

AD-A225 112

DTIC FILE COPY

1



SANDIA REPORT

SAND90-1513
Unlimited Release
Printed June 1990

Distribution Category UC-700

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185 and Livermore, California 94550
for the United States Department of Energy
under Contract DE-AC04-76DP00789

Sponsored by the ATSD/AE and funded
by the Defense Nuclear Agency under
IACRO 88-830 and the Department of Energy.

Carol A. Yarnall and James R. Caruthers
Survivability and Security (S²) System Studies Division
Sandia National Laboratories
Albuquerque, NM 87185

DTIC
ELECTE
JUL 31 1990
S D G D

FUTURE LOOK

Volume I.B

The Future World in Europe and Its
Implications for the Security and
Survivability of Non-Strategic Nuclear Forces

DISTRIBUTION STATEMENT A
Approved for public release
Distribution Unlimited



90 07 30 110



OFFICE OF THE SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301



07 APR 1988

Future Look is a joint activity between the Office of the Secretary of Defense for Atomic Energy, the Defense Nuclear Agency and the Department of Energy. Sandia National Laboratories in Albuquerque is conducting the technical effort. It is our joint intent to use the results of this work to be the basis for a technology jump in the 21st Century and beyond to enable us to make significant improvements in the security and survivability of our nuclear weapons.

I encourage your interest, support and feedback as the program progresses. The ideas and concepts of highest interest should be the focus of further efforts to gain additional knowledge or to explore variations of the themes. We need to look beyond our current, sometimes constrained, situations for opportunities to exploit in the future. Your comments may be addressed either to me; the Director, DNA, ATTN: OPNS; or, to DOE, ATTN: DASMA.

Robert B. Barker
Assistant to the Secretary of
of Defense (Atomic Energy)



Accession For	
NTIS CRA&I	☒
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution /	
Availability Codes	
Dist	Avail and/or Special
A-1	

FUTURE LOOK: Volume I.B

The Future World in Europe and Its Implications for the Security and Survivability of Non-Strategic Nuclear Forces

Carol A. Yarnall and James R. Caruthers
Survivability and Security (S²) System Studies Division
Sandia National Laboratories
Albuquerque, NM 87185

Abstract

→ This study was performed under FUTURE LOOK, a joint Defense Nuclear Agency/Department of Energy (DNA/DOE) sponsored study. The intent of FUTURE LOOK is to identify and develop means of providing requisite security and survivability to the Non-Strategic Nuclear Forces (NSNF) in the Twenty-First Century. Our current thinking about the future world in Europe is summarized. In this report we develop four scenarios/stockpile cases to cover the spectrum of potential happenings in Europe; we also develop general security and survivability implications and recommendations for each case. The four cases are: (1) A substantially reduced (factor of 2-10) European stockpile; (2) A near-zero stockpile, with no Army weapons remaining in Europe; (3) Current stockpile in Europe remains; and (4) Current stockpile numbers remain, but aggressive modernization is allowed. We plan to use the information in this report to assist in developing detailed security and survivability options as part of our follow-on to FUTURE LOOK studies. (j.c.)

be used

Preface

FUTURE LOOK is being conducted by Sandia National Laboratories (SNL). The purpose of this study program is to go beyond current activities and initiatives and to explore the application of new and emerging technologies with the intent of improving the survivability and security of the Non-Strategic Nuclear Forces (NSNF). The FUTURE LOOK goal is to provide a basis for an NSNF survivability and security posture for the year 2000 and well into the Twenty-First Century.

FUTURE LOOK is sponsored by the Assistant to the Secretary of Defense for Atomic Energy (ATSD/AE). Prior to Sandia's formal agreement to perform FUTURE LOOK, the ATSD/AE obtained the endorsement of the DOD NSNF Survivability Steering Committee. This Committee, now authorized in Department of Defense Directive 3150.3, will periodically monitor the progress of the program. The Committee is cochaired by the ATSD/AE and the Deputy Under Secretary of Defense for Strategic and Theater Nuclear Forces. SNL periodically briefs NATO's Nuclear Planning Group: the Senior Level Weapons Protection Group (SLWPG).

The FUTURE LOOK program is jointly funded and managed by the Defense Nuclear Agency (DNA) and by the Office of Military Applications of the Department of Energy (OMA/DOE). The Detailed technical management of FUTURE LOOK is provided by David Anderson of DNA, (703)325-1465.

Contents

1. Background	9
2. Objectives	9
3. Method of Investigation	9
4. Problem Definition and Potential Environmental Events.....	10
4.1 Conventional Forces in Europe (CFE) Treaty.....	10
4.2 Short-Range Nuclear Treaty	10
4.3 The German Question	10
4.4 Social Considerations.....	11
4.5 Economic Considerations.....	11
4.6 Decreasing Budgets for Defense.....	11
4.7 Technological Capabilities	11
4.8 European Stability	11
4.8.1 Eastern Europe.....	11
4.8.2 Western Europe.....	11
4.8.3 England and France.....	12
4.8.4 Soviet Union	12
4.9 Threat	12
4.9.1 Soviet Union Military.....	12
4.9.2 Terrorists	12
4.10 Third-World Nuclear Countries.....	12
4.11 Concerns of the US Congress	12
5. Findings	13
5.1 NSNF Will Not Be Eliminated But May Be Reduced	13
5.2 Multiple Factors Will Influence Security/Survivability	13
5.3 Plan for a Broad Range of Scenarios	13
6. Solutions: Four Cases Should Be Analyzed.....	14
6.1 Case One: Substantially Reduced (Factors of 2-10) Stockpile	14
6.2 Case Two: Near-Zero Stockpile in Europe with Air Force and Navy Systems Only.....	14
6.3 Case Three: Current Stockpile in Europe Remains	15
6.4 Case Four: Current Stockpile Numbers, Aggressively Modernized	15
7. Security and Survivability Defined	16
7.1 Security.....	16
7.2 Survivability.....	16
8. S ² Implications and Recommendations for Each Case.....	17
8.1 Case One: Factors of 2-10 Reduction	19
8.1.1 Implications for S ²	19
8.1.2 Recommendations for S ²	20

Contents (continued)

8.2	Case Two: Near-Zero European Stockpile.....	21
8.2.1	Implications for S ²	21
8.2.2	Recommendations for S ²	23
8.3	Case Three: Current Stockpile	24
8.3.1	Implications for S ²	24
8.3.2	Recommendations for S ²	24
8.4	Case Four: Current Numbers Modernized.....	25
8.4.1	Implications for S ²	25
8.4.2	Recommendations for S ²	25
9.	Conclusions and Recommendations	27
9.1	US Should Manage Weapons Reductions Carefully	27
9.2	Storage Sites Should be Closed and Hardened	27
9.3	Put Additional Warning Time to Good Use	27
9.4	Revise Employment Plans	27
9.5	Plan for Contingency Deployments.....	27
	Bibliography.....	29
	APPENDIX—Acronyms and Abbreviations.....	31

Tables

1	Stockpile Case Definitions.....	14
2	Case One: S ² Summary.....	17
3	Case Two: S ² Summary	18
4	Case Three: S ² Summary.....	18
5	Case Four: S ² Summary.....	19
6	Security and Survivability Conclusions and Recommendations	28

FUTURE LOOK: Volume I.B

The Future World in Europe and Its Implications for the Security and Survivability of Non-Strategic Nuclear Forces

1. Background

This report was performed under FUTURE LOOK, a joint Defense Nuclear Agency/Department of Energy (DINA/DOE) sponsored study to identify and develop means of providing requisite security and survivability (S^2) to the Non-Strategic Nuclear Forces (NSNF) in the Twenty-First Century.

A Sandia FUTURE LOOK Report, "Future World Environment" was published in December 1988. (See Laura B. Herndon, SAND88-1352, Volume IA, Sandia National Laboratories, Albuquerque, NM, 1988). Since that time, the European and Soviet Union environments have changed dramatically. This report updates the previous work, concentrates on the European condition and summarizes the major S^2 issues associated with future nuclear weapon stockpile possibilities.

References to the "environment" include such factors as political stability, social demands, economic considerations, and threats. These factors (as well as future arms control treaty negotiations) may well radically change the European stockpile, delivery systems, and associated troop levels.

The future is always difficult to predict, and since history-making events are happening so fast in Europe, predictions are made even more difficult. There are no existing documents that define the future environment and assumptions for the NSNF. Therefore to assist in our S^2 technological efforts, we have developed our own assumptions for the Twenty-First Century environment and the North Atlantic Treaty Organization (NATO) European NSNF stockpile.

2. Objectives

Because the future is uncertain, we determined that several scenarios should be developed to cover the entire spectrum of potential occurrences. Our objective was not to spend a lot of time refining the political/environmental arena, but to select a spectrum of events which would cover the gamut of potential impacts for S^2 .

In this paper, we try to summarize current thinking about the future world in Europe and the general implications/recommendations for S^2 . We will use these assumptions to develop S^2 technological options as part of our follow-on to FUTURE LOOK Studies. The implications and recommendations should not be interpreted as advocating any one method or technique, but rather as options to be analyzed.

3. Method of Investigation

Newspapers, journals, and periodicals were researched for current and real-time factual events. Editorials and articles documenting knowledgeable people's opinions about the future were also screened. NSNF historical information was gleaned from unclassified sources. Primarily, the report contains the opinions of the Sandia National Laboratories' (SNL) FUTURE LOOK Study Team.

4. Program Definition and Potential Environmental Events

There is no way to know what the future holds for the NSNF stockpile in Europe. A host of questions comes to mind. Will there be any NSNF left there? If so, how many, what kind, and where will they be located? What will the threat to these weapons and their systems be? What should the principles for ensuring NSNF S² be? What advanced technological concepts are best suited for future S² use?

To develop a framework for answering these questions, we analyzed the potential environmental factors which can influence the future European NSNF stockpile. The factors are complex and include such diverse influences as arms control treaties, the question of German unity, social pressures, economic issues, technological capabilities, European stability, the nature of the threat, and the perception of the US Congress in regard to NSNF modernization. Potential ramifications within each of these areas is discussed below.

4.1 Conventional Forces in Europe (CFE) Treaty

On-going CFE talks may indirectly affect the NSNF. It is expected that a Phase 1 Treaty will be signed by the US and the Soviet Union at a summit this summer (1990) and that it will be approved by a 35-nation summit late this year. The exact contents of the CFE remain to be seen. However, potential effects which could impact NSNF include a 10-15% reduction in delivery vehicles, i.e., aircraft, helicopters, artillery pieces, and armored troop carriers. A Phase 2 Treaty could reduce the same systems by an additional 25%. (See Jonathan Dean, "Conventional talks: A Good First Round.")

A reduction in US European troop strength (from 305,000 to 225,000) and Soviet Union troops (from 675,000 to 195,000) is very likely since President Bush and Secretary Gorbachev have already agreed on the matter.

Geographic zones (which could restrict the kinds and numbers of armaments, equipment, or personnel within certain regions) might also be stipulated. If nuclear storage sites fall within such a restricted region, they would have to be moved.

If a CFE agreement is signed, conventional forces will be significantly reduced. Because of the reduction, any subsequent buildup of forces would be more evident to intelligence sources. Because of the early

warning indicators, more time would be available to prepare for an attack. The *New York Times* and *The Washington Post* recently printed stories regarding US national intelligence estimates. These estimates concluded that NATO can now expect 33-44 days of warning prior to a Warsaw Pact attack. Previously, NATO could expect only 14 days of warning. This additional preparation time could impact future conventional and nuclear system storage and "transition to war" procedures.

4.2 Short-Range Nuclear Treaty

Some NATO countries and the Soviet Union wanted to address NSNF in conjunction with the CFE treaty; however, NSNF discussions will be delayed until a CFE treaty is in force.

If short-range nuclear negotiations begin after a Phase I CFE Treaty is signed and if the talks proceed quickly, the US could expect a short-range nuclear treaty by the end of 1991. It is expected that a treaty will significantly reduce the numbers of NSNF in Europe.

It is likely that Army artillery fired atomic projectiles (AFAPs) will be removed from Europe. The Lance modernization decision was postponed by NATO until 1992. In addition, President Bush has recently decided, unilaterally, that the US will not develop a follow-on to Lance (FOTL). Hence, the remaining primary nuclear weapons in Europe may be Air Force and Navy weapons. A proposed Air Force air-delivered, tactical, short-range attack missile system, the SRAM-T, could also be a subject of treaty negotiations.

There are two options for the disposition of the weapons reduced by the treaty: (1) All the subject weapons (now located in Europe) could be destroyed/retired; or (2) The weapons could be returned to the US/Soviet Union for use elsewhere. The intermediate-range nuclear force (INF) set a precedent for destroying classes of weapon-delivery systems (nuclear warheads were retained for future use). It is unlikely that destruction of a class of short-range nuclear weapons will be agreed to since neither country will want to jeopardize its nuclear weapons/delivery systems located outside of Europe.

4.3 The German Question

Recent rapidly moving events in East Germany will continue to impact the relationship between East and West Germany. The opening of Hungary's borders to the West and the subsequent opening of the Berlin Wall on November 9, 1989 lead many people to predict that within a year or two the two Germanys

will unite. This political alignment is still being discussed. The united Germany could become a neutral country (as advocated by the Soviet Union) or it could be associated with NATO.

The US, most NATO countries, and even Czechoslovakia, Hungary, and Poland believe that Germany must remain associated with NATO. One significant issue is the German/Poland border and Poland's fear that Germany may want to retake territory that was part of Germany before World War II.

If a united Germany is associated with NATO, US troops and nuclear weapons could conceivably remain in the western section. If Germany declares itself a neutral country, it could ask for the removal of all foreign troops and weapons.

There is a possibility, although apparently very slight, that reunification will not occur in the near term. This could mean that each Germany would retain superpower troops/weapons, but possibly at lower levels than they do at the present time.

4.4 Social Considerations

Some factions advocate reductions in all troop levels and in military equipment. Public attitudes toward nuclear weapons can influence modernization decisions and even create enough tension to force removal of existing weapons. There is pressure from certain Western European countries to reduce battlefield nuclear weapons unilaterally. Army, short-range, nuclear-artillery systems are very unpopular because they will inflict damage only on Germany or on East/West Europe and not on the Soviet Union. German reunification and Warsaw Pact disintegration exacerbates this problem.

4.5 Economic Considerations

The twelve-nation economic unity plan (EC 92) has been thrown into turmoil by potential German unification and the democratization of Eastern European countries that may now want to join Czechoslovakia's foreign minister has indicated that his country seeks full membership as quickly as possible.

There is a possibility that Europe will eventually share a common currency. Eastern European countries are in dire economic straits and want the US and Western nations to provide funds in the form of aid or loans. The Soviet Union will most certainly decrease or stop financial assistance to these countries. Japan and other Western countries look to the East for economic growth in the long term, by providing new markets for goods and perhaps sources of labor.

4.6 Decreasing Budgets For Defense

The apparent reductions in Soviet defense expenditures is occurring because the Soviets are unable to continue spending vast amounts on military prowess when they have so many grave internal economic problems. The US is likely to cut its defense budget significantly in an attempt to solve the budget deficit and to divert funds to social and economic needs. Indications are that other Western European countries also want to spend less on defense and more on internal social issues.

4.7 Technological Capabilities

The Soviet Union continues to improve its technology and still poses a significant military threat to the US. SMART munitions or precision targetable weapons can be deployed to threaten even hardened storage facilities or airbases. Computers and more sophisticated command, control, and intelligence (C²I) gathering techniques will allow the Soviets to keep better track of US mobile systems.

US technology capabilities are rapidly expanding in areas such as computer information, masking techniques, robotics, navigation aides, signal processing, silent power, and materials. These areas, as well as many others, can be applied to the development of new or upgraded S² systems which can reduce costs and manpower requirements. It should be noted that the US still faces challenges from the vexing problems associated with Soviet mobile weapon systems.

4.8 European Stability

4.8.1 Eastern Europe. Eastern European nations are very unstable now and will remain so in the near future. Communism is looking less attractive and the desire for democratic elections and economic status similar to the West is strong. Hungary and Czechoslovakia have demanded Soviet Union troop withdrawals over the next few years. Normal Western physiological needs (which are now visible to the East Europeans) are not being met in Eastern Europe. Even a totally democratic government will require a lot of time to turn things around. In the near term, living standards could conceivably be worse under democracy than they have been under communism.

4.8.2 Western Europe. The German question will have a great influence on the stability of Western Europe. East German problems could detrimentally impact West German economics and its standard of living.

4.8.3 England and France. British and French nuclear weapons have been a stabilizing factor in Europe. Changes in policies regarding their own weapons or for maintaining US weapons could have a significant affect on European security.

4.8.4 Soviet Union. The insurrection in parts of the Soviet Union, like the ethnic riots in the Aserbaijan capitol of Baku, create grave instabilities in the Soviet Union and could result in political overthrows or even military intervention by the Soviet Union.

The state of Georgia has been one of the leaders in moving toward increased autonomy. Most of the Central Asian republics want greater economic autonomy from Moscow and are creating internal strife previously unknown in the Soviet Union.

The consequences of the recent Lithuanian decision to withdraw from the Soviet Union remain to be seen, but is creating a significant problem for the Soviet Union.

Soviet policy is changing quickly under Gorbachev; however, the policy could be slowed, revised, or reversed under a new leader. Historical occurrences indicate he could be replaced at a moment's notice by a complete autocrat. The West would like to think he will remain in power or that if he is replaced, his successor could not use force to change things around. Only time will tell. Economic progress or economic decline will be strong determinants for any Soviet leader.

4.9 Threat

4.9.1 Soviet Union Military. In their efforts at independent rule, Hungary and Czechoslovakia have requested that all Soviet troops be removed from their countries over the next few years. These actions, coupled with a CFE treaty, indicate that the Soviet Union threat to Europe will be significantly reduced. Current popular sentiment is that the Soviet Union is less of a threat worldwide. However, leopards do not change their spots over night and many urge that the US be wary of letting its guard down too soon. Also, the Soviets have not taken steps to reduce modern strategic systems which, of course, are capable of targeting Europe.

Most sources indicate that the future threat is likely to be a mix of nuclear, conventional, and chemical systems. This threat will be more technically sophisticated and probably very mobile.

4.9.2 Terrorists. International terrorism is ever present and terrorist tactics are getting more sophisticated. Chemical and biological systems are within their grasp and we can assume they have access to high technological weapons and explosives. The reduction in Soviet influence on Eastern European countries could potentially result in an increase in terrorism from some factions within those countries.

The openness between East and West also means there is a greater probability for terrorists or spies to get "inside" NATO facilities to sabotage, overtly destroy, or steal weapons. A terrorist activity to steal a nuclear weapon could hold Europe hostage and jeopardize the positioning of all nuclear weapons. In a transition-to-war posture, insiders (who could be terrorists or spies) can seriously impact survivability. Security response and tactics are also affected by a hostile insider.

4.10 Third-World Nuclear Countries

Many Third-World countries (like South Africa and Pakistan) now have or can quickly obtain nuclear weapons. CIA Director, William Webster, has stated that "by the year 2000, at least six countries probably will have missiles with ranges up to 3,000 kilometers; at least three of them may develop missiles with ranges up to 5,500 kilometers." Four of these nations will have "either nuclear weapons or advanced nuclear weapons programs." Webster predicts that four more nations could be added to the nuclear list by the end of the decade. (See Brian Green "A Modified Estimate of the Threat," *Air Force Magazine*, March 1990, p. 89.) It is possible that Germany could also develop a nuclear capability in response to changes in long-standing treaties. The US must be prepared to respond in kind to deter others from using nuclear weapons in any part of the world.

4.11 Concerns of the US Congress

Given the perception of a reduced Soviet Threat, many Congressman are demanding withdrawal of more troops and weapons from Europe and the draw-down of our Defense Department, in general.

If NATO will not allow deployment of modernized nuclear weapons, Congress will be reluctant to fund the development of new, short-range nuclear systems.

5. Findings

The range of disparate potential environmental events outlined in Section 4 amplify the difficulty in predicting and planning for the future. Our findings indicate that the NSNF will not be totally eliminated from Europe, and that multiple and very diverse factors will influence security and survivability. Therefore, the US should plan for a broad range of scenarios or stockpile cases to assure that all bases are covered. A more specific discussion of these three findings are given below.

5.1 NSNF Will Not Be Eliminated But May Be Reduced

NSNF will not be totally removed from Europe in the foreseeable future because of the political deterrent and linkage between NSNF and US strategic nuclear systems. However, the possibility of a major reduction in the near future does exist.

5.2 Multiple Factors Will Influence Security/Survivability

We have assumed that it does not matter *which* event(s) actually changes the stockpile. The important thing is the potential change and its impact on S². Hence, we will not spend any more time on discussing whether there will be a short-range nuclear treaty which will reduce nuclear weapons or whether it will be a unilateral or public sentiment forced decision. We will only analyze the factors which are

significant for S². We have determined that the primary factors which will influence security and survivability planning are:

- NATO guidelines/employment posture
- treaty verification provisions
- kind and number of nuclear weapons
- whether the weapons can be modernized or not
- kinds and numbers of delivery systems
- locations of weapons/delivery systems
- locations and configurations of storage sites
- warning time for attack
- Soviet threat
- terrorism threat
- Third World threat
- disposition of nuclear weapons which leave Europe (Weapons are either destroyed/retired or returned to the US for contingency use.)

5.3 Plan for a Broad Range of Scenarios

There are a number of disparate events that could occur in Europe. We could choose to plan for the ones we feel are most likely to occur and ignore the less likely ones. But where security and survivability are concerned, we must be prepared to deal with any scenario, especially if that scenario represents a total departure from current operations and if it requires different plans. We conclude that the US and NATO cannot afford to concentrate on the most probable scenario and, thus, be caught short.

6. Solutions: Four Cases Should Be Analyzed

From the discussions in Section 4 we have developed four scenarios or cases which depict the range of potential changes. We can envision a variety of other options and sub-options, but feel the four cases represent the range of environments that are adequate for security and survivability planning. Please note the four cases are static snapshots, whereas *the* actual case will be dynamic. For example, NATO is currently operating under Case Three. We could evolve to Case Two in the 1990s, and to Case One in early 2000. In addition, at any time, we could end up with an increased Soviet threat and a condition like Case Four. The dynamics are hard to predict. But the US should not be caught short; adequate contingency planning must be accomplished. In every instance, we have assumed that U.K. and French nuclear systems remain status quo. The cases are described in more detail in the following sections. Table 1 summarizes the cases for easier reference.

6.1 Case One: Substantially Reduced (Factors of 2-10) Stockpile

Scenario Assumptions: Cold war ending cautiously, medium Soviet threat. Conventional, strategic, and short-range nuclear treaties are signed. NATO/WTO remain as defense pacts and troops/weapons remain, but at substantially reduced levels. German unification occurs, but they remain associated with NATO and US weapons/troops remain in West Germany. Modernization of Army, Navy and Air Force weapons is allowed. Nuclear weapons which leave Europe are retired/destroyed. Sophisticated terrorism threat exists.

6.2 Case Two: Near-Zero Stockpile in Europe with Air Force and Navy Systems Only

Scenario Assumptions: Cold war ends, little Soviet threat. Conventional, strategic and short-range nuclear treaties are signed. Total US force reduction by factors of 10 to 100. NATO/WTO serve as weak

Table 1. Stockpile Case Definitions

Four Stockpile Cases				
Case 1:	Substantially Reduced European Stockpile			
Case 2:	Near-Zero European Stockpile			
Case 3:	Current Stockpile in Europe Remains			
Case 4:	Current Stockpile Numbers, Aggressively Modernized			
	Case Summary			
	Case 1	Case 2	Case 3	Case 4
Army Wpns in Europe	Yes	No	Yes	Yes
AF Wpns in Europe	Yes	Yes	Yes	Yes
Navy Wpns in Europe	Yes	Yes	Yes	Yes
Modernization	Yes	Yes; AF/Navy	No	Yes
Disposition	Retire/Destroy	Retain in US	N/A	N/A
German Unification	Yes	Yes	Yes	Yes
German Alignment	With NATO	Neutral	With NATO	With NATO
Nuc Wpns Reduced By	Factor of 2-10	Factor of 10-100	Not Reduced	Not Reduced

economic unions only. German unification and nuclear neutralization occur. US and Soviet Troops/weapons are removed from Germany. U.K./French dominate north and central regions while US dominates southern region. Increased emphasis on US air and naval forces. No army systems in Europe. Air Force and Navy modernization allowed. A portion of the nuclear weapons which leave Europe are stored in US for contingency redeployment around the world.

Note: Before Army weapons (like the W-88 or Lance) can be used following the mid-nineties, a service life extension program must be completed. Sophisticated terrorism threat exists.

6.3 Case Three: Current Stockpile In Europe Remains

Scenario Assumptions: Status quo, Soviet threat viewed in the same way as in the past several years. Current peace initiatives in Soviet Union *do not* continue and optimism of end of cold war turns to concern/pessimism. A conventional treaty is signed, but NATO weapon and troop levels drop only mod-

erately from what we have today. Warfighting is compensated by technical improvements and mutual reductions. No short-range nuclear treaty is signed. East and West Germany reunify, but remain associated with NATO and allow US troops/weapons in West Germany. No modernization is allowed. Sophisticated terrorism threat exists.

6.4 Case Four: Current Stockpile Numbers, Aggressively Modernized

Scenario Assumptions: Complete turnaround, worse Soviet threat. Soviet Union becomes threatened economically and militarily by loss of status in Eastern Europe and by instability in their Republics. Conventional and nuclear treaties are signed, but then abrogated. Soviet Union introduces troops to recoup losses. West reacts by retaining current force levels and a program of modernization to increase effective strength. Army, Navy, and Air Force systems are aggressively modernized. Sophisticated terrorism threat exists.

7. Security and Survivability Defined

7.1 Security

Security is broadly defined as measures taken to protect people, information, supplies or equipment from espionage, observation, sabotage, annoyance, theft, fire, or attack. (See AFM 11-1, *Air Force Glossary of Standardized Terms and Definitions*.)

Security in FUTURE LOOK is defined as the prevention of:

- unauthorized access to nuclear weapons
- unauthorized or malevolent access to the facilities, personnel, and equipment directly associated with the weapons.

Our security goals are to detect any breach, deny alien access, delay enemy penetration, reduce any opportunity to damage or remove equipment, systems, or material, and to recover any loss.

7.2 Survivability

Survivability is defined as "the capability of NSNF and their supporting systems and facilities to endure and maintain the ability to perform their assigned missions." The scope of NSNF survivability applies to all of the following:

- all mission-essential assets (personnel, equipment, facilities, nuclear and non-nuclear elements of weapon systems, weapon systems support, and command, control, communications, and intelligence C³I).
- the entire threat spectrum (unconventional, conventional, chemical, nuclear).
- doctrine, organization, procedures, training and equipment. (See DOD Directive 3150.3.)

In FUTURE LOOK we use a more general definition which helps to develop a design goal. Our definition is: Survivability is frustration of enemy plans or actions to prevent employment of the weapon as (and when) intended. Our survivability goals are detect, deny access, delay penetration, and reduce opportunity to damage or destroy.

8. S² Implications and Recommendations for Each Case

The following tables, Tables 2-5, summarize the security and survivability implications and corresponding recommendations for each case.

Detailed discussion of the implications and recommendations for each case follows the tables. These recommendations are not in priority order, nor do we wish to imply that they should all be implemented. Rather, these recommendations are viewed as starting points or bases for further analysis.

Table 2. Case One: S² Summary

Implications	Recommendations
Weapons more valuable/vulnerable	Analyze increased need for survivability
Weapons retired to US	Plan for safe, secure transport and disposal; anticipate rapid withdrawal
Reduction in storage sites	Analyze optimum number/site
Need new hardened storage	Design underground sites; consider AF vault concept; plan for co-located dedicated delivery systems
Minimize site signatures	Employ CC&D and obscuration
Fewer US personnel in EUROPE	Substitute technology for people
Security forces must be survivable	Evaluate technologies to protect security forces
Treaty verification may provide critical data to enemy; insider threat may increase	Design reconfigurable sites/other measures to withhold information and enforce procedures
Fewer military exercises	Use simulations and non-nuclear-unique equipment and procedures
Command and control different	Evaluate C ³ systems and PAL procedures
Dispersal and mobility are vital	Develop portable S ² systems for field use
Transportation options are needed	Develop alternative modes; develop hardened containers
More warning time available	Maximize use for safety and S ²
Weapons more political	Review employment guidelines

Table 3. Case Two: S² Summary

Implications	Recommendations
Weapons more valuable/vulnerable	Analyze increased need for survivability
Nuclear weapons are removed from Germany	Need S ³ movement plan; analyze new locations
Plan for contingency deployment around the world	Develop plans for removal of reduced weapons, storage back in US, and return of weapons to foreign soil
Large reduction in storage sites	Analyze optimum number/site; design new site; with co-located delivery systems; emphasize lateral dispersal
Minimize site signatures	Employ CC&D/obscuration
Fewer US personnel in Europe	Need more technology; may want elite nuclear force
Security forces must be survivable	Evaluate technologies to protect security forces
Treaty verification may provide critical data to inspectors; insider threat may increase	Design reconfigurable sites/measures to withhold information
Fewer military exercises	Use simulations and non-nuclear-unique equipment and procedures
Command and control easier/different	Evaluate C ³ systems and PAL procedures
Dispersal and mobility are vital	Develop portable S ² systems for field use
Transportation options are needed	Develop alternative modes; develop hardened containers
Modernization of AF/Navy systems	Analyze new class of NSNF; study increased Navy option
More warning time available	Maximize time for S ³
Weapons mostly political	Review NATO employment guidelines

Table 4. Case Three: S² Summary

Implications	Recommendations
Minimal changes to S ²	Assess current weaknesses; identify highest priority fixes; do cost/benefits analyses
Security forces must be survivable	Evaluate technologies to protect security forces
Treaty verification may provide critical data to inspectors; insider threat may increase	Modify sites for reconfiguration/other measures to withhold information; improve PRP/PAL
Fewer US personnel in Europe	Substitute technology for people
Storage site locations may be compromised	Employ CC&D and implement obscuration technology
Dispersal and mobility remain principles	Develop portable S ² systems for field use; study alternative transportation modes; consider dedicated FAASVs
Warning time same as today	Analyze current practices

Table 5. Case Four: S² Summary

Implications	Recommendations
Need new hardened storage sites	Design new underground sites and/or expand AF vault concept
Minimize site signatures	Employ CC&D and obscurity
Insider threat may increase	Consider reconfiguration; other measures; improve PRP/PAL
Dispersal and mobility are vital	Develop portable S ² systems for field use
New weapons fielded with S ² designed into them	Develop link between system designers and S ² experts
Transportation options are needed	Develop alternative modes; develop hardened container
Security forces must be survivable	Evaluate technologies intended to protect security forces
Warning time same as today	Analyze current practices

8.1 Case One: Factors of 2-10 Reduction

8.1.1 Implications for S²

• **Weapons Are More Valuable/Vulnerable.** Because there are fewer weapons in Europe, each one becomes more valuable and more vulnerable to further significant attrition. Hence, S² concerns will be greater than today.

• **Weapons Retired To US Need Safe, Secure Transport.** The nuclear weapons that are removed from Europe are retired and returned to the US for recovery of the nuclear material. Safety and security for their transport and disposal needs to be addressed.

• **Number Of Storage Sites In Europe Will Be Reduced.** The reductions in size of the stockpile could result in reductions in a number of storage sites in Europe. The critical question is how many weapons should be co-located together. Obviously if you only have a few hundred weapons, you would not want to disperse them by tens; likewise, you would not want to put all your weapons in one place.

• **New Harder Storage Sites Are Needed.** Totally new concepts for storage may be desirable. Very hard storage sites may be needed because of the high technology nature of the threat. Several advanced storage concepts are applicable: a vault underground system, a semi-buried "FORT" structure, or a modified underground storage complex. Chemical warfare

protection must be included for all options. (See Appendix I, Volume V.D, report pending.)

• **Site Signatures Should Be Minimized.** It is important to obscure on-site as well as deployed-site activities from public and threat view. Overall signatures which give sites away must be reduced through technological innovations and by reducing manpower-intensive operations.

• **Fewer US Personnel in Europe Will Affect S².** There will be fewer US military personnel in Europe to handle S² tasks. Technology must replace people. But personnel reductions must be consistent with the entire concept of operations, i.e., we cannot reduce numbers below the minimum number required for successful operations in the following areas:

- mobile and fixed operations
- flexible operations
- responsive security operations
- survivability operations.

• **Security Forces Must be Survivable.** The on-site security forces and any reinforcing forces must survive a variety of threats to protect the weapons and must execute any recapture or recovery operations should weapon access be lost.

• **Treaty Verification May Provide Critical Data To Enemy.** Because of the CFE or short-range nuclear treaties, Russian inspectors may have access to NSNF storage sites and/or may gain critical information about locations/numbers of nuclear weapons and their inherent survivability.

- **Insider Threat May Increase.** Because of the increased terrorist threat and openness between East and West Europe, there is a higher likelihood that people working inside the nuclear weapons units may be compromised or may become an "inside" threat.

- **Fewer Military Exercises Will Reduce Proficiency.** Military exercises will probably be fewer because of reduced people/weapons, economic considerations, and also because the exercises may cause attention and perhaps even give a transition-to-war impression.

- **Command and Control Will be Different.** Fewer weapons will affect C³ problems. Connectivity between fewer points and executing agents should be easier to implement and maintain. At the same time, weapons will need to cover a larger employment area, and C³ after dispersal may be more difficult. Dedicated nuclear command and control may be a cost-effective option. Current permissive action link (PAL) code management practices will need reevaluation in light of changed employment plans.

- **Dispersal and Mobility are Vital.** Dispersal and mobility will remain important factors in the survival of both air and ground delivered systems; security enhancements to protect warheads during transport and field storage should be developed. Lateral dispersal concepts should be pursued.

- **Transportation options are Needed.** Several modes of transportation for operational and logistical moves are desirable to provide flexible response for S² measures. Broad areas must now be protected with fewer weapons. Containers which meet full safety, security, and survivability requirements must be designed.

- **More Warning Time Should Assist Survivability Measures.** Case one implies there will be more warning time for transition to war. Hence, there will be more time to take active survivability measures, e.g., once the troops are warned, they can relocate. Part of the warning time could be used to improve safety and security. For example, storing nuclear warheads separately from their propulsion systems is a safer practice than storing an all-up round. If there is enough warning time to assemble the weapon and if this will not detrimentally impact the mission, storage practices could be changed. If available warning is to help survivability, however, the extra time gained by the early warning must be productive. If the extra time is used for further analyses and only succeeds in postponing action, it is a hindrance rather than a help.

- **Weapons' Purpose Becomes More Political Than Military.** Fewer nuclear weapons may mean these few become concentrated "political instruments." As a result, current dilemmas with NATO resolve and unanimity for employment may be amplified.

8.1.2 Recommendations for S²

- **Consider Dedicated Delivery Systems Located With Weapons.** If the numbers of nuclear weapons are significantly reduced and if warheads are stored far away from delivery vehicles, there is a potential for increased vulnerability during transportation for mating. There is also a loss of valuable time between the decision to employ and the employment itself. Also, requiring large numbers of delivery vehicles and personnel to be dual-capable is no longer efficient or effective because only a small number of delivery vehicles and personnel will employ nuclear weapons in an actual situation. The large peacetime costs for training, safety, etc., to be dual-capable may not be warranted. Personnel can be more effective if they are trained to operate or maintain a single type of weapon. For these reasons, we also recommend dedicated nuclear delivery vehicles and personnel.

- **Plan to Build New Storage Sites.** Very hard storage sites are needed and the US should plan to build new ones using new underground security and survivability technologies such as the Air Force vault concept or a semi-buried "FORT" concept. Special attention should be given to the possibility of chemical weapon attack. Of course, the need for new storage sites must be analyzed in conjunction with the concept of early dispersal for increased survivability.

- **Analyze the Increased Need for Survivability Due To Weapon Reductions.** Having fewer weapons means they are more valuable and more vulnerable to total elimination. Qualitative and quantitative analyses should be used to describe the additional need for survivability measures.

- **Develop a Plan for Disposal of Weapons.** A plan should be developed to assure the security of the "reduced" weapons from the time the reduction decision is made until they are safely back in the US disposal area. This plan should anticipate short notice and rapid withdrawal as an option.

- **Analyze Optimum Number of Weapons Stored In Each Site.** Assuming that a specific number of nuclear weapons would remain, detailed analyses of the optimum number of sites and the number of weapons

per site should be performed. This optimum number should be stored at each site. Both security and survivability should be taken into account.

- **Develop Technologies to Reduce Site Signatures.** The concepts of camouflage, concealment, deception and obscurity should be thoroughly analyzed and applied to fixed storage sites and to dispersal operations.

- **Evaluate the Technologies which Can Replace People.** Since the number of military personnel in Europe will be reduced, the technology base should be screened for those concepts which minimize the number of people required for operation and maintenance.

- **Evaluate Technologies to Better Protect Security Forces.** Surveillance, detection, assessment, and response can benefit from applying technology in a manner that ensures that on-site security forces will survive an initial attack and that they will retain the capabilities of weapon protection, recapture, or recovery. Technologies such as robotics, remote sensors, cameras, etc., should be exploited.

- **Develop Protection Against Insider Threat and Inspectors.** The PRP program should be continued and procedures and technology should be added for insider protection, prevention, and detection. Sites should be designed so that security operations, plans, and capabilities can be withheld from arms control verification inspectors, e.g. storage-site security should be reconfigured periodically. Technology should be used to ensure that procedures for people and materials are enforced.

- **Devise On-Site Exercises/Simulations for Training.** Computer-based simulations should be analyzed for their application to security and survivability proficiency training at each site. Realistic exercises should be accomplished within the confines of the site. Equipment and procedures which are not nuclear unique will enhance training and proficiency.

- **Develop a Plan for New Command and Control Concept.** The current command and control system should be analyzed and changed to accommodate this case. PAL code management materials and equipment should be analyzed for flexible broad employment.

- **Develop Portable S² Systems.** Need to develop easily transported sensors, robots, barriers, masking/quieting techniques and other technologies which are

portable and will be effective in a dispersed-field environment.

- **Develop Alternative Transportation Modes.** To maximize security and survivability, develop alternative modes of transportation for operations and logistics. Fewer weapons will be transported to broader areas of application. Containers which meet full safety and security requirements for transportation, storage, dispersal, and employment must be designed. Dedicated field artillery ammunitions supply vehicles (FAASV) should be evaluated.

- **Make Maximum Use of Additional Warning Time.** The additional warning time that is anticipated should be analyzed to make sure survivability measures take advantage of the increased time. The command and control decisions and message process must support the measures.

- **Review/Revise NATO Guidelines for Nuclear Weapons.** If necessary, NATO guidelines for nuclear weapons employment and decision making should be revised, in light of the decreased number of weapons. Employment must still convey a message of NATO unanimity and resolve.

8.2 Case Two: Near-Zero European Stockpile

8.2.1 Implications for S²

- **Weapons are Much More Valuable/Vulnerable.** Because there are fewer weapons in Europe, each one becomes more valuable and more vulnerable to further significant attrition.

- **Nuclear Weapons Must be Removed from Germany.** If Germany reunifies and becomes nuclear neutral, all NSNF weapons will have to be moved out of Germany. Whether the weapons would be moved to England or some other country, to Naval ships, or back to the US needs to be determined.

- **Weapons Moved to US for Deployment Around the World.** In this case some Army and Air Force nuclear weapons are moved from Europe back to the US for retention and contingency deployment back to Europe or elsewhere in the World. The Army weapons will need to go through a service life extension program before they can be used past the year 2000. Also, totally new security and survivability measures will need to be designed for flexible worldwide contingency operations.

• **Numbers of Storage Sites in Europe are Drastically Reduced.** Large reductions in size of the stockpile will result in reductions in the number of storage sites, i.e., all Army sites are scrapped. The AF vault concept and the storage of AF bombs need to be readdressed, likewise storage of new missiles like the short-range attack missile, the SRAM-T. The critical question is how many weapons should be co-located. The US would not want to disperse them by tens, nor would they want to put them all in one place. Co-located weapons and delivery vehicles (such as the AF vault concept) need to be continued. Also, dedicated nuclear delivery systems, rather than dual-capable systems, need to be explored. Totally new concepts for storage may be desirable. Chemical warfare protection must be included. Of course, the need for new storage sites must be analyzed in conjunction with the concept of early dispersal for increased survivability.

• **Site Signatures Must be Minimized.** Because the public is more curious and better informed than ever before, it will be increasingly important to obscure on-site activities from public view. Overall signatures must be reduced through technological innovations and by reducing manpower-intensive operations which give the site away.

• **Fewer US Personnel Will Affect Security/Survivability.** There will be fewer US military personnel in Europe to handle security and survivability tasks. Reliable technology must replace people. But personnel reductions must be consistent with the entire concept of operations, i.e., we cannot reduce numbers below that required for mobile and fixed, flexible, responsive S² operations.

• **Security Forces Must be Survivable.** The on-site security forces and any reinforcing forces must be survivable against a variety of threats to protect the weapons and execute any recapture or recovery operations should weapon access be lost.

• **Treaty Verification May Provide Critical Data to Enemy.** Because of the CFE or short-range treaties, Russian inspectors may have access to NSNF storage sites and/or gain critical information about locations/numbers of nuclear weapons and their inherent security and survivability.

• **Insider Threat May Increase.** Because of the increased terrorist threat and openness between East and West Europe, there is a higher likelihood that people working inside the nuclear weapons units may be compromised or may become an "inside" threat.

• **Fewer Military Exercises Will Reduce Proficiency.** Military exercises will probably be fewer because of reduced people/weapons, but also because the exercises will be visible enough to cause attention. These exercises could give a transition-to-war impression. Simulations and exercises on site need to aid training and proficiency.

• **Command and Control May be Easier, But Different.** Employing only a few hundred weapons (none of which are Army) should make command and control easier overall. Connectivity between fewer points and executing agents should be easier to implement and maintain. At the same time, however, weapons will need to cover a larger employment area, and command and control after dispersal may be more difficult. Dedicated nuclear command and control may be a cost-effective option. Current PAL-code management practices will need to be reevaluated in light of changed employment plans.

• **Dispersal and Mobility are Vital.** Dispersal and mobility will remain important for survival. This means we need security enhancements and cost-effective options for lateral dispersal.

• **Transportation Options are Needed.** Several modes of transportation for operational and logistical moves are desirable to provide flexible response for S² measures. Broad areas must now be covered with fewer weapons. Containers which meet full safety, security, and survivability requirements must be designed.

• **More Warning Time Should Assist Survivability Measures.** This case implies there will be more warning time for the transition to war. Hence, there will be more time to take active survivability measures, like relocating, upon warning. But if warning time is to help survivability, it must be put to good use.

• **Weapons' Purpose Become More Political Than Military.** There are no Army weapons left in Europe under this option. When the number of nuclear weapons are drastically reduced, it means that their use as "political instruments" is greater than before and current dilemmas with NATO resolve and unanimity are amplified. This resolve and unanimity are less meaningful if Germany is not part of NATO. It may become important for France to rejoin NATO under the assumptions of this case.

8.2.2 Recommendations for S²

- **Develop Plans/Concepts of Operations for Contingency Deployments.** Plans and concept of operations to return Army weapons to the US from Europe must be developed. The plan needs to address weapon removal from Europe, storage in US, a service life extension program, transportation back to Europe (or other theater) in a crisis, and weapon protection and transportation once back in Europe or some other theater. This plan should anticipate short notice and rapid withdrawal as an option. It should also address the Army organization for ordnance and logistics for contingency operations.

- **Develop an Action Plan to Move Weapons out of Germany.** An S² plan for moving AF weapons out of Germany should be developed. Analyses of the new locations must be accomplished. New locations could be US, England, other European countries, or naval vessels. Plans for installation of a weapons storage and security system (WS³) must stay in sync with these options.

- **Analyze the Increased Need for Survivability Due to Weapons Reductions.** Having fewer weapons means they are more valuable and more vulnerable to total elimination. Qualitative and quantitative analyses should be used to describe the additional need for survivability measures.

- **Design a Storage Site with New Technologies using the Air Force Vault Concept, Colocated with Dedicated Delivery Systems.** A site of the future should be designed and S² technologies should be prototyped. Protection against chemical weapon attack must be provided. The site should be designed so that security plans and capabilities can be withheld from arms control verification inspectors, e.g. storage site security should be reconfigured periodically. The AF weapons storage-vault concept should be compared to other concepts. Sites may be at different locations than those sites now planned (because of the potential for removing nuclear weapons from Germany). Warheads should continue to be stored along with their aircraft delivery vehicles. In fact, with so few nuclear weapons, delivery vehicles and people should be dedicated to the nuclear mission. Fewer nuclear weapons will be less costly and more easily supported. Dual-capable systems would be less efficient because training and operational readiness for nuclear weapons would have to be spread across a large number of launch platforms. People who would never actually use nuclear weapons would have to be

trained in their use. Numbers and locations of sites should be determined by optimizing security, survivability, and operational performance. With fewer AF weapons, alternative, cost-effective approaches to lateral dispersal should be given a high priority.

- **Develop Technologies to Reduce Site Signatures.** The concepts of camouflage, concealment, deception, and obscurity should be thoroughly analyzed for application to fixed storage sites and to dispersal operations.

- **Evaluate the Technologies Which Can Replace People.** Since the number of military personnel in Europe will be reduced, the technology base should be screened for those concepts which minimize the number of people required for operation and maintenance.

- **Evaluate Technologies to Better Protect Security Forces.** Surveillance, detection, assessment, and response can benefit from applying technology in a manner that ensures the on-site security forces will survive an initial attack and that the forces will maintain capabilities for weapon protection, recapture, or recovery. Technologies such as robotics, remote sensors, cameras, etc., should be exploited.

- **Develop Protection Against Insider Threats and Inspectors.** Continue the PRP program, but add procedures and technology for insider protection, prevention, and detection. Design sites so that security plans and capabilities can be withheld from arms control verification inspectors, e.g., periodically reconfigure storage site security. Technology should be used to ensure procedures for people and material are enforced.

- **Devise On-Site Exercises/Simulations for Training.** Computer-based simulations should be analyzed for application to S² proficiency training at each site. Realistic exercises should take place within the confines of the site. Equipment and procedures which are not nuclear unique will enhance training and proficiency.

- **Develop a Plan for New Command and Control Concept.** The current command and control system should be analyzed and changed to accommodate this scenario. Reevaluate PAL code management, materials, and equipment for flexible broad employment.

- **Develop Portable S² Systems.** A need exists to develop efficient, easily transported sensors, robots, barriers, masking/quieting techniques, and other

technologies which are portable and which will be effective in a field environment.

- **Develop Alternative Transportation Modes.** To maximize security and survivability, develop alternative modes of transportation for operations and logistics. Fewer weapons will be transported to broader areas of application. Containers which meet full safety and security requirements for transportation, storage, dispersal and employment must be designed.

- **Analyze the Potential for New Class of NSNF.** Security and survivability experts and weapon system experts should initiate a study to determine if entirely new weapons which require less maintenance and handling might be preferable. Given the large budget reductions, it may be very difficult to obtain funds for "new program starts", but that should not hinder Sandia, DNA, and Service Personnel from evaluating the options.

- **Study Naval Options for NSNF.** Navy weapons and S² alternatives must be studied to determine if their role should be expanded, since weapons cannot be stored in Germany and since Army systems are totally removed from Europe. An allied role for employment of Navy tactical systems should be investigated.

- **Make Maximum Use of Additional Warning Time.** The anticipated additional warning time should be analyzed to make sure survivability measures take advantage of the increased time. The command and control decision and message process must support the measures.

- **Review/Revise NATO Guidelines for Nuclear Weapons.** NATO guidelines for nuclear weapon employment and decision making should be revised, if necessary, in light of the decreased numbers of weapons. Employment must still convey the NATO message of unanimity and resolve.

8.3 Case Three: Current Stockpile

8.3.1 Implications for S²

- **Only Minimal Security/Survivability Upgrades Allowed.** Minimal changes or upgrades to S² systems will be funded. Detailed analyses of these systems must identify the highest priority fixes and the cost-benefit tradeoffs for each.

- **Security Forces Must Survive.** The on-site security forces and any reinforcing forces must survive

against a variety of threats. These forces are expected to protect the weapons and to execute any recapture or recovery operations if weapons access is lost.

- **Treaty Verification May Provide Critical Data to Enemy.** Russian inspectors will have access to NSNF storage sites and will be able to gain insight into our assets, capabilities, and perhaps weaknesses.

- **Insider Threat May Increase.** Because of the increased terrorist threat and the openness between Eastern and Western Europe, there is a higher likelihood for people who work inside the nuclear weapons units to be compromised or to become "inside" threats.

- **Fewer US Personnel in Europe Will Affect Security/Survivability.** There will be fewer US military personnel in Europe to handle S² tasks. Technology must replace people. But personnel reductions must be consistent with the entire concept of operations, i.e., we must not reduce numbers below those required for mobile and fixed, flexible, and responsive S² operations.

- **Current Storage Sites' Locations May be Compromised.** Storage sites remain in the same location and are widely known. Therefore, special S² measures are needed to obscure on-site activities from view.

- **Dispersal and Mobility Remain Principles.** Dispersal and ground mobility remain a survivability concept. Very low cost technology options which can enhance security and survivability in a dispersed mode are required.

- **Warning Time Same as Today.** Case Three assumes that the threat from the Soviet Union remains the same as it has been over the past few years because of the instability in Eastern Europe and within the Soviet Union. It assumes the warning time for the transition to war will be similar to what it is today.

8.3.2 Recommendations for S²

- **Assess Current Weaknesses in NSNF Storage Sites.** A detailed assessment of current-day weaknesses in NSNF storage sites, logistics, and operations (e.g. obscuration barriers, defensive fighting positions, and sensor upgrades) needs to be performed and any corrections need to be identified. The analysis must look at the entire system.

- **Outline Alternative Upgrade Options.** Attractive upgrade options should be researched and cost-benefit analyses and development/procurement schedules should be accomplished.

- **Evaluate Technologies to Better Protect Security Forces.** Surveillance, detection, assessment, and response can benefit from applying technology in a manner that ensures the on-site security forces survive an initial attack and that they can maintain capabilities for weapon protection, recapture, or recovery. Technologies such as robotics, remote sensors, cameras, etc., should be exploited.

- **Study Alternative Cost Effective Transportation Modes.** Alternative modes of transportation which improve security and survivability while minimizing costs should be studied. Current containers should be evaluated for adequacy. Dedicated FAASVs should be investigated.

- **Develop Portable S² Systems.** The need to develop efficient, easily transported sensors, robots, barriers, masking/quieting techniques and other technologies which are portable and which will be effective in a field dispersal environment should be studied.

- **Evaluate the Technologies Which Can Replace People.** Since the number of military personnel in Europe will be reduced, the technology base should be screened for those concepts which minimize the number of people required for operation and maintenance.

- **Develop Insider Threat Protection.** The PRP program should be continued, but procedures and technology for insider protection, prevention, and detection should be added. Sites should be designed so that security plans and capabilities can be withheld from arms control verification inspectors, e.g., storage-site security should be reconfigured.

- **Analyze Current Day Warning Time.** Current warning time estimates should be reviewed and analyzed to assist in upgrading S².

8.4 Case Four: Current Numbers Modernized

8.4.1 Implications for S²

- **All New Storage Sites Developed.** Storage sites are designed from scratch to accommodate the new systems and the high technology threats. Numbers and locations of sites are determined by maximum security, survivability, and operational performance. Underground storage and vaults are preferable to above-ground storage.

- **Transportation Options are Needed.** Several modes of transportation for operational and logistical moves are desirable to provide flexible response for S² measures. Containers which meet full safety and security requirements must be designed.

- **Site Signatures Should Be Minimized.** It is important to obscure on-site activities from public view. Overall signatures which give the site away must be reduced through technological innovations and by reducing manpower-intensive operations. Camouflage, concealment, and deception must be widely used.

- **Security Forces Must Survive.** The on-site security forces and any reinforcing forces must survive against a variety of threats. These forces are expected to protect the weapons and to execute any recapture or recovery operations should weapon access be lost.

- **Insider Threat May Increase.** Because of the increased terrorist threat and the openness between Eastern and Western Europe, there is a higher likelihood for people working inside the nuclear weapons units to be compromised or to become "inside" threats.

- **Dispersal and Mobility are Vital.** Dispersal and ground mobility remains a survivability concept. Technology options which can enhance security and survivability in a dispersed mode are required.

- **New NSNF Weapons Developed/Fielded in Europe.** Case Four assumes new weapons are developed and fielded by all services and that S² systems (in order to minimize costs and to maximize system performance) are designed in conjunction with the weapons.

- **Same Warning Time as Today.** Case Four assumes that the threat from the Soviet Union is very real and that the basis of the threat is due to the instability in both Eastern Europe and within the Soviet Union itself. This case assumes the warning time for the transition to war is equal to that perceived in 1989-1990.

8.4.2 Recommendations for S²

- **Include Security/Survivability in New System Designs.** Security and survivability experts must be included on the development teams for SRAM-T and FOTL now. Optimum S² measures should be incorporated in the design as early as possible.

• **Design a Storage Site of the Future with Prototype Technologies.** A site of the future should be designed and S² technologies should be prototyped. Protection against chemical weapon attack must be provided. The site should be designed so that security plans and capabilities can be withheld from arms control verification inspectors, e.g., storage site security should be reconfigured periodically. The concepts of camouflage, concealment, and deception should be thoroughly analyzed and applied to fixed storage sites and to dispersal operations.

• **Evaluate Technologies to Better Protect Security Forces.** Surveillance, detection, assessment, and response can benefit from applying technology in a manner that ensures the on-site security forces survive an initial attack and that they can maintain capabilities for weapon protection, recapture, or recovery. Technologies such as robotics, remote sensors, cameras, etc., should be exploited.

• **Develop Insider Threat Protection.** The PRP program should be continued, but procedures and technology for insider protection, prevention, and detection must be improved. Sites should be designed so that security plans and capabilities can be withheld from arms-control verification inspectors, e.g., storage-site security should be reconfigured periodically.

Technology should be used to ensure procedures for people and material are enforced.

• **Develop Alternative Transportation Modes.** Alternative modes of transportation for operations and logistics should be developed to maximize security and survivability. Containers which meet full safety and security requirements for transportation, storage, dispersal, and employment must be designed.

• **Develop Portable S² Systems.** Need to develop efficient, easily transported sensors, robots, barriers, masking/quieting techniques and other technologies which are portable and which will be effective in a field-dispersal environment.

• **Analyze Current Day Warning Time.** Current warning-time estimates should be reviewed and analyzed. Current estimates will be useful in S² upgrade plans.

• **Analyze the Potential for New Class of NSNF.** S² experts and weapon system experts should initiate a study project to determine if entirely new weapons might be preferable. Given budget reductions, it may be very difficult to obtain funds for "new program starts", but that should not hinder Sandia and DNA Service Personnel from evaluating the options.

9. Conclusions and Recommendations

Predicting the future is difficult any time, but is made even more difficult with the rapid events of the past year. Environmental factors such as the changes in Eastern Europe and in the Soviet Union military threat, combined with many other political, social, and economic considerations, will most probably result in reductions to the European nuclear stockpile in the near term. Because of this uncertainty in predicting the future, the US should be prepared for several potential scenarios, including a reversal in the current "peace positive" trends. Even if all NSNF weapons are removed from Europe, some weapons should be maintained in the US for deployment back to Europe or elsewhere in the world. Our future security and survivability emphasis should be on providing flexible, versatile, cost-effective systems to assure the US is not caught short. The implications and recommendations in this paper are not advocating any one method or technique; rather, they are options which should be pursued to assure ourselves that we are keeping current in S² technology and to assure we maintain a strong future national defense. A summary of the conclusions and recommendations which are common to several cases is given in Table 6. These should be analyzed thoroughly and then used in the continuing FUTURE LOOK studies to develop specific S² technologies and concepts of operations.

9.1 US Should Manage Weapons Reductions Carefully

The most likely case involves significant nuclear weapon reductions in Europe. The US should determine the optimum number of sites and the optimum number of weapons per site to ensure a proper balance of safety, security, survivability, control, and allied participation. The US should maintain the weapons with the most modern security and control features. The Air Force WS³ should be continued and security and safety risks in transportation should be eliminated. Plans should support a rapid withdrawal of weapons.

9.2 Storage Sites Should be Closed and Hardened

We should reduce the signature of peacetime nuclear weapon storage, handling, and transportation against a spectrum of threats, including peaceful demonstrations. We should minimize access, including visual access, to weapons. Storage sites should be

hardened. Technology can be used to reduce manpower requirements and to provide better protection of the security forces. Consideration should be given to protecting information from site visitors, including treaty-verification inspectors. Technology should be employed to ensure nuclear weapons handling procedures are enforced and that insider threats are countered. Simulations for exercises and training on-site should also be developed.

9.3 Put Additional Warning Time to Good Use

Increased warning time provides the opportunity to enhance safety and security of nuclear weapons storage, handling, and peacetime transportation. We should reevaluate our peacetime activities and rebalance them in favor of additional security and safety. We should ensure, however, that our command and control system supports rapid dispersal and full readiness in time of crisis.

9.4 Revise Employment Plans

Fewer weapons at fewer locations will require revised employment plans. The weapons must be distributed so that, if used, the message of NATO unanimity and resolve is conveyed. Dedicated systems may be preferable; requiring that large numbers of delivery systems and personnel be dual-capable is not efficient and may be ineffective. Future employment will be across a broader geographic area; lateral dispersal and alternative transportation options are needed. The command and control system should evolve with the employment plans; PAL-code management should be analyzed for flexible, broad employment. Options for new NSNF systems to support revised employment plans should be developed. Expansion of the Navy's role in weapons should be explored.

9.5 Plan for Contingency Deployments

The US should develop plans for removing weapons and systems suitable for deployment from Europe and for storing these in the US. The Army weapons will need to undergo a service life extension program to extend their life beyond the year 2000. Also, the Army organization for ordnance and logistics for contingency operations should be evaluated. Portable, modular S² and C³ systems will be needed to support these contingency operations.

Table 6. Security and Survivability Conclusions and Recommendations

US Should Manage Weapon Reductions Carefully

- Determine optimum number of sites and weapons per site.
- Maintain these with the most modern S² features available.
- Ensure Air Force WS³ is continued and properly located.

Storage Sites Should be Closed and Hardened

- Employ technology to reduce site signatures and access.
- Harden sites.
- Evaluate technology to reduce security personnel.
- Use technology to protect security forces.
- Withhold S² measures from treaty inspectors.
- Employ technology to counter insider threat.
- Use computer simulations to enhance exercise and training.

Put Additional Warning Time to Good Use

- Enhance security and safety.
- Evaluate C³ to ensure rapid dispersal and full readiness.

Revise Employment Plans

- Convey NATO unanimity and resolve.
- Encourage dedicated systems.
- Develop transportation options.
- Develop lateral dispersal plans.
- Review PAL code management, materials, and equipment.
- Examine new NSNF systems and Navy role.

Plan for Contingency Deployments

- Plan for removal, life extension, storage, and deployment.
 - Develop portable, modular S² systems.
 - Develop portable, modular C² systems.
 - Evaluate Army organizations for ordnance and logistics.
-

Bibliography

AFM 11-1, *Air Force Glossary of Standardized Terms and Definitions*, 1 Jan 1967.

Coit D. Blacker and Gloria Duffy, ed, *International Arms Control. Issues and Agreements* (Stanford California: Stanford University Press, 1984).

Conventional Arms Control and European Security Proceedings from a Congressional Seminar, Washington, DC, March 9, 1989, American Association for the Advancement of Science, Program on Science, Arms Control, and National Security.

DOD Directive 3150.3 (Encl 1), Survivability of Non-Strategic Nuclear Forces, February 27, 1986.

Jonathan Dean, "Conventional talks: A Good First Round", *The Bulletin of the Atomic Scientist*, Vol 45, No. 8, October 1989.

Editorial #1, *Armed Forces Journal International*, Jan 1990.

Brian Green, "Modified Estimate of the Threat," *Air Force Magazine*, March 1990.

Multiple newspaper articles from *The Washington Post*, September 20, 1989 through March 23, 1990.

APPENDIX

Acronyms and Abbreviations

AF	Air Force
AFAPs	Army artillery fired atomic projectiles
ATSD/AE	Assistant to the Secretary of Defense for Atomic Energy
C ²	command and control
C ³ I	command, control, communications, and intelligence
CC&D	camouflage, concealment, and deception
CFE	Conventional Forces in Europe
CIA	Central Intelligence Agency
DNA	Defense Nuclear Agency
DOE	Department of Energy
FAASV	field artillery ammunition supply vehicle
FOTL	follow-on to Lance
INF	intermediate nuclear force
NATO	North Atlantic Treaty Organization
NSNF	Non-Strategic Nuclear Forces
NUC	nuclear
OMA/DOE	Office of Military Application of the Department of Energy
PAL	permissive action link
PRP	Personnel Reliability Program
SNL	Sandia National Laboratories
SLWPG	Senior Level Weapons Protection Group
SRAM-T	short-range attack missile-tactical
S ²	security and survivability
S ³	safety, security, and survivability
wpn	weapon
WS ³	weapons storage and security system
WTO	Warsaw Treaty Organization

DISTRIBUTION:

- | | |
|--|--|
| <p>9 Office of the Assistant to the Secretary of
Defense (Atomic Energy)
Attn: Col. Emery Chase
Room 3E1074, The Pentagon
Washington, DC 20301-3050</p> | <p>1 Director, Strategic Forces Policy
OASD/ISP/SFP
Room 4B 880 The Pentagon
Washington, DC 20301-2600</p> |
| <p>1 Headquarters DA (DAMO-SWS)
Attn: Col. Joseph P. Monko
LTC. L. G. Larue
LTC. W. T. Russell
Major Trevor J. Whitworth
Major Charles Holmes
LTC. Lewis S. Fowler
Washington, DC 20310-0430</p> | <p>1 Director, Theater Nuclear Policy
OASD/ISP-NF and ACP
Room 4B 856, The Pentagon
Washington, DC 20301-2600</p> |
| <p>10 Office of the Assistant to the Secretary of
Defense (Atomic Energy)
For: NATO Distribution:
SHAPE
NATO (International) Staff
SLWPG Delegation
FRG
United Kingdom
Italy
Greece
Turkey
Belgium
The Netherlands
Room 3E1074, The Pentagon
Washington, D.C. 20301-3050</p> | <p>4 Director
Defense Nuclear Agency
Attn: OPNS
Washington, DC 20305</p> |
| <p>1 OUSDRE(TWP)OM
Attn: Robert Henderson
Room 3B1060, The Pentagon
Washington, D.C. 20301-3100</p> | <p>3 Joint Chiefs of Staff (J-3, J-5, and J-6)
Director, Operations Directorate
Attn: Col Frank Meier, J-3
Col Ernie Schmidt, J-5
LtCol Rob Brock, J-6
Washington, DC 20330-5040</p> |
| <p>1 Deputy Director of Defense Research
and Engineering
Strategic & Theater Nuclear Forces (S&TNF)
Attn: George R. Schneider, Actg.
Room 3E130, The Pentagon
Washington, DC 20301-3090</p> | <p>1 Commander, Naval Sea Systems Command
Theater Nuclear Warfare Prog. (PMS-423)
Attn: Capt J. E. Killian
Washington, DC 20362-5101</p> |
| <p>1 Office/Deputy Under Secretary
Defense (Policy)
Attn: Col R. E. Pike
The Pentagon, Room 3C285
Washington, DC 20301-2200</p> | <p>1 Office of the Chief of Naval Operations
Attn: OP-653
Navy Department
Washington, DC 20350-2000</p> |
| | <p>2 Director of Operations
HQ USAF/XOO
For: Checkmate Group (XOXQC)
AFIS/INKT
Attn: R. Boyd
The Pentagon
Washington, D.C. 20330-5054</p> |
| | <p>1 HQDA ODCSINT
Attn: DAMI-FIT-RT, Major R. Alexander
Room 2E453, The Pentagon
Washington, D.C. 20310</p> |

DISTRIBUTION (Continued):

- | | | | |
|---|---|---|---|
| 3 | <p>Defense Intelligence Agency
 Attn: DT-1B
 For: Asst Dep Dir for Research (DB)
 Library RTS-2
 Attn: DB-1F
 For: J. M. McNulty, C5-858A
 Washington, D.C. 20301-6111</p> | 1 | <p>Commander
 US Army Combined Arms Center
 Attn: Top Secret Control Officer
 For: ATZL-CAP-S
 Fort Leavenworth, KS 66027</p> |
| 2 | <p>Top Secret Control Officer (TSCO)
 For: Director SOVA
 Director OSWR
 Office of Central Reference, C.I.A.
 Room GE-47
 Washington, D.C. 20305</p> | 1 | <p>HQAFOSP/SPOS
 KAFB, NM 87117-6001</p> |
| 1 | <p>US Department of Energy
 For: Deputy Assistant Secretary
 for Military Application
 DP-20
 PO Box A
 Germantown, MD 20874</p> | 1 | <p>Directorate of Nuclear Surety/SNA
 Attn: Chief, Engineering Analysis Division
 KAFB, NM 87117-5000</p> |
| 1 | <p>US Department of Energy
 Director, Office Weapons Safety and
 Operation
 DP-22
 PO Box A
 Germantown, MD 20874</p> | 1 | <p>US Department of Energy
 Manager, AL
 Attn: B. G. Twining
 KAFB, NM 87117</p> |
| 1 | <p>US Department of Energy
 For: DP23
 DP24
 PO Box A
 Germantown, MD 20874</p> | 1 | <p>Deputy Commanding General
 Marine Corps Combat Development Command
 Code DG
 Attn: Classified Material Control Ctr.
 (C-013)
 For: A. Woodson, CMCC-MCCDC
 Quantico, VA 22134-5080</p> |
| 1 | <p>US Department of Energy
 Attn: W. M. Pollack, DP40
 PO Box 23865
 Washington, D.C. 20026</p> | 1 | <p>Chief, Weapons Surety Division
 US CINCEUR/ECJ4-LW
 Attn: Chief, Weapons Surety Division
 APO, NY 09128</p> |
| 1 | <p>Commander
 US Army Nuclear & Chemical Agency
 Attn: Top Secret Control Officer
 For: MONA-ZB (Dr. C. Davidson)
 MONA-MS (Col Franck)
 7500 Backlick Road
 Springfield, VA 22150-3198</p> | 1 | <p>Commander-in-Chief, US Pacific Command
 Attn: Chief, Nuclear Oper.
 Safety Division (J32)
 Camp H. M. Smith, HI 96861-5025</p> |
| | | 1 | <p>Commander-in-Chief
 US Pacific Fleet
 Attn: CODE 0041B
 For: CINCPACFLT Code 626
 Pearl Harbor, HI 96860-7000</p> |
| | | 1 | <p>Commander-in-Chief
 HQ USAREUR 7/A
 Attn: AEAGC Top Secret Control Officer
 APO, New York 09403</p> |

DISTRIBUTION (Continued):

- | | |
|---|---|
| <p>1 HQ USEUCOM
(ECJ3-CCD, PMCT)
Attn: PAL MGMT Control Team A or B
APO New York 09128</p> | <p>1 William R. Barry, Program Engineer
Nuclear Systems/Surety Division
Air Force Weapons Laboratory
Kirtland AFB, NM 87117-6008</p> |
| <p>1 Office of Security Police
HQ USAFE/SPO
APO New York 09012-5001</p> | <p>1 Commander, US Army Missile Command
For: W. Fowler, AMSMI-SI-FO-FS
C. Domaracki, AMCPM-FL
Redstone Arsenal, AL 35898-5700</p> |
| <p>2 Directorate of Operations Analysis
HQ USAFE/DOA
For: Dep. Chief Staff, Intelligence (IN)
Directorate of Operations Analysis
APO New York 09012-5001</p> | <p>1 HQ AMC (AMCCN-N-IOW 18)
Attn: Chief Nuclear Division
For: Cpt W. R. Chadwell, AMCMI-FS
5001 Eisenhower Avenue
Alexandria, VA 22333-0001</p> |
| <p>1 Headquarters DA
Nuclear & Chemical Directorate
Office of the Deputy—Chief of Staff
for Operations and Plans
Nuclear Division
Washington, D.C. 20310-0430</p> | <p>2 Commander, Field Command
Defense Nuclear Agency
Attn: FCSAC (for LTC M. Mitchell)
Capt. J. L. Bailey, USN
Director, Plans and Operations FCP
Kirtland AFB, NM 87115-5000</p> |
| <p>1 Commander
US Army Materiel Command
OPM Nuclear Munitions
For: C. K. Widmaier, AMCPM-NUC
Dover, N.J. 07801-5001</p> | <p>1 US Army Foreign Science and Tech Ctr.
Attn: Supv. Mail and Doc. Control Unit
For: K. Cheeves
220 Seventh St. NE
Charlottesville, VA 22901-5396</p> |
| <p>2 Commander
US Army ARDEC
Attn: Restricted Data Control Officer
For: P. Angelotti, SMCAR-FSS-E
D. Miller, SMCAR-ASH
Dover, N.J. 07801-5001</p> | <p>1 Administrator
Def Tech Information Center
Building 5, Cameron Station
Alexandria, VA 22304-6100</p> |
| <p>1 Director
US Army Concepts Analysis Agency
For: Col D. Evans
8120 Woodmont Avenue
Bethesda, MD 20814-2797</p> | <p>1 The Johns Hopkins University
Applied Physics Laboratory
For: J. P. Berry
John Hopkins Road
Laurel, MD 20707</p> |
| <p>4 Commandant
US Army Field Artillery School
For: TSM-RAMS
ATSF-TN
ATSF-CD
Dir. Sys. Dev. Support Activity,
Col. M.F. Curtis
Fort Sill, OK 73503-5600</p> | <p>1 National Security Agency
Attn: Milo M. Hruby, R5
Fort G. G. Meade, MD 20755</p> |

DISTRIBUTION (Continued):

5	Los Alamos National Laboratory	1	20	O. E. Jones
	Mail Station 5000	1	2541	N. B. Botsford
	For: F. Smith and J. Howard, A-6	1	5000	E. H. Beckner
	Library, IS-4	1	5100	H. W. Schmitt
	E. C. Dudziak, IT-2	1	5120	W. R. Reynolds
	E. Palanek, WT-WP	1	5160	G. R. Otey
	H. R. Lehman, WT/NWAP	1	5200	J. Jacobs
	PO Box 1663	1	5210	C. C. Hartwigsen
	Los Alamos, NM 87545	1	5220	J. W. Kane
3	University of California	1	5220A	R. R. Neel
	Lawrence Livermore National Laboratory	1	5220A	J. L. Rea
	L-313	1	5221	D. E. McGovern
	For: D-Div, L-81	5	5222	J. R. Caruthers
	Z-Div, L-389	1	5248	D. L. Caskey
	Library, L-53	1	5260	J. R. Kelsey
	PO Box 808	1	5290	A. A. Lieber
	Livermore, CA 94550	1	7200	C. H. Mauney
		1	7230	J. F. Ney
3	Sandia National Laboratories	1	9000	R. L. Hagengruber
	Attn: J. C. Crawford, 8000	1	9010	W. C. Hines
	E. E. Ives, 8100	1	9011	G. S. Brown
	J. A. Wackerly, 8524	1	9100	R. G. Clem
	Livermore, California 94551-0969	1	9127	C. E. Olson
		1	9200	T. A. Sellers
		5	3141	S. A. Landenberger
		8	3141-1	C. L. Ward
				For DOE/OSTI
		3	3151	W. I. Klein

Issued by Sandia National Laboratories, operated for the United States Department of Energy by Sandia Corporation.

NOTICE: This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government, any agency thereof or any of their contractors or subcontractors. The views and opinions expressed herein do not necessarily state or reflect those of the United States Government, any agency thereof or any of their contractors.

Printed in the United States of America. This report has been reproduced directly from the best available copy.

Available to DOE and DOE contractors from
Office of Scientific and Technical Information
PO Box 62
Oak Ridge, TN 37831

Prices available from (615) 576-8401, FTS 626-8401

Available to the public from
National Technical Information Service
US Department of Commerce
5285 Port Royal Rd
Springfield, VA 22161

NTIS price codes
Printed copy: A03
Microfiche copy: A01