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LA-5712-MS
Informal Report

Special Distribution
Reporting Date: August 1974
Issued: September 1974

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Tactical Nuclear Weapons: Objectives and Constraints

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UNITED STATES
ATOMIC ENERGY COMMISSION
CONTRACT W-7405-ENG. 36

In the interest of prompt distribution, this LAMS report was not edited by the Technical Information staff.

Authors from Lawrence Livermore Laboratory were supported under Contract W-7405-ENG-48.

TACTICAL NUCLEAR WEAPONS: OBJECTIVES AND CONSTRAINTS

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W. S. Bennett, R. P. Gard, and G. C. Reinhardt

ABSTRACT

Tactical nuclear weapons can provide a deterrent by offering the prospect of an effective military defense, in contrast to strategic weapons, which deter by the threat of retaliation. Tactical doctrine needs to recognize this distinction and could provide immediate improvements. Longer term technological evolution can also improve military effectiveness but needs to be guided by a clear recognition of tactical objectives and constraints. This discussion ranges from safety and vulnerability through command-control to costs.

I. BACKGROUND

"The Framework of Tactical Nuclear Weapons Policy (U)," is a recent report by the Stanford Research Institute, prepared under contract to the Defense Advanced Research Projects Agency and the Office of the Secretary of Defense (International Security Affairs).[1] SRI's review of U.S. (and NATO) policy is epitomized by the title of the first chapter: The Unresolved Issue, whose first paragraph says:

> "Among the unfinished tasks for the seventies President Nixon listed in his 1973 Foreign Policy message (is the question): 'When, in what way, and for what objective should we use tactical nuclear weapons?' In somewhat different words, the same question was posed in the President's first State of the World Report three years earlier. As his question suggests, there are still a number of unresolved issues relating to tactical nuclear weapons. It is therefore difficult, if not impossible, to identify the current U.S. policy for tactical nuclear weapons."

The AEC supports two weapon design laboratories to foster deliberate competition in their approaches to new weapons problems. In view of the current intense interest--and confusion--on the roles and requirements for tactical nuclear weapons, we believe it is appropriate to identify those aspects of the problem on which we find agreement. We retain our spirit of competitiveness and will tend to place differing emphasis on some of the issues. But we also feel that our collective understanding of weapons design and effects gives us a certain competence to provide input to the decision makers who must choose the best course for our nation regarding tactical nuclear weapons and policy.

To anticipate the section on "military effectiveness and collateral damage,"--a confession remains:

> Military effectiveness is an awkward criterion while there is still debate on the objectives of tactical nuclear warfare...

yet there <u>are</u> objectives, <u>and constraints</u>, that affect the whole problem and on which we agree. Our hope is that this discussion will help reduce some of the confusion surrounding "the unresolved issue."

II. INTRODUCTION

The renewed interest in the subject of tactical nuclear warfare probably stems from a recognition that the United States has lost whatever useful margin of strategic superiority it once possessed. The SALT I agreements are the formal recognition of nuclear parity and call attention to inadequacies in the old philosophy of massive retaliation. In Dr. Kissinger's words:[2]

"...to the extent that neither side is building a territorial defense, it is, of course, vulnerable, and to the extent that neither side can destroy the retaliatory force of its opponent enough to prevent a counterattack on its population, it remains vulnerable.

"The implications of this are what they have always been over the last 5 years, because both sides are now vulnerable to each other and, therefore, the simplistic notions of the early 1960's which measured deterrence by the amount of civilian carnage that could be inflicted by one side on the other were always wrong; hence, to consider the mass use of nuclear weapons in terms of the destruction of civilian populations, one faces a political, not to speak of a moral, impossibility.

"But this has been a fact, now, for 5 or 6 years."

By contrast, tactical nuclear weapons represent a more limited capability, serving a purely counterforce function. Thus, the tactical emphasis should be on invulnerability, not vulnerability; on credibility, rather than the incredibility of use.

This assertion of the differences between tactical and strategic objectives is fundamental to the unresolved issue and is not accepted in many circles. The matter of overriding concern is the fear that any tactical use of nuclear weapons will inevitably escalate to a strategic holocaust. It is essential that concepts of operations (objectives) be evolved that deter escalation, instead of making it "inevitable." Until this is done, fears will remain that too much military effectiveness is detrimental; readiness or responsiveness will be viewed as dangerous instead of desirable in the context of battlefield nuclear force.

Everyone must fear escalation to the strategic holocaust. Yet some still regard tactical nuclear weapons merely as a link to make that escalation more automatic, relying completely on the deterrent threat of civilian carnage, in direct contrast to Kissinger's judgment that this threat is a political and moral impossibility. To satisfy those who view tactical nuclear forces this way, those forces should be vulnerable and ineffective. If the weapons ever are used, that use should be ineffective by itself--therefore: escalatory. We feel that our laboratories can infer no useful guidance for the development of "better" warheads from such implied objectives.

This distinction between strategic and tactical objectives reveals the fundamental dilemma in the present structure and arming of our tactical nuclear forces: our concern must be with military effectiveness, but other issues pose constraints which, though arising from other-than-military considerations, cannot be disregarded in the design of weapons systems. Tactical nuclear doctrine and weapons must be militarily effective in terms that are politically acceptable. The laboratories are working on technological approaches to this challenge.

Of more immediate concern are the doctrinal and policy decisions that must be faced within existing constraints. In many cases the technological approaches may take some time, or, more importantly, will never be funded until after the doctrinal policy issues have been resolved. In this sense, the doctrinal solutions might be regarded as short-term solutions, leaving the technological changes for the longer term.

In the balance of this report we have chosen to group these constraints into six major areas: (1) Safety, (2) Vulnerability, (3) Command, control, and release, (4) Military effectiveness and collateral damage, (5) Dual capability, and (6) Costs. These six topics neither exhaust the subject, nor are they mutually exclusive, but they do form a logical sequence for discussion. Much of the confusion surrounding the issue of nuclear weapons in NATO comes from an attempt to deal with these factors singly, as if they could be isolated from each other. The problems of our nuclear posture in NATO are precisely due to the mutual interactions of these factors: the relations among them in the context of the conflicting objectives to avoid escalation, yet to imply it. Charged with "the design and development of nuclear explosives," it is the primary responsibility of our laboratories to investigate technological means of achieving military effectiveness, but we would be derelict in our duty if we neglected either doctrinal issues or the question of political acceptability.

This discussion is in terms of the problems of NATO Europe because that theater dominates the current debates. Extension of the discussion to other theaters is valid in most instances, but no attempt has been made to examine that extension in this report.

III. SAFETY

A high degree of assurance against an accidental nuclear detonation is required for all nuclear weapons.

Apart from the potential loss of life and property, a nuclear accident in any part of the world would result in at least great pressure for the withdrawal of all forward-based U.S. nuclear weapons.

Safety interlocks, such as interrupts on fire sets, contribute a high degree of protection against getting an unwanted explosion. But even extremely high confidence statements about extremely low probabilities of an accident are poorly understood, unfortunately, by the public. Thus designers are seeking concepts which preclude a nuclear yield if a fire signal is "accidentally" applied to the detonators, or even after accidental high explosive (HE) detonation.

Designs that separate the HE from the nuclear material are attractive in some applications, as is the idea of fielding only manufactured duds (that is, even if the HE detonates, no nuclear yield results unless some positive action has been taken beforehand). Mechanical devices, which prevent proper assembly of the pit, have advantages when weight and volume are severely constrained. Designs that separate the HE and the nuclear materials have peacetime appeal, since final assembly of the nuclear round is actually completed only at the time of intended use. Since a "politically significant" accident need not involve any nuclear yield, as in Palomares and Thule, there is added value in the separable designs. Plutonium contamination considerations make it relevant to consider all-oralloy designs where possible.

Safety must be inherent in the warhead design itself rather than procedure-dependent. Undue emphasis on complex, inspection-generated procedures dilutes the importance of the few really critical procedures that do warrant emphasis. Military effectiveness is certainly reduced in operations where it is necessary to handle unsafe ordnance of any kind. So safety is an important requisite for military effectiveness. On the other hand, safety must be achieved in ways that do not unduly penalize military requirements for readiness and reliability.

IV. VULNERABILITY

The United States has around 7000 weapons in NATO stored in a relatively limited number of permanent storage sites. This limited number of storage sites, coupled with readily known locations, individual vulnerability, and Soviet capabilities, lead us to conclude that our stockpile in NATO is vulnerable to a Soviet preemptive strike. This vulnerability seriously degrades the credibility of our tactical nuclear deterrent.

Our forward sites are also vulnerable to enemy overrun if we fail in a conventional initial defense. Those responsible for NATO defenses must expend manpower to protect those forward sites, plan forward nuclear deployment in case release takes place, and plan for weapon evacuation or destruction if release is delayed. The total number of all NATO sites is sufficiently low that the Soviets could execute a preemptive strike against them without depleting their current inventory of MRBMs or aircraft-delivered weapons. Whatever our plans for wartime dispersal and use of these weapons, we must worry, in peacetime, that we are maintaining an "attractive nuisance."

There are many ways to decrease vulnerability: hardening storage sites, increasing the number of sites, and continually moving the weapons. Considerations of cost, availability of real estate, political acceptability, safety and control make adoption of these measures unattractive. Predelegation is a recurrent suggestion--and political dynamite, both in Europe and in the U.S. Moving our weapons back, either in the theater or out of the theater, is seen by many as a denial of our obligations to NATO. Reliance on Polaris/Poseidon or even Minuteman has been suggested as a way to attack battlefield targets, but such use poses many operational problems, and is liable to be regarded as escalatory.

V. COMMAND, CONTROL, AND RELEASE

If the credibility of a forward defense for NATO is to rest on the early use of tactical nuclear weapons, then timely release of appropriate weapons is essential. Fear of unauthorized use has been a dominant factor driving both our tactical nuclear deployment and control and release procedures. Control of nuclear weapons has deep political roots which imposes real constraints on their rapid availability and hence on their military effectiveness.

The spectre of unauthorized use of nuclear warheads, or loss of control over them, can be summarized under the following headings:

1) Unauthorized (or premature) military use by friendly forces.

2) Loss of weapons to unfriendly military forces.

3) Capture (of even one weapon) by terrorists or dissidents resulting in use of the warhead, propaganda attacks, or possible blackmail threats.

These concerns about unauthorized use are not NATO-specific. The last item is as important for weapons in the United States as it is for weapons deployed overseas.

Loss of weapons to unfriendly military forces, at least in NATO Europe, is perhaps of lesser concern than the other types of unauthorized use. In combat, the capture of a few weapons by the Soviet Union would be a tactical military loss, but not a political or strategic disaster. The loss of critical design information and/or special nuclear materials would be of relatively little importance in a tactical nuclear war.

Over the years increasingly complex procedures have evolved in an effort to protect against unauthorized use or sabotage. Many of these are the result of concepts that governed the deployment of nuclear weapons twenty years ago. Nuclear weapons were extremely rare then, new to the thinking of both military planners and civilian authorities, and shrouded in secrecy. This has given rise to a number of problems.

Successive Chiefs of State have been well aware of the awesome psychology of nuclear weapons, and justifiably concerned about the possibilities of escalation. This reinforces the fear of unauthorized use. Even "authorized" use has many problems, as reflected in recent NATO emphasis on consultation procedures. Peacetime requirements for the physical security of storage areas, escort procedures when moving weapons, PAL* code management, personnel reliability programs, and the use of personnel with special security clearances all impose heavy manpower burdens in a period when manpower costs have come to be the major portion of our defense budget.

Control technology, specifically the newer categories of electronic PAL devices, will ameliorate the problem to a large extent, especially when they are integrated with the safety concepts already discussed. The subject is so rich in interest that work will continue for some time to come to improve control and communication systems so that safe but rapid release of selected weapons is insured; but doctrinal concepts must be considered too--imposing requirements on the technological community alone will not suffice. Too often it is just an expensive way to avoid difficult doctrinal decisions.

*Permissive Action Link

VI. MILITARY EFFECTIVENESS AND COLLATERAL DAMAGE

Military effectiveness is an awkward criterion while there is still debate on the objectives of tactical nuclear warfare. These objectives are more obviously dealt with in recent Army guidance than in guidance published for Air Force and Navy. Army policy, interpreted from the NOC II study and the DCSOPS synthesis paper, is that the objective of tactical nuclear forces is deterrence. If conflict does start, the objective then becomes conflict termination. Thus, the capability for battlefield deterrence can never be separated from the capability to defend. A resolute opponent must be expected to see through a bluff.

Collateral damage is unwanted damage to the civilian populace and infrastructure, whether friendly, neutral, or enemy. For NATO, the prospect of such damage is a prime inconsistency in the current defensive posture of the alliance. The perceived inability to use our tactical weapons without destroying what we are trying to defend raises serious doubt about the credibility of our tactical deterrent.

If our current stockpile were used without constraint, the prompt effects from these weapons could cause a vast amount of collateral civilian casualties and damage. Short-term delayed effects (fallout and rainout) are less predictable, but could be even more severe. The importance of long-term radiation damage and of secondary effects, like the destruction of crops, cropland, livestock, is even more uncertain, but not negligible and certainly worrisome to Europeans.

Past estimates of the collateral damage (particularly civilian casualties) resulting from the use of nuclear weapons in the defense of NATO suffered from "the unresolved issue:" the lack of an answer to the question, "...for what objective should we use tactical nuclear weapons?" If the objective is indeed early war termination, without escalation, then it is important to estimate collateral damage

relative to that which could result from a prolonged conventional-only defense that would presumably encompass a far greater geo-political arena.

Near-term solutions addressing what can be done with the current stockpile are as important as, and a great deal more pressing than, long-term solutions requiring new warheads and delivery systems. Technology may offer some long-term solutions; but for the short term the emphasis must be on doctrine. Any suggested solutions must be severely tested to be sure they do not degrade military effectiveness.

As already suggested, many of our current doctrinal practices are a heritage from a bygone era: a period of very limited stockpiles of medium and high-yield weapons: concepts of use only in a general war; and unquestioned U.S. superiority in nuclear weapons. Adopted as solutions to the problems of that era, these practices have now become part of the problem. For example, the potential for collateral damage increases with yield, yet present targeting practices tend to preclude the selection of smaller yields by emphasizing such things as: extremely high damage assurance criteria, insistence on attacking a target with only one weapon, and overreliance on blast rather than radiation target defeat criteria regardless of target type, mission, posture, or threat. Similarly, a clear method for the avoidance of populated areas, when this is permitted by the military situation, is lacking in today's doctrine.

Studies indicate that much of the current stockpile (very low and low yields)* could achieve satisfactory military effects with a great reduction in potential collateral damage if appropriate weapon assignment procedures were used. Offset aiming techniques offer an effective way to engage targets close to populated areas and still avoid collateral damage. Such techniques apply to problems regarding our own troop safety and would make more effective close support possible. This seems particularly important since it is our forward elements that are most likely to acquire targets.

Nuclear weapons basically are area-coverage weapons, so improved guidance of conventional munitions requires decisions as to what types of point targets should be hit with nuclear rather than nonnuclear weapons. But the tendency to emphasize precision-guided-munitions (PGMs) versus nuclear warheads is unwarranted since precision-guidance can be used with both types of ordnance. Indeed, even for area targets, delivery accuracy can contribute to achieving required military effects with low yields.

The requirements for military effectiveness and for low collateral damage may or may not conflict with each other; this must be determined by the field commander. But it is important to shape doctrine in such a way that it does not make it more difficult to avoid collateral damage.

For the longer term, the laboratories have many technical proposals relating to the problems of both military effectiveness and collateral damage. A variety of yields has been made available through research and testing programs. The potential spectrum of tactical yields extends over a wide range, starting with a few tens of tons. The upper limit depends on targeting criteria and the locale and scope of the battle, while the lower limit is really dependent on the accuracy with which targets can be located, and weapons delivered. The limitation on the number of tactical weapons which can be stockpiled could emphasize the necessity for flexibility, so that selectable-yield or selectable-effect weaponry may become useful--depending on the objectives.

Enhanced radiation devices, for example, can achieve radiation kill at greater ranges with lower "yield." But the requirement for such a capability will not be real unless the utility of radiation kill is accepted. "Yield" alone is losing its relevance as a measure of weapon characteristics; it is more to the point to specify the ranges at which various effects are desired or not desired--and these are still open questions. Clean design technology offers a technological solution to the rainout and fallout questions. An evaluation of the seriousness of these effects and the operational and dollar costs involved will determine whether low fission to fusion ratio warheads are an urgent requirement, or whether they can be introduced into

*We will abide by the following definitions, from JCS Pub 1 ("Dictionary of United States Military Terms for Joint Usage," The Joint Chiefs of Staff, August 1, 1968):

very low yield	less than 1 kt
low yield	1 kt to 10 kt
medium yield	over 10 kt to 50 kt
high yield	over 50 kt to 500 kt
very high yield	over 500 kt

the stockpile as part of the normal (slow) evolutionary change. In the long run, low fission fraction warheads will probably dominate our tactical nuclear stockpile. This could come about for reasons of military capability or because of the political appeal inherent in the label "clean weapons."

The potential for increased military effectiveness and decreased collateral damage does exist. In the short term there is an opportunity to change doctrine in order to better utilize weapons effects inherent in the current stockpile; in the long term several new ideas in nuclear technology could be useful. None of the technological proposals is a cure-all, and none can, alone, remove the need for policy and doctrinal guidance.

VII. DUAL CAPABILITY

Since the introduction of tactical nuclear warheads into the stockpile, the Army and the tactical branches of the Air Force and the Navy have been required to have dual-capable forces and to some extent dual-capable weapons. The first term means forces capable of employing either conventional or nuclear warheads; the latter, weapons capable of handling either nuclear or nonnuclear munitions. The cost of dual capable forces and weapons is measured in terms of organization, training, equipment, and in development of appropriate doctrine.

The optimum organization to conduct conventional warfare is not necessarily that for nuclear warfare. Since logistic requirements, probable casualty rates, and the relative importance of firepower and maneuver will likely change, a revised organization might be advisable for nuclear warfare. A lower troop density is envisioned in a nuclear situation, thus the need for rapid transition from a conventional formation to a less-dense nuclear formation is one aspect of dual capability which causes serious concern.

Dual capable weapon systems offer obvious advantages in terms of versatility and flexibility, and perhaps even cost. But the limited size and high acceleration of cannon projectiles require greater usage of nuclear material.

Dual capable forces have been justified to support a policy of graduated deterrence, and dual capable close-support weapons are used to equip these forces. A further important justification for dual capability stems from the need for both conventional and nuclear fires in tactical nuclear warfare, but there has never been a full assessment of all the pros and cons on this question.

VIII. COST

Cost, a topic of paramount importance and high political visibility, is far more complex than mere consideration of hardware procurement or of research and development costs alone. For example, the decision to close down production reactors resulted in a limited supply of special nuclear materials (SNM). Certainly this has affected technical design criteria. But it also implies the need for tradeoff considerations relative to making more SNM available. These tradeoffs become highly controversial, not just because of the dollar costs involved but also because of their interactions with national policy and the nation's energy programs.

Over a 10-year life cycle, manpower usually represents the major fraction of tactical nuclear weapons systems dollar costs. The increased manpower costs of an all-voluntary army indicate that this fraction will continue to increase. Further, the number of men available in Europe may be yet more severely limited (MBFR talks, Mansfield-type amendments). It is reported that 22,000 men are required to provide security and maintenance for the weapons currently stockpiled in Europe. In the future even this number may be prohibitive, and any changes in the stockpile which would increase this requirement may not be feasible. The outlook for any new tactical system requiring a significant increase in personnel is poor.

While the dollar cost of SNM for a weapon is small in comparison to the 10-year life cycle costs, the hard fact is that the supply of SNM is limited. The cost of SNM is related to the production cost, but the marketplace laws of supply and demand do not apply. Thus, the dollar costs of SNM cannot be traded off for other system costs. Of course reactors can be reopenad to increase the supply, but despite JCS and AEC requests, the political temper of the times and the energy crisis motivate against the restarting of production reactors.

It thus seems that even though manpower, hardware, and SNM costs can all be measured in dollars, these costs are not interchangeable. Limitations

in manpower, hardware procurement dollars, and the supply of SNM individually pose different constraints on the procurement and fielding of new tactical nuclear weapons systems. No "preferred mix" will be accepted until national strategy and the supporting doctrine are more rational to Congress.

IX. SUMMARY

This report has presented a general discussion of six major factors bearing on the tactical nuclear capability of United States forces in Europe. It has become apparent that these six factors, although discussed separately, are in fact so closely related that any change in one will influence the others. Thus, suggested technological or procedural improvements must be carefully evaluated in terms of their overall impact.

A number of challenging areas of opportunity in which technology and doctrine can increase the effectiveness of NATO forces have been recognized. These are perhaps important enough to be repeated here, despite their obvious simplicity.

First: Our tactical nuclear weapons must be safe from accident and from unintended nuclear or high explosive detonation.

Second: The disposition of our tactical nuclear stockpile cannot be so vulnerable as to encourage a preemptive strike.

Third: Communications and control technology and procedures must make feasible the timely release of the appropriate nuclear weapons by political and military command authority.

Fourth: U.S. forces in Europe must be able to combine nuclear and conventional operations effectively.

Fifth: If it becomes necessary to engage in tactical nuclear warfare, military effectiveness must be achieved without causing unacceptable levels of collateral damage or unwanted escalation of the conflict.

Sixth: Changes in tactical nuclear capability must be evaluated in the light of increasing costs, as measured not only in dollars, but also in manpower, special nuclear materials, and political impact.

ACKNOWLEDGMENTS

The authors gratefully acknowledge suggestions from a great many colleagues at both laboratories, but the opinions expressed here are their own and do not necessarily represent the views of either laboratory or of the AEC.

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