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VULNERABILITY OF NORTH KOREAN FORCES

Volume I - Evaluation of Vulnerability of North Korean Divisions to Tactical Nuclear Weapons

Science Applications, Inc.
8400 Westpark Drive
McLean, Virginia 22101

March 1978

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[redacted] SUMMARY [redacted]

[redacted] PROBLEM AND OBJECTIVES

[redacted]

The key objectives are to determine the vulnerability of deployed NK divisions as a function of quality and quantity of resources in the attack, to identify driving factors affecting vulnerability and to define attractive concepts of operation for enhancing allied capability in Korea. Some attention is also directed toward a comparison of the asymmetries existing between NK and S[illegible] forces under nuclear engagements.

This research was sponsored by the Field Command and the Vulnerability Directorate of the Defense Nuclear Agency. The Nuclear Plans and Policy Division of the Deputy Chief of Staff for Operations and Plans, Headquarters, US Army and the Intelligence Analysis Group (IAG), US Army, assisted in the definition of nuclear resources, operational concepts and enemy threat for the Korean theater.

[redacted] FACTS BEARING ON THE PROBLEM

[redacted]

[redacted]

[redacted]

TECHNICAL DISCUSSION

The evaluation of NK Division vulnerability centers on individual enemy targets or units deployed on the terrain, the capability of allied forces to acquire these targets, the damage achieved against these targets from an appropriate combination of weapons effects, and the significance of this damage on the performance of combat missions. This examination reveals some of the critical factors affecting allied system capabilities, operational procedures, and goals/objectives that can be employed to increase the vulnerability of deployed NK tactical forces. In addition, some comparisons are made between the vulnerabilities of Soviet and NK forces to provide an improved basis for extending the results developed from detailed examinations of possible nuclear conflicts in Europe to the less definitive and heretofore lightly treated Korean theater.

Representative military scenarios are employed to define the operational characteristics and to identify the factors which either constrain the application of tactical nuclear weapons or affect combat operations involving deployed forces. Characteristics of the units

[redacted]

[redacted]

provide part of the necessary information for examining the effects of thermal and nuclear radiation and blast on target responses. Nuclear weapons are allocated against an acquired target list according to selected military objectives and target priorities as well as nuclear delivery system capabilities and resources. Damage calculations are performed as a function of target characteristics, threat levels, weapon effects, time after the nuclear strike, and allocation strategies.

[redacted] Three types of nuclear effects (direct, indirect, and internal) are produced by warhead laydowns against a target array. Nuclear effects produce damage which may result in unit incapacitation (unavailability of the unit for military actions), or unit degradation (due to some losses in personnel or materiel), or unit impairment (due to the interruption of support to surviving units).*

[redacted] The direct effects from nuclear bursts are postulated to incapacitate combat units by damaging a sufficient fraction of the personnel or materiel within the unit to render it unable to carry out designated tasks. The number of incapacitated units from a prescribed weapons attack depends upon the unit incapacitation criteria, the distance from the burst point, the shielding available at the target and the environmental conditions. Incapacitation or damage to personnel/principal equipment can be treated in terms of the blast, nuclear radiation, and thermal radiation levels experienced by the elements of the combat units. Incapacitated units are considered to be unable to participate in the combat mission assigned to the force.

[redacted] The indirect and internal effects from nuclear bursts cause temporary reductions in the combat capability of surviving units. In the case of indirect effects, impairment in capability is caused by an interruption in the flow of personnel, materiel, or information needed to perform designated tasks or missions. For internal effects, degradations occur from the decrease in output caused by the loss of materiel or personnel within a unit. Thus, reduction in capability can evolve

*The Combat System Survivability Model is described in detail in DNA report 4401F-1, 2, 3 and 4.

[redacted]

[redacted]

from direct damage to units which support the surviving unit (indirect effects) or from direct damage to the unit itself which must be compensated for by reassigning personnel/materiel or by repairing damage using assets within the unit (internal effects).

[redacted]

The bonus effects depend upon the spacing between combat units, the number of warheads expended and the posture of the personnel within the unit. The number of nuclear warheads delivered on targets is a function of allied target acquisition capability, the available firing time, and weapon system launch or sortie rate. Target spacing, exposure of personnel, and number of acquired targets and delivered warheads depend upon the phase of combat under investigation. While this analysis is focused upon attacks against acquired targets, some consideration is also given to the use of deduced targeting against suspected enemy positions or terrain targets.

[redacted]

The treatment of internal and indirect effects is beyond the scope of this initial investigation of NK division vulnerability. More detailed information on the NK operating procedures, communication links and personnel cross training capability is needed before further work can be undertaken to assess the consequences of internal and indirect effects in the Korean theater.

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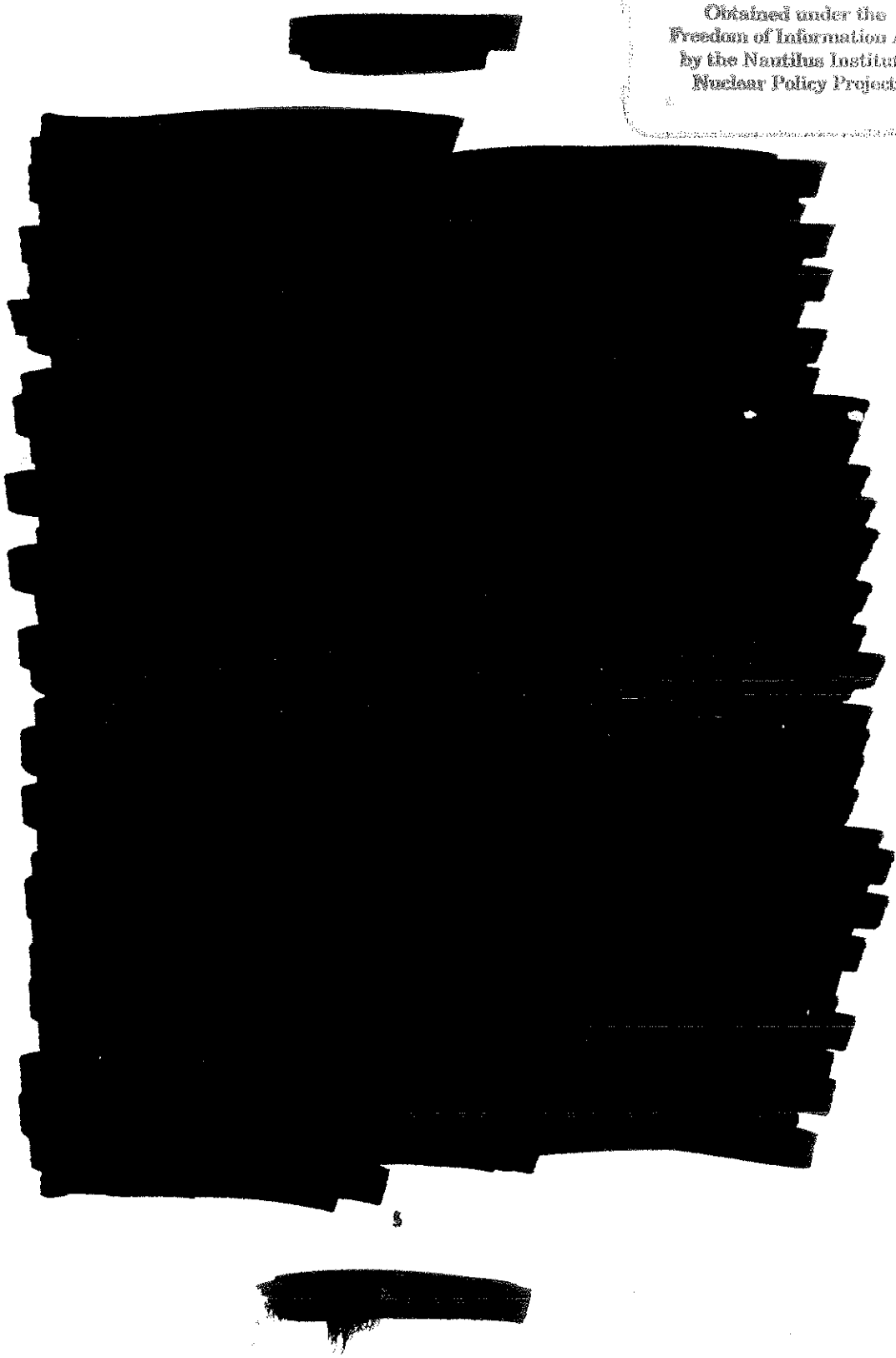
[redacted]



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LIST OF TABLES (CONT.)

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[redacted] Chapter 1

INTRODUCTION AND PERSPECTIVE[redacted]

[redacted] BACKGROUND AND PROBLEM

[redacted] The analysis deals with the capability to incapacitate important targets and combat arms units in deployed NK divisions with US weapons along with options and techniques for enhancing the effectiveness of the allied (ROK and US) combat systems. This research was sponsored by the Field Command and the Vulnerability Directorate of the Defense Nuclear Agency (DNA).

[redacted]

[redacted]

The evaluation of NK Division vulnerability centers on individual enemy targets or units deployed on the terrain, the capability of allied forces to acquire these targets, the damage achieved against these targets from an appropriate combination of weapons effects, and the significance of this damage on the performance of NK combat missions. This examination reveals some of the critical factors affecting allied system capabilities, operational procedures, and goals/objectives that can be employed to increase the vulnerability of deployed NK tactical forces. In addition, some comparisons are made between the vulnerabilities of Soviet and NK forces to provide an improved basis for extending the results developed from detailed evaluations of possible nuclear conflicts in Europe to the less definitive and lightly examined Korean theater.

[redacted] OBJECTIVES AND SCOPE

[redacted]

The objectives of this project are as follows:

- Identify major factors affecting NK division vulnerability in tactical nuclear engagements near the FEBA.
- Determine vulnerability of a deployed NK division as a function of quality and quantity of the attack systems.
- Define opportunities for acquiring and engaging front line division forces and contrast NK and Soviet division vulnerabilities in critical phases of combat.
- Ascertain gaps and deficiencies in current capabilities, uncertainties in performance, needs for further research, attractive concepts of operation, and opportunities/options for enhancing allied capability to damage or deter enemy division forces.

[redacted]

[redacted]

The major areas of emphasis in the study are guided by the following considerations and constraints:

[redacted]

- Allied nuclear doctrine and concepts of operations are considered for attack phases of combat near the FEBA.

- Target arrays associated with NK division forces in shallow and deep penetration with counter attacks by allied forces represent the combat phases of interest for this study.

- Variations and contrasts in target vulnerability between NK and Soviet division forces and equipment are delineated and highlighted.

- The Combat System Survivability Model is used to assess division vulnerability and revised to reflect appropriate weapons effects, data base, and times.

[redacted]

- Significance of changes in target acquisition capability and introduction of tailored weapons effects are reflected in the analysis.

The following factors are treated in considering the NK division vulnerability:

• Number of each type of acquired target	Target Characteristics
• Time in position and vulnerability	
• Size and distribution	
• Level of shielding at each target	
• Response time and rate of fire	Delivery System Characteristics
• Number of each type of delivery system	
• System accuracy and warhead yield	
• Allocation strategy	

[redacted]

[redacted]

- Target location error
- Selected level of target damage
- Command and control systems/procedures

} Operational Considerations

Measures of effectiveness used in the assessment of NK Division vulnerability are listed below:

- Nuclear resources expended against the division
- Number of combat arms units incapacitated by direct nuclear effects as a function of available resources
- Fraction of the functional areas in the division destroyed in nuclear weapon laydown
- Number of incapacitated units per expended warhead
- Fraction of the division destroyed per expended nuclear warhead.

The capability to inflict sufficient damage on a deployed NK division using theater nuclear weapons depends upon the characteristics of the NK division target array, the phase of combat, and the allied target acquisition capability. In addition, constraints imposed by considerations of allowable warhead yields, and troop safety as well as the selected weapon allocation and targeting strategy can markedly influence enemy division vulnerability.

Issues of interest considered in the analysis are as follows:

[redacted]

- How do the terrain features and threat characteristics for Korea affect the engagement situations?

[redacted]

- What asymmetries in combat system vulnerability exist between North Korean and Soviet forces under nuclear engagements?

[redacted]

[redacted]

A number of simplifying assumptions and constraints are introduced into the analysis in order to perform the work indicated by the objectives and scope. The primary factors or bounds bearing on the problem of NK division vulnerability are outlined below:

- Target damage is considered under conditions of discrete (independent) attacks for different phases of combat.
- Moderate levels of the enemy force are used as the baseline for calculations to ensure that reasonable, non-trivial results are produced in the engagement analysis.
- Platoons and batteries are considered as equivalent units to provide a means for summing the total number of damaged units within each functional area.
- The implications of Electromagnetic Pulse (EMP) and Transient Radiation Effects on Electronics (TREE) as well as thermal effects on equipment are not addressed in the study.
- Combat arms targets are nominally considered as point targets instead of area targets, but side analyses reveal no significant differences in results are produced for platoon equivalent targets due to their small size ($\leq$ 150 m).
- Emphasis in the analysis is on the employement of current or near term technology available to the allied forces.

[redacted] METHOD OF ANALYSIS

The analysis of NK division vulnerability focuses on damage achieved against targets deployed on the terrain under expected operating situations. Emphasis is on the calculation and interpretation

[redacted]

[redacted]

of direct damage sustained against critical elements of the division.

Figure 1-1 shows the basic structure of the analysis used in this study. Representative military scenarios are employed to define the operational characteristics and to identify the factors which either constrain the application of tactical nuclear weapons or affect combat operations involving deployed forces. Characteristics of the units provide part of the necessary information for examining the effects of thermal and nuclear radiation and blast on target responses. The selection of the nuclear weapons allocation strategy depends on the acquired target list, military objectives, and target priority as well as the nuclear delivery system type, yield, rate of fire, accuracy and number of warheads. The Combat System Survivability Model is used to perform the damage calculations as a function of target characteristics, threat levels, weapon effects, time after the nuclear strike, and allocation strategies.

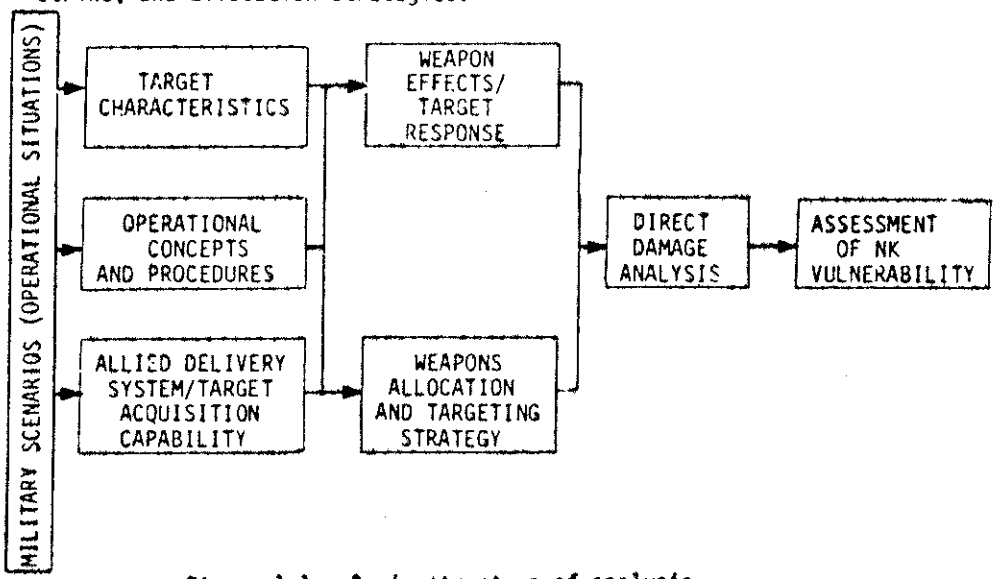

Figure 1-1. Basic structure of analysis

[redacted]

[redacted]

Based on resources expended, targets damaged/functions impaired, and the assigned missions, assessments of division vulnerability and division capability to undertake military operations are made for selected phases of land combat.

Since numerous calculations and data manipulations are required to reflect variations in operational situations, weapons effects and attack strategies, the Combat System Survivability Model (CSSM) is refined to expedite the determination of target incapacitation and to provide a mechanism for further evaluations by DNA and DOD*. The key elements of the CSSM are portrayed in Table 1-1.

Also contained within the CSSM is a routine for portraying detailed damage to the combat forces in terms of target type, combat units, and functional areas affected by a nuclear attack as a function of time, as well as a listing and description of the targets used in the analysis. The model results are presented in terms of a damage overview including the fraction of the combat units incapactiated to specified levels in each functional area and combat phase. The model is exercised to permit an examination of the sensitivity of results to variations in operating conditions, environmental situations, threat characteristics and weapon effects.

[redacted] SOME HIGHLIGHTS OF THE TECHNICAL APPROACH [redacted]

The recent SAI studies sponsored by DNA dealing with the vulnerability of Soviet/WP divisions and the survivability of US brigades, non-US NATO brigades, and US divisions provide a suitable basis for undertaking this assessment of NK division vulnerability. The Brigade Survivability Analysis contains a model for calculating direct damage to high resolution targets using a weapon effects data base, systematic target acquisition procedures, and sophisticated weapons allocation techniques. This model was modified and expanded to the Combat System Survivability Model and reflects the special aspects of problems associated with division level forces and

*The Combat System Survivability Model is described in detail in DNA report 4401F-1, 2, 3 and 4.

[redacted]

[redacted]

Table 1-1. Key elements of combat system survivability model.

Sub-routine	Features	Primary Output
Acquired Target List	• Target list by range • Time period of interest • Probability of acquisition	• List of potential targets
Weapons Allocation	• Target value/vulnerability • Damage objectives • Target dynamics • Weapon characteristics • Target location errors • Targeting constraints	• Target selection • Weapon aim points
Weapon Effects	• Target exposure • Environment • Target vulnerability • Target response • Damage criteria (EMP, blast, thermal & nuclear radiation)	• Probability of incapacitation or damage as function of weapon characteristics and range from burst point
Direct Damage Calculation	• Weapon aim points, CEPs, yields, and HOB • Target characteristics/ deployments • Damage criteria • Rules for assessing damage	• Damage to attacked personnel and materiel • Damage to nearby targets (bonus effects)
Indirect Damage Calculation	• Probability of direct damage to supporting units • Utilization level for each unit (node) • Storage time at surviving units • Recovery and replacement time for damaged nodes	• Fraction of impaired units due to interruptions in flow of required support
Internal Damage Calculation	• Probability of direct damage to personnel or materiel in the unit • Personnel cross-training efficiency • Unit reorganization and recovery time • Mission life time and demand rates	• Level of degradation in unit capability to accomplish combat mission

[redacted]

[redacted]

the corresponding longer mission times, or differences in the characteristics of equipment and personnel in the national forces of friendly or enemy countries. In addition, developments were incorporated into the CSSM to reflect the influence of indirect and internal effects on system survivability or vulnerability.

[redacted] Figure 1-2 illustrates two types of nuclear effects (direct and indirect). Nuclear effects produce damage which may result in unit incapacitation (unavailability of the unit for military actions), or unit degradation (due to some losses in personnel or materiel), or unit impairment (due to the interruption of support to surviving units).

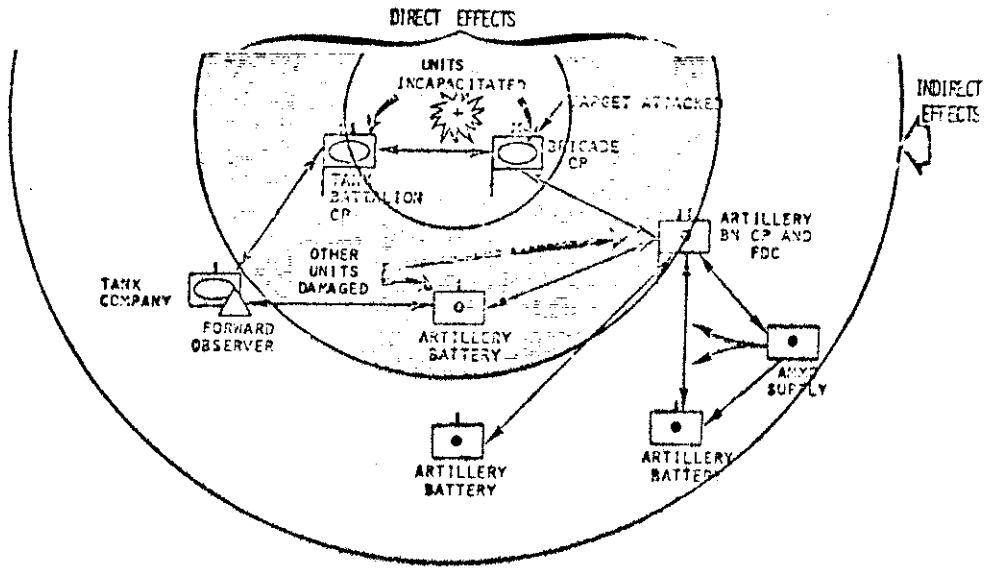

Figure 1-2. Example of types of nuclear effects on combat units.

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[redacted]

[redacted]

[redacted] The bonus effects depend upon the spacing between combat units and the posture of the personnel within the unit. The number of nuclear warheads delivered on targets are a function of allied target acquisition capability, the available firing time, and weapon system launch or sortie rate. Target spacing, exposure of personnel, and number of acquired targets and delivered warheads depend upon the phase of combat under investigation.

[redacted] The level of damage achieved against a deployed force due to the indirect and internal effects depends upon the actual type of targets affected by the nuclear weapons laydown. Since the actual number of targets acquired and engaged in the weapons laydown is a random or probabilistic process, significant variations can occur in the indirect damage sustained by the combat force. Accordingly, the analyses of the indirect and internal effects are usually structured to show bounds on the level of damage expected by these temporary reductions in combat capability.

[redacted] The treatment of internal and indirect effects are beyond the scope of this initial investigation of NK division vulnerability. More detailed information on the NK operating procedures, communication links and personnel cross training capability is needed before further work can be undertaken to assess the consequences of internal and indirect effects in the Korean theater. [redacted]

[redacted] ORGANIZATION OF THE REPORT

This report, titled, "Vulnerability of North Korean Forces," is contained in two volumes. The first volume (I) is the main report and presents an evaluation of the vulnerability of deployed NK divisions to nuclear attacks [redacted] The characteristics of the targets in NK divisions are contained in the second volume (II).

[redacted]

[redacted]

Chapter 2 of this volume describes the military situation and target characteristics of the NK division as well as the characteristics of [redacted] weapons laydowns against division target arrays. The factors and components affecting the engagement analysis are outlined in Chapter 3 and include a description of the input data for the direct damage assessment models. Also, a summary of the weapon effects and damage criteria as well as a list of the targets selected for attack in each of the combat phases are indicated in Chapter 3.

Chapter 4 contains the evaluation of direct target damage for NK divisions. An examination of the implications of variations in key parameters and assumptions on study results is presented in Chapter 5.

[redacted]

[redacted]

[redacted] Chapter 2

TARGET AND THREAT CHARACTERISTICS [redacted]

[redacted] GENERAL REMARKS

This chapter describes the military situations, NK target arrays, and [redacted] target acquisition capability used in the performance of this study. The characteristics of the NK division are presented for two different combat situations.

The information contained in this chapter provides insight into the operational factors and considerations bearing on the allied capability to acquire and engage deployed targets in NK division forces. Target types, structure, and distribution are included to serve as a basis for relating personnel exposure, spacing between units, type of equipment, and unit physical dimensions to the division vulnerability. In addition, some comparisons are made between NK and Soviet division targets to highlight asymmetries and differences in the opportunities and limitations associated with the use of nuclear weapons in the two theaters.

The military situations deal with a general scenario and the layout of opposing formations involved in a NK conventional attack against allied forces (ROK/US) in defensive positions. This layout provides a basis for determining representative numbers of units and their relative locations during each combat situation phase. Target arrays of the NK force are developed so the effects of variations in combat intensity, troop exposure, and deployment can be examined.

Information is presented on the number and type of targets in several functional areas.* These areas are artillery, combat (maneuver elements), command and control, air defense, and antitank. Targets which are considered to be less important are included in the functional area of support. A target is a unit deployed as a platoon, section, battery, or company.

*More detailed descriptions of the characteristics of the military situation and targets are contained in Volume II.

[redacted]

[redacted]

DESCRIPTION OF MILITARY SITUATION

Military Scenario

In view of possible confrontations with the North Korean forces, the South Korean government is postulated to place all military forces on general alert and to call for partial mobilization of the reserve forces. Following full mobilization by North Korea, the South Korean government is assumed to follow with the declaration of a full mobilization. The United States units in South Korea are also considered to be on full alert and the United States is postulated to confirm the commitment to support South Korea in case of attack by any aggressor

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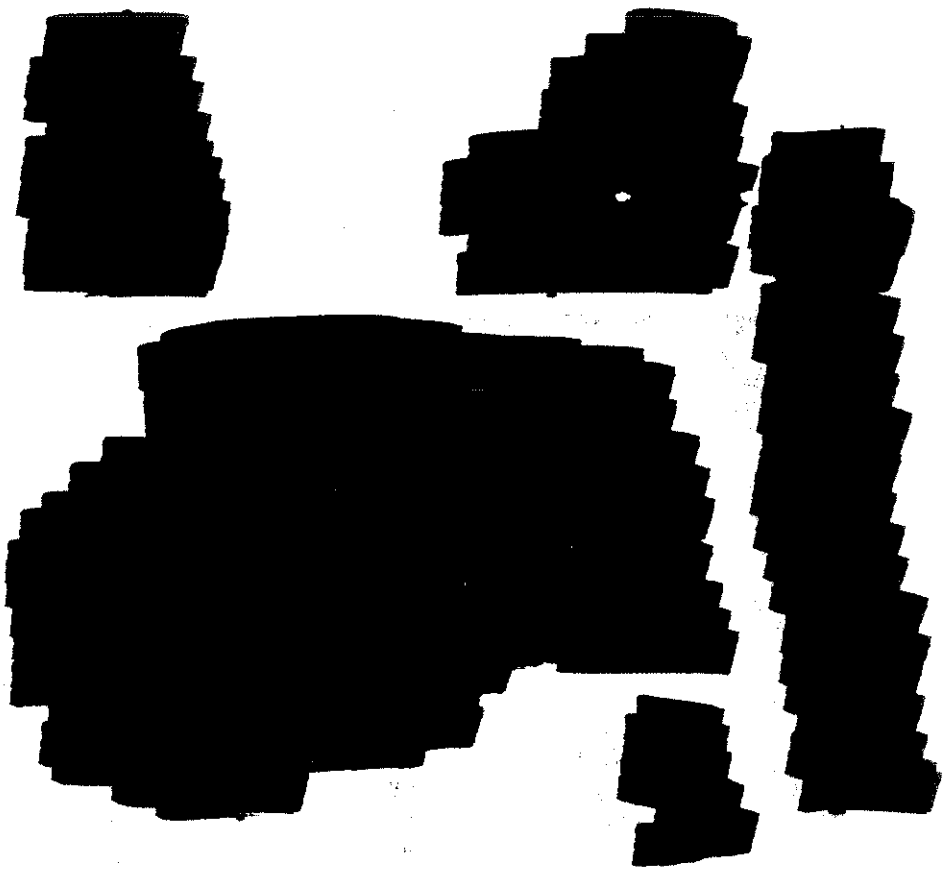

[redacted]

[redacted]

[redacted]

[redacted] Division Target Arrays [redacted]

To provide a suitable basis for exploring the effects of variations in threat level and target exposure, deployments of units in the terrain are specified for NK division forces in shallow and deep penetrations near the DMZ. The enemy penetrations are considered to take place over an short time period and the allied counterattack is assumed to include nuclear fire support. For ease in performing target damage calculations, the initial numbers of personnel and materiel in the opposing forces are considered to be those which existed before the engagement began.

[redacted] A description of several representative targets of interest to the allied defensive force armed with nuclear weapons is presented in Table 2-1. The characteristics of interest are the physical dimensions

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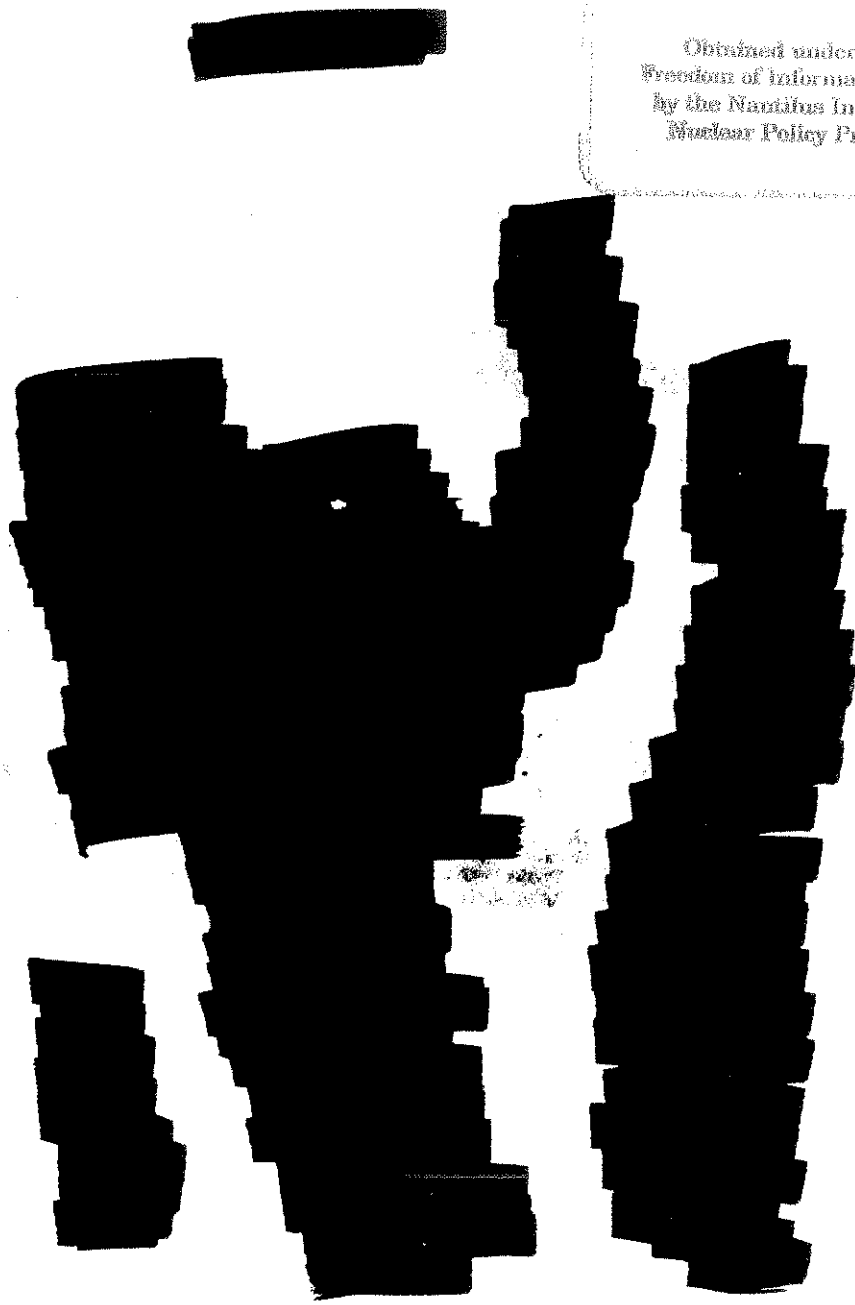

Pages 2-6 through 2-9 were deleted.

[redacted]

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ASYMMETRIES BETWEEN NK AND SOVIET TARGETS [redacted]

Type of Targets in Enemy Forces [redacted]

Detailed assessments have been undertaken on the vulnerability of Soviet division forces in recent studies sponsored by DNA.* Extrapolations of some of these results can be translated into an improved basis for defining enemy vulnerability by comparing the characteristics of NK and Soviet division forces.

[redacted] Soviet Division Threat Vulnerability - DNA Contract No. DNA001-77-C-0037 and Nuclear Cannon Effectiveness - DNA Contract No. DNA001-77-C-0077.

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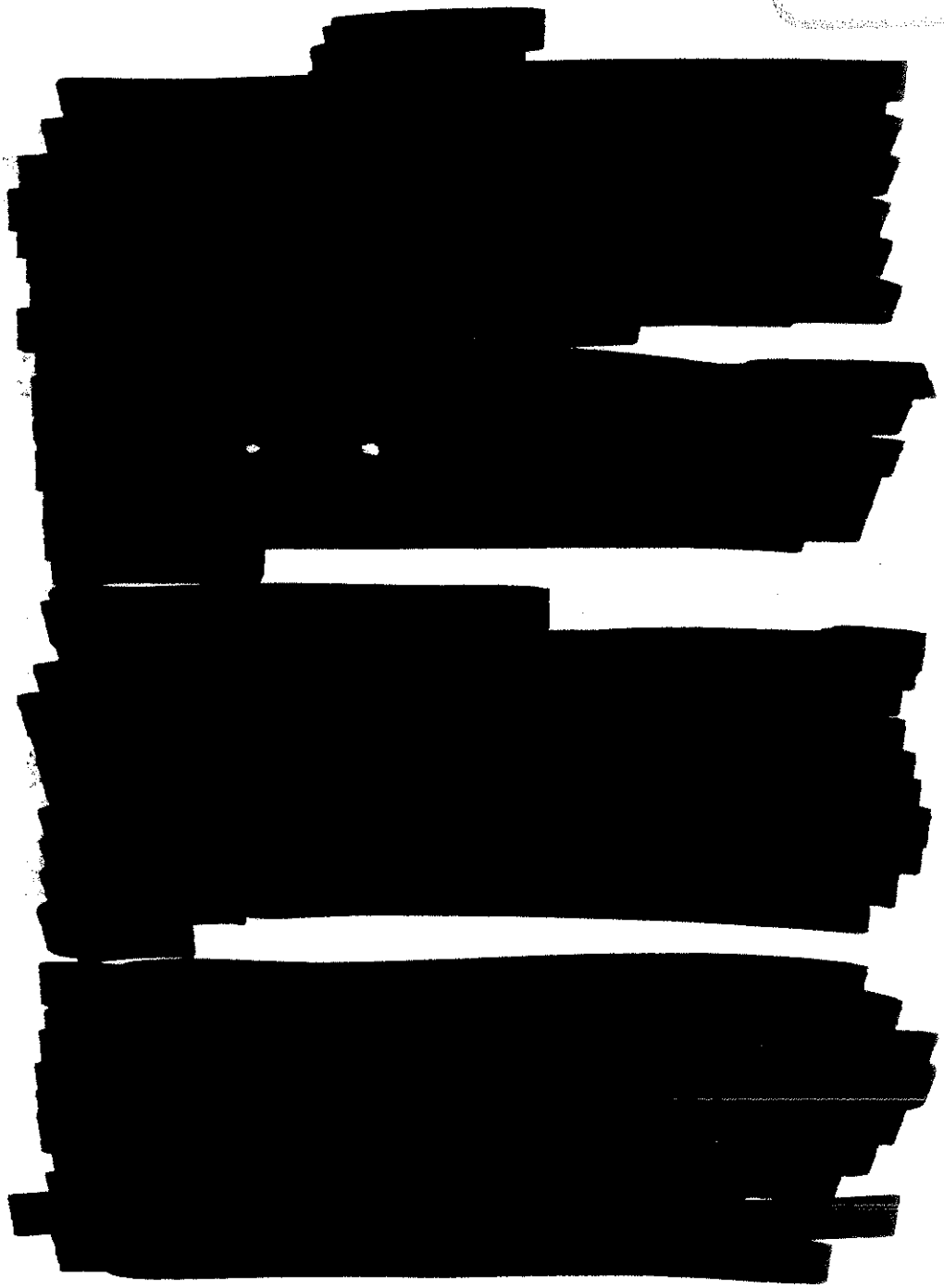

Pages 2-12 through 2-17 were deleted.

[redacted]

Characteristics of US Weapon Systems [redacted]

The operational characteristics of the 155 mm and 8 inch cannon, missiles, and strike aircraft are summarized in Table 2-11. These data for cannon and aircraft are used as nominal values in this study.

[no APMs, no DSs, nor N-WHs.]

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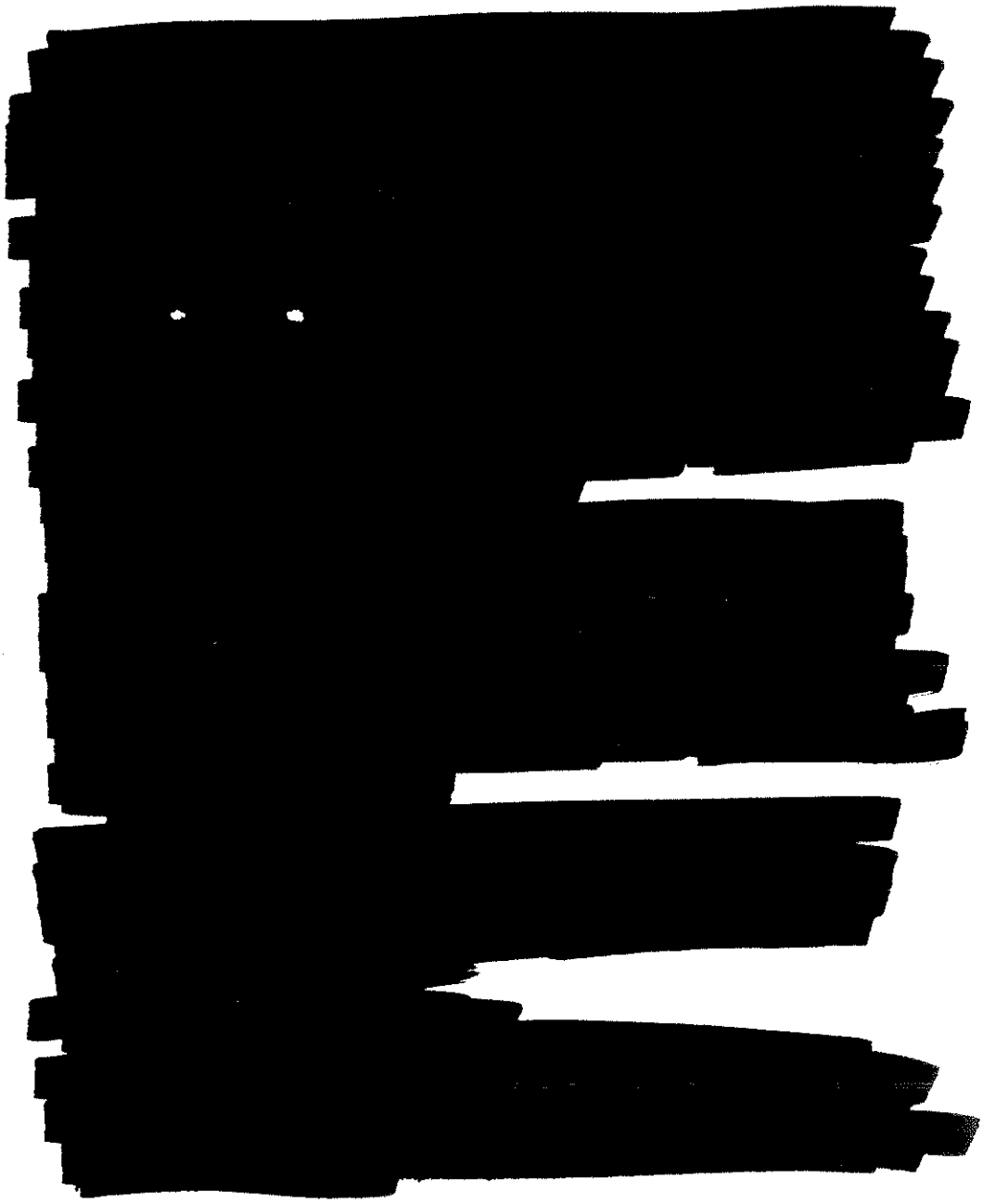


[redacted]

[redacted]

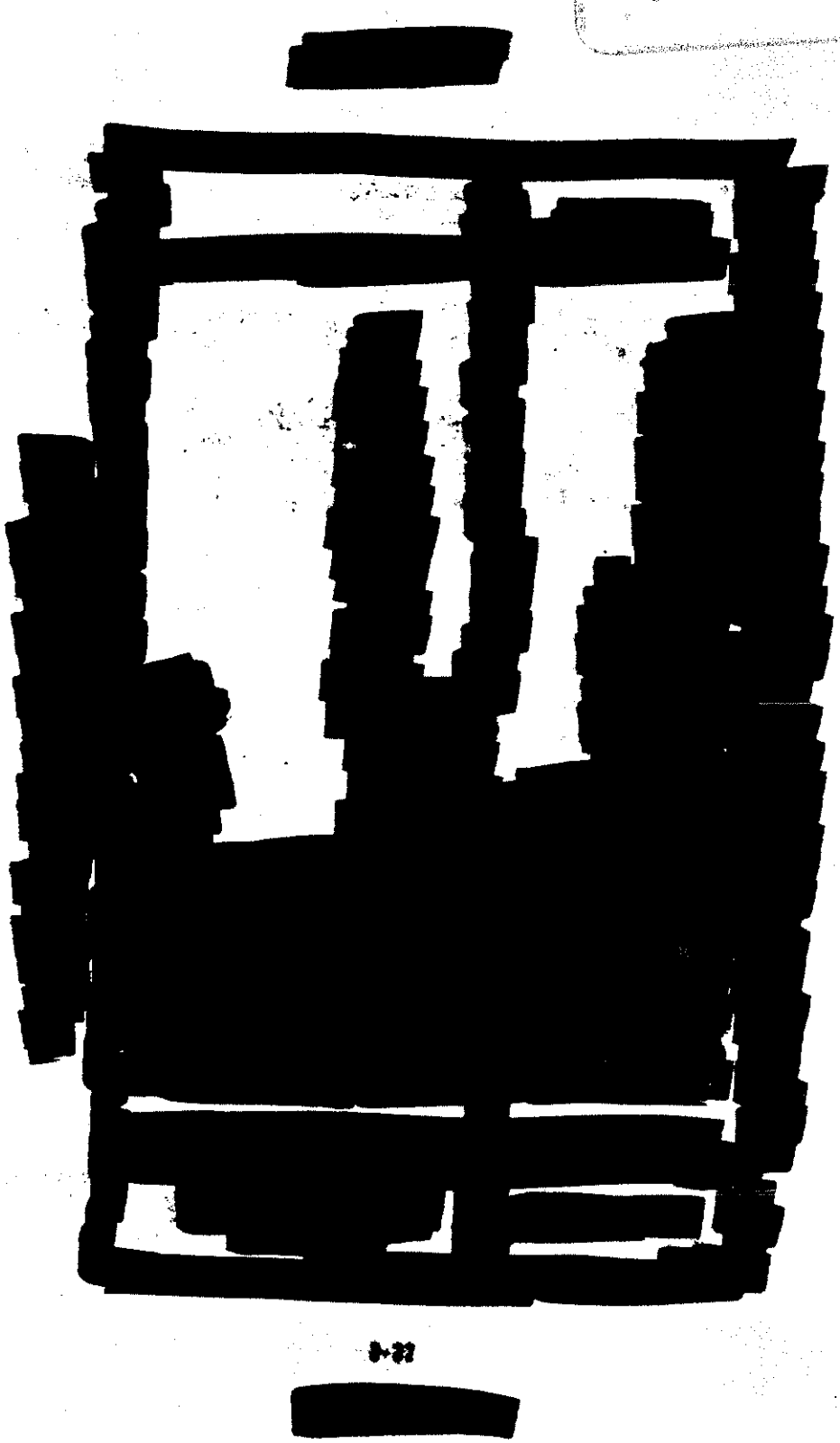
[redacted]

[redacted] The capability of allied forces to acquire targets is based on both the number of sensor assets and their projected performance levels. The capability to acquire selected targets using these assets must be predicted based on an evaluation of the cumulative acquisition capabilities of individual sensors operating within specified operational conditions. Allied capability is assessed in terms of target location error as well as the probability of target acquisition.

[redacted] Target Acquisition Capabilities [redacted]

The major variables that affect US capability to acquire targets are sensor performance, number of sensors, frequency of observations, target time in position, cover and concealment at the target, degree

[redacted]



[redacted]

[redacted]

[redacted] In situations where the primary target acquisition means are forward observers, the shape of the FEBA has a marked influence on the capability to acquire targets for nuclear fire support. Figure 2-4 illustrates three different FEBA configurations associated with enemy penetration attacks. Obviously, target acquisition is best when strong shoulder defenses can be maintained. The implications of FEBA shape on TA are explained in the sensitivity analysis contained in Chapter 5. Terrain features as well as military operations in adjacent divisions affect the FEBA shape. Limited shoulder defense (Case B) is used to reflect the nominal or typical situation for ROK forces deployed to defend against shallow and deep enemy penetrations. Values for P_A* are developed by the TA routine described in Chapter 3 from factors for visibility, target availability, target activity, probability of line-of-sight, and cover/concealment for each sensor type and time period of interest. The number of acquired units portrayed in this table are developed by combining the P_A with target lists extracted from the target arrays.

[redacted]

*Probability of Acquisition

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[redacted]

[redacted]

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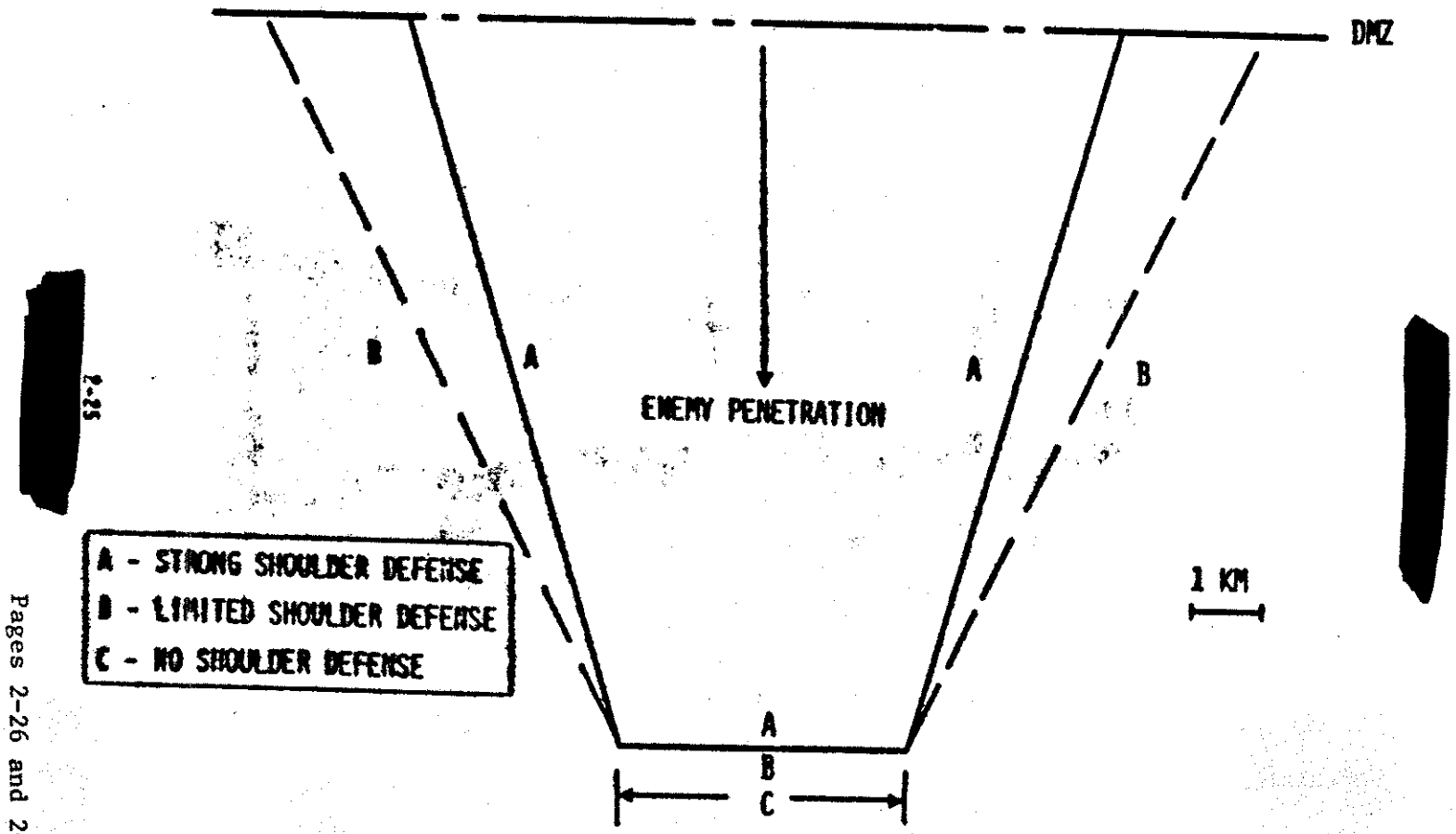

Figure 2-4. Alternative FEBA configurations.

Pages 2-26 and 2-27 were deleted.

[redacted]

[redacted] Chapter 3

ENGAGEMENT FACTORS AND CONSIDERATIONS[redacted]

[redacted] GENERAL REMARKS

This chapter presents a description of the models used to calculate target damage and the input data used to assess the outcome of tactical nuclear attacks on deployed NK forces. A discussion is also included on the various targeting options and weapon allocation schemes which could be employed against combat arms units* near the FEBA.

The Combat Systems Survivability Model (CSSM) is used to calculate damage to combat arms units and functional areas from direct nuclear effects. Targeting options are tailored to satisfy delivery system constraints, firing doctrine, and damage objectives. Assumptions on troop safety considerations, permissible spread in firing times, allowable distances between nearby burst points and available nuclear assets are incorporated into these targeting concepts.

(constraints)

The direct nuclear effects are based upon calculations of the fraction of personnel or materiel within a combat unit incapacitated or damaged according to some specified criterion. The number of units incapacitated by a weapons laydown depends upon the unit incapacitation criteria, the distance from the burst point, the shielding available at the target and the environmental conditions. Incapacitation of personnel is based upon the weapon effects from blast, nuclear radiation and thermal radiation. Weapon effects associated with blast are employed to determine materiel damage levels. An incapacitated unit is considered to be unable to participate in the mission for the duration of the phase of combat being evaluated.

*Combat arms units are considered to be platoon or battery equivalent size forces in the functional areas of artillery, combat (maneuver), command and control, air defense and antitank.

[redacted]

[redacted]

[redacted]

CHARACTERISTICS OF DIRECT EFFECTS ASSESSMENT MODEL

Key Elements and Procedures

This section presents an overview of relevant elements of the Combat Systems Survivability Model and serves as a framework for describing the required input data, major assumptions, and critical factors involved in the engagement analysis and direct target damage calculations.* Also, the procedures performed by the model are outlined to provide an indication of the data requirements and type of results produced in the analysis of threat division vulnerability.

The key sub-routines of the Direct Damage Effects portion of the CSSM consist of the following:

- Acquired Target List (ATL)
- Weapon Allocation (ALG)
- Weapon Aim Point (WAP)
- Weapon Effects (WE)
- Direct Damage Calculation (DDC)

The Direct Effects Assessment Model has a routine for portraying detailed damage to the combat force in terms of target type, combat units, and functional areas affected by a nuclear attack as a function of time

*Although the CSSM has routines for determining the indirect and internal damage effects, these sub-models will not be described in this report as the main thrust of the analysis is on the evaluation of direct damage effects.

[redacted]

[redacted]

and expended nuclear resources. A listing and description of the targets used in the analysis is also included. Model results are presented in terms of the fraction of the combat arms units damaged to specified levels by each type of warhead effect (blast, thermal, nuclear radiation and EMP) and the number of units damaged in each of the functional areas.

Features of Direct Effects Calculations

Table 3-1 shows the key components which are included in the Direct Effects Model. The Model has routines and logic for performing calculations dealing with weapon effects, target vulnerability, nuclear weapons allocation and target damage.

The Acquired Target List Routine (ATL) operates on the list of targets available to determine the number of each type of target acquired. The selection of acquired targets is determined based upon estimates of the probability of target acquisition. A Monte Carlo technique is employed to specify which targets of a given type are acquired and the expected damage to targets from direct effects is assessed as a function of time.

Weapons are allocated against the acquired list using the Weapons Allocation Routine (ALG) which incorporates the desired attack strategy and the constraints on available weapons. Weapons are allocated on the basis of target value and capability to damage each target using a modified Lagrange Multiplier technique. Yields are based upon the matching of target vulnerability to yield or the achievement of maximum target damage to both the acquired and adjacent targets (bonus effects).

The Direct Damage Calculation Routine (DDC) uses the designated aim point and the warhead yield defined by the Weapons Allocation Subroutine (ALG), along with the nuclear environment defined by the Weapons Effects Sub-routine (WEM), to determine the damage to all targets near the burst point of the nuclear warhead. The burst point is different from the aim point due to delivery system error.

[redacted]

Table 3-1. Key components of direct effects assessment model.

Direct Effects Model	Driving Factors/Parameters	Model Applications
Acquired Target List Routine	Available Sensors Target list by range Time period of interest Probability of Acquisition	• List of potential targets
Weapons Allocation Routine	Target value/vulnerability Damage objectives Target dynamics Weapon characteristics Target location errors Targeting constraints	• Target selection • Weapon aim points • Weapon yields
Weapon Effects Routine	Target exposure Environment Target vulnerability Target response Damage criteria (EMP, blast, thermal, nuclear rad)	• Probability of incapacitation/ damage as function of: Weapon characteristics Distance from burst point Damage criteria
Direct Damage Calculation Routine	Weapon aim points, CEPs, yields, and HOB Target characteristics/deployments Damage criteria Rules for assessing damage	• Damage to attacked personnel/ materiel • Damage to combat units • Damage to types of targets • Bonus effects

[redacted]

ATTACKER OPTIONS AND PLANNING FACTORS

Military Damage Objectives

The attacker must consider the value of targets and the level of desired damage against acquired or suspected targets before weapons are assigned against an opposing force. Damage objectives and target values are means for allocating the nuclear assets of the attacker in a systematic manner. Table 3-2 displays a partial list of objectives postulated for representative targets in a NK reinforced infantry division. Target priorities are based upon the desired level of target damage (to achieve unit destruction or suppression) and target value (to account for military significance and threat to the combat operation).

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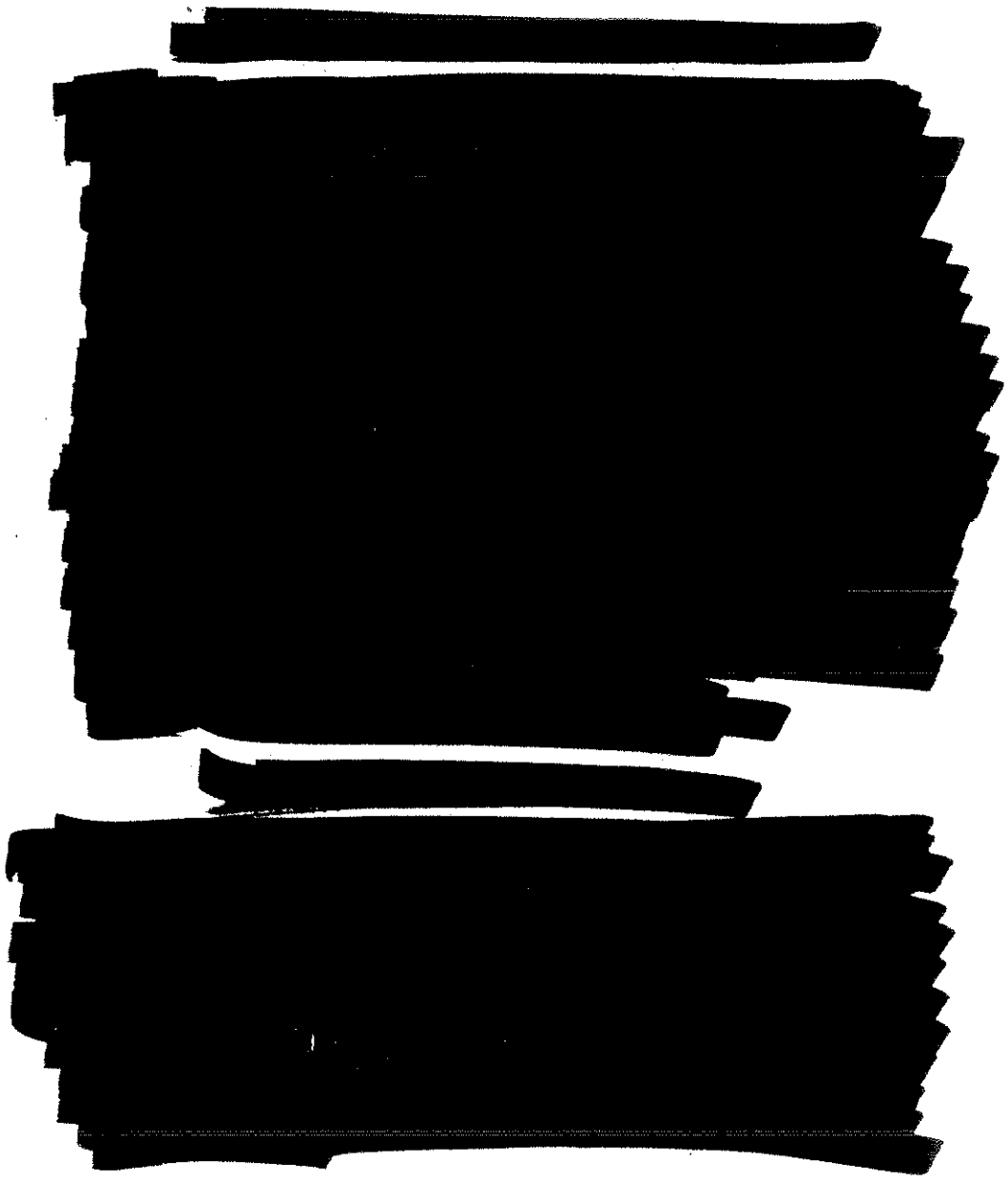

[redacted]

[redacted]

[redacted]

[redacted] Laydowns for each phase of combat are tailored within the constraints imposed by reaction times, firing rates, and phase duration. Target development is considered to commence early enough to facilitate daylight engagements and acquired targets are randomly selected for attack at designated times. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted] Prediction of Target Vulnerability for an Attack [redacted]

In order to assign an appropriate number of warheads and yields to a target consistent with delivery system accuracy, the elements within the target must be selected for incapacitation or damage and the likely posture of these elements must be estimated.

[redacted]

[redacted] Selection of Targets for an Attack [redacted]

Targets are selected for attack based upon the acquired target list, the value of each target, and the target vulnerability to the available weapons. The acquired targets are determined from the target arrays in the NK division and target acquisition capability of the opposing allied force as outlined in Chapter 2. The number of targets acquired in each major group is determined by the probability of acquisition, the number of each type target in each range band, and

[redacted]

[redacted]

the target acquisition means (current, nominal or enhanced). Within the model, a Monte Carlo technique is used to select the types and locations of targets actually acquired, as a means to simulate the operational situation. For simplicity, targets with similar characteristics and probabilities of acquisition are grouped and processed together. Accordingly, the total number of targets acquired in a given functional area (e.g., command and control) will vary and may not reflect the increase in acquisition capability as additional means are included. Nevertheless, the total number of targets of all types acquired increases as the acquisiton means improve.

[redacted] Targets selected by the Weapons Allocation Sub-routine are listed in Tables 3-9 and 3-10 for various operational situations. Table 3-9 shows the targets selected in the shallow penetration phase as a function of allied target acquisition means and capability. Table 3-10 portrays the influence of phase of combat on the list of selected targets.

[redacted] The values indicated for each of the targets selected offer some insight into relative target ranking and payoff from the allocation of warheads. Tables 3-9 and 3-10 show that most of the acquired targets are found in the combat functional area. For the examples in Tables 3-9 and 3-10, the acquired targets can be attacked if sufficient warheads are present in the defending forces.

[redacted] Limited improvements in US acquisition capability, as shown in Table 3-9 result in about a 10 percent increase in acquired targets. Modest increases in capability to acquire artillery and air defense units are realized by improved TA.

[redacted] Table 3-11 shows the distribution of weapon types and warheads assigned to targets in two phases of combat. [redacted]

[redacted] Table 3-12 shows the details of the warhead/target match in the NK shallow penetration phase. This table reveals that the largest

[redacted]

[redacted]

[redacted]

3-14 Pages 3-15 and 3-16 were deleted.

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[redacted]

[redacted]

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[redacted]

fraction of the cannon warheads is assigned to combat targets due to their high signature and proximity to the FEBA.

[redacted]

[redacted] WEAPON EFFECTS CONSIDERATIONS [redacted]

[redacted] Weapon Effects Parameters [redacted]

[redacted] This section highlights some aspects of the weapons effects calculations that have a bearing on the vulnerability of deployed division forces. Damage to personnel is defined as combat incapacitation (CI). The CI calculation includes nuclear radiation, blast, and thermal effects. In the case of materiel, blast damage is indicated for light, moderate, and severe levels.

[redacted] The input parameters for the calculation of expected combat incapacitation from a nuclear burst include:

- Yield, height of burst, and type of warhead
- Delivery system and target location errors
- Target posture or exposure
- Time after nuclear burst detonation
- Season, cloud-cover, and visibility.

[redacted] Target posture is determined by considering the fraction of personnel in the open, foxholes, weapon emplacements, APCs, and tanks. For calculation of the blast effects, personnel in the open are standing, prone, or in a combination of positions.

[redacted]

[redacted]

Table 3-14 [redacted] Nuclear radiation transmission factors [redacted]

Posture of Personnel Target	Neutrons	Gammas
Exposed	1.0	1.0
Foxholes	0.3	0.2
Weapon Emplacements	0.05	0.05
APCs	0.9	1.0
Tanks	0.6	0.4

[redacted]

[redacted]

[redacted]

[redacted] Tables 3-15 and 3-16 provide some insights into personnel and materiel vulnerability data for selected warhead yields. Vulnerability radii for personnel at 3000 rads are shown in Table 3-15 for each shelter category. In Table 3-16 moderate II damage level criteria are used to illustrate blast damage radii for principal equipment in the NK divisions.

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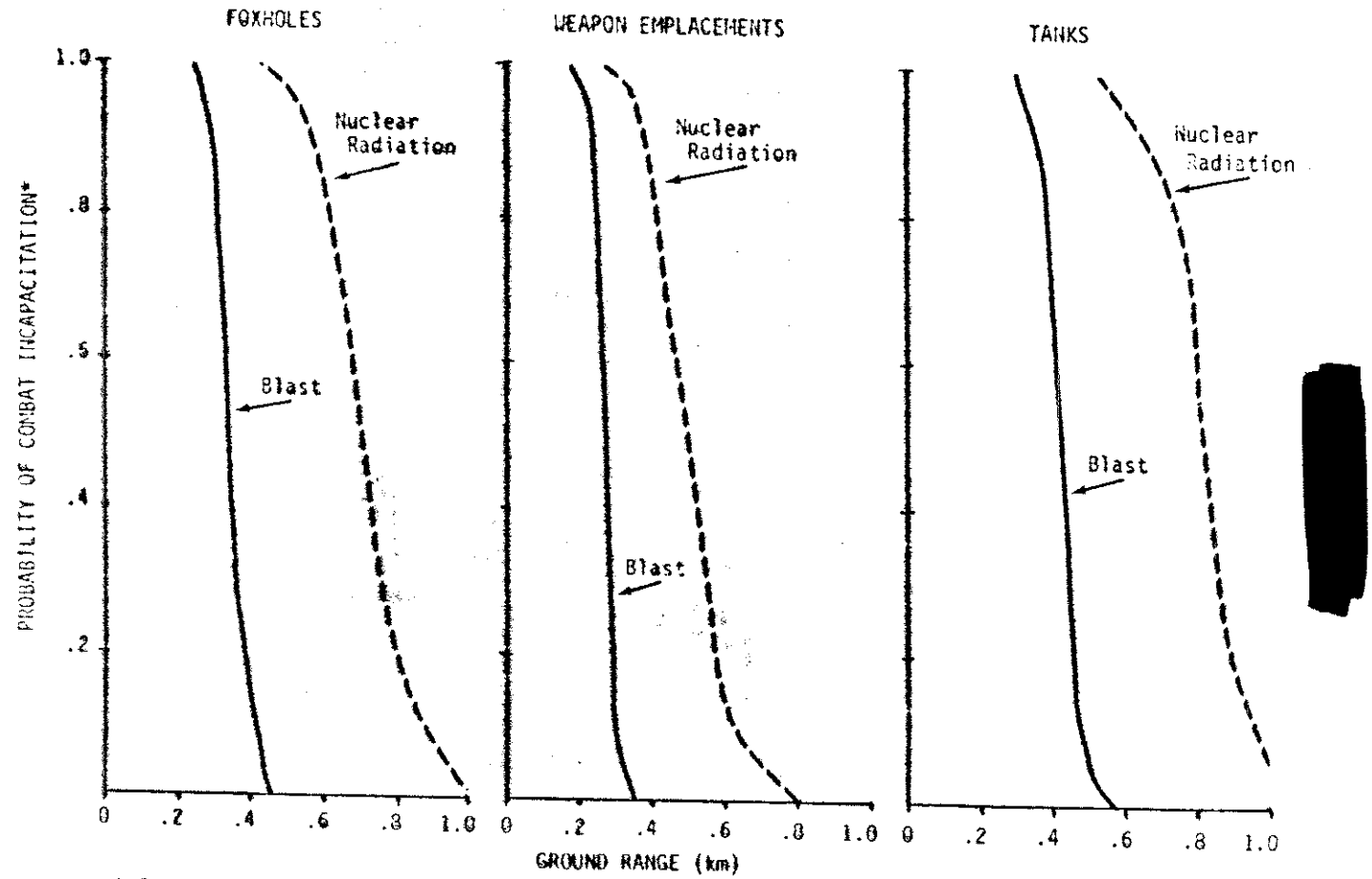

* Combat incapacitation from 650 rads or 43 psi (W=10 kt; HOB = 131 m 1 hour after burst)

Figure 3-2. Influence of target posture on combat incapacitation due to blast or radiation

[redacted]

[redacted]

[redacted]

[redacted] Chapter 4

COMBAT DAMAGE ANALYSIS [redacted]

[redacted] GENERAL REMARKS

This chapter presents an examination of the direct damage achieved against North Korean divisions [redacted] Emphasis in this chapter is placed on the number of combat arms units incapacitated by attacks against acquired targets. Since other units near the burst point may be within the warhead damage effects radii, the analysis focuses upon the bonus effects caused by the nuclear attack and the number and types of surviving combat forces.

The fraction of assets (personnel and equipment) and the number of incapacitated combat arms units in each functional area are used as indicators of the vulnerability of NK division forces. The influence of target damage criteria on type and level of damage sustained by a NK division in typical weapons laydown is also addressed in this chapter. Damage criteria of interest include level of nuclear radiation for personnel incapacitation, and the level of materiel damage and fraction of personnel or materiel lost in a unit prior to unit incapacitation.

Several excursions are considered in the following chapter to show the sensitivity of the results to variations in key assumptions and combat situations. The sensitivity to damage sustained by NK divisions is explored as a function of variations in combat phase, defense along shoulders of the enemy forces, target acquisition capability, targeting strategies and intensity of attack.

[redacted] INCAPACITATION OF A NK DIVISION [redacted]

Level of Unit Incapacitation [redacted]

For this analysis, levels of damage for unit incapacitation are estimated from considerations about the mission for the combat force.

[redacted]

[redacted]

a review of wartime experiences, and estimates of the interchangeability of personnel and materiel within a unit. Units are postulated to be unable to continue their combat mission when significant portions of key items of the unit are lost. For the base case, units are considered to be mission ineffective from losses to 30 percent of the principal equipment (e.g., howitzers, tanks) or, 40 percent of the personnel, or, 50 percent of the radios.

[redacted]

Damage to Key Items in a Nuclear Attack

To provide a basis for exploring the vulnerability of a NK division size force, a shallow penetration phase of an attack is selected as the base or reference combat situation for analysis. A NK infantry division is postulated to penetrate across the demilitarized zone on a 5 km front against part of a ROK division force.

Shelton
5km front

[redacted]

[redacted]

The Allied Force is considered to employ only visual and radar means for target acquisition. [redacted]

[redacted] In the penetration phase, 85 percent of the combat arms units in a reinforced infantry division are within 7 km of the FEBA. Artillery units are deployed as batteries and maneuver units are primarily deployed as platoons. The penetration phase is considered to take place over an 8 hour time period. The Allied forces are considered to maintain a limited defense along the shoulders of the enemy penetration in the base case situation to aid in target acquisition and containment of enemy forces.

[redacted]

Pages 4-4 through 4-7 were deleted.

[redacted]

[redacted]

[redacted] Type of Materiel Damage [redacted]

In addition to the personnel incapacitation criterion employed, unit incapacitation may depend upon damage to principal equipment or radios. Table 4-1 shows the number of combat units incapacitated in the preparation phase when the unit incapacitation criterion is based upon personnel casualties or materiel damage. The number of units incapacitated by nuclear blast effects on principal equipment using materiel damage as the criterion (based on definitions described in EM-1) is compared to the number of units ineffective due to personnel casualties.

[redacted]

[redacted] Figure 4-4 shows the change in number of units considered incapacitated in the shallow penetration phase using different casualty/damage criteria for personnel, equipment, and radios. The number of units incapacitated is based on a combination of blast and radiation for personnel and blast for principal equipment and radios. The vulnerability of NK radios to EMP effects is not assessed due to the lack of information on possible equipment hardening an designs for radist/electronic devices in the enemy divisions.

[redacted]

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Pages 4-10 through 4-13 were deleted.

[redacted]

[redacted]

[redacted] Number of Delivered Warheads [redacted]

[redacted] The number of warheads employed in the attack of an enemy combat force depends upon the number of acquired targets, the number of delivery systems available, the rate of fire or sorties per day, and the time available for attack.

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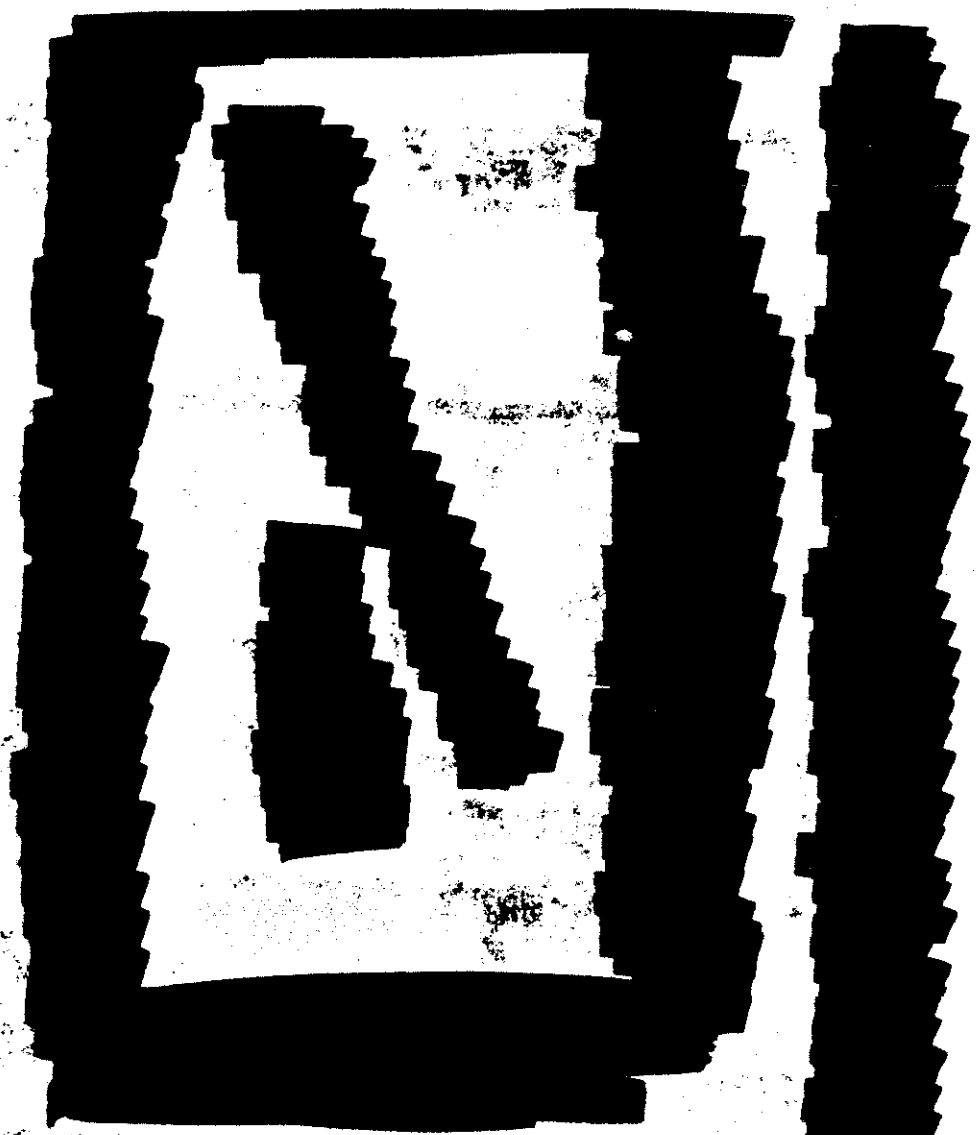

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[redacted] Targeting Doctrine [redacted]

The examination of the direct nuclear effects in the preceding sections is based upon the engagement of acquired NK targets under a set of constraints designed to minimize hazards [redacted] This section shows the implications of changes in targeting doctrine to include actual troop safety constraints and the employment of packages of nuclear weapons against deduced or suspected targets.

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4-17 Pages 4-18 through 4-21 were deleted.

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Chapter 5

SENSITIVITY ANALYSIS

GENERAL REMARKS

The intent of this chapter is to show the influence of variations in key assumptions and driving factors on the damage analysis presented in the preceding chapter. Attention is directed toward evaluating the impact of changes in the combat situation, target vulnerability and the warhead technology. The implications of variations in target acquisition capability are treated in the previous chapter so further considerations are only related to situations involving changes in the phase of combat, the strength of the defensive positions or the application of new warheads.

Since a large fraction of the acquired targets is obtained by forward observers (especially in the absence of US sensors), the capability of the defenses to position available assets along the flanks and edges of the penetration affects the engagement opportunities. Also, some differences in vulnerability of enemy forces are expected to occur as the various phases of combat unfold over time.

why absent? troop WD?

[redacted]

VARIATIONS IN COMBAT SITUATIONS

Phase of Combat

The target damage analysis presented in the previous chapter is based upon a shallow penetration of about 8 KM by a NK division. This section deals with the vulnerability of 2 NK divisions

[redacted]

[redacted]

deep - 15 km into SK

penetrating to a depth of about 15 KM into South Korea [redacted] The variations in weapon and sensor assets available for use [redacted] are considered to be the same as the shallow penetration case. The enemy forces are more uniformly distributed throughout the division areas and the shape of the FEBA caused by the characteristics of the terrain is more distinct in the deep penetration case.

[redacted]

5-2 Pages 5-3 and 5-4 were deleted.

[redacted]

[redacted]

[redacted]

Defense Strategy [redacted]

The previous analyses assume that limited defense exists along the shoulders of the penetrations so some opportunities are available to observe and acquire enemy targets all along the flanks using ground based forward observers and airborne sensor systems. The implications of maintaining strong defenses along the shoulders (close contact with enemy forces) or no defenses along the shoulders (only contact with the forward edge or line of the enemy penetration) is examined in this section for shallow and deep penetrations.

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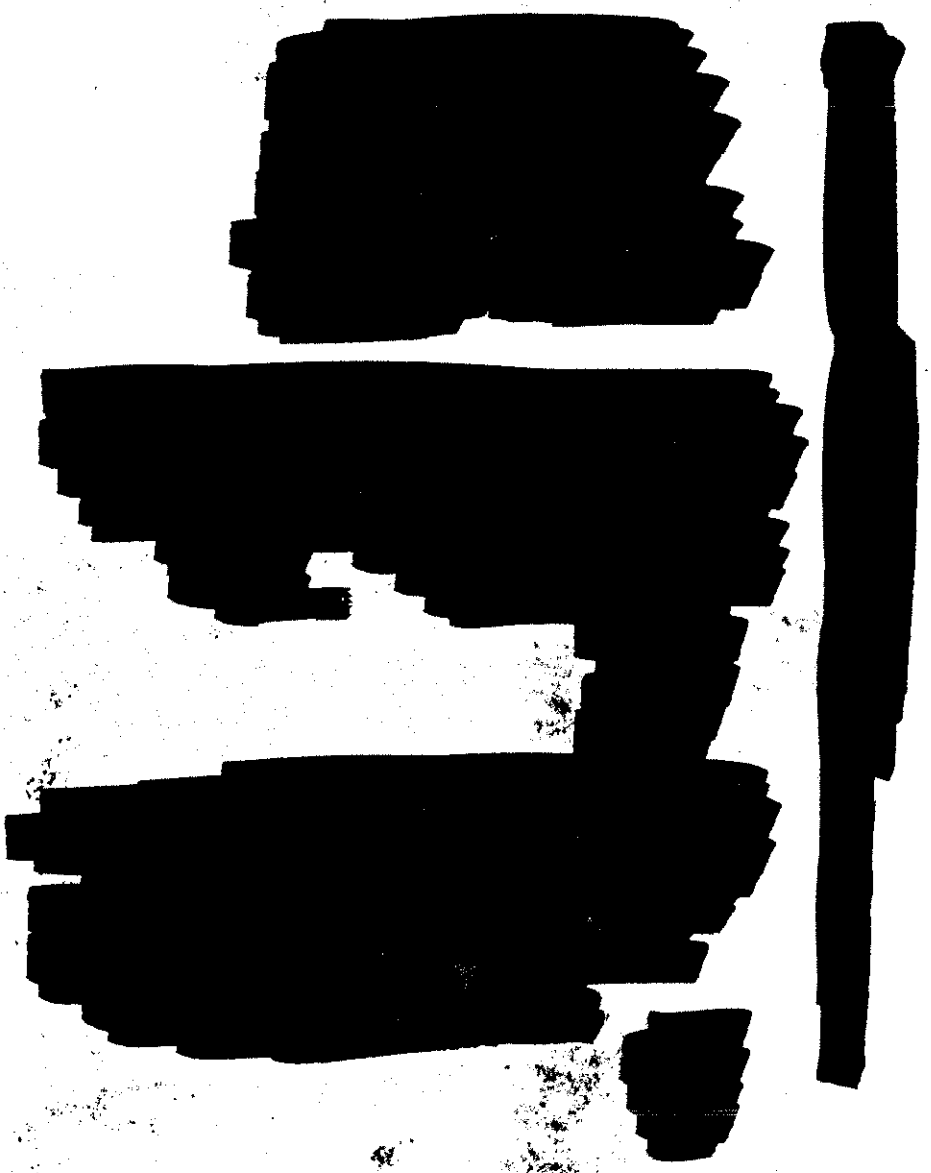

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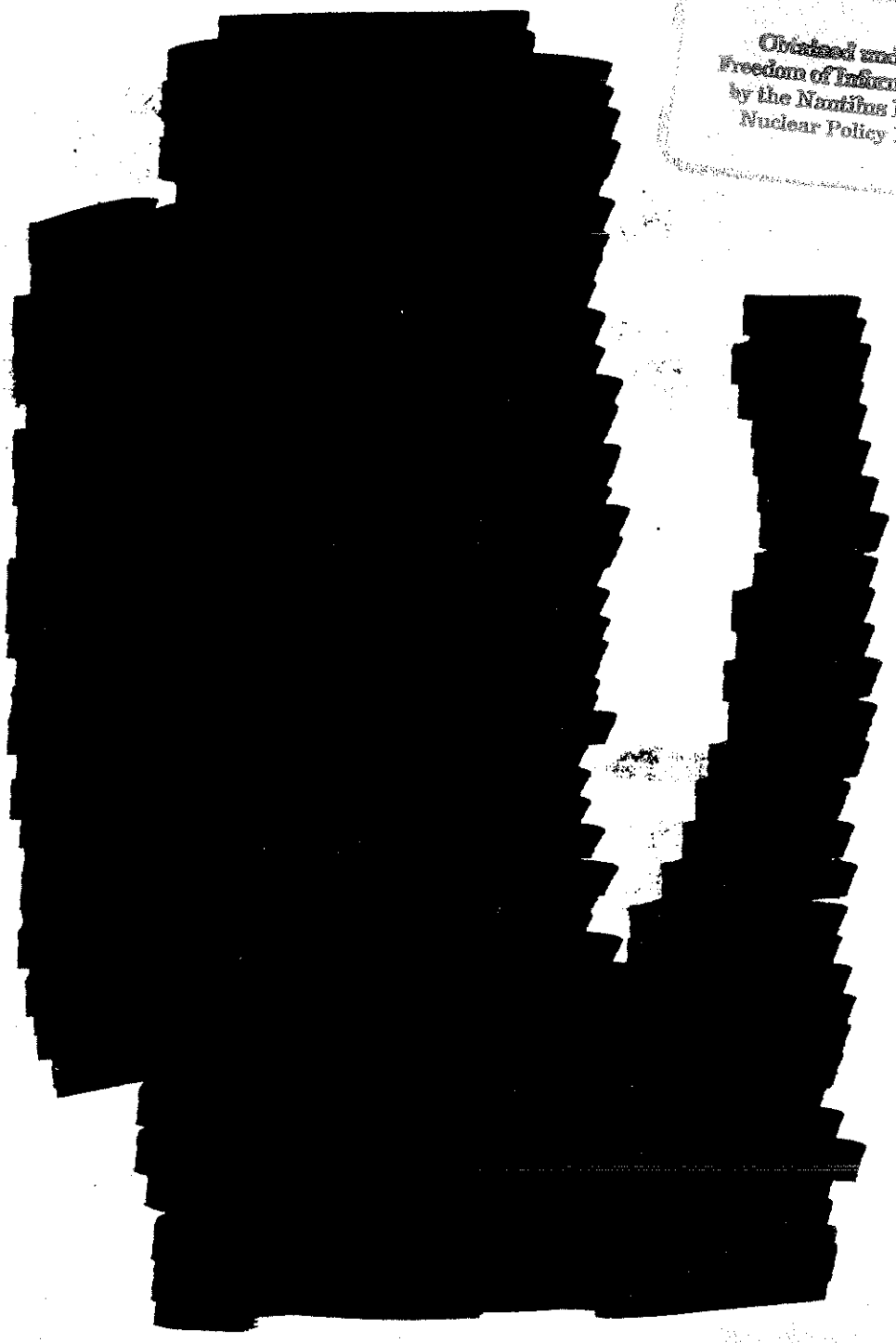

[redacted]

[redacted]

Level of Personnel Exposure

In the base case, target vulnerability is determined by assuming that 50 percent of the exposed personnel are standing and 50 percent are prone at the instant of nuclear burst. The remainder of the personnel are considered to be in some combination of foxholes, tanks, weapon positions or APCs depending on the type of unit. The amount of personnel damage produced by the thermal effects is directly related to personnel exposure level.

[redacted]

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[redacted]

Chapter 6

[redacted]CONCLUSIONS

[redacted] GENERAL

This chapter synthesizes the results and findings associated with the vulnerability of North Korean Divisions to tactical nuclear effects. The information and highlights presented in this chapter are based upon the analyses contained in the previous chapters of this report.

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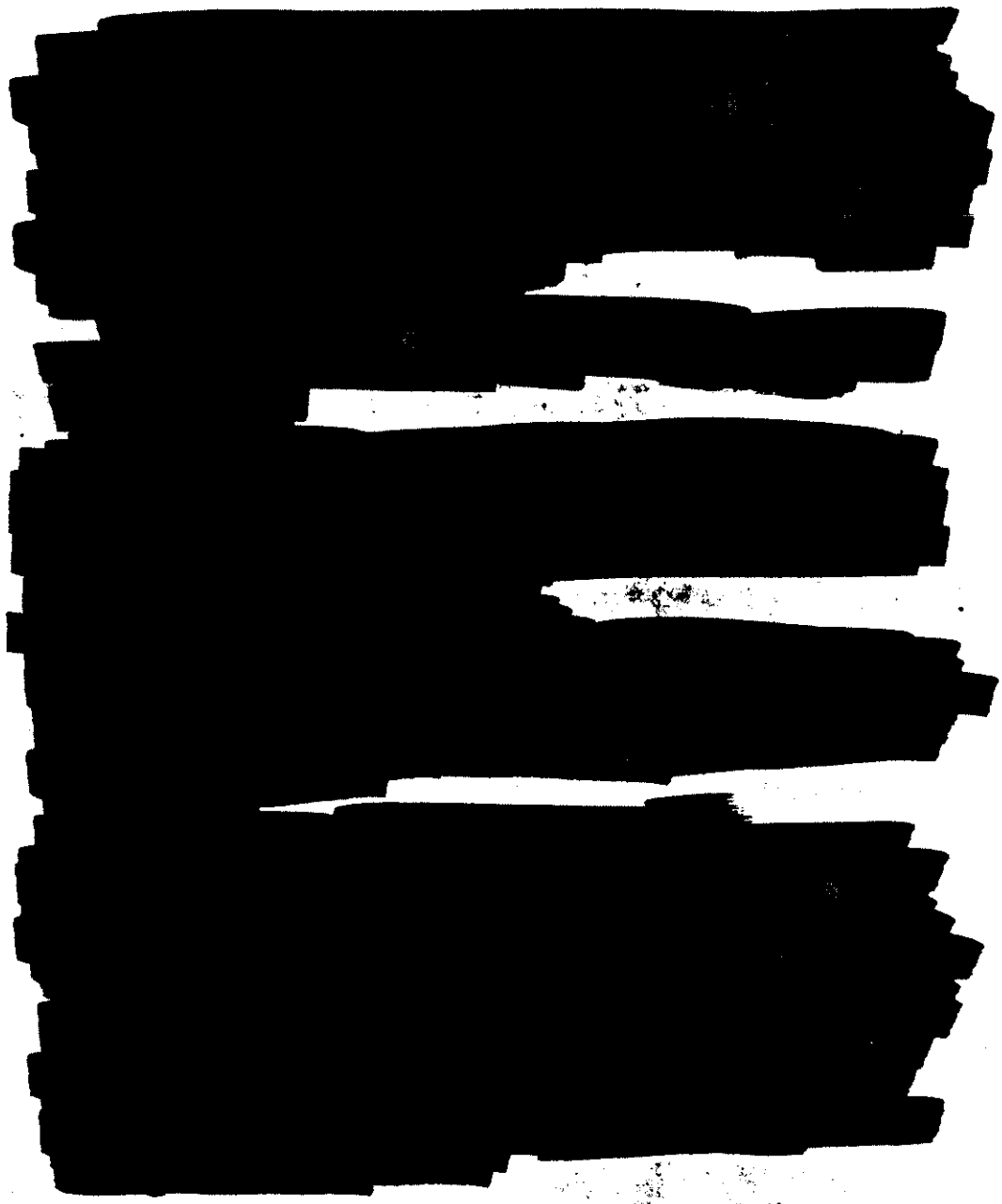

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