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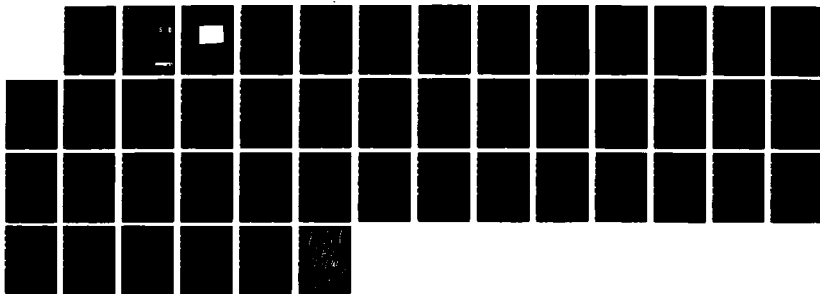
CURRENT AND PROJECTED TECHNOLOGICAL THREAT TO NATO
THEATER NUCLEAR FORCES (U) PACIFIC-SIERRA RESEARCH
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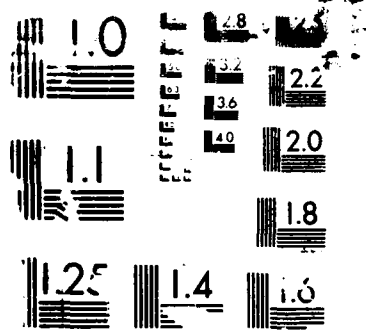
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CURRENT AND PROJECTED TECHNOLOGICAL THREAT TO NATO THEATER NUCLEAR FORCES (U)

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31 January 1980

Final Report for Period 1 February 1979-31 January 1980

CONTRACT No. DNA 001-79-C-0200

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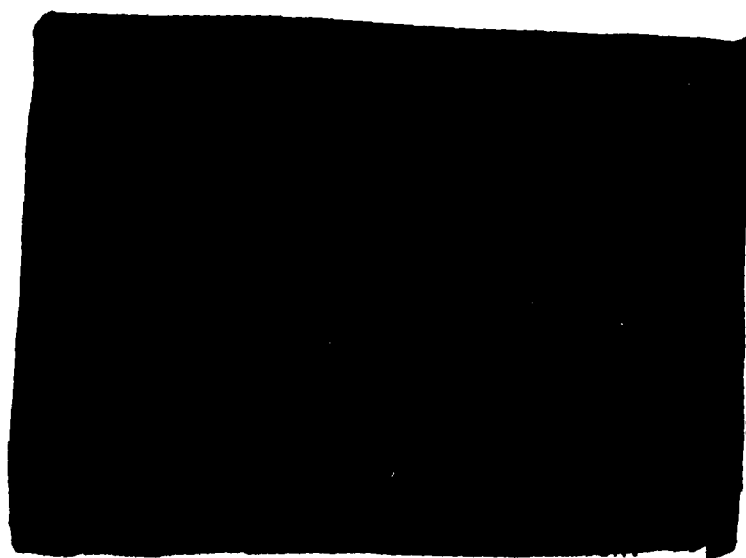
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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER DNA 5272F	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE and Subtitle CURRENT AND PROJECTED TECHNOLOGICAL THREAT TO NATO THEATER NUCLEAR FORCES (U)		5. TYPE OF REPORT & PERIOD COVERED Final Report for Period 1 Feb 79-31 Jan 80
6. AUTHOR D. H. Gloeckner E. A. Carroll		7. PERFORMING ORG. REPORT NUMBER PSR Report 1001
9. PERFORMING ORGANIZATION NAME AND ADDRESS Pacific-Sierra Research Corporation 1515 Wilson Blvd. Arlington, Virginia 22209		8. CONTRACT OR GRANT NUMBER(s) DNA 001-79-C-0200 ✓
11. CONTROLLING OFFICE NAME AND ADDRESS Director Defense Nuclear Agency Washington, D.C. 20305		10. PROGRAM ELEMENT PROJECT, TASK AREA & WORK UNIT NUMBERS Subtask A99QAXFA101-01 ✓
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE 31 January 1980 ✓
		13. NUMBER OF PAGES 180 ✓
16. DISTRIBUTION STATEMENT (of this Report)		15. SECURITY CLASSIFICATION (of this report)
		15
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES This work sponsored by the Defense Nuclear Agency under RDT&E RMSS Code B390079465 A99QAXFA10101 H2590D.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Soviet Theater Nuclear Forces, Technological Threat, Soviet Chemical Capability, Warsaw Pact Biological Warfare Threat Soviet CBR Capability Threat Projections		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) (U) This study presents estimates for Soviet/Warsaw Pact system characteristics that present a threat to NATO theater nuclear forces. It provides a baseline estimate of current threat while focusing on the characterization of a ten-year projected threat. This study expands on previous work characterizing current and projected threat systems from a technological point of view to include nuclear, chemical, and biological threat systems.		

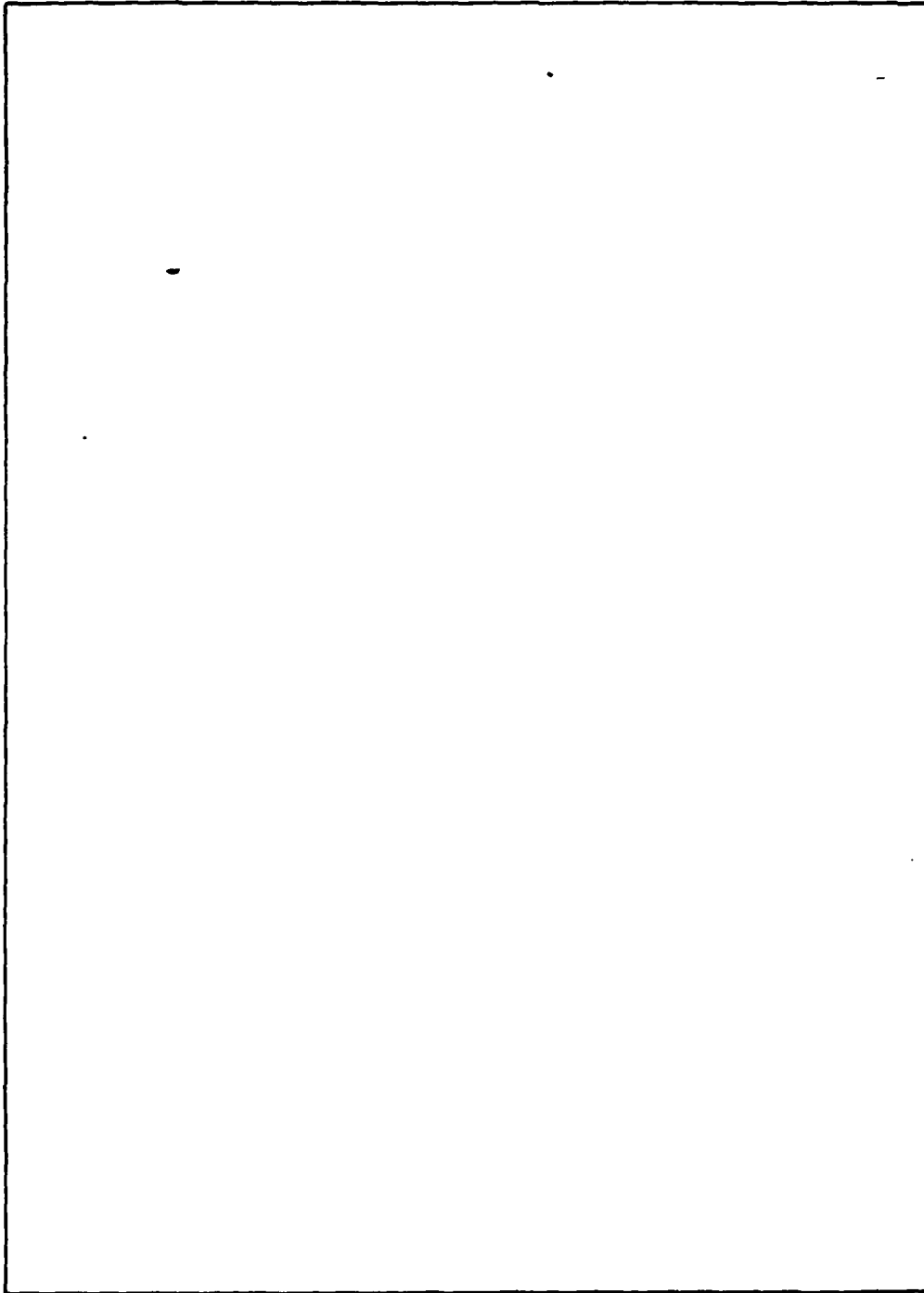
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EXECUTIVE SUMMARY

(U) This study presents estimates for those technical characteristics of Soviet/Warsaw Pact systems that affect their operational capability against NATO theater nuclear force (TNF) units and systems. It provides a baseline estimate of threat from current systems while focusing on the characterization of the threat projected ten years ahead. Threat characterizations and projections are based on approved Defense Intelligence Agency (DIA) documentation wherever possible. Where such documentation does not exist, estimates are based on assessments from DIA and other government analysts.

(U) The discussion expands on previous work characterizing current and projected conventional threat systems from a technological point of view [Gloeckner and Moe, 1979]. That work treated three aspects of the conventional threat: (1) target acquisition, (2) weapon delivery and lethality, and (3) sensor and weapon responsiveness. The description of threat system capabilities was presented in the context of weapon effectiveness to expedite subsequent use of the projected characteristics in anticipated survivability modeling of NATO forces under the TNF Survivability and Security program. This study expands that work to include nuclear, chemical, and biological threat systems.



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(U) It is also possible that one or more new agents, in addition to the low-volatility nerve agent noted above, may be deployed with significantly enhanced toxicity against partially protected troops. Additionally, it is possible that new agents could force NATO troops to accept increased burdens to maintain acceptable levels of protection. The new agents may be binary, hence making possible the stockpiling and fielding of otherwise unstable agents. The introduction of binary agents would also greatly reduce safety-related constraints imposed on handling during manufacturing and use.

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PREFACE

(This Preface is Unclassified)

This volume reports on work performed under contract to the Defense Nuclear Agency from February 1979 through January 1980.

All primary results in this report are presented in metric (SI) units; in a few places, however, conversion of supporting data to metric units seemed inappropriate. In those cases, the following table may be useful:

Conversion factors for U.S. customary to
metric (SI) units of measurement.

To Convert from	To	Multiply by
degree of angle	milliradian (mr)	$1.745\ 329 \times E + 1$
nautical mile (nm)	kilometer (km)	1.852
foot (ft)	meter (m)	$3.048\ 000 \times E - 1$
inch (in.)	meter (m)	$2.540\ 000 \times E - 2$
micron (μ)	meter (m)	$1.000\ 000 \times E - 6$
knot (nm/hr or kn)	meters/second (m/sec)	$5.144\ 444 \times E - 1$
pound (lb)	kilogram (kg)	$4.535\ 920 \times E - 1$

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Section 1
(This Section is Unclassified)

INTRODUCTION

This report develops estimates of the technical characteristics and capabilities of Warsaw Pact nuclear, chemical and biological weapon systems that threaten NATO Theater Nuclear Forces (TNF). The study, in support of the Defense Nuclear Agency (DNA) TNF Survivability and Security (TNF S²) program, characterizes threat systems in the context of weapon effectiveness to better facilitate subsequent survivability modeling, testing, and S² upgrade evaluation within the program.

An estimate of the current threat, and two estimates of the ten-year projected threat are provided. The current threat is presented as a baseline point of departure, while the study emphasizes the projected threat. The study gives two ten-year projections in an attempt to bracket the threat to upgraded NATO TNF at the end of the 1980s. The threat estimates are based on approved Defense Intelligence Agency (DIA) documentation wherever possible. Where such documentation does not exist, estimates are based on personal assessments from DIA or other government analysts.

The report focuses on threat system capabilities rather than on threat tactics, doctrine, or intentions and the discussion of capabilities is mainly confined to those of a technological nature. No order of battle or descriptive scenarios are provided.

The discussion expands on previous work characterizing conventional threat systems from a technological point of view [Gloeckner and Moe, 1979]. That work treated three aspects of the conventional threat: (1) target acquisition, (2) weapon delivery and lethality, and (3) sensor and weapon responsiveness. The work did not include direct-fire ground systems or Soviet naval assets. This study includes Soviet naval (nuclear) assets capable of targeting Europe, but does not include Soviet antiship or antisubmarine systems, nor direct-fire ground systems.

The report consists of three self-contained sections covering the nuclear (Section 2), chemical (Section 3) and biological (Section 4) threats, and an appendix covering details of Soviet/Warsaw Pact chemical-biological-radiological (CBR) defensive capabilities. An unclassified annex [Anno and Dore, 1979] provides a parametric analysis used in Section 2 to assess the possible impact of the projected threat systems.

SECTION 2

(U) CURRENT AND PROJECTED NUCLEAR THREAT

(U) This section is divided into three parts. The first part describes current Warsaw Pact nuclear weapon systems (which are under strict Soviet control), concentrating on the delivery systems, but including estimated yields for all systems. The second part presents estimates for the projected systems, and also includes a discussion of Soviet nuclear warhead technology. While projections for nuclear delivery systems are based on relatively firm intelligence, there is little information on current tactical nuclear warhead design. Therefore projection for Soviet tactical warhead design types are speculative, and are based largely on perceived Soviet requirements. The second part ends with a preliminary, first-cut analysis of the capability of the projected systems as a function of target hardness. The last part of this section concludes with an assessment of the impact of current and projected Soviet nuclear weapon systems on NATO TNF.

(U) CURRENT SOVIET/WARSAW PACT THEATER NUCLEAR WEAPON SYSTEMS

(U) There are two broad categories of Soviet theater nuclear forces (TNF): (1) the theater-strategic^{*} forces of the Strategic Rocket Forces (SRF), the Long Range Aviation (LRA), and navy (aircraft and missiles); and (2) forces under control of the front and subordinate commanders. The theater-strategic forces may provide the initial, massive nuclear assault, and, in addition, be called upon for secondary strikes when forces under the front commanders are not available, or are unsuitable. Nuclear-capable assets under direct control of the front include SCALEBOARD and SCUD missiles, FROG rockets, tactical aviation and possibly nuclear capable artillery.

^{*}(U) Theater-strategic refers to Soviet strategic assets, including Soviet operational-strategic missiles, that have a probable European mission, and contrasts with intercontinental strategic assets, such as the SS-18, and with the operational-tactical missiles, such as SCALEBOARD controlled under front or subordinate commands.

(U) Soviet naval cruise missiles are launched from both submarines and surface ships. Table 6 includes all current and projected naval cruise missiles with a nuclear capability. A new long-range submerged-launch cruise missile, SS-NP-VI, is not included in Table 6 due to lack of specific projection data. That missile may be intended for the new class SSGN-P-I submarine that should be operational in 1981.

* (U) The capability of the Soviet navy for antisubmarine warfare or anticarrier warfare against elements of NATO INF is not systematically explored here.

(U) The following section discusses nuclear weapon technology judged achievable for the Soviets by 1989 and notes those technologies that appear particularly interesting from the Soviet point of view.

(U) The nuclear weapon innovations outlined above, all judged achievable for the Soviets by 1989, are summarized in Table 11. This list is by no means comprehensive. Consideration has been limited to innovations directly related to weapon effectiveness, and innovations in nuclear logistics, and command and control may also be expected.

Soviet Nuclear Delivery System Technology Trends (U)

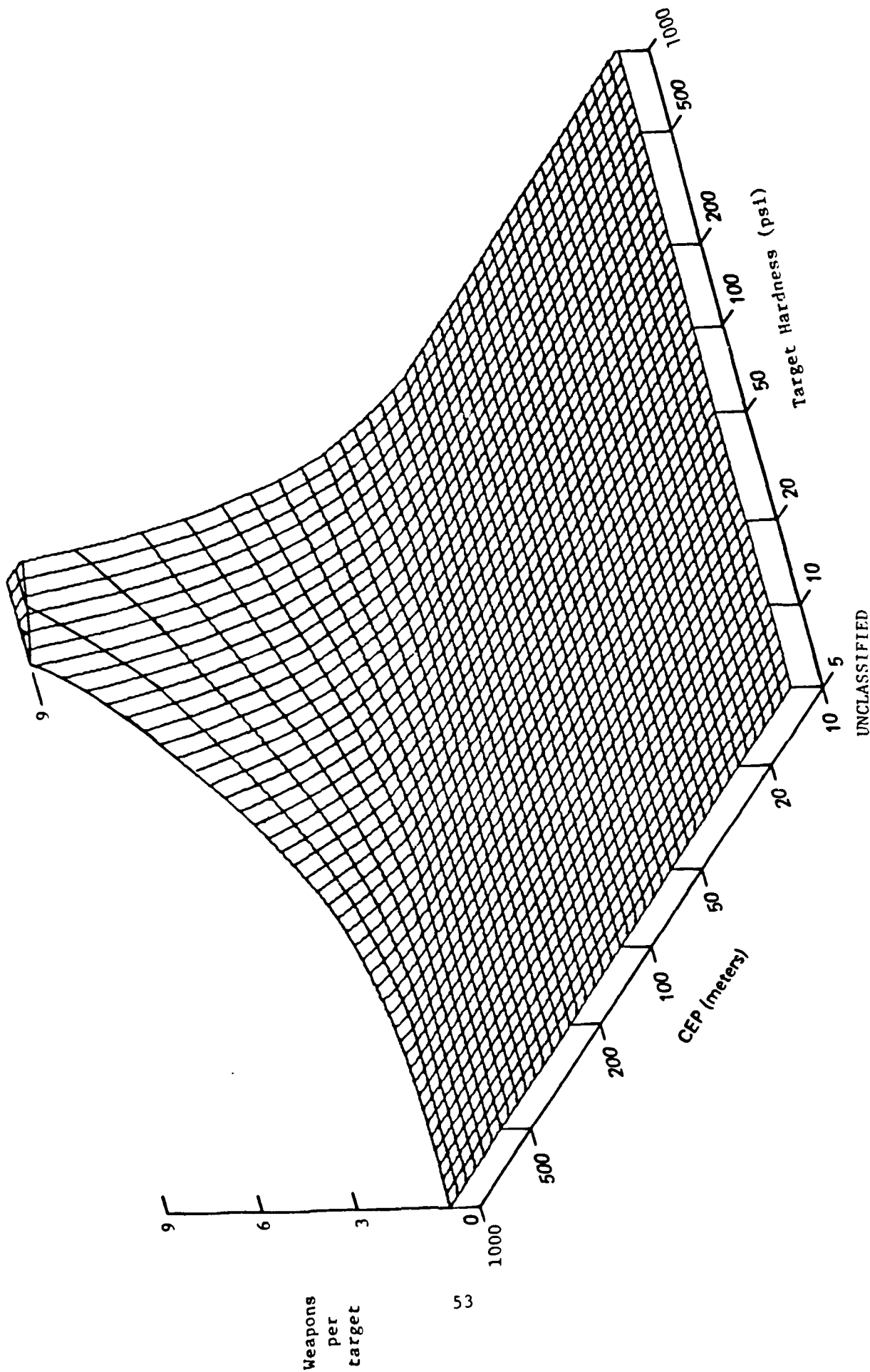
(U) Soviet nuclear delivery systems are visible in development, and hence are much more susceptible to accurate projections.* New

artillery, aircraft and missiles are being developed, and based on recent trends, additional systems can be expected to enter and complete development, and become operational by 1989.

(U) Table 13 gives the number of nuclear weapons per target required to achieve an 80 percent probability of kill as a function of target hardness (in pounds per square inch [psi]), delivery system accuracy (CEP in meters), and weapon yield (in kilotons). Values are given for probability of arrival (or weapon system reliability) equal to 0.6 and 0.8. Details of the calculations leading to Table 13 are published separately [Anno and Dore, 1979].

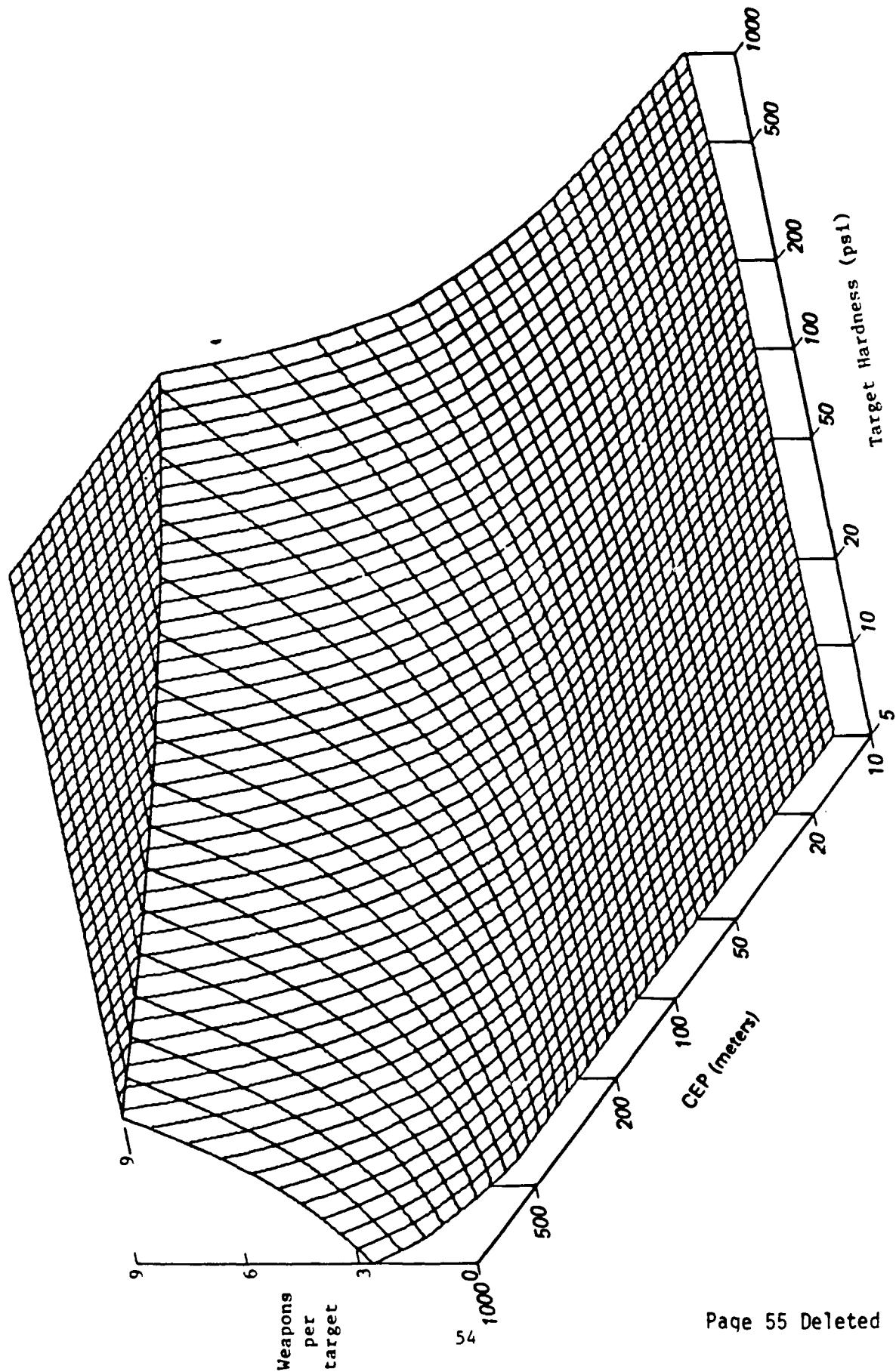
(11) TABLE 13. NUMBER OF SHOTS REQUIRED AT EACH TARGET TO ACHIEVE A PROBABILITY OF KILL $\geq .8$
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Target Hardness (psi)	Accuracy CEP(meters)	Yield					
		Weapon system reliability = .6			Weapon system reliability = .8		
		W = 10 KT	W = 100 KT	W = 1000 KT	W = 10 KT	W = 100 KT	W = 1000 KT
5	10	2	2	2	1	1	1
	100	2	2	2	1	1	1
	200	2	2	2	1	1	1
	500	2	2	2	2	1	1
	1000	4	2	2	3	2	1
10	10	2	2	2	1	1	1
	100	2	2	2	1	1	1
	200	2	2	2	1	1	1
	500	3	2	2	2	1	1
	1000	8	3	2	6	2	1
20	10	2	2	2	1	1	1
	100	2	2	2	1	1	1
	200	2	2	2	2	1	1
	500	5	2	2	4	2	1
	1000	> 9	5	2	> 9	3	1
50	10	2	2	2	1	1	1
	100	2	2	2	1	1	1
	200	3	2	2	2	1	1
	500	> 9	3	2	8	2	1
	1000	> 9	> 9	3	> 9	7	2
200	10	2	2	2	1	1	1
	100	3	2	2	2	1	1
	200	6	3	2	5	2	1
	500	> 9	9	3	> 9	6	2
	1000	> 9	> 9	7	> 9	> 9	5
1000	10	2	2	2	2	1	1
	100	5	3	2	4	2	1
	200	> 9	5	2	> 9	3	2
	500	> 9	> 9	5	> 9	> 9	4
	1000	> 9	> 9	> 9	> 9	> 9	> 9



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(U) Figure 1. Number of 1000 KT weapon shots per 100 x 100 m target to achieve a kill probability of 0.8 assuming a weapon system reliability of 0.8.



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(U) Figure 2. Number of 10 KT weapon shots per 100 x 100 m target to achieve a kill probability of 0.6 assuming a weapon system reliability of 0.8.

(U) Table 14 summarizes the projected changes in Soviet target acquisition and weapon systems. The table reflects only those systems seen in development, or in the early stages of deployment today. It is possible that other new systems--as yet unobserved--may be heavily deployed by 1989.

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(U) Protective Equipment

(U) The countries of the Soviet-Warsaw Pact have produced and stockpiled large quantities of CBR protective equipment. For respiratory protection, the majority of military personnel are issued one of several standard protective masks which are manufactured throughout the Soviet-Warsaw Pact. When combined with the available canisters, these masks provide excellent protection against all known NATO and Soviet chemical agents (for test data see Table A-2), biological agents, and radioactive fallout down to a particle size of 0.3 μ m. When worn, the masks have peripheral and outlet valve leakages of 0.005 percent or less, and are impervious to mustard and sarin face piece penetration for more than 24 hours at 45°C [USA TB 381-5-07A, 1977]. They are limited, however, by a lack of provision for communication and by poor vision. Several types of special purpose masks and self-contained breathing apparatus are also produced, such as IP-46 and the K1P series of closed-cycle, oxygen-generating masks. These masks have reportedly good capabilities with operating times ranging from 15 to 60 minutes.

(U) Table A-3 gives the breaktime for various pieces of clothing against various agents. The criteria for determining breaktimes for HD ($4 \mu\text{g}/\text{sq cm}$, cumulative penetration) and GD ($1.25 \mu\text{g}/\text{sq cm}$, cumulative penetration) are found in MIL-STD-282. The VX breaktime ($0.06 \mu\text{g}/\text{sq cm}$, cumulative penetration) is based upon the LD_{50} for a clothed man [FSTC, AST-1640X-193-75, 1976].

(U) In addition, vehicle-mounted decontamination units for large-scale decontamination of personnel, clothing, equipment, vehicles, structures, and terrain, are located throughout the military structure. This vehicle-mounted equipment has been designed to partially decontaminate vehicles and equipment during an assault at a rapid enough rate that the advance is not slowed, and has the mobility to keep up with the assault elements so that when time and the battle permits, complete decontamination may be undertaken.

(U) To accomplish this task, the Soviet Union and, to a lesser extent, her Warsaw Pact allies have developed and deployed over 8,000 decontamination vehicles. This number includes several thousand each of the DDA and ARS series of vehicles, several hundred AGV sets and several hundred of the technologically advanced TMS-65 truck-mounted decontamination apparatus. The TMS-65 utilizes a MIG-15 jet engine to heat decontaminants to improve their efficiency, and enables two vehicles to accomplish the partial decontamination of an armed column while it is moving by [USAREUR PAM 30-60-4, 1973]. Table A-5 lists the capabilities of the four most widely utilized types of vehicle-mounted decontamination equipment. In addition, the Soviet Warsaw Pact have over 4,000 CBR reconnaissance vehicles.

(U) Large quantities of decontaminants required to support these operations, including chlorinated lime, alkaline, ammoniacal solutions and organic solvents, have been produced and stockpiled. Because readily available commercial chemicals can be used as decontaminants, the supply of decontaminants should be considered inexhaustible. The probable use of non-preprepared decontaminants is indicated in Soviet military literature, which discusses the use of emergency decontamination techniques when standard decontamination equipment and agents are not available.

(U) Ideally, a new protective suit should have a useful wear life of 7 to 21 days, before replacement, and should not need to be removed and replaced for at least 6 to 8 hours after exposure to an agent. With new chemically encapsulated, impregnated materials,

such a suit could be developed by 1989 by the Soviets. Neutralizing or absorbing chemicals in the suit would not be activated until contacted by the agent, thus improving shelf and wear life [Weckel, 1979].

(U) Decontamination Equipment

(U) The CBR decontamination of large quantities of water has been of a lesser concern to the Soviet-Warsaw Pact. When decontaminating massive numbers of ground force equipment in the past, an adequate supply of clean water has been assumed. Standard unilateral/filtration processing will not remove all chemical agents, however. In fact, the only presently deployed Soviet water purification capabilities for chemical agents are limited-capacity throughput water distillation and cannister filtration units. If the Soviet-Warsaw Pact field-deploys a reverse osmosis water purification unit, as the United States is about to, the Soviet-Warsaw Pact will have the needed capacity to decontaminate large quantities of chemically contaminated water. U.S. tests at a 2000 gal/hr reverse osmosis unit indicate that this technology is capable of removing 99.9 percent VX, 99.9 percent BZ, and 99.1 percent GB from water contaminated at a concentration level of 1 mg/L. Note that the LD₅₀ for ingested GD is .4 µg [Harris, 1979].

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GLOSSARY
(This Glossary is Unclassified)

AC	hydrogen cyanide
BW	biological warfare
CBR	chemical-biological-radiological
CEP	circular error probable
CTBT	comprehensive test ban treaty
CW	chemical warfare
DIA	Defense Intelligence Agency
DNA	Defense Nuclear Agency
ER	enhanced radiation
FEBA	forward edge of the battle area
GB	sarin
GD	soman
H	mustard
HL	mustard/lewisite
ICBM	intercontinental ballistic missile
IMU	inertial measurement unit
IRBM	intermediate-range ballistic missile
LRA	Long Range Aviation
LRRP	long-range reconnaissance patrol
LTBT	limited test ban treaty
MMD	mass median diameter
MRBM	medium-range ballistic missile
MRL	multiple rocket launcher
PBV	post-boost vehicle
PMMA	polymethyl methacrylate
R ³	reduced residual radiation
RV	re-entry vehical
SBM	shallow burst munition
SLBM	sea-launched ballistic missile
SNA	Soviet Naval Aviation
SP	self-propelled

GLOSSARY (Continued)
(This Glossary is Unclassified)

SRBM	short-range ballistic missile
SRF	Strategic Rocket Forces
SSBN	nuclear-propelled ballistic missile submarine
S ²	survivability and security
TEL	transporter-erector-launcher
TNF	theater nuclear forces

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