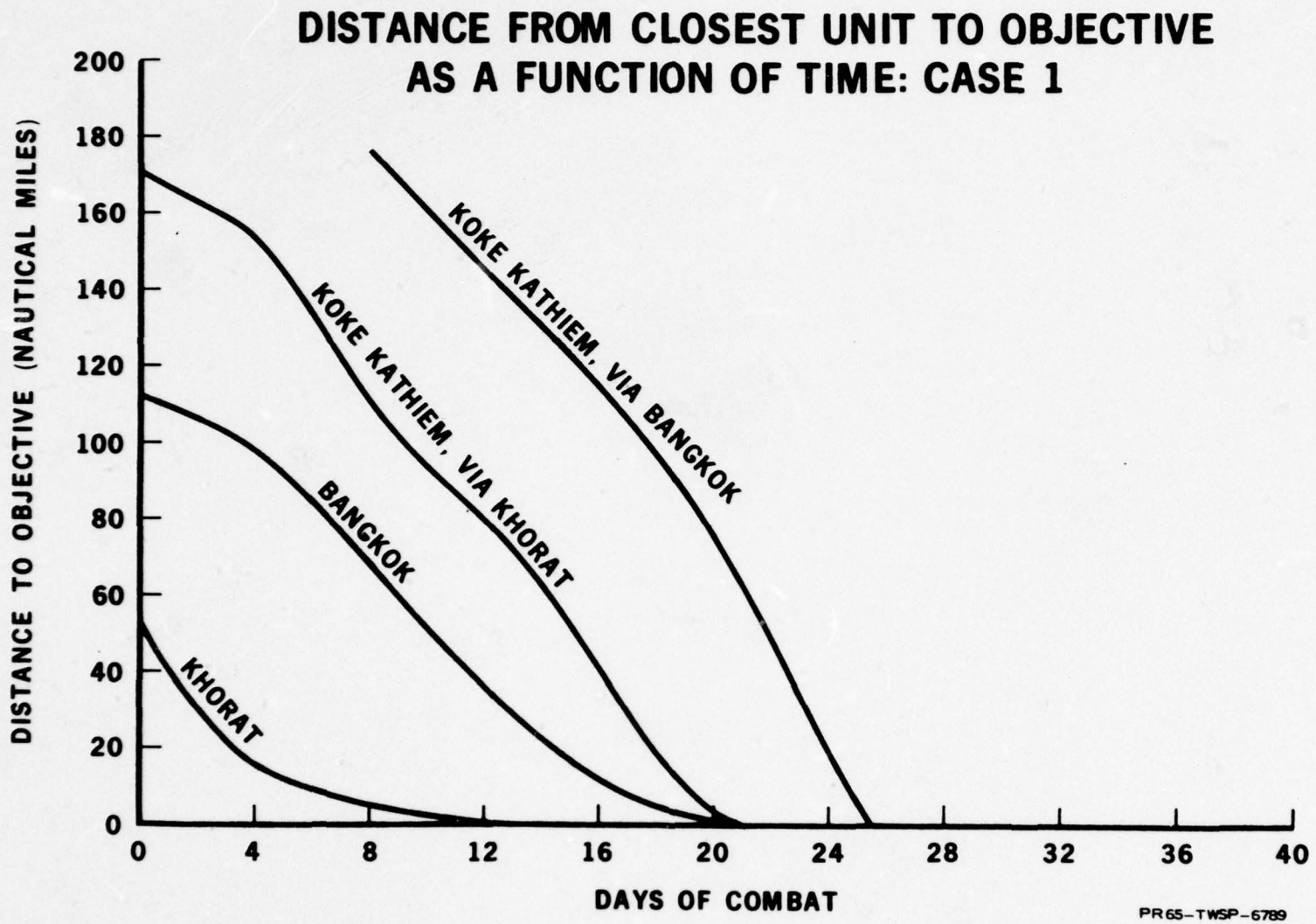

DISTANCE FROM CLOSEST UNIT TO OBJECTIVE
AS A FUNCTION OF TIME: CASE 1
DISTANCE TO OBJECTIVE (NAUTICAL MILES)
200
180
160
140
120
100
80
60
40
20
0
0
4
8
12
16
20
24
28
32
36
40
DAYS OF COMBAT
KOKE KATHIEM, VIA BANGKOK
KOKE KATHIEM, VIA KHORAT
BANGKOK
KHORAT
PR65-TWSP-6789

FIGURE 21.

DISTANCE FROM CLOSEST UNIT TO OBJECTIVE AS A FUNCTION OF TIME: CASE 2

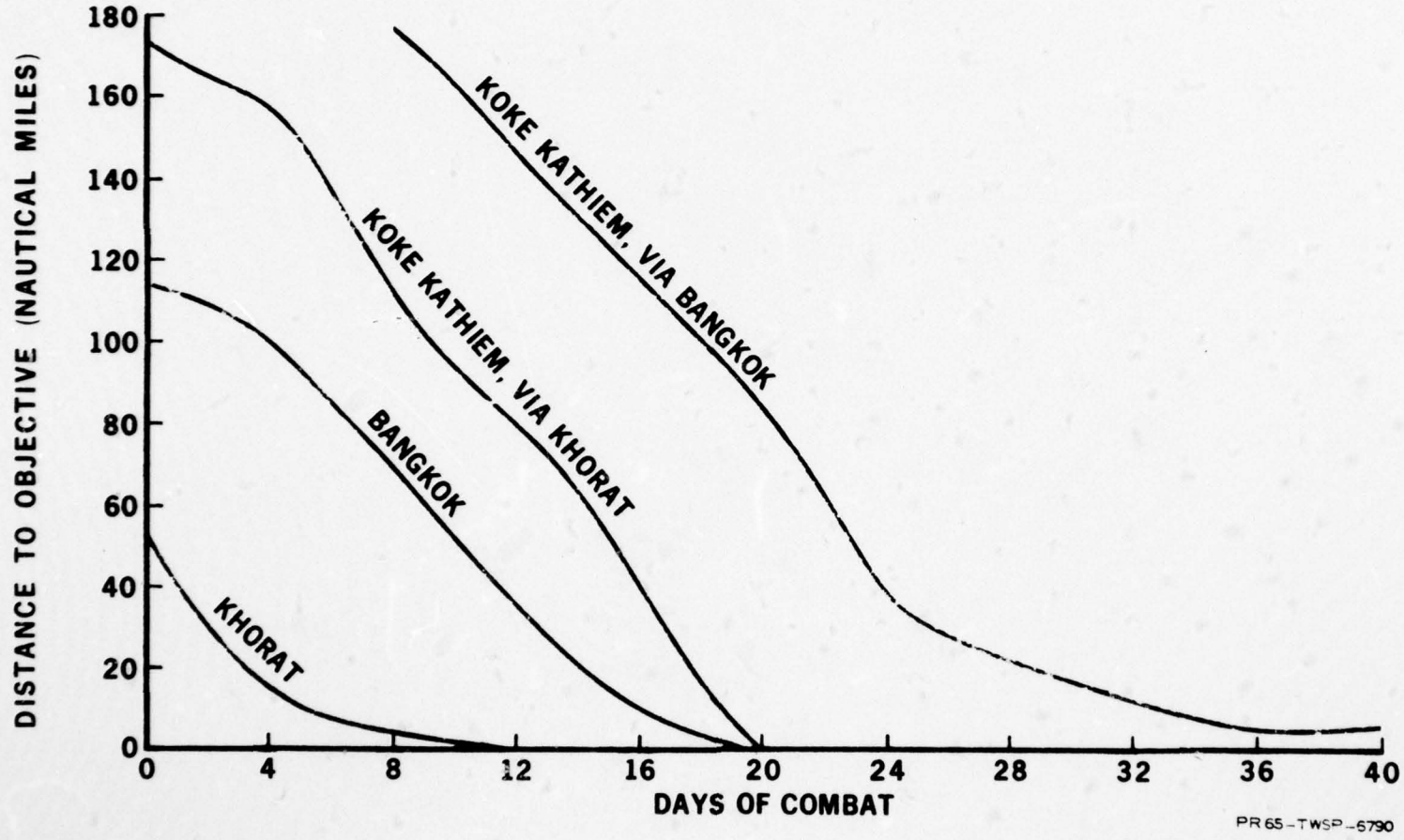


FIGURE 22.

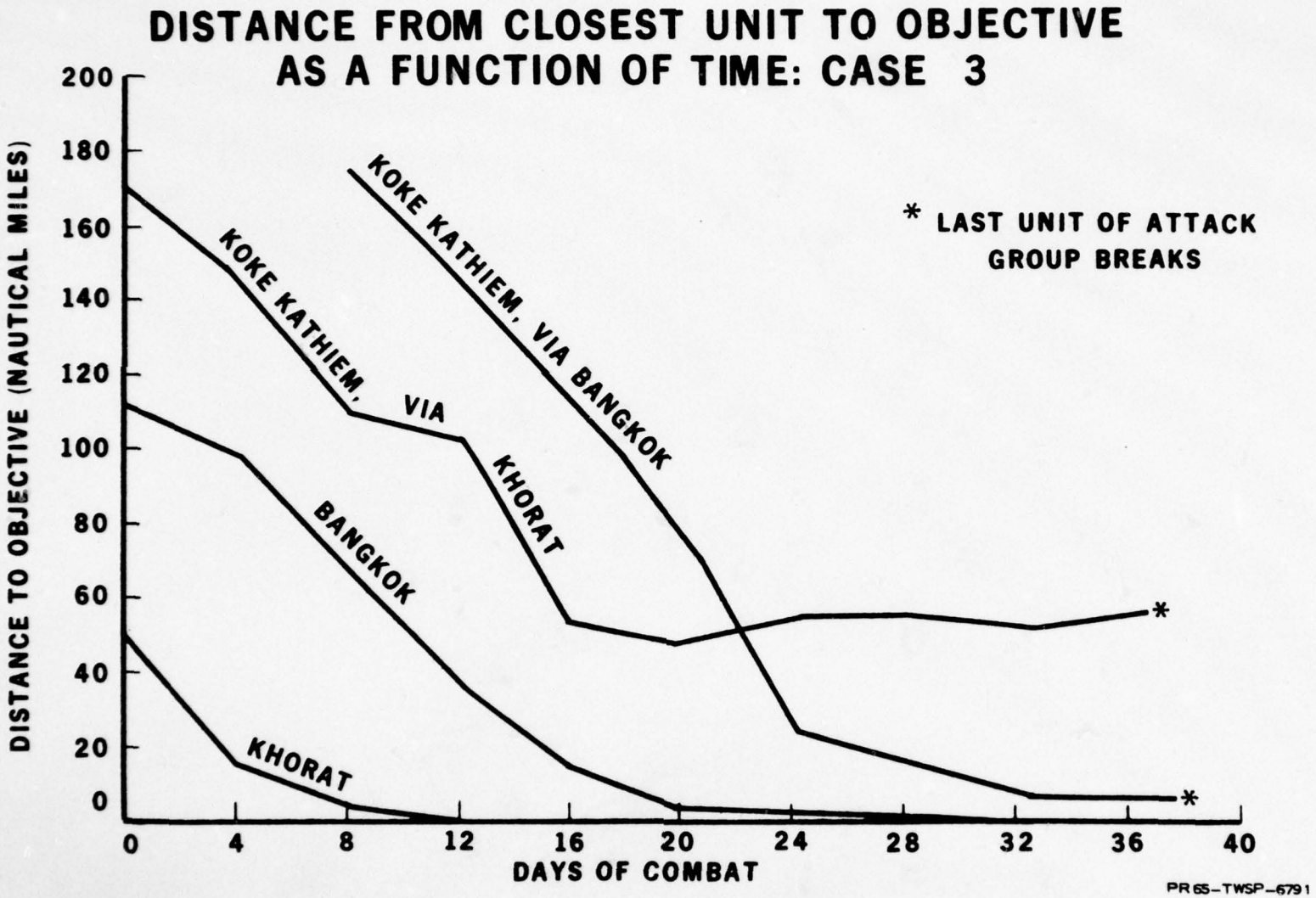

DISTANCE FROM CLOSEST UNIT TO OBJECTIVE
AS A FUNCTION OF TIME: CASE 3
DISTANCE TO OBJECTIVE (NAUTICAL MILES)
200
180
160
140
120
100
80
60
40
20
0
0
4
8
12
16
20
24
28
32
36
40
DAYS OF COMBAT
KOKE KATHIEM, VIA BANGKOK
KOKE KATHIEM, VIA KHORAT
BANGKOK
KHORAT
* LAST UNIT OF ATTACK GROUP BREAKS
*
*
PR65-TWSP-6791

FIGURE 23.

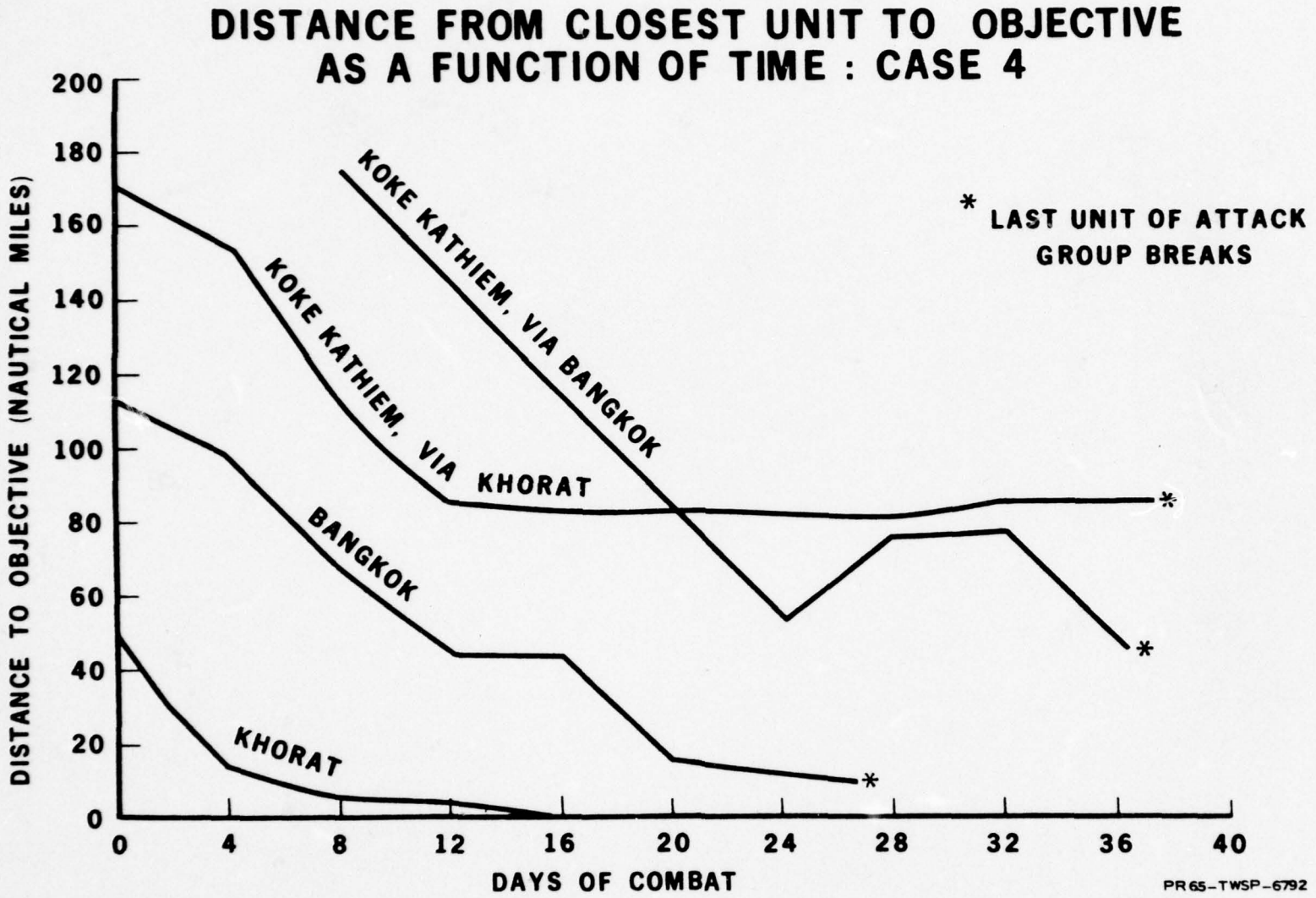

DISTANCE FROM CLOSEST UNIT TO OBJECTIVE
AS A FUNCTION OF TIME : CASE 4
DISTANCE TO OBJECTIVE (NAUTICAL MILES)
200
180
160
140
120
100
80
60
40
20
0
0
4
8
12
16
20
24
28
32
36
40
DAYS OF COMBAT
KOKE KATHIEM, VIA BANGKOK
KOKE KATHIEM, VIA KHORAT
BANGKOK
KHORAT
* LAST UNIT OF ATTACK GROUP BREAKS
PR65-TWSP-6792

FIGURE 24.

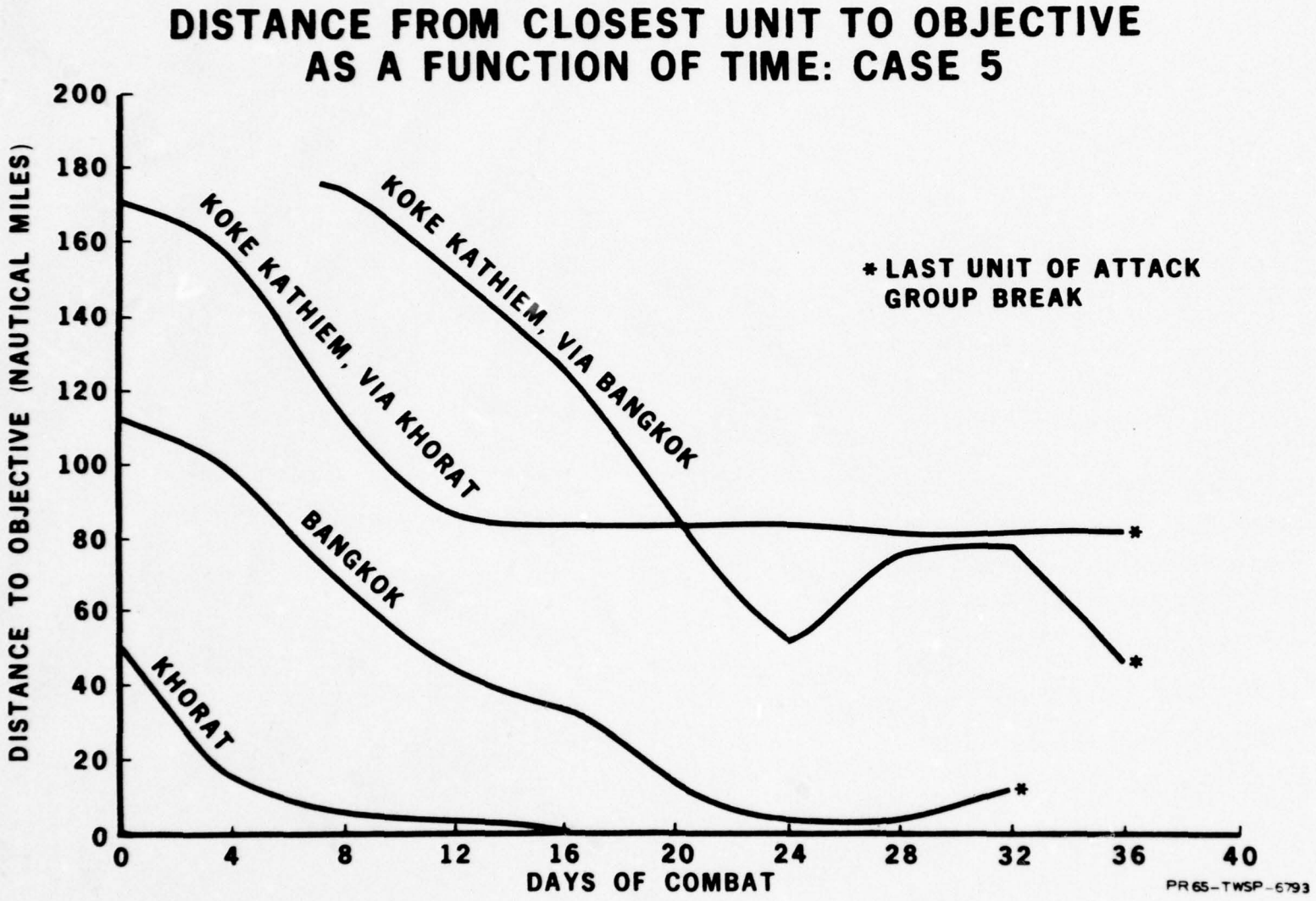

DISTANCE FROM CLOSEST UNIT TO OBJECTIVE
AS A FUNCTION OF TIME: CASE 5
DISTANCE TO OBJECTIVE (NAUTICAL MILES)
200
180
160
140
120
100
80
60
40
20
0
0
4
8
12
16
20
24
28
32
36
40
DAYS OF COMBAT
KOKE KATHIEM, VIA BANGKOK
KOKE KATHIEM, VIA KHORAT
BANGKOK
KHORAT
* LAST UNIT OF ATTACK GROUP BREAK
PR65-TWSP-6793

FIGURE 25.

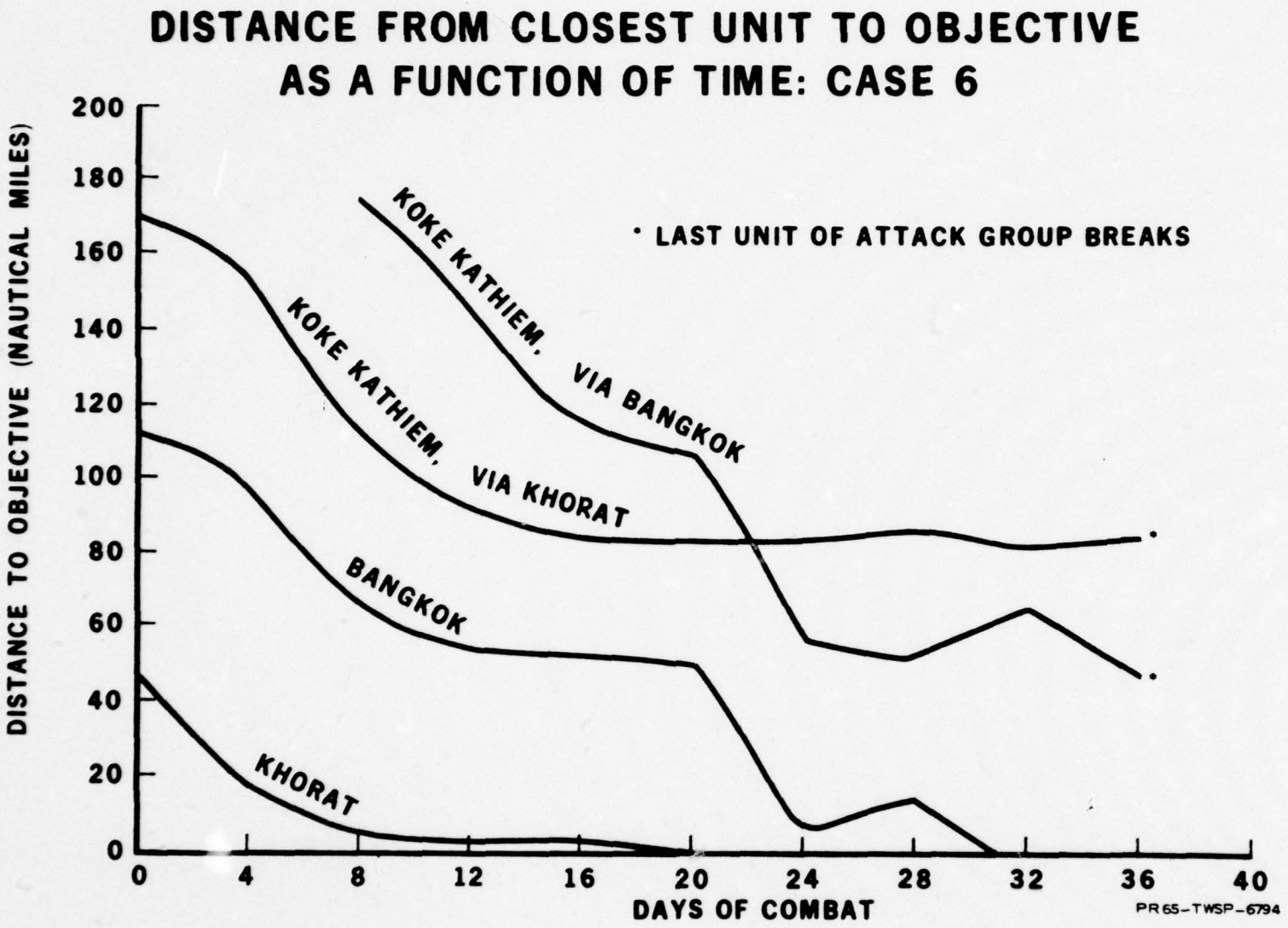

DISTANCE FROM CLOSEST UNIT TO OBJECTIVE
AS A FUNCTION OF TIME: CASE 6
DISTANCE TO OBJECTIVE (NAUTICAL MILES)
200
180
160
140
120
100
80
60
40
20
0
0
4
8
12
16
20
24
28
32
36
40
DAYS OF COMBAT
• LAST UNIT OF ATTACK GROUP BREAKS
KOKE KATHIEM, VIA BANGKOK
KOKE KATHIEM, VIA KHORAT
BANGKOK
KHORAT
PR65-TWSP-6794

FIGURE 26.

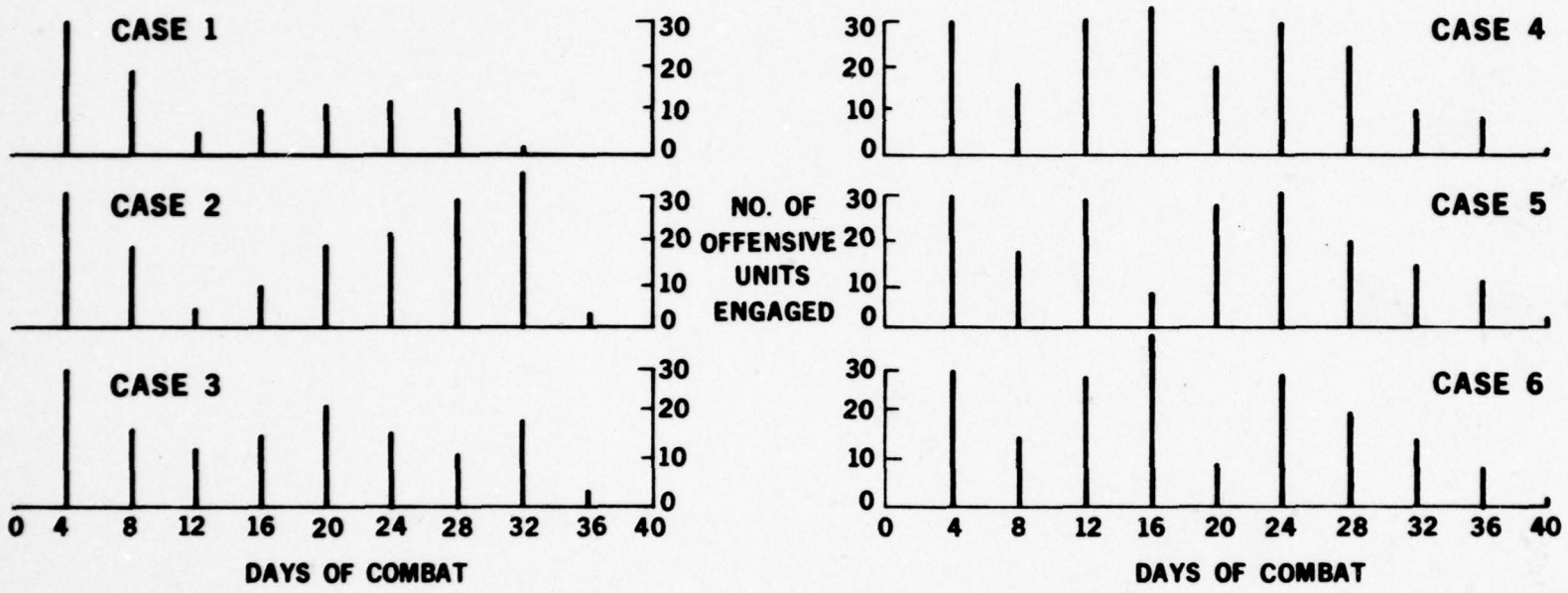
effects were reversed. It is the Bangkok-group which nearly reached Koke Kathiem, while the Khorat-group was stopped and finally destroyed about 60 n.mi. from the objective. Cases 4 and 5 are identical with respect to this northern attack. The pattern is the same as in Case 3, except the stabalization of the front line and final combat activity occurred around ninety miles from Koke Kathiem. In these latter cases, the group proceeding by Bangkok came closer to Koke Kathiem although it also failed to reach the objective.

The level of daily combat activity is indicated in Figure 27 where is shown the number of offensive units engaged in combat on a given day*. At first glance no obviously significant patterns emerge. Cases 1 and 2 are identical, of course, until the first U.S. arrival on D+16. Thereafter the combat activity gradually dies out in Case 1 as the Thai units are destroyed and builds up in Case 2 as the U.S. forces arrive. The results for Cases 3-6 suggest an average level of combat activity of about twenty Communist units engaged per day.

Two general comments regarding the results shown in Sections 7 and 8 are necessary. In Figures 4 and 8 which show the build-up of forces, the time scale is labeled "Days After Start of War". In Figures 13-26, which show some results of the simulation, the time scale is labeled "Days of Combat". The labels were selected to be most descriptive for the particular curves involved, but it should be made clear that the time scales are the same; i.e., the fourth "day of combat" is the fourth day "after the start of the war".

*This is not the number of individual engagements in progress since several units may be taking part in one engagement. Neither can these numbers be added to give the total number of offensive units engaged, since some of the units engaged on, say, D+12 are still engaged on D+16. In addition, some engagements occur between D+12 and D+16 and are not counted.

NUMBER OF OFFENSIVE UNITS ENGAGED ON A GIVEN DAY



PR 65-TWSP-6796

FIGURE 27.

Finally, the force strengths and distances were sampled every four days. In Figures 13 and 15-26 these four-day samples are plotted and connected by straight lines. Therefore, the values shown for days 0, D+4, D+8, D+12, etc., are accurate, but information on variations within the four-day sampling period is not available*.

From the mass of tables and figures which have been presented, there gradually emerges a picture of these wars. The remainder of this section will be devoted to a case-by-case summary of the wars.

*The limitation of four-day samples is not, of course, inherent in either the model or the simulation program. Summaries of the military situation can be computed as often as desired. A four-day sampling interval appears to be a reasonable compromise between level of detail and pounds of computer output!

Case 1.

In Case 1 the offensive forces moved rapidly toward their objectives, reaching all three within the first twenty-six days. Khorat, being the closest, was the first to be reached. By D+4 the offensive units had begun to mass outside the area for the final attack which occurred on the 12th day. Although the offensive forces had taken over a week to reach the outskirts of Khorat and prepare for the final attack, the first unit entered Khorat less than five hours after the attack began.

The attack on Bangkok followed the same general pattern although the times were somewhat longer. The forces began to mass outside the city by the 14th day. The attack started on the 26th day, with the first offensive unit entering the city some two hours later.

The Thai units were able to offer no really effective resistance to the offensive advance. By the 16th day, they had retreated to their last defense positions in the north. They held somewhat better in the south, their last retreat occurring on the 24th day.

Of the offensive forces assigned to Khorat, 74.8% were at the objective on D+40. Of the group assigned to Bangkok, 73.2% reached the city; and of the Koke Kathiem-assigned group, 94.0% reached their objective. It will be recalled that the two groups assigned to Koke Kathiem started out on D+3 and D+6. That so large a portion of these forces survived is due to the fact that, for most of their paths, the Thai defenses had already been cleared out by the groups attacking Khorat and Bangkok.

The most striking demonstration of the military disaster in this case is shown by the force ratio curve of Figure 13. The force ratio

remains always in the region of offensive superiority. By D+7 it is off-scale at nearly 3.5 and by D+40, it has reached 21.2.

It is doubtful that in this case the war would actually last forty days. It is much more probable that, without any outside help, the Thais would agree to a "cease-fire" sometime between the fall of Khorat on the 12th day and the entry of offensive units into Bangkok on the 26th day. A negotiated peace could leave a Communist-dominated puppet government in Bangkok. However, such speculations lie outside the stated purpose of this report.

Case 2.

The course of the war in Case 2 is identical with that of Case 1 for the first sixteen days. During this period the battle for Khorat was fought, with the offensive forces entering Khorat and the northern defenses pulling back to their positions in zone 5N just in front of Koke Katheim. It can be seen from Table 6 that the U.S. forces assigned to the northern region entered Zone 5N initially. They, therefore, had no close combat engagements with the forces assigned to Khorat. The slight decrease (less than one battalion) over Case 1 in offensive forces at Khorat was due entirely to air attacks.

Although their arrival on D+16 was too late to affect the battle for Khorat, the presence of U.S. forces did materially alter the battle for Bangkok. From Table 5 it is seen that the first U.S. forces arriving in Thailand entered Zone 3S, which is the zone around Bangkok (See Figure 7). Therefore, the U.S. forces did engage in combat with the attacking offensive forces and, although the offensive forces were able

to enter the city, their entry was delayed by a week and only 43.6% of the assigned forces survived.

The greatest effect of the U.S. forces, however, is shown in the situation at Koke Katheim. The first offensive arrival time was the same as in Case 1, but only 23.2% of the assigned force survived to D+40.

Case 3.

Going back to Figure 8, it can be seen that the U.S. build-up is characterized by a small first force commitment (three battalions) at D+1, a slow build-up to one division by D+14, rapid build-up of the second division over the next week, followed by a slower deployment of the last division.

Looking at the results, it is apparent that very little about the battle for Khorat was changed from Cases 1 and 2. The defense forces retreated beyond Khorat at the same times (Figure 14); and the offensive units advanced to Khorat at about the same rate (Compare Figure 21 with Figures 19 and 20). Why the early entry of U.S. forces should make so little difference can be explained by referring again to Table 5. Although some U.S. forces were in Thailand as early as D+1, they were in the southern area. It was not until D+10 that U.S. forces reached the northern combat region. By that time the defense positions in zones 1N and 2N had been overrun and the defenses had pulled back beyond Khorat to zone 3N. It is apparent that to take part effectively in the battle for Khorat, U.S. forces must arrive in zones 1N or 2N no later than D+5.

However, the effect of U.S. forces was very evident in the battles for Bangkok and Koke Kathiem. Looking at Figure 10 it is seen that less than one offensive battalion actually reached Bangkok and none survived

to enter Koke Kathiem. Also, the attack on Bangkok was delayed by 5 days.

An interesting change in the battle for Koke Kathiem has already been noted in the discussion of Figures 21-26. Going back to Figure 21 it can be seen that the attack group proceeding via Khorat arrived on D+21 while the forces going by way of Bangkok did not arrive until about five days later. This is expected, of course, because the Khorat group starts earlier and has a shorter distance to go.

In Case 2, the Khorat group arrived at Koke Kathiem at the same time as in Case 1, while the group going by Bangkok was no closer than eight and miles by D+40. But, in Case 3, the Khorat group was held by the defense and never reached a point closer than fifty miles from the objective. The Bangkok group, however, moved more rapidly and actually reached a point less than ten miles from Koke Kathiem before the last unit breaks.

This suggests the following general conclusion: When the U.S. units could get into combat early, the greater threat to Koke Kathiem came from the southern attack. When they were delayed, the northern group arrived first. However, for early arrival of sufficient U.S. units neither group actually succeeded in reaching their objective.

Cases 4 and 5.

These cases were mainly slowed-down versions of Case 3. The U.S. forces arrived in Thailand earlier and more offensive forces were killed. The U.S. units did not, however, arrive early enough to change greatly the battle around Khorat, but the other offensive units were destroyed earlier.

Case 6.

It was only here that the U.S. forces arrived sufficiently early to take part in the battle for Khorat. Of the eighteen offensive battalions assigned to attack Khorat, the Thais destroyed about five. In Cases 2-5, an additional one-two battalions are destroyed by U.S. air power. In Case 6 the U.S. ground forces accounted for about five more offensive battalions, so that less than 40% of the assigned offensive force reached the objective.

As expected, no offensive forces reached Bangkok or Koke Kathiem. As stated earlier, the question of who won the war is really outside the scope of this work. However, in Case 6 some general comments seem appropriate. If one looks again at Figure 16 it can be seen that the offensive forces entered a period of high combat losses at about D+20. A check of Figure 24 shows that during this same period they advanced very little. The U.S.-Thai forces, on the other hand, experienced much lower combat losses. This is shown most strikingly in Figure 18, which shows that as early as D+13 the force ratio passed into the region of U.S.-Thai superiority. By D+30 this ratio had passed 2/1 and was rising rapidly. Without making questionable judgements on their political intentions, it nevertheless seems probable that in this case the offensive forces would withdraw from Thailand at this time. Their only alternative would be to increase their force commitment since it is not likely that the few remaining forces could withstand a U.S.-Thai counterattack.

8. History of a Chinese Infantry Battalion

The simulation program follows the activities of each military unit, recording the results of every event in which it is involved. From this list of events the role played by each unit can be examined. As an example, one Chinese unit has been selected. It is the purpose of this section to look in detail at how this unit fared in each case.

The unit chosen was the 8th Chinese infantry battalion (designated* CHI08S). It was assigned to the Bangkok attack group and scheduled to move into Thailand on D day along the path shown in Figure 28. The unit was routed for a short distance through the mountains to outflank the Thai defense on the south. After coming down out of the mountains, the unit was to continue west for about twenty-five miles before turning north to take advantage of the concealment offered by the forest. Its path ran north through the forest for about forty miles before again turning west. With a short detour for a river crossing, the unit planned to proceed to a hold point about four miles from Bangkok. With the arrival of the last member of its attack group, the final attack on Bangkok was scheduled to start.

Figure 29 illustrates the close combat engagements of CHI08S. It can be seen that in all cases there was an engagement with a Thai unit during the second through the sixth days. In Case 1 CHI08S entered Bangkok without further engagements. In Case 2 it encountered two U.S. units during the fight for Bangkok, but it was still successful in reaching the city. In Case 3 it broke during the assault on Bangkok; in Cases 4-6 it broke before the assault began. A good picture of how the war went for this unit

*CHinese Infantry unit number 08 assigned to the Southern section.

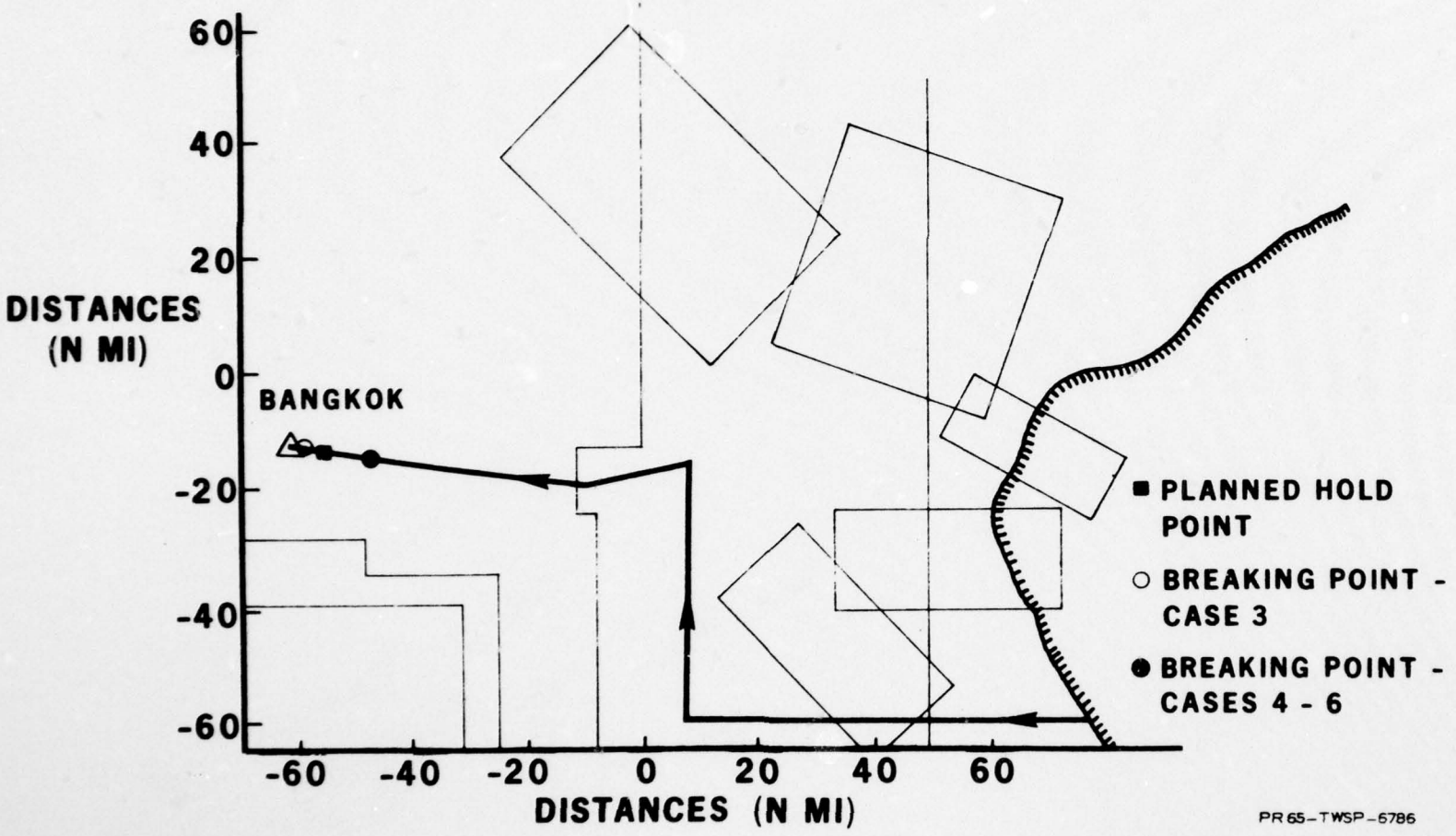

ATTACK ROUTE OF CHIO8S
60
40
20
0
-20
-40
-60
DISTANCES (N MI)
BANGKOK
-60 -40 -20 0 20 40 60
DISTANCES (N MI)
PLANNED HOLD POINT
BREAKING POINT - CASE 3
BREAKING POINT - CASES 4 - 6
PR 65-TWSP-6786

FIGURE 28.

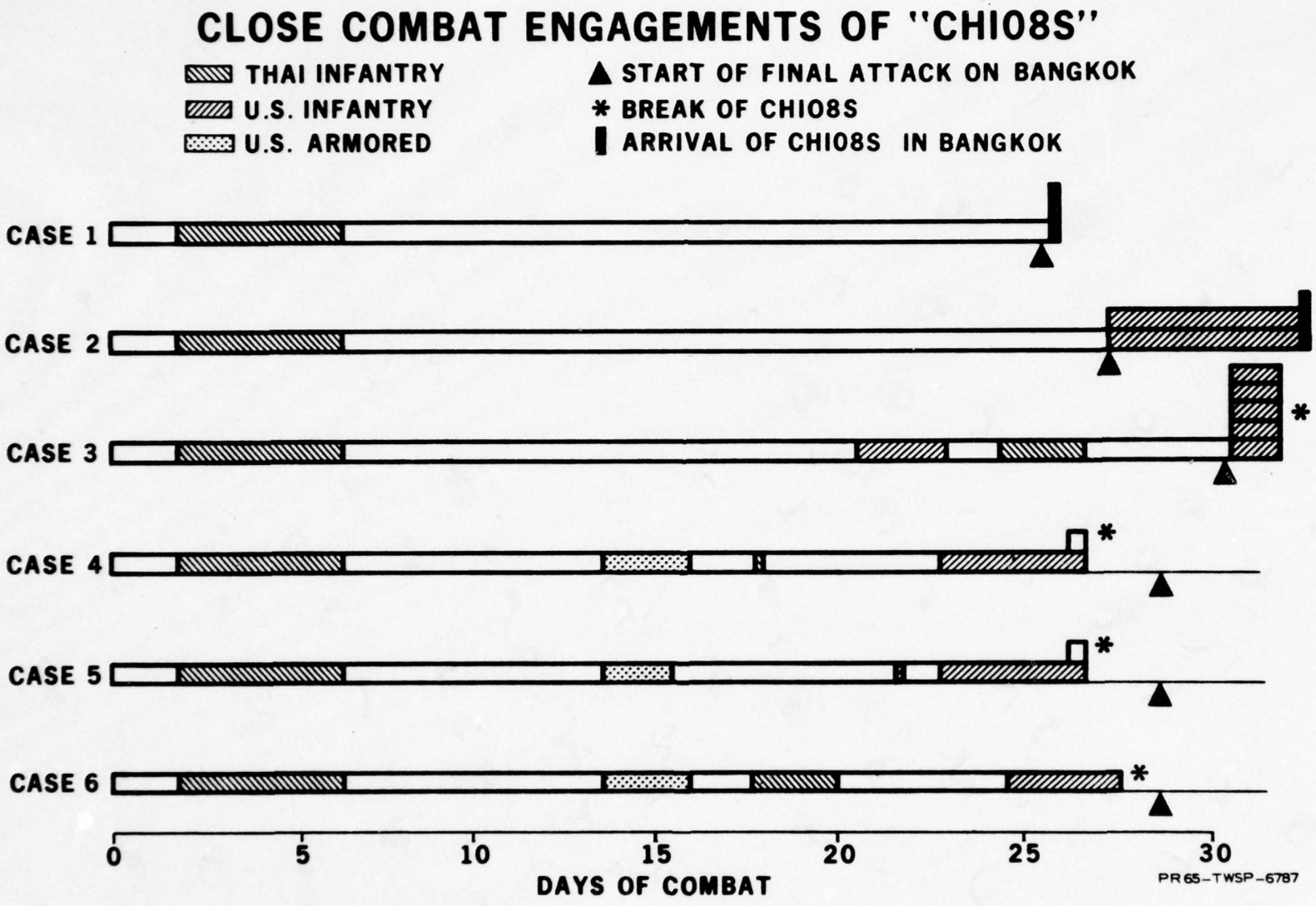
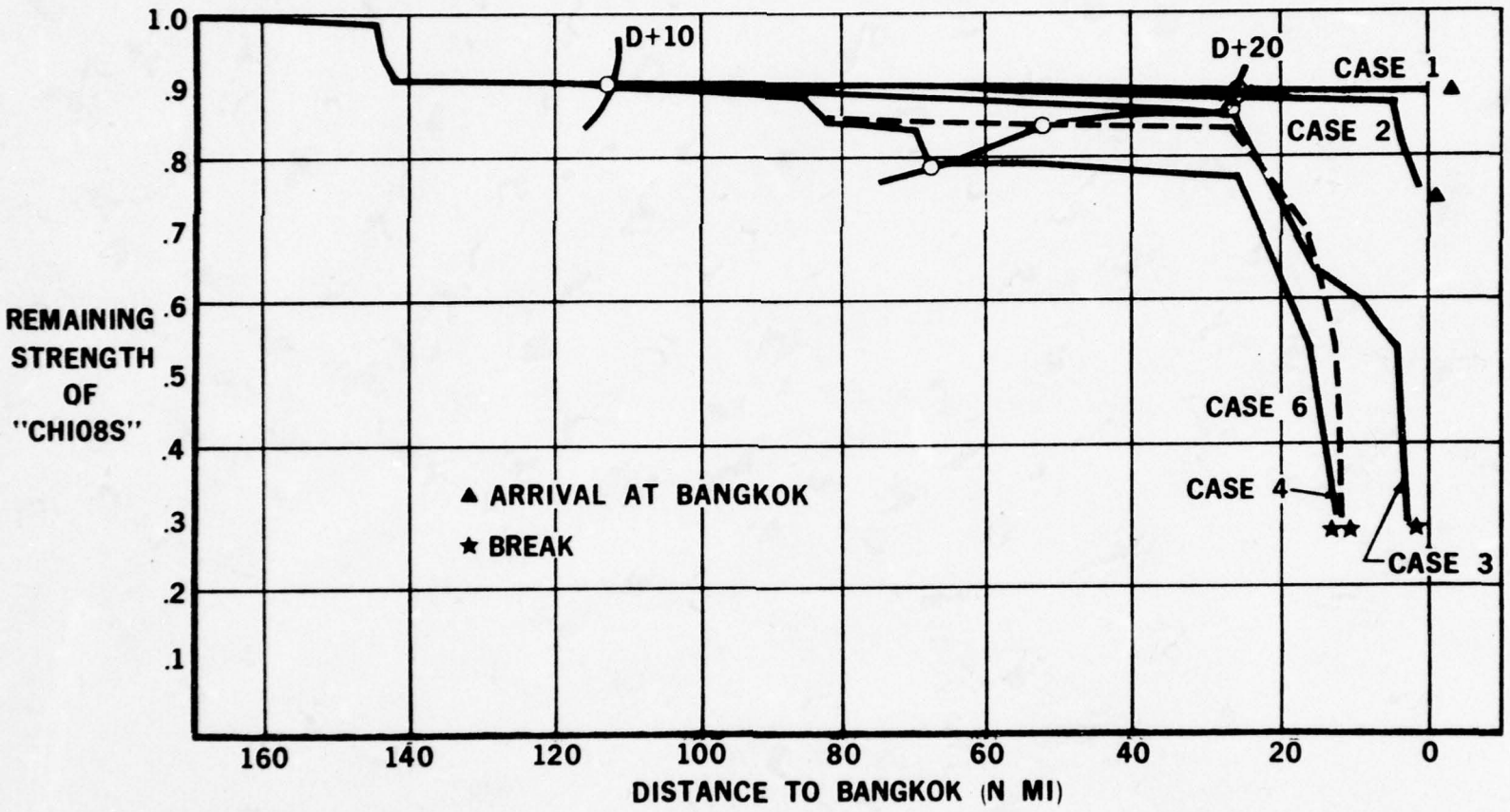

CLOSE COMBAT ENGAGEMENTS OF "CHIOBS"
THAI INFANTRY
U.S. INFANTRY
U.S. ARMORED
START OF FINAL ATTACK ON BANGKOK
* BREAK OF CHIOBS
ARRIVAL OF CHIOBS IN BANGKOK
CASE 1
CASE 2
CASE 3
CASE 4
CASE 5
CASE 6
0
5
10
15
20
25
30
DAYS OF COMBAT
PR65-TWSP-6787

FIGURE 29.

STRENGTH OF CHI08S AS A FUNCTION OF DISTANCE TO BANGKOK



PR65-TWSP-7104

FIGURE 30.

is shown in Figure 30 where its remaining strength is plotted against distance from Bangkok. The following sections describe in more detail what happened in each case.

Case 1.

This is the case of Thai defenses only. On D day, CHI08S moved out as planned. They reached the hill country in about twenty-five hours. A little later, during the morning of this second day, they ran into artillery fire which lasted about seven hours. An hour later they encountered a Thai infantry battalion which was supported by artillery fire. This engagement lasted a little over four days and ended with the breaking of the Thai unit. During these four days, the Chinese advanced only three miles. By the seventh day CHI08S had left the hill region and was traveling west through the forest. It was down by this time to about 90% of its starting strength. On the thirteenth day the unit turned north and advanced without meeting further opposition. On D+21, it arrived at its hold point where it dug in and waited. With the arrival of the last unit of its group on D+25, the attack on Bangkok began. Seven hours later CHI08S was in Bangkok, having lost less than 11% of its strength.

Case 2.

There is no change from Case 1 until D+16 when U.S. air attacks start. At this time there began an attrition of .1 to .4% per day which continued from then on. Although CHI08S reached its hold point at D+21 as in Case 1, other members of this group were held up and the attack was delayed for six days until D+27. An hour after the attack started, CHI08S became engaged with two U.S. units at a point less than three

miles from Bangkok. Although the U.S. units were greatly outnumbered, they held out for over five days before breaking. After a short four-hour encounter with a Thai defense at Bangkok, CHI08S entered the city on D+33 with 75% of its original strength. The U.S. forces had delayed the unit for eight days and had destroyed an additional 15%.

Case 3.

In this case, the U.S.-Thai forces gained air superiority by D+10. However, the total strength lost to air attacks throughout the entire conflict period was only about 1%.

The early stages of the war for CHI08S proceeded as in previous cases. However, the 6th infantry battalion of the U.S. first division arrived in Thailand in time to intercept the Chinese unit about twenty-five miles from Bangkok on the twenty-first day. Although the U.S. unit was forced to pull back after thirty-three hours, only 65% of the Chinese unit survived. An encounter with a Thai unit stationed at Bangkok delayed CHI08S for more than four additional days, and it was not until nearly D+27 that the hold point was reached. The rest of the Bangkok attack group was delayed even more, the final attack not beginning until D+30. CHII08S started the attack, but ran into a solid defense of five U.S. battalions and lasted a bare five hours before breaking.

Case 4.

This is identical with Case 3 through D+13. However, on the fourteenth day, CHI08S met a U.S. armored battalion. The U.S. unit broke on the sixteenth day, but CHI08 had lost two days and an additional 3% of its strength, being down now to 85%. The next day, D+17, it had a brief (just

over a hour) encounter with a Thai infantry unit before the Thai unit retreated. Because of the two day delay caused by the U.S. armored unit, the U.S. sixth infantry battalion was not encountered until D+22. Unlike Case 3, the U.S. unit does not retreat, but remains engaged. On the twenty-seventh day, CHI08S encountered a second infantry unit, this time a Thai unit defending Bangkok. Five hours later CHI08S breaks without having reached its hold point.

Case 5.

This case is almost identical with Case 4. However, a minor encounter on D+21 with a U.S. infantry unit reduces the strength of CHI08S sufficiently to cause its final break three hours earlier.

Case 6.

This case follows Case 5 in general outline; the details are, however, somewhat different. In both cases, CHI08S engaged a U.S. armored unit on D+13. In Case 5, a general retreat occurred on D+15 and the U.S. unit pulled back. In Case 6, the retreat did not occur until nearly D+20 and the U.S. unit remained engaged until it broke. Because of the delay in the general retreat, CHI08S became engaged with a Thai infantry unit which had retreated by this time in earlier cases. This engagement slowed the advance of CHI08S, so that, although it survived a day longer than in Case 5, it was stopped further from its objective.

APPENDIX A. The Simulation of Combat

1. Purpose of Appendix A

A war is a set of very complex events brought about by a complicated set of interacting forces. A simulation of war which has any degree of realism is also composed of very many complex interacting elements. It is difficult, therefore, to convey simply an adequate picture of it. This appendix has two purposes:

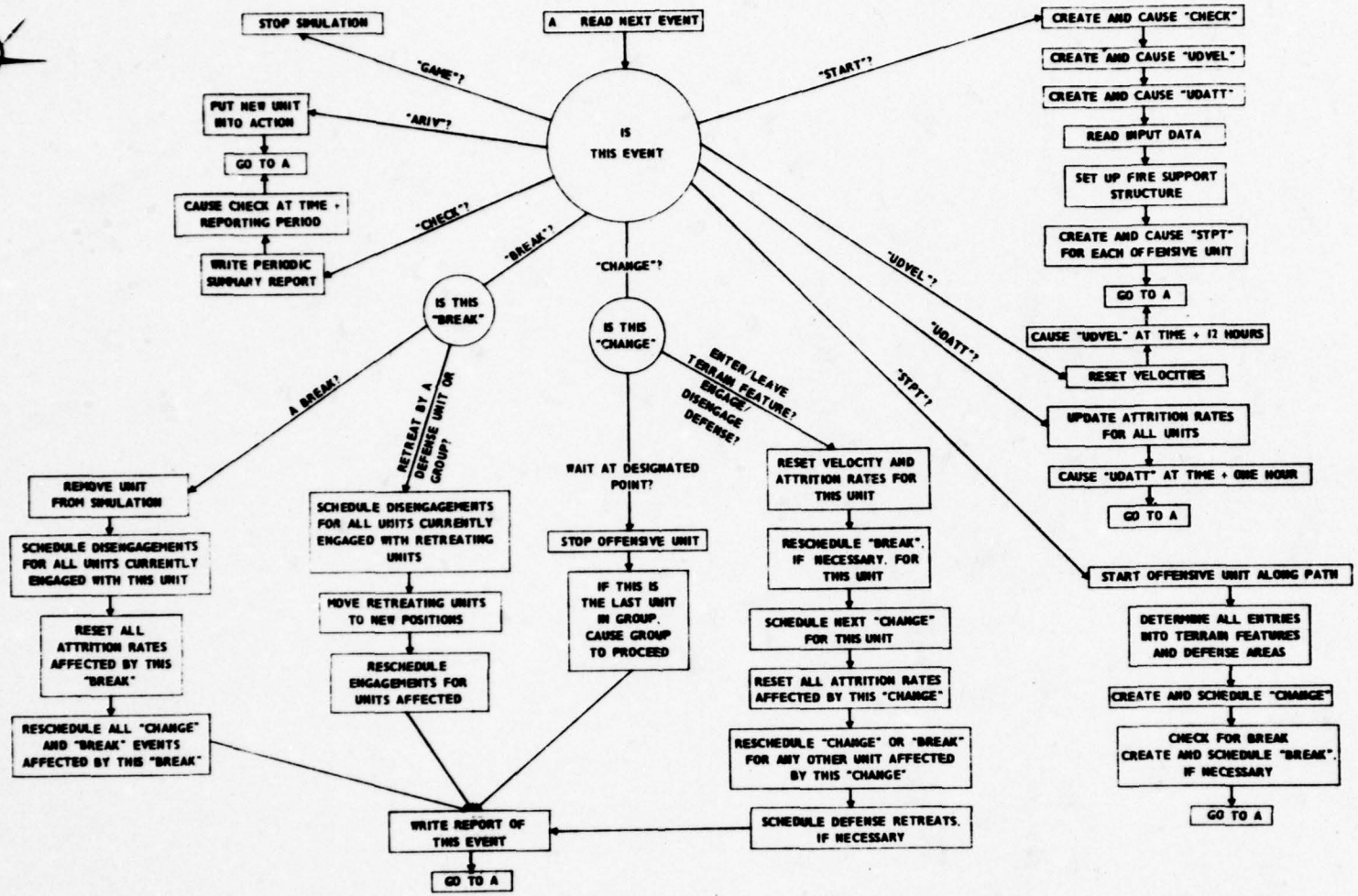
(1) to provide insight into the elements of the simulation and their interactions, and

(2) to aid in checking the credibility of some of the inputs.

The reader who understands the simulation and who accepts the input data may, therefore, find nothing of interest in this section.

2. The Treatment of Attrition

The total simulation program has been described elsewhere (1). For reference, a brief flow diagram is given in Figure A-1, but details of the computer program will not be discussed again. This section will cover only what happens during combat. It will be remembered that an offensive unit is put into action at the time specified in the attack plan. It moves along its planned path with a velocity determined by the terrain through which it travels. When it encounters a defense unit, its velocity is reduced according to the defense type and the unit begins to suffer, and to cause, attrition. The combat continues until the strength of one of the units drops below a pre-specified level and the unit is removed from combat, or until the two units are no longer in physical contact. Although its velocity is greatly reduced during periods of combat, the offensive unit does continue to advance and may in time



TACTICAL WARFARE SIMULATION PROGRAM

PR65–TWSP–7103

FIGURE A1.

pass completely through the defense. Or, contact can be lost by a defense unit retreat.

The rate of attrition suffered by unit A when engaged with unit B depends on a number of factors:

(1) the types of units A and B

(2) the strength of B

(3) the total number of units engaged with B

(4) the fire support assigned to B

(5) the type of terrain in which the combat takes place

"Attrition" refers to the continuous decrease in the strength of engaged units, because of and during the time of, the engagement. Two types of engagements are possible: (1) close combat engagements, in which the units are in physical contact, and (2) artillery engagements, in which a unit is under fire from a unit located some distance away. The present version of the program treats the effect of air support basically as artillery fire (although, of course, with different rates of attrition). Both units suffer, and cause, attrition in the first case; only the unit under fire suffers attrition in the second. It is, of course, possible for a given unit to be engaged in both types at the same time, i.e., suffering artillery fire while in close combat.

Attrition is calculated from Lanchester-like equations. It will be recalled that the most familiar forms of the Lanchester equations are:

$$\frac{dR(t)}{dt} = -K_B\, B(t) \qquad (1)$$

$$\frac{dB(t)}{dt} = -K_R\, R(t) \qquad (2)$$

The constants K_B and K_R will be referred to as the basic attrition rate constants and represent the rate at which a unit which can be destroyed

by a full strength opponent. The attrition constants used in this study are given in Tables A-1 and A-2.

For the purpose of this simulation, equations (1) and (2) are approximated by:

$$\Delta R^j = K_B \cdot B^j \cdot \Delta t_j \qquad (3)$$

$$\Delta B^j = K_R \cdot R^j \cdot \Delta t_j \qquad (4)$$

where

Δt_j is the length of the jth period. It is one hour, or the time between changes in the engagement status of either unit, whichever period is shorter.

ΔR^j=strength lost by the R unit during the jth period.

ΔB^j=strength lost by the B unit during the jth period.

B^j =strength of the B unit at the beginning of the jth period.

R^j =strength of the R unit at the beginning of the jth period.

The constants K_B and K_R have the same meaning as above. The products $(K_B \cdot B_j)$ and $(K_R \cdot R_j)$ are generally referred to as the "attrition rate".

Equations (3) and (4) hold for the situation in which one red unit is engaged with one blue unit. The actual engagements are generally very much more complex. A hypothetical situation might be represented by:

R_1 engaged with B_1, B_2, B_3

R_2 engaged with B_1

R_6 engaged with B_2

B_1 engaged with R_1, R_2

B_2 engaged with R_1, R_6

B_3 engaged with R_1

TABLE A-1. Basic Attrition Rates Suffered By Offensive Units (Expressed In Fractions of a Full Unit Lost Per Day of Combat).

a) During Close Combat*

DEFENSIVE UNITS \ OFFENSIVE UNITS	IN BASIC TERRAIN (OPEN COUNTRY)		IN MOUNTAINS		IN FORESTS	
	INFANTRY	ARTILLERY	INFANTRY	ARTILLERY	INFANTRY	ARTILLERY
Infantry	.160	.120	.128	.096	.080	.060
Armored	.200	.240	.160	.192	.100	.120
Artillery	.160	.200	.128	.160	.080	.100

b) Used As Support*

DEFENSIVE UNITS \ OFFENSIVE UNITS	INFANTRY	ARTILLERY	INFANTRY	ARTILLERY	INFANTRY	ARTILLERY
Armored	.020	.080	.016	.064	.010	.040
Artillery	.120	.400	.096	.320	.060	.200

*The attrition suffered by offensive units is lower in mountains and forests because of the effect of concealment.

TABLE A-2. Basic Attrition Rates Suffered By Defensive Units (Expressed In Fractions of a Full Unit Lost Per Day of Combat).

a) During Close Combat*

OFFENSIVE UNITS / DEFENSIVE UNITS	INFANTRY	ARTILLERY
Infantry	.04	.06
Armored	.10	.12
Artillery	.06	.10

b) Used As Support*

OFFENSIVE UNITS / DEFENSIVE UNITS	ARTILLERY	
Infantry	.04	
Armored	.03	
Artillery	.02	

*Attrition rates suffered by defense units are not dependent on terrain; the effect of concealment is already considered.

The firepower of R_1 is divided equally over B_1, B_2, and B_3. R_1 receives the fire of B_1, B_2, and B_3. However, R_1 receives only 1/2 the firepower of B_1, since B_1 must spread its firepower over R_1 and R_2. The computer program can be considered as a very fast, efficient, accurate bookkeeping scheme to keep track of the complex interaction patterns.

The general forms of (3) and (4) appear more complicated:

$$\Delta R_1^j = \left(\sum_p K_{B_p} \frac{B_p^j}{n_p}\right) \cdot \Delta t_j \tag{5}$$

$$\Delta B_k^j = \left(\sum_q K_{R_q} \frac{R_q^j}{n_q}\right) \Delta t_j \tag{6}$$

where: ΔR_1^j is the strength lost by R_1 during the jth period

K_{B_p} = basic attrition rate of B_p against R_1

K_{R_q} = basic attrition rate of R_q against B_k

B_p^j is the strength of B_p at the beginning of the jth period.

n_p is the number of red opponents of B_p during the jth period.

ΔB_k^j is the strength lost by B_k during the jth period.

n_q is the number of blue opponents of R_q during the jth period.

R_q^j is the strength of R_q at the beginning of the jth period.

$\sum_p$ indicates a summation over all blue opponents of R_1 during the jth period.

$\sum_q$ indicates a summation over all red opponents of B_k during the jth period.

As an example, the set of equations representing the engagement pattern given above are:

$$\Delta R_1^j = \left(K_{B_1} \frac{B_1^j}{2} + K_{B_2} \frac{B_2^j}{2} + K_{B_3} \frac{B_3^j}{2}\right) \cdot \Delta t_j$$

$$\Delta R_2^j = K_{B_1} \frac{B_1^j}{2} \cdot \Delta t_j$$

$$\Delta R_6^j = K_{B_2} \frac{B_2^j}{2} \cdot \Delta t_j$$

$$\Delta B_1^j = \left(K_{R_1} \frac{R_1^j}{3} + K_{R_2} R_2^j\right) \Delta t_j$$

$$\Delta B_2^j = \left(K_{R_1} \frac{R_1^j}{3} + K_{R_6} R_6^j\right) \Delta t_j$$

$$\Delta B_3^j = K_{R_1} \frac{R_1^j}{3} \cdot \Delta t_j$$

The principles expressed by these equations are rather simple:

(1) A unit spreads its fire equally over all its close combat opponents.

(2) A supporting unit spreads its fire equally over the close combat opponents of those units to which it is assigned.

(3) The total attrition suffered by a unit is the sum of the attrition caused by each of its opponents, both close combat and artillery support.

3. Two-Unit Duels

For the purpose of checking the credibility of such input numbers as unit sizes, movement rates, breaking points, and attrition rates, the results of idealized engagements between two full strength units, without fire support, have been estimated* from equations (3) and (4).

The movement rates of the offensive units are given in Table 2 of the text; the attrition rates, in Tables A-1 and A-2, and the sizes and breaking points, in Table A-3. In this context "size" means the area controlled by the unit rather than the minimum area physically occupied by it. The "breaking point" is that strength below which the unit is no longer an effective combat force.

Results from a total of eighteen different engagement types are given in Table A-4. It will be seen that most of these engagements end with a disengagement (i.e., loss of physical contact); a few, with the breaking of an offensive unit; and two only, with the breaking of both units. In no case was there a clear offensive win. This indicates that the offensive forces should not count on winning combat engagements without superior forces**. It can be seen that the engagements are, in general, terminated earlier in open country than in areas offering concealment to the offensive forces. In open country the average engagement time is about three days; in forests, about six days.

*As pointed out above, the Δt_j in eqns (3) and (4) is never longer than an hour in the simulation. For these hand calculations, Δt is taken to be the total engagement period. This has the effect of making the offensive units appear somewhat more effective than they are.

**These calculations are not concerned with such questions as the possibility that effective tactics could allow the offense to achieve their objectives without engaging in combat.

TABLE A-3. Sizes and Breaking Points of the Military Units

Military Unit	Shape	Size		Breaking Strengths
Offensive Infantry	Circular	Radius	0.25 n.mi.	.3
Offensive Artillery	Circular	Radius	0.20 n.mi.	.3
Defensive Infantry	Square	Length of Side	12.0 n.mi.	.3
Defensive Armored	Square	Length of Side	24.0 n.mi	.2
Defensive Artillery	Square	Length of Side	2.0 n.mi.	.5

TABLE A-4. Approximate Results Of Single Unit - Single Unit Close Engagements.

	Offense Type	Defense Type	(Days) Length of Engmnt	(Fraction of A Battalion) Remaining Offensive Strength	Remaining Defensive Strength	Engagement Ended By
In Basic Terrain(Open)	Infantry	Infantry	4.34	.308	.864	Disengagement
		Armored	3.50	None	.650	Offensive Unit Break
		Artillery	1.0	.840	.940	Disengagement
	Artillery	Infantry	4.27	.487	.744	Disengagement
		Armored	2.92	None	.650	Offensive Unit Break
		Artillery	.93	.813	.917	Disengagement
In Mountains	Infantry	Infantry	5.37	None	.785	Offensive Unit Break
		Armored	4.39	None	.561	Offensive Unit Break
		Artillery	1.5	.808	.910	Disengagement
	Artillery	Infantry	6.40	.385	.616	Disengagement
		Armored	3.65	None	.563	Offensive Unit Break
		Artillery	1.4	.776	.860	Disengagement
In Forests	Infantry	Infantry	8.14	.350	.674	Disengagement
		Armored	7.00	None	None	both Units Break
		Artilley	1.88	.849	.887	Disengagement
	Artillery	Infantry	8.00	.520	.520	Disengagement
		Armored	5.84	None	None	Both Units Break
		Artillery	1.75	.825	.825	Disengagement

Several general comments may be made about the effectiveness of the various units in these simplified model engagements. The offensive units never survive encounters with armored units. In forests, they are able to render the defensive units ineffective after five to seven days but, even so, are themselves destroyed. The offensive artillery units survive close combat better than the offensive infantry, but, of course, cause less destruction to the defense. Engagements taking place in forests are more favorable to the offensive forces because of the effect of concealment. Of course, then, engagements in the open are more favorable to the defensive forces*.

It must be emphasized that the information in Table A3 is itself neither directly an input to the simulation program nor an output from it. Rather, it is the result of a detailed look at the consequences of the input data which was used. It is not expected, nor is it desirable, that it contain any surprises. The credibility of the results of the simulation rests on the credibility of the input data, which is judged, in part, by how well the results of Table A3 fit military history and judgement. In judging the information in Table A3, several points should be kept in mind:

1. Table A3 gives no indication of the frequency which the various engagements will occur in the war. Some, such as artillery-artillery engagements in the mountains, probably never actually happen. The major part of the war will certainly be made up of infantry-infantry engagements.

*Programs, such as the defoliation carried out in Vietnam, which change "forests" to "open country" are, therefore, advantageous to the defensive forces.

2. Effects of artillery fire and air support are not included here. These could, of course, change radically the results of any of the engagements.

While it is doubtful that any engagements occuring during the simulation are actually of the simple type discussed here, these results suggest that the input data lies within the bounds of credibility.

APPENDIX B. Data for the Figures Shown in this Report

The majority of the results were presented in the form of diagrams and curves. It is the purpose of this section to show the numerical data from which those diagrams and curves were prepared. Table B-0 correlates the tables in this section with the figures in the main part of this report.

TABLE B-0. Correlation of Tables in Appendix B with Exhibits in the Text

Table	Exhibit in text	Presented on page:	Subject
B-1	Figure 8	24	build-up of defense forces
B-2	None	None	composition of U.S. combat forces
B-3	Figure 9	27	ratio of committed forces
B-4	Figure 10	32	offensive forces at objectives
B-5	Figure 11	33	combat losses
B-6	Figure 12	34	offensive strength vs distance
B-7	Figure 13	36	force ratio vs time
B-8	Figure 14	40	retreat times
B-9	Figure 14	40	final assault times
B-10	Figures 15-20	42-47	combat force strength vs time
B-11	Figures 21-26	49-54	position vs time
B-12	Figure 27	56	combat activity vs time
B-13	Figure 29	65	close combat engagements of CHIOSS
B-14	Figure 30	66	CHIOSS strength vs distance

TABLE B-1. Build-up of Defense Forces* (Figure 8, p.24)

TOTAL NUMBER OF U.S. BATTALIONS COMMITTED

Day	Case 2	Case 3	Case 4	Case 5	Case 6
1		3	6	6	12
2					
3					19
4					
5		6	12	12	26
6					
7			19	19	31
8					
9			26	26	36
10		12			
11			31	31	42
12					
13			36	36	50
14		19	42		
15		26	50	42	54
16	6	31	54		
17	12	36			
18	19			50	
19	23				
20	29				
21				54	
22	32	42			
23	37				
24	42				
25	46				
26		49			
27					
28					
29					
30		52			

*This table shows the U.S. forces only. To match Figure 8, it is necessary to add the 22 Thai battalions which are committed from the beginning.

TABLE B-2. Composition of the Combat Portion of One Division Used in This Study.

QUANTITY	TOE	GROUP FORCE TITLE
2	1-77E	Air Mobile Company, Aviation Bn, RAC
1	1-89D	TRNSPT Airplane Co., ND RAC
1	1-207E	AIR TRAF FLT REG PLAT, ND RAC
	CHEMICAL	
1	3-267E	Chemical Smoke Gen Co ND RAC
	ENGINEER	
1	5-52	HQ + HQ CO, ENGR CMBT GRP ND RAC
1	5-156E	HQ + HQ CO, ENGR BN RAC
3	5-157E	Combat ENG CO, ENG BN RAC
3	5-35D	Combat ENG BN, ND RAC
	FIELD ARTILLERY	
3	6-156E	HQ + HQ SVC BTRY, FA BN 105 MM TWD, DIV ART RAC
9	6-157E	FA BTRY, 105MM TWD, INF DIV ARTY RAC
1	6-315	FA BN 105MM, SP ND RAC
1	6-401D	HQ + HQ BTRY, FA GROUP ND RAC
1	6-415	FA BN 8-IN, SP ND RAC
2	6-425D	FA BN 155MM SP ND RAC
1	6-435D	FA BN 175MM, SP, ND RAC
1	6-577E	FA TGT AGQ BTRY ND RAC
	INFANTRY	
7	7-15E	Infantry Battalion RAC
3	7-42E	HQ + HQ CO, Brigade RAC
2	7-45E	Mechanized INF BN ARM DIV OR MECH

TABLE B-2. (Cont'd)

QUANTITY	TOE	GROUP FORCE TITLE
	MEDICAL	
3	8-37E	Medical Co, MED BN RAC
	QUARTERMASTER	
1	10-7E	Supply + SVC CO, SUPLY + TRANS BN RAC
	SIGNAL	
1	11-37E	COMD OPERS CO, SIG BN RAC
1	11-38E	RND COMM CO, SIGNAL BN RAC
1	11-39E	SIG SPT OP CO, SIG BN RAC
1	11-67D	Combat Electronic Warfare SIG CO, ND RAC
	ARMOR	
2	17-35E	Tank Battalion RAC
1	17-55D	ARMD CAV SQDN, ND RAC
2	17-107E	Armed CAV TRP, ARMD CAV SQDN RAC
	COMPOSITE	
3	29-17E	FWD SUPPORT CO, MAINT BN RAC
	AIR DEFENSE ARTILLERY	
1	44-235T	ADA MSL BN, HAWK, ND RAC
	TRANSPORTATION	
1	55-88E	TRANS MTR TRANS CO, SUPLY + TRANS BN RAC

TABLE B-3. Ratio of Committed Forces (Offense/Defense)

(Figure 9, P.27)

Day	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
0	1.96	1.96	1.96	1.96	1.96	1.96
4	2.27	2.27	2.00	1.78	1.78	1.22
8	2.69	2.57	2.04	1.39	1.39	1.07
12	3.23	3.22	2.08	1.34	1.34	1.11
16	3.50	2.75	1.45	1.07	1.20	1.01
20	3.64	1.57	1.38	1.05	1.11	1.05
24	3.85	1.33	1.33	1.12	1.12	1.12
28	3.85	1.25	1.20	1.12	1.12	1.12
32	3.85	1.25	1.15	1.12	1.12	1.12
36	3.85	1.25	1.15	1.12	1.12	1.12
40	3.85	1.25	1.15	1.12	1.12	1.12

TABLE B-4. Offensive Force Strengths At Their Objectives on D+40

For the Various Cases (Figure 10, P. 32)

NUMBER OF OFFENSIVE BATTALIONS AT THE OBJECTIVES

Case	Khorat	Bangkok	Koke Kathiem Via Khorat	Koke Kathiem Via Bangkok	Total	Total Surviving Offensive Forces (Battalions)
1	13.4671	24.1455	19.0863 (.9952)	11.8769	31.9584	69.5710
2	12.6120	14.3862	5.9009	(1.9709)*	7.8718	34.870
3	12.3653	.8381	.0	.0	.0	13.2034
4	11.6221	0.	0.	0.	0.	11.6221
5	11.6221	(.3329)	(.4971)	0.	(.4971)	12.4521
6	6.5042	0.0	0.0	0.0	0.0	6.5042

*Figures in parentheses represent surviving combat forces which have not yet reached their objectives.

TABLE B-5. Percent Combat Losses During the First Forty Days of War for the Various Cases

(Figure 11, P. 33)

Case	Thai Losses			U.S. Losses			Communist Losses		
	No. Bns.	Percent	Percent/ Day	No. Bns.	Percent	Percent/ Day	No Bns.	Percent	Percent/ Day
1	18.7	85.0	2.1	0.	0.	0.	15.4	18.2	.45
2	17.8	80.9	2.02	6.0	11.1	.30	50.1	59.0	1.47
3	16.0	80.0	2.00	7.3	13.5	.33	71.8	84.5	2.11
4	15.0	68.1	1.70	7.5	32.5	.81	73.4	86.3	2.15
5	14.7	66.8	1.67	17.0	31.6	.79	72.5	85.4	2.13
6	14.5	65.9	1.64	18.7	34.7	.86	78.5	92.3	2.30

TABLE B-6. Strength of Offensive Forces as a Function of Their Average Distance-to-Objective For the Various Cases (Figure 12, P. 34)

	Case 1		Case 2		Case 3		Case 4		Case 5		Case 6	
Day	No. Bns.	N. Mi.	No. Bns.	N. Mi.	No. Bns.	N. Mi.	No. Bns.	N. Mi.	No. Bns.	N. Mi.	No. Bns.	N.Mi.
0	85.0	138.9			85.0	138.9	85.0	138.9	85.0	138.9	85.0	138.9
2	83.6	130.7			83.6	130.7	83.6	130.7	83.6	130.0	83.6	130.7
4	81.8	124.8			81.8	124.7	81.8	124.7	81.8	124.7	81.8	124.8
6	79.8	118.7	SAME AS		79.8	118.6	79.4	118.8	79.4	118.8	78.4	119.0
8	78.7	110.2	CASE 1		78.6	110.3	77.9	110.5	77.9	110.5	74.2	114.5
10	78.2	101.4			77.3	102.6	76.5	103.9	76.5	103.9	72.1	108.2
12	77.9	91.5			75.4	94.5	74.3	96.8	74.3	96.8	69.4	103.1
14	77.6	77.6			74.0	82.4	70.6	89.3	70.6	89.3	64.7	99.3
16	76.1	66.4	76.1	66.4	71.6	70.8	66.2	84.2	67.3	81.0	60.4	94.1
18	74.9	57.2	74.5	57.2	65.1	63.6	61.1	77.2	64.0	69.5	55.0	87.9
20	73.8	48.8	72.4	49.3	58.4	58.0	58.4	63.7	57.4	62.2	48.3	82.8
22	72.8	40.3	69.5	41.3	52.4	50.8	52.3	55.7	51.6	54.3	45.9	67.1
24	72.3	32.9	65.9	35.5	49.6	44.2	46.1	49.0	44.2	48.4	40.0	57.1
26	71.6	24.3	60.0	29.8	45.4	38.0	37.0	43.2	36.4	42.2	32.6	51.3
28	70.6	17.4	56.8	23.1	39.9	32.9	31.4	42.5	30.5	45.3	24.5	53.1
30	70.0	11.6	53.1	18.8	35.7	27.8	26.6	40.2	26.6	44.6	20.8	54.1
32	69.9	7.4	49.3	14.2	29.0	19.1	22.7	40.7	23.0	40.9	17.7	53.5
34	69.8	4.3	45.1	10.2	22.0	13.0	18.5	27.2	19.6	30.2	13.6	39.5
36	69.7	2.9	40.2	7.2	17.9	7.2	15.9	21.9	16.9	25.5	10.9	33.8
38	69.6	.9	37.7	3.4	14.7	3.3	14.4	19.2	14.8	22.7	9.1	27.9
40	69.6	.0	34.9	1.1	13.2	.0	11.6	.0	12.5	4.3	6.5	.0

TABLE B-7. Variation of Force Ratio with Time (Figure 13, P. 36)

Day	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
0	1.96	1.96	1.96	1.96	1.96	1.96
4	2.55	2.55	2.20	1.92	1.95	1.25
8	3.62	3.62	2.52	1.49	1.49	1.01
12	5.31	5.31	2.64	1.42	1.43	1.03
16	6.26	4.04	1.55	1.01*	1.20	1.12*
20	7.72	1.67	1.27	1.05*	1.05*	1.25*
24	11.8	1.17	1.07	1.06*	1.27*	1.28*
28	20.2	1.03*	1.30*	1.53*	1.60*	1.90*
32	21.2	1.11*	1.83*	2.08*	2.01*	2.55*
36	21.2	1.32*	2.90*	2.76*	2.64*	4.00*
40	21.2	1.50*	3.92*	3.74*	3.56*	6.66*

*Force ratio in favor of the Thai-U.S. forces.

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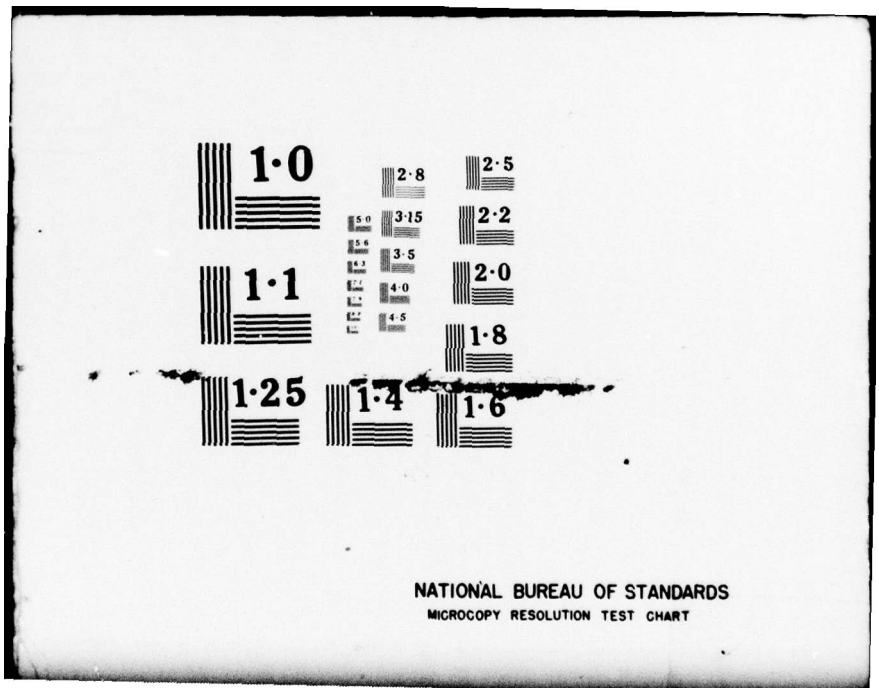
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TABLE B-8. Summary of Defense Retreats for the Various Cases (Figure 14, P.40)

	SOUTHERN (BANGKOK) REGION		NORTHERN (KHORAT) REGION	
	Retreat Time (Day-Hour-Minute)*	To Zone:	Retreat Time (Day-Hour-Minute)*	To Zone:
Case 1	6- 7-48	2S	1-17- 3	2N
	8-14-40	3S	8- 9- 9	3N
	21-20-58	4S	13- 5-24	4N
	23-23-36	5S	15-17-13	5N
Case 2	6- 7-48	2S	1-17- 3	2N
	8-14-40	3S	8- 9- 9	3N
	21-20-58	4S	13- 5-24	4N
	25-21- 4	5S	15-17-13	5N
Case 3	6- 6- 6	2S	1-17- 3	2N
	12-16-27	3S	8- 9- 9	3N
	21-20-58	4S	13- 5-24	4N
	26-21-12	5S	-	--
Case 4	6- 6- 6	2S	1-17- 3	2N
	17-15-35	3S	8- 9- 9	3N
	31-22- 5	4S	-	--
	-	--	-	--
Case 5	6- 6- 6	2S	1-17- 3	2N
	15- 7-22	3S	8- 9- 9	3N
	32-12-21	4S	-	--
	-	--	-	--
Case 6	6- 6- 6	2S	1-17- 3	2N
	19-21-52	3S	8-10-15	3N
	32-17- 9	4S	-	--
	-	--	-	--

*The war starts at C- 0- 0.

TABLE B-9. Timing of Final Attacks on Objectives (Day-Hour-Minute)* (Figure 14, P. 40)

Case	BANGKOK			KHORAT		
	First Arrv'l at "Hold Pt"	Start Final Attack	First Arrv'l at Objective	First Arrv'l at "Hold Pt"	Start Final Attack	First Arrv'l at Objective
1	13-21-21	25-11-35	(18-16-19)** 25-13-11	4- 5-44	11-14-16	11-19-28
2	13-19-43	27- 1-21	(18-16-54)** 32-14-34	4- 5-44	11-14-16	11-19-28
3	16- 7-54	30-15-50	----	4- 5-44	11-15-11	11-20-23
4	22-13- 5	28-19-20	----	4- 5-44	12- 9- 9	12-14-21
5	21-11-16	28-19-48	----	4- 5-44	12- 9- 9	12-14-21
6	24-12- 3	28-17-47	----	4-15-40	16- 4-24	16-12-27

* The war starts at 0-0-0.

**The first arrivals were by units which were not part of the main attack group.

TABLE B-10. Variation of Combat Forces With Time (Figures 15-20, pp. 42-47)

DAY	CASE 1		CASE 2			CASE 3			CASE 4			CASE 5			CASE 6		
	CHINESE	THAI	CHINESE	THAI	U.S.	CHINESE	THAI	U.S.	CHINESE	THAI	U.S.	CHINESE	THAI	U.S.	CHINESE	THAI	U.S.
0	43.0	22.0	43.0	22.0	0.	43.0	22.0	0.	43.0	22.0	0.	43.0	22.0	0.	43.0	22.0	0.
4	46.8	18.4	46.8	18.4	0.	46.8	18.4	3.0	46.8	18.4	6.0	46.8	18.4	6.0	46.8	18.4	19.0
8	50.7	14.4	50.7	14.4	0.	50.6	14.4	6.0	49.9	14.5	18.9	49.9	14.5	18.9	46.2	15.3	30.3
12	63.9	12.1	63.9	12.1	0.	61.4	11.7	11.5	60.3	12.0	30.5	60.3	12.0	30.5	55.4	13.5	40.5
16	68.1	10.9	68.1	10.9	6.0	63.6	11.1	30.1	58.6	11.1	49.3	59.3	11.1	38.3	52.4	10.9	48.1
20	68.8	8.9	67.4	9.1	31.0	53.4	10.5	31.8	53.4	10.7	45.3	52.4	10.3	44.8	43.3	10.9	43.4
24	72.3	6.1	65.9	6.8	49.7	49.6	9.5	36.7	46.1	8.8	40.0	44.2	9.0	42.9	40.0	10.3	40.7
28	70.6	3.5	56.8	5.6	52.7	39.9	7.7	44.3	31.4	8.1	39.9	30.5	8.3	40.5	24.5	8.5	39.3
32	69.9	3.3	49.3	4.7	50.2	29.0	6.9	46.5	22.7	7.7	38.0	23.0	7.8	38.3	17.7	8.2	37.0
36	69.7	3.3	40.2	4.2	48.8	17.9	6.0	45.9	15.9	7.0	36.9	16.9	7.5	37.2	10.9	8.0	35.7
40	69.5	3.3	34.9	4.2	48.0	13.2	6.0	45.7	11.6	7.0	36.5	12.4	7.3	37.0	6.5	7.5	35.3

TABLE B-11. Distance of Closest Unit To Objective (Figures 21-26, pp. 49-54)

	CASE 1				CASE 2				CASE 3			
			Koke Kathiem				Koke Kathiem				Koke Kathiem	
Day	Khorat	Bangkok	N	S	Khorat	Bangkok	N	S	Khorat	Bangkok	N	S
0	50.6	110.6	170.0	174.2	50.6	110.6	170.0	174.2	50.6	110.6	170.0	174.2
4	14.8	98.5	155.0	174.2	14.8	98.5	155.0	174.2	14.8	99.1	155.0	174.2
8	6.0	69.1	111.7	174.2	6.0	69.1	111.7	174.2	5.4	69.1	111.7	174.2
12	0.	38.4	81.7	146.9	0.	38.4	81.7	146.9	0.	38.4	103.6	146.9
16		10.2	42.1	117.4		10.2	42.1	117.4		17.0	52.5	117.4
20		0.	1.2	78.6		1.0	1.2	82.1		2.8	49.0	78.6
24			0.	18.6		0.	0.	37.2		2.2	55.7	27.0
28				0.				21.2		1.6	56.1	16.5
32								11.9		0.	53.0	8.0
36								6.2			57.1	6.5
40								8.5			*	*

* All units in this group have broken.

TABLE B-11. (cont'd)

Day	CASE 4				CASE 5				CASE 6			
	Khorat	Bangkok	Koke Kathiem		Khorat	Bangkok	Koke Kathiem		Khorat	Bangkok	Koke Kathiem	
			N	S			N	S			N	S
0	50.6	110.6	170.0	174.2	50.6	110.6	170.0	174.2	50.6	110.6	170.0	174.2
4	14.8	99.1	155.0	174.2	14.8	99.1	156.4	174.2	20.1	99.1	155.0	174.2
8	5.4	69.1	111.7	174.2	7.1	69.1	111.7	174.2	6.7	69.1	112.3	174.2
12	3.3	45.0	85.9	146.9	5.0	45.0	85.9	146.9	6.3	45.0	93.9	146.9
16	0.	42.0	83.5	117.4	0.	34.8	83.5	117.4	4.5	42.0	85.5	117.4
20		17.6	83.3	85.1		10.8	83.2	82.1	0.	40.7	83.9	107.8
24		10.2	82.1	52.5		2.9	82.1	58.4		6.8	83.9	59.1
28		10.2	80.2	76.5		2.3	80.2	69.8		12.2	86.2	52.3
32		*	85.8	78.5		13.4	80.1	64.5		*	82.2	66.3
36			85.8	46.2		*	80.3	48.8			85.9	48.8
40			*	*			*	68.8			*	*

*All units in the group have broken.

TABLE B-12. Number Of Offensive Units Engaged On A Given Day (Figure 27, p. 56)

	NUMBER OF UNITS					
Day	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
4	31	31	31	31	31	31
8	18	18	15	17	17	15
12	5	5	13	29	30	28
16	10	10	15	34	7	40
20	12	19	23	21	28	9
24	13	22	17	30	31	29
28	12	30	13	25	21	20
32	0	36	20	10	14	14
36	0	3	3	8	10	9
40	0	5	0	0	1	0

TABLE B-13. Combat Engagements of CHI08S (Figure 29, p. 65)

TIME	CHI08S STRENGTH	ACTIVITY
CASE 1		
1 -18-22	.9964	Engages TH1IN6
6 - 1-52	TH1IN6 Breaks	
25-18-11	.8972	Reaches Bangkok
CASE 2		
1 -18-22	.9964	Engages TH1IN6
6 - 1-52	TH1IN6 Breaks	
27- 2-35	.8571	Engages US1MI2, US1AC1
32- 8-31	US1MI2, US1AC1 Breaks	
32- 8-54	.7578	Engages BNKI01
32-12-41	BNKI01 Break	
32-16- 1	.7562	Reaches Bangkok
CASE 3		
1 -18-22	.9964	Engages TH1IN6
6- 1- 52	TH1IN6 Breaks	
20-11-49	.8742	Engages US1IN6
21-20-58	US1IN6 Retreats	
22- 3-21	.6451	Engages BNKI03
26-12-30	.5479	Disengages BNKI03
30-17- 4	.5299	Engages US1MI2, US1AC1, US3MI1, US3MI2, US3AC1
30-22-23	.3000	Breaks
CASE 4		
1 -18-22	.9964	Engages TH1IN6
6 - 1-52	TH1IN6 Breaks	
13-12- 1	.8942	Engages US1TK1
15-23-20	US1TK1 Breaks	
17-14-40	.8560	Engages TH1IN5
17-15-35	TH1IN5 Retreats	
22-12- 6	.8396	Engages US1IN6
26-13- 6	.3578	Engages BNKI03
26-18-20	.3000	Breaks

TIME	CHIOBS STRENGTH	ACTIVITY
CASE 5		
1 -18-22	.9964	Engages TH1IN6
6 - 1-52	TH1IN6 Breaks	
13-12- 1	.8942	Engages US1TK1
15- 7-22	US1TK1 Retreats	
21-20-35	.8463	Engages US1IN5
21-21-37	US1IN5 Breaks	
21-23-26	.8447	Engages US1IN6
26- 0-26	.4659	Engages BNKI03
26-15-50	.3000	Breaks
CASE 6		
1 -18-22	.9964	Engages TH1IN6
6 - 1-52	TH1IN6 Breaks	
13-12- 1	.8942	Engages US1TK1
15-23-20	US1TK1 Breaks	
17-14-40	.8560	Engages TH1IN5
19-21-52	.7961	Disengages TH1IN5
24-12-57	.7813	Engages US1IN6
27-14- 7	.3000	Breaks

TABLE B-14. Strength of CHI08S as a Function of Distance to Bangkok (Figure 30, p. 66)

DAY	CASE 1		CASE 2		CASE 3		CASE 4		CASE 5		CASE 6	
	S	D	S	D	S	D	S	D	S	D	S	D
0	164.5	1.000									164.5	1.0000
2	145.6	.9898			145.6	.9898	145.6	.9898	145.6	.9898	145.6	.9898
4	144.1	.9409					144.1	.9409	144.1	.9409	144.1	.9409
6	142.6	.9039					142.6	.9039	142.6	.9039	142.6	.9039
8	128.1	.9023	128.1	.9023	128.1	.9023	128.1	.9023	128.1	.9023	128.1	.9023
10	113.1	.9019	113.1	.9019	113.1	.9019	113.1	.9019	113.1	.9019	113.1	.9019
12	98.1	.9015			98.1	.8975	98.1	.8975	98.1	.8975	98.1	.8975
14	83.1	.9011			83.1	.8931	86.1	.8841	86.1	.8841	86.1	.8841
16	68.1	.9007	68.1	.9007	68.1	.8887	83.0	.8596	79.0	.8637	83.0	.8596
18	53.1	.9003	53.1	.8963	53.1	.8843	68.2	.8541	64.0	.8593	70.6	.8450
20	25.9	.8995	25.9	.8884	25.9	.8764	53.2	.8497	47.6	.8545	68.5	.7959
22	4.1	.8987	4.1	.8796	14.5	.6457	26.1	.8418	18.5	.8411	53.5	.7915
24	4.1	.8979	4.1	.8708	9.7	.5922	16.3	.7029	15.5	.6640	26.6	.7837
26	0.	.8971	4.1	.8620	6.7	.5555	13.3	.4903	12.5	.4683	16.3	.5327
28			3.2	.8212	4.1	.5414	12.0	.3000	12.0	.3000	12.5	.3000
30			2.9	.7866	4.1	.5326		*		*		*
32			2.6	.7610	2.3	.3000						
34			0.	.7503		*						

S = Strength of CHI08S (Fraction of a Full Unit)

D = Distance to Bangkok (N. Mi.)

REFERENCES

[1] Fain, W. W., Janice B. Fain, H. W. Karr, "Tactical Warfare Simulation Program", (Douglas internal report, 6 November 1964).

[2] Douglas Report No. 50008A, C-5A System Analysis Summary, Vol. 3, Part 2, 17 April 1965.

[3] D. L. Schilling, "Notes on the Deployment and Effectiveness of Tactical Air Forces" (Douglas internal report, 17 March 1965).

[4] Los Angeles Times, p. G-1, April 4, 1965.

LIST OF ILLUSTRATIONS

FIGURES Page

LIST OF ILLUSTRATIONS (cont'd)

FIGURES Page

TABLES

LIST OF TABLES (cont'd)

Page