

INDEPENDENT SCIENTISTS' CONTRIBUTION TO DISARMAMENT

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I will discuss in my talk two ways in which independent scientists can contribute to disarmament:

- 1) By challenging the "experts" who rationalize the arms race,
- 2) By making alternative futures credible.

I will also bring to your attention a new archival journal, Science and Global Security, which will publish some of the increasing numbers of technical analyses which are being done by the community of independent scientists interested in these issues.

Challenging the Experts

Weapons technology is sophisticated and therefore the public tends to think that one must be an expert to critique weapons policy. However, weapons policy is primitive. The level is that of caveman psychology. The group around Gorbachev has aptly termed it "old thinking."

Let me, however, allow the policy makers to speak for themselves by quoting two statements from officials at the highest level of the U.S. weapons bureaucracy. The first quote is from an article written in 1982 by Dr. Richard DeLauer, then U.S. Undersecretary of Defense for Research and Engineering explaining to the aerospace community why it was important for the U.S. to deploy the MX missile with its ten highly-accurate and powerful nuclear warheads:¹

"Increases in nuclear hardness of Soviet ICBM silos and other important facilities have reduced our ability to put those targets at risk. Knowing this, the Soviets feel less constrained from adventurism around the world..."

The second quote is from the 1983 testimony to the Senate Armed Services Committee of Dr. Richard Wagner, then Assistant to the Secretary of Defense for Atomic Energy. He was explaining why he opposed a nuclear test ban:²

"What it comes down to in the end is to keep [the Soviets'] image of themselves inferior to their image of us, so that if a crisis comes they will have a gut feeling that they won't measure up against us...Our job is to keep them feeling inferior...By the 90s we'll need some really new technology to keep the image ratio in our favor."

Note that these are opinions of people who have achieved their positions through their technical expertise not their expertise on the psychology of the Soviet leadership.

I suspect that our Soviet colleagues could extract similar quotes from the justifications for new weapons systems offered by their weapons technologists.

Weapons-technology experts are asked and ask themselves questions like:

"How do we improve our war-fighting capabilities?"

"How do we counter improvements in their war-fighting capabilities?"

They are not asked and usually do not ask themselves questions like:

"What would the consequences for civilians be of nuclear attacks on military targets?"

"What might the other side do if we build this sexy new weapons system?"

"Will we be worse off when the other side builds it too?"

It is therefore one of the jobs of independent scientists to raise these questions and to show how important their answers are to weapons policy.

In doing so, the independent scientists will not only educate their governments but will also, like the boy in Hans Christian Andersen's fairy tale, "The Emperor's New Clothes," empower the public. The governments always tell their citizens: "These matters are too complicated for you, so please leave the management of the arms race to our experts." But, if the citizens see that that their

governments have not, in fact even asked their experts the key questions, the credibility of the governments is undermined and political movements for change become more credible.

In the past, independent scientists raising and suggesting answers to the unasked questions have laid the basis for all the major successes of arms control -- perhaps most notably the 1972 Treaty Limiting Anti-Ballistic Missile Systems.

Making Alternative Futures Credible

But, in order for a movement for change to have real credibility, it must be able to offer a credible alternative to the status quo. Some of us learned this in the U.S. nuclear-weapons-freeze movement. This movement effectively challenged the legitimacy of the nuclear arms race in the early 1980's in the United States but, in the end, it was marginalized as a protest movement because it did not have answers to questions like:

"Can you verify a halt of nuclear-warhead production?"

"Can you freeze bomber technology if strategic air-defense technology is not frozen?"

"Will nuclear-weapons systems remain safe and reliable if they cannot be tested?"

Very few independent scientists had been studying the technical basis for the freeze or any other alternative future at that time and the answers to these questions had simply not been worked out.

Today, however, there are growing, if still small, numbers of scientists working on the technical bases for very different futures -- at least for nuclear weapons and for conventional weapons in Europe. Specifically, independent scientists are looking at the technical basis for order-of-magnitude reductions of U.S. and Soviet nuclear arsenals and on restructuring the huge conventional forces in Europe into non-offensive postures.

Ten-Fold Reductions in U.S. and Soviet Nuclear Arsenals. A large fraction of U.S. and Soviet strategic nuclear weapons are targeted on each other. They therefore tend to justify each other.

But, after 40 years of the nuclear arms race, both sides are further than ever from the ability to eliminate the other side's nuclear forces with a first strike.

For example, a Soviet "bolt-out-of-the-blue" attack on U.S. strategic forces with 3,000 warheads could destroy almost 9,000 U.S. strategic warheads (see Figure 1).³

It would also kill 10-40 million U.S. citizens by blast, heat, and radioactive fallout plus tens of millions more in the longer term (see Figure 2).⁴ Under such circumstances, the U.S. reaction could not be expected to be much different than if the

Soviet Union had deliberately attacked the U.S. population.

The U.S. would certainly be in a position to make a devastating counter attack. Even if it absorbed the attack without launching its land-based missile on warning, it would still have 4500 nuclear warheads left with a destructive power equivalent to 1200 1-Mt warheads. Five percent of this surviving destructive power could kill 20-40 million Soviet citizens with blast and heat alone (see Figure 3).⁵

Of course, U.S. attacks on Soviet strategic-nuclear forces would be just as destructive (see Figure 4).⁶ Similarly, the use of even hundreds of theater nuclear warheads in Europe would cause millions to tens of millions of deaths (see Figure 5).⁷

Nuclear "counterforce" attacks involving thousands of warheads are therefore insane -- which makes most strategic nuclear warheads redundant.

We could eliminate at least 80 percent of U.S. and Soviet strategic warheads and still have a stable mutual-hostage relationship. If we abandoned the idea that virtually every military unit of significant size should have its own "tactical" nuclear weapons, we could eliminate 10,000+ more nuclear warheads on each side.

Table 1 shows in parentheses the numbers of strategic delivery vehicles and warheads on each side which knowledgeable U.S. analysts guess would result from the START agreement by the mid-1990's if it were completed soon. The total number of

warheads is approximately 10,000 instead of the advertised 6,000 because bomber-carried warheads would be grossly undercounted by the START counting rules.

The numbers not in parentheses describe alternative strategic nuclear forces which we in Princeton call "finite-deterrence" forces. These strategic forces would have a total of 2000 nuclear warheads on each side.⁸ In both cases, we have assumed existing weapons systems or weapons systems in advanced development. However: the ICBMs in the finite-deterrence force are single-warhead missiles, the number of launchers in each ballistic-missile submarines have been reduced to 6, and the bombers each carry only about five warheads.

The finite-deterrence arsenals would be more survivable than the START arsenals because it would take more warheads to attack them and there would be many fewer warheads available to the other side for barrage attacks against bomber flyout routes and mobile-missile dispersal areas. Indeed, the main difference between the START and finite-deterrence arsenals, aside from size, is that the START arsenals are designed primarily to maximize their ability to attack each other and the finite-deterrence arsenals are designed to maximize their ability to survive.

One of the major questions to us from those experts who would be just as comfortable to pursue the arms race in its current course is:

"Very nice, but are such massive reductions verifiable?"

The Federation of American Scientists and the Committee of Soviet Scientists have therefore undertaken a collaborative project to outline the necessary verification system. Foci of this project include:

Verification of a cutoff in the production of fissile material for weapons,
Detection of nuclear warheads,
Verification of total numbers of warheads,
Verification of dismantlement of warheads,
Verification of numbers of warheads on ballistic missiles,
Verification of limits on cruise missiles.

Our first results will be published next year in a joint book and in the new journal, Science and Global Security which I will describe further below.

One question that has been raised in this conference is whether the U.S. and Soviet Union would be willing to reduce their nuclear arsenals to 2000 each if the British, French and Chinese arsenals were not limited to perhaps a few hundred nuclear warheads each. Perhaps it is not too early for some British and French scientists to begin considering how far their arsenals could be reduced from the levels currently projected for the 1990s.

Since we are talking about how independent scientists can contribute to disarmament, I must mention the most dramatic

recent example, the cooperative incountry seismic monitoring project involving U.S., Soviet and now British seismologists. The number of international stations in the U.S.S.R. will soon increase to 10 -- enough to monitor a low-threshold test ban there. A full analysis of the research findings of this project will be published in the first issue of Science and Global Security.

Non-Offensive Defense in Europe. Independent scientists in Europe have already had a major impact on the design of the conventional arms reductions talks which are to begin here soon by changing the agenda from balance to stability. The governments have learned from their critics that a balance between forces equipped primarily with offensive weaponry would not necessarily be stable. This understanding is evidenced by the change in title of the the new talks from "Mutual and Balanced Force Reductions" to "Conventional Stability Talks."

However, more independent analysis is required if these talks are not to go into an early stalemate. NATO believes that it requires a minimum force-to-space ratio all along the inter-German border if it is to be able to hold the line against a surprise attack until the reserves are able to arrive and it is currently convinced that its forces are already at this minimum level and that it cannot reduce them significantly further even if the WTO reduces its forces to less than NATO's current force levels!⁹

More independent analysis is required to develop a more sophisticated measure of conventional stability which takes into account the structure and deployment of the forces, transparency, barrier arrangements, ability to concentrate long-range indirect fire, etc.

Science and Global Security

Every discipline needs a journal and it appears that the community of independent scientists involved in analyses of the technical basis for global-security policy now has matured to the point where it can sustain its own technical journal. A group of U.S. and Soviet Scientists has therefore established a new journal, Science and Global Security. The purpose of this journal is to provide an outlet for technical analyses relating initially primarily to arms control and reductions but, in the not-too-distant-future, to other global security issues such as man-caused climate change.

Harold Feiveson of Princeton University is the editor of the journal and its founding board of editors is made up of U.S. and Soviet weapons-policy analysts (see Table 2). However, we hope to broaden it soon to include Europeans as well. The publisher in English is to be Gordon and Breach Science Publishers and, in Russian, the Mir publishing house which currently publishes the Russian-language edition of Scientific American.

We hope to have the first issue available in late spring.

Conclusion

In conclusion, we should be encouraged by the fact that such a small community of independent scientists confronting the weapons bureaucracies with their huge resources has already had such an enormous impact. We are now in a period when the further professionalization of the work of this movement is in full swing -- especially in Europe, as this conference attests. We therefore have some basis for hope -- if we work hard -- for having further important successes in the future.

Table 1. HYPOTHETICAL STRATEGIC ARSENALS
 ["Finite-Deterrence" (START)]

	<u>Delivery Vehicles</u>	<u>Warheads</u>
<u>U.S.</u>		
ICBMs	500. (400.)	500. (1300.)
SLBMs	126.(21 subs.) (408., 17subs.)	1000. (3264.)
Bombers	100. (231.)	500. (3698.)
TOTAL		2000. (10,262.)
<u>USSR</u>		
ICBMs	1020. (808.)	1020. (2640.)
SLBMs	120.(20 subs.) (348., 23 subs.)	480. (2232.)
Bombers	100. (230.)	480. (3200.)
TOTAL		2000. (10664.)

Table 2. SCIENCE AND GLOBAL SECURITY

Founding Board of Editors

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Prof. John Holdren, University of Cal, Berkeley
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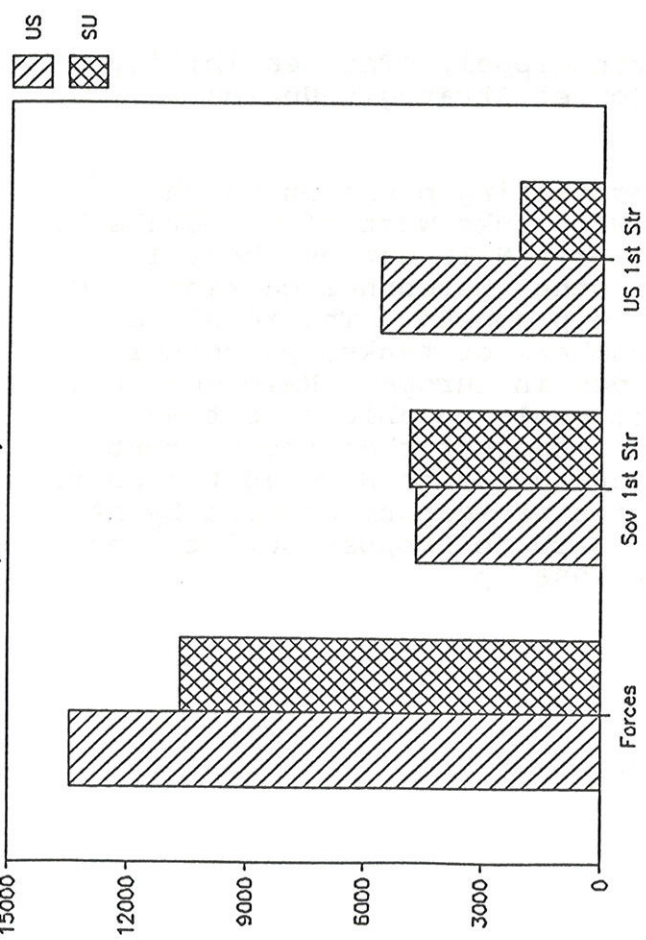
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REFERENCES AND NOTES

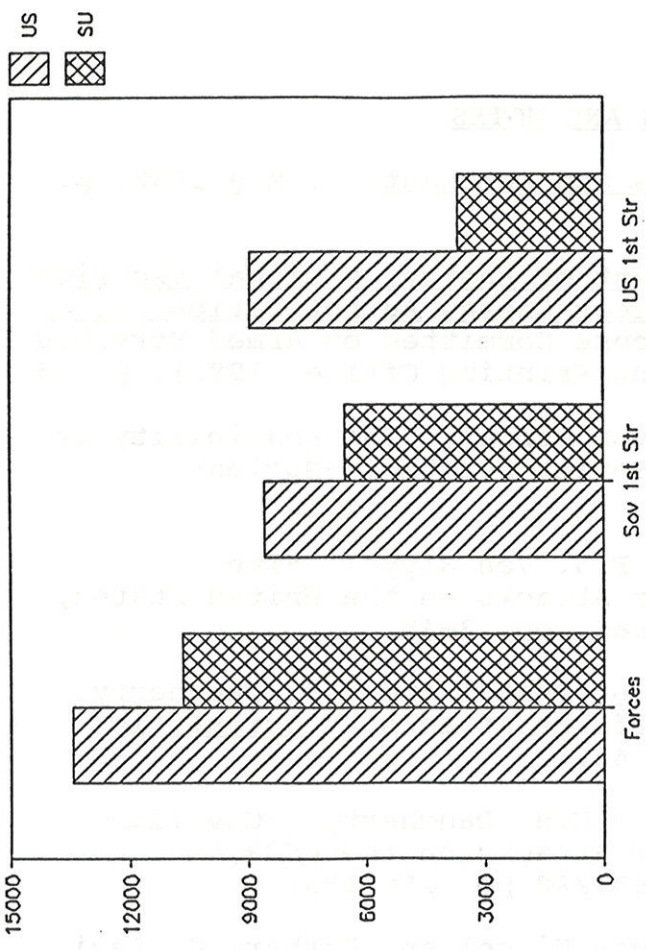
1. Richard DeLauer, Astronautics and Aeronautics, May 1982, p. 39.
2. Richard L. Wagner in Department of Energy, National Security and Military Applications of Nuclear Energy Authorization Act of 1984, Hearings before the U.S. House Committee on Armed Services (Washington, D.C.: U.S. Government Printing Office, 1983), p. 33.
3. Harold A Feiveson and Frank von Hippel, "The Feasibility of Deep Reductions in the U.S. and Soviet Strategic-Nuclear Arsenals" (to be published).
4. W.H. Daugherty, B.G. Levi and F.N. von Hippel, "The Consequences of 'Limited' Nuclear Attacks on the United States," International Security, Spring 1986, pp. 3-45.
5. F.N. von Hippel, B.G. Levi, T.B. Postol and W.H. Daugherty, "Civilian Casualties from Counterforce Attacks," Scientific American, September 1988, pp. 36-42.
6. B.G. Levi, F.N. von Hippel and W.H. Daugherty, "Civilian Casualties from 'Limited' Nuclear Attacks on the USSR," International Security, Winter 1987/88 pp. 168-189.
7. See William M. Arkin, Frank von Hippel and Barbara G. Levi, "The Consequences of 'Limited' Nuclear War in East and West Germany," Ambio XI (1982), pp. 163-173 and "Addendum," Ambio XII, (1983) p. 57.
8. Harold A Feiveson and Frank von Hippel, "The Feasibility of Deep Reductions in the U.S. and Soviet Strategic-Nuclear Arsenals" (to be published).
9. See e.g. the leak of NATO's negotiating position which proposes a cut in the numbers of WTO tanks West of the Urals by more than 60 percent in exchange for a NATO cut by about 10 percent. Similar unequal cuts in other personnel carriers and mobile artillery will apparently be proposed. The result after the proposed cut would be equal numbers of tanks, personnel carriers and artillery on both sides in Europe. NATO does not suggest any other area in which it would be able to cut -- although many independent analyses suggest that the current balance is nowhere near as disadvantageous to NATO as the current inequality numbers in the categories of weapons covered by NATO would suggest. [Michael Gordon, "NATO to Propose Soviet Tank Cuts," New York Times, 4 December 1988, p. 5.

FIGURE 1

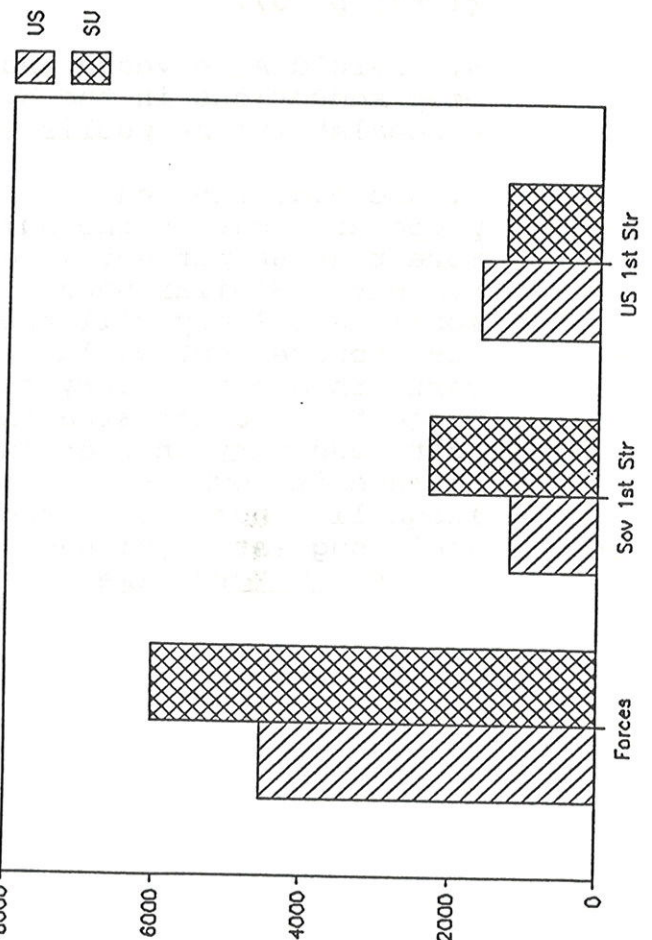
Warheads Before/After Exchange 1988 Forces Day-to-Day Alert



Warheads Before/After Exchange 1988 Forces Generated Alert



EMT Before/After Exchange 1988 Forces Day-to-Day Alert



EMT Before/After Exchange 1988 Forces Generated Alert

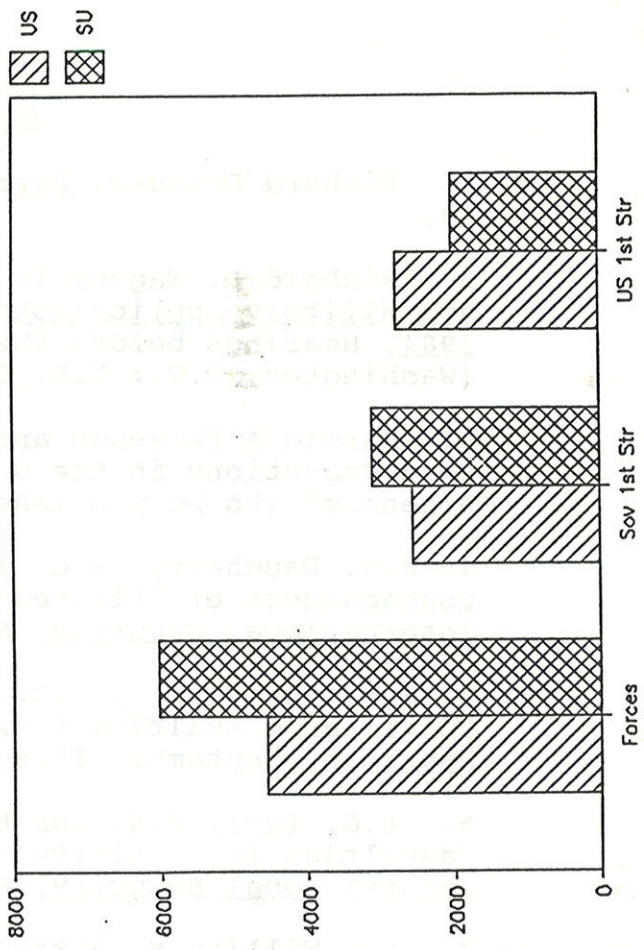


FIGURE 2
FALLOUT PATTERN
(FEBRUARY ATTACK ON US STRATEGIC NUCLEAR TARGETS)

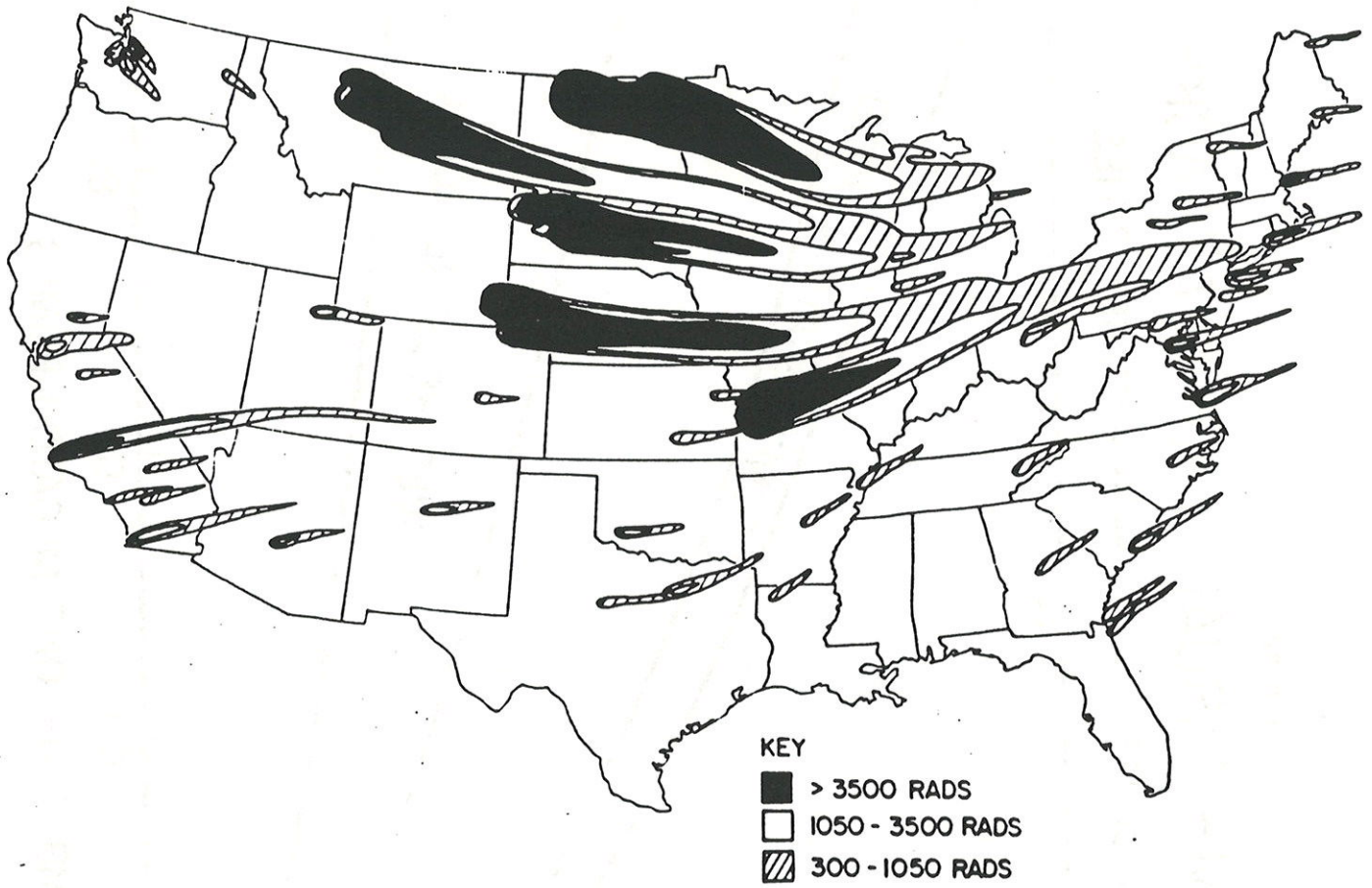


FIGURE 3

MAXIMUM - CASUALTY CITY ATTACKS

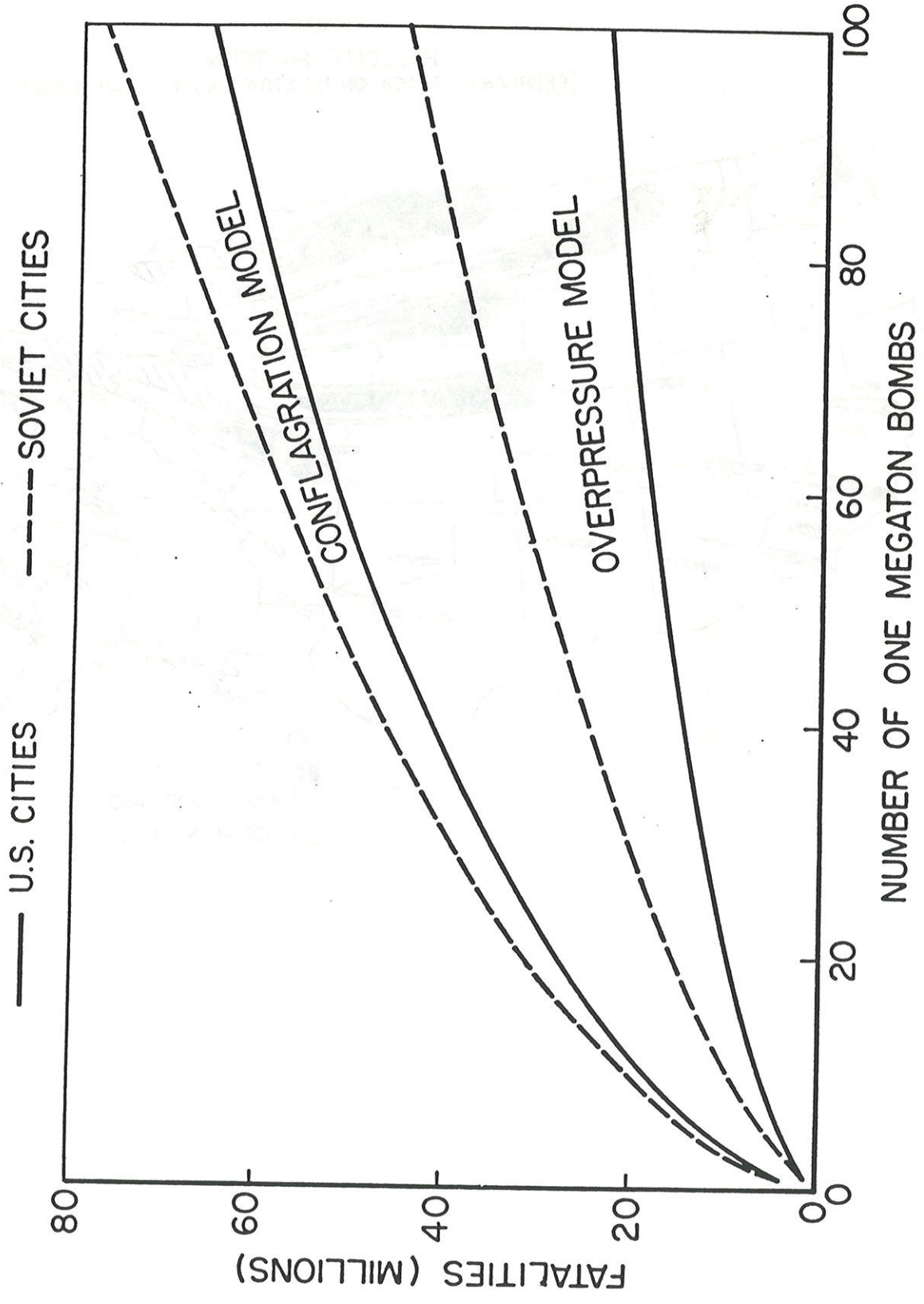


FIGURE 4

FALLOUT PATTERN
FEBRUARY ATTACK ON SOVIET STRATEGIC NUCLEAR TARGETS

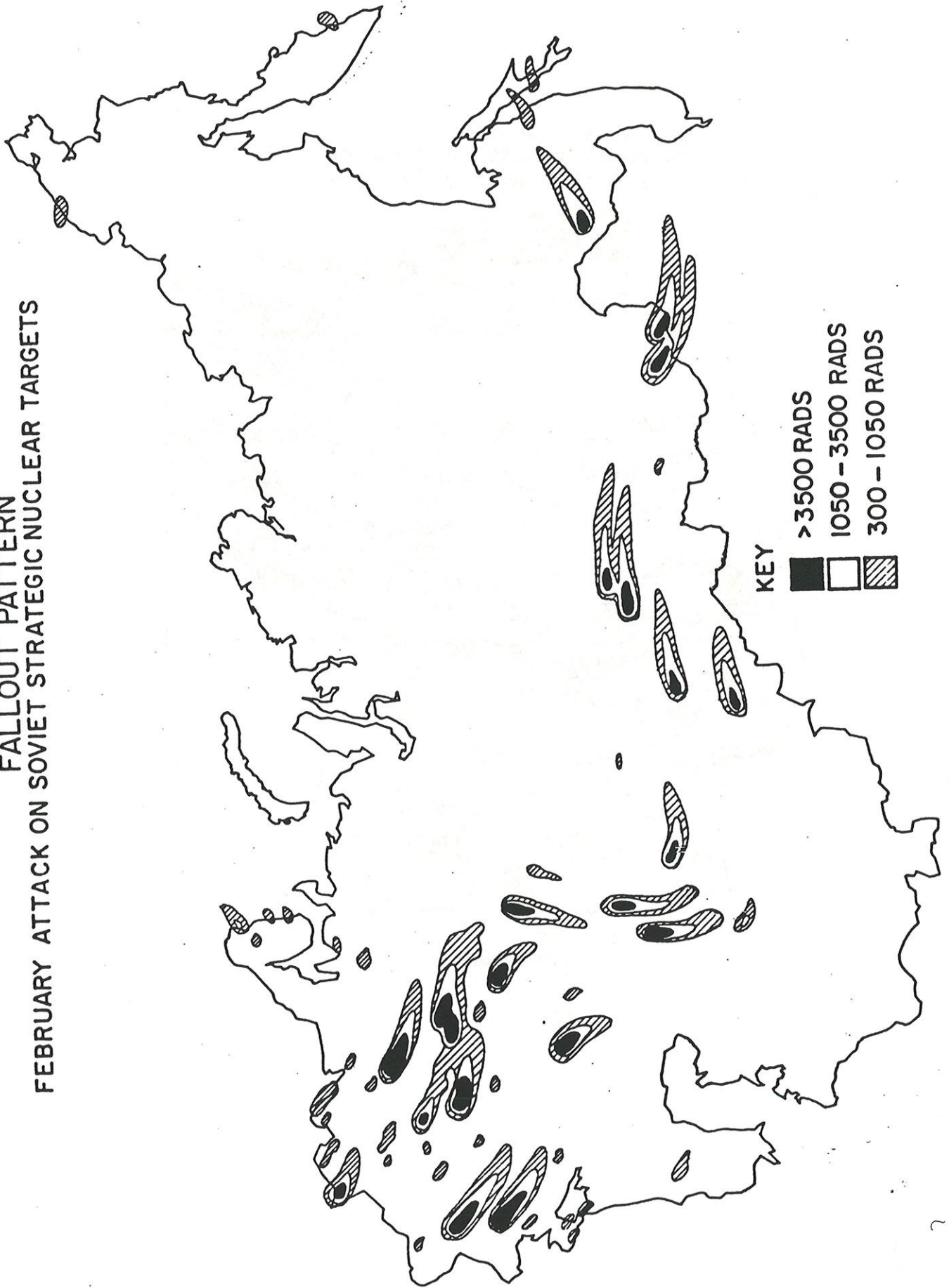


Figure 5 Fallout Pattern
From an Attack with 200-Kiloton Weapons on 171
Military Nuclear Targets in the Germanies

