AIM

Association for Information and Image Management

1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910
301/587-8202

Centimeter

Inches

MANUFACTURED TO AIM STANDARDS
BY APPLIED IMAGE, INC.

1 of 1

THE FUTURE OF NONNUCLEAR STRATEGIC WEAPONS**-- FINAL SUMMARY REPORT --****Prepared for Los Alamos National Laboratories****by****Pan Heuristics
A Division of R&D Associates****In Fulfillment of Subcontract ~~LA-5000-1~~****Richard Brody and James Digby****31 January 1989****DISCLAIMER**

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, 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 or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Pan Heuristics
A DIVISION OF R&D ASSOCIATES
P.O. BOX 9695, MARINA DEL REY, CA 90295

JUN 16 1989**MASTER****DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED**

Preface

In this brief study, Pan Heuristics (PAN) has (1) evaluated the future importance of nonnuclear strategic weapons (NNSW), (2) considered their impact on forces and operations, and (3) investigated the technical requirements to support NNSW. In drawing conclusions, PAN has emphasized aspects that might be important to Los Alamos National Laboratory over the long run. It presents them here in a format similar to that used in a briefing at the laboratory.

This paper reflects independent PAN research as well as conclusions drawn from discussions with other offices and individuals involved in nonnuclear strategic weapons development. (See Appendix B). Pan Heuristics' research included contributions by Marcy Agmon, Brian Chow, Fred Hoffman, and Gregory Jones, as well as the authors of this paper.

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
Basic Points	iii
OVERVIEW	1
Definition	1
Roles and Missions	1
Related Missions	3
Wider Issues	4
MISSIONS FOR NONNUCLEAR STRATEGIC WEAPONS	7
MAIN MESSAGES OF THE STUDY	16
APPENDIX A: Targeting Requirements	19
APPENDIX B: Points of Contact in Research	20

Basic Points

A series of thoughtful studies, recent DoD level actions, and, most particularly, the position of the Navy and Strategic Air Command, all indicate an enduring push in DoD to acquire nonnuclear strategic strike capabilities. In assessment of the direction of that effort, a set of basic points emerged in PAN's study of Nonnuclear Strategic Weapons (NNSW):

- NNSW's most important role will be for extending strike options for both sides during conventional conflict. They will open new targets to attack and allow rapid concentration of firepower against distant invasion forces.
- A major issue will be reconciling NNSW deployments with verifiable arms control measures on nuclear strategic weapons.
- Enduring C3I capability for locating and identifying targets, providing navigation support, and coordinating strikes with broader theater operations will be critical to NNSW effectiveness. Counter-C3I strikes (including against space facilities) will be an early high leverage role for NNSW.
- Central Europe is not typical nor is it the likely first potential conflict area in which NNSW will be important. Outside Central Europe, lack of infrastructure makes fixed targets more lucrative and movable targets easier to find.
- Available target lethality data is inadequate to support NNSW in light of higher accuracies, new nonnuclear warhead designs, and new targets for nonnuclear attack.
- More analysis is needed on how NNSW will interact with nuclear weapons and stealth delivery vehicles.

We conclude that NNSW will be an increasingly important part of U.S. force postures. Much technical development remains to be done, much of it in areas where LANL could play an important long-term role. Among the most important may be: warhead design, simulation and analysis of warhead effects on targets, advanced materials for propulsion systems and delivery vehicles, and verification of permitted conventional strategic systems under a new nuclear arms control treaty.

OVERVIEW

Definition

Nonnuclear strategic weapons may be defined--narrowly--as conventional weapons for effectively attacking those targets traditionally seen as subject to attack only with "strategic" nuclear weapons (i.e., ICBMs, SLBMs, and B-52 delivered weapons). However, a more useful practical definition--consistent with what we actually examined--is that they are long-range (>500 km) strike systems capable of delivering a useful conventional payload against a target with a sufficient accuracy and warhead combination to have a high probability of inflicting substantial damage with few nonnuclear shots. A major implication of such weapons under either definition is that they would make it more feasible for "strategic targets" to be attacked in the course of a conventional war. Another key aspect of the broader, but not the narrower, definition is that NNSW capable of such deep attacks may also be the best weapons for enhancing our flexibility to provide fire support against tactical targets, including in areas where we have no forward deployed forces. We believe that alternate uses of long-range precision strike systems should not be artificially compartmented from each other by designating some weapons or missions as "strategic."

Roles and Missions

NNSW will have some role in augmenting nuclear strikes by substituting for some nuclear weapons: notably for SIOP support if there are very deep START cuts, and for very-low-collateral-damage support to selective nuclear employment plans, particularly against targets in urban

areas. However, nuclear weapons will still generally be much more effective than conventional ones for single-shot long-term kills.

The main role for NNSW will be in qualitatively augmenting the conventional campaign by providing new nonnuclear strike options. While NNSW options will be important to both sides, they should be asymmetrically advantageous to the West--we have bases around the Soviet Union for launching strategic conventional strikes (which generally still will have less than intercontinental range). Long-range capability can also make up for the advantage which the Soviets derive, as the attacker, in mobilizing an initial force concentration at the point of invasion. Moreover, the Soviets have the most to gain if neither superpower has the effective capability to strike the other's homeland. The Soviet Union is adjacent to the most critical theaters of a conventional US/SU conflict: Europe, the Middle East, and Northeast Asia. In these theaters, NNSW will be the most important means to deny the Soviets the advantage of sanctuaries at their homeland bases .

Long-range precision-strike systems can be used for many purposes. Some examples of missions for NNSW will be reviewed more specifically in the next section. Speaking in general terms, long-range weapons make it possible to launch from bases in the rear strikes against tactical targets near the front--thereby increasing the survivability of launchers. Their lateral reach allows immediate concentration of firepower from scattered or maldeployed forces. Their targets might include airfields and transport infrastructure in Eastern Europe or in the Soviet Union adjacent to a possible front in North Norway or in Northern Iran.

Strikes could also be made against theater support targets well away from the front--such as bomber facilities and reconnaissance satellite

ground support. A further mission, one that would raise sharp escalation concerns, is that of striking Soviet nuclear forces, such as missiles or SSBN bases, to degrade their escalation options during a conventional conflict. The Soviets appear to be especially interested in conventional counternuclear options by both sides. The threat of such attacks may inflict virtual attrition on the opponent, forcing them to defend nuclear systems during the conventional conflict, thereby diverting resources that could otherwise be used for conventional operations (as U.S. ASW capability has led the Soviets to devote much of their general purpose navy to "bastion" defense of their SSBN operating areas). Of course, theater-related and strategic nuclear-related target categories will often overlap where forces or facilities (like bombers and C3I) are dual-capable.

Related Missions

In addition to high explosives delivered against ground targets, a few variant missions are worth noting. Some objects on the sea, in the air, or in space may be critical targets for long-range precision strike weapons: they can be used for ASAT, perform long-range air-defense, and make long-range antiship strikes. ASAT capabilities, of course, may grow out of SDI-related directed-energy and kinetic-energy systems.

If NNSW systems are developed, they are likely to be useful for delivery of chemical warheads (though an association with chemical weapons would create political problems in initial arguments for NNSW). One particular attraction of NNSW may be to use their precision to deliver chemicals inside structures, directly contaminating the contents of depots and command centers.

Finally, nonnuclear EMP or high-powered microwave warheads may be used on NNSW in attacks on electronics related to strategic C3I and air

defense. We note, as an important aside, that nuclear high-altitude EMP or high-power microwave weapons could uniquely offer options for very low-collateral-damage nuclear barrage and urban-area attacks on C3I and, as well, as electronic equipment associated with forces.

Wider Issues

A few wider issues raised by NNSW are worth noting. The first is the critical importance of guidance and targeting. The development of range-independent precision guidance has been a critical technology in making NNSW increasingly feasible in the past several years. However, in developing improved NNSW capability, accurate identification of where and when to strike a target, including both locating mobile systems and identifying what vulnerable points will cause the most disruption of target functions, will probably be of at least equal importance. Indeed, against soft distributed targets, such as most ground-mobile systems made up of clusters of vehicles, ultra-precision may be secondary since area munitions will be used.

A major problem is the lack of good target vulnerability data to support efficient use of NNSW. Lack of sufficiently fine-grained understanding of target subelements and their functions makes it impossible to take full advantage of CEPs on the order of a meter. Before the advent of accuracies now becoming possible, it had been unnecessary for the targeting community to locate vulnerable points with the precision now desirable. Another problem is that very little conventional target damage analysis has been done at all for many deep targets, such as space-launch facilities and large phased-array radars, which have been thought of as subject only to nuclear attack.

NNSW weaponeering deficiencies are widely appreciated but are only inadequately being addressed, particularly in light of the immediate need in support of assessments of NNSW's potential roles and the design of the best warheads for them. A major obstacle complicating current efforts to improve weaponeering analysis is the limited resources and methodology for testing new conventional warhead/target combinations now available via subscale models, or computer simulations. The laboratory may well have the skills and facilities which could be very useful in such analysis.

The capability and endurance of the C3I system supporting NNSW will be at least as important as the guidance system carried aboard the missile. Two sorts of navigation schemes are now in use. One requires map matching information at update points on the way to the target which is provided to the missile prior to launch. The second depends on GPS satellites surviving to operate during missile flight. In either case, relocatable or recovered targets must be located and identified by the supporting C3I system. Because of their expense and the temporary nature of damage done by NNSW against most targets, effective use of NNSW will require close coordination with theater operations for selecting strike targets and timing. The SIOP approach of a semi-independent operation knocking out entire target categories for the duration of the war is unlikely to be feasible in the near term, given foreseeable NNSW stockpile sizes.

The last wider issue is the "threat" to NNSW from strategic nuclear arms control. What might be called "collateral damage" on strategic conventional strike capabilities may be one of the most important consequences of a START accord nominally focused on nuclear weapons; such consequences must be given priority attention in assessing START options.

The fact, little noted in the press, that the INF Treaty banned forever conventional as well as nuclear ground-launched intermediate range missiles--essentially eliminating one category of NNSW--shows how important such consequences can be.

MISSIONS FOR NONNUCLEAR STRATEGIC WEAPONS

This section discusses three examples of operations with NNSW: in Europe, against an invasion of Southwest Asia, and against Soviet space facilities.

The first example comes from the work of the Commission on Integrated Long-Term Strategy. It is natural that a Commission led by Albert Wohlstetter and Fred Iklé would take a careful look at prospects for non-nuclear ways of exercising military power. But it is also natural that they would see this power as a complement to nuclear power, a force that might be exercised in the shadow of a nuclear force.

The Commission's Offense-Defense Working Group, led by Henry Rowen and Fred Hoffman, created a Panel on Standoff Weapons headed by George Donohue, then of RAND, and Theodore Gold, formerly at DDRE, and now Hicks and Associates. PAN research contributed to their paper, which summarizes the promise of extended-range ground-attack weapons systems.* While we are largely in agreement with their conclusions, we believe that one aspect needs some expansion, as indicated below.

The Donohue-Gold report focuses on smart weapons of over "tens of kilometers range"--actually 500 to 2000 km. It provides a very useful discussion of the merits of various delivery vehicles. It also notes that the INF Treaty prohibition on medium-range ground-launched missiles intensifies interest in naval platforms or B-52-size aircraft as carriers.

Table 1 summarizes the main illustrative case examined in the Donohue-Gold report, an example of possible NNSW target allocations in

*George Donohue and Theodore Gold, "Extended-Range Smart Conventional Weapons Systems," Commission on Integrated Long-term Strategy, forthcoming.

Table 1

**DONOHUE-GOLD: TARGETING REQUIREMENTS FOR
CONVENTIONAL STANDOFF WEAPONS
(EXCERPT-EUROPEAN THEATER)**

TARGET CLASS	NUMBER WITHIN RANGE OF 1400 KM	NUMBER TARGETS ATTACKED	NUMBER WEAPONS EMPLOYED
<u>FIXED TARGETS</u>			
MAJOR AIRFIELDS	300	30	810
RAILROAD BRIDGES	400	130	3900
KEY HIGHWAY BRIDGES	450	130	1950
TACTICAL COMMAND BUNKERS	>300	300	1500
POL PUMPING STATIONS	70	30	300
TOTAL FIXED	>1220	620	8460
<u>MOBILE TARGETS</u>			
MANEUVER UNITS	1700	1700	22000
MOBILE MISSILES	800	800	4200
TOTAL MOBILE	2500	2500	26200
<u>TOTAL FIXED & MOBILE</u>	3720	3120	34660

support of NATO in the Central Region. Of note, while the specific numbers shown, totaling almost 34,660 weapons, is explicitly the result of a sample calculation, it is indicative of the quantities required in the analysis for this sort of a broad strike against a major Warsaw Pact invasion. (The full table from which Table 1 was abstracted is shown in Appendix A.) While the Donohue-Gold report also considers a Southwest Asia example, their main concern is for Central Europe and for a period when very large stockpiles of NNSW will be available.

Here we complement the Donohue-Gold analysis with a brief consideration of a case dealing with an intermediate period when there might be one or two thousand weapons. While such numbers might well be inadequate to have substantial direct effect on a Central European battle, they could be quite important in strengthening deterrence of Soviet military moves on the NATO flanks, in Northeast Asia, or in Southwest Asia. At lower risks than in the Center, attacks in these areas on the Soviets' periphery could offer them high return.

Based on PAN work on Southwest Asia over many years, we have constructed an example of a Soviet invasion toward the Persian Gulf oil fields. There the Soviets have the major advantage of immediate access to the region, inasmuch as the Soviet Union borders Iran (see Fig. 1). The United States, on the other hand, is about 5,000 miles away. We have relatively few forces deployed or even solidly committed for that region. Experience suggests that our European allies are very timid about commitments and our local friends near the Gulf would be less than stalwart in time of danger.

NNSW might make a big difference in the early defense against--and, therefore, in the deterrence of--a Soviet attack towards the Gulf oil fields. In Central Europe the transport infrastructure is dense; there

Southwest Asia

Figure 1

are redundant paths for an invasion force and its supplies. However, this is not the case in Southwest Asia or in much of the rest of the world (see Fig. 2). The infrastructure (roads, bridges, airfields, etc.) is sparse and, due to the rough terrain, difficult to bypass. Forces tend to operate in clumps; therefore, far fewer NNSW could have a much greater effect, in other words, "you get more for your NNSW money."

We have examined a defense against a Soviet invasion of Iran through the Zagros Mountains toward the oil-producing region near the Gulf, accompanied by deep operations by air and airborne forces. Table 2 provides an example of allocating NNSW strikes against selected high-value targets so as to disrupt that invasion. It considers an early period--perhaps ten years from now--when the total U.S. inventory of NNSW is about 2,000. It assumes that the JCS allocates about a third of the inventory to the initial defense of Southwest Asia. While we would probably run through the inventory within a few days, they could provide the margin of critical time required to, for example, bring in U.S. tacair to support a sustained defense.

Finally, we examined an NNSW attack against Soviet space-related facilities. While assessment of this mission is particularly dependent on classified research reported separately, several important points can be made. Table 3 summarizes the critical targets, placing priority on use of a relatively few NNSW (approximately 70). These could seriously disrupt Soviet ASAT capability.

There are three reasons for focusing on Soviet ASAT related facilities: 1) they make a relatively concentrated target set; 2) they threaten some of our otherwise highly vulnerable satellites, upon which we depend very heavily (including to support NNSW strikes); and 3) the same boosters

Figure 2

THE CENTER VERSUS THE FLANKS: DENSITY OF DEFENSE INFRASTRUCTURE

Table 2

ILLUSTRATIVE CUT AT TARGETING PRIORITIES:
EARLY SWA CONTINGENCY STRIKES

<u>HIGH VALUE FIXED TARGETS</u>		<u>NNSW EMPLOYED</u>
TRANSPORT		100
SPACE-RELATED		70
SNA BASES		100
MAJOR FIXED C3I		20
<u>HIGH VALUE RELOCATABLE TARGETS (GENERALLY SOFT)</u>		
SUAWACS	]	50
	]	
BOMBERS	] -- ON THE GROUND	100
	]	
LARGE TRANSPORT A/C	]	100
MAJOR MOBILE C3I		20
DUAL-CAPABLE MISSILE UNITS		50
FORWARD DEPLOYED GCI SITES		40
<u>MIDDLE VALUE OR ACCESSIBLE RELATIVELY SOFT TARGETS</u>		
TACAIR (OUTSIDE HANGARETTES)		
GCI SITES		
<u>TARGETS LIKELY TO REQUIRE IMPROVED MUNITIONS/TARGET RECOGNITION</u>		
TACAIR IN HANGARETTES		
INVASION FORCE AND AIRBORNE CONCENTRATIONS		

<u>TOTAL NNSW FOR PRIORITY TARGETS</u>		650

Table 3

**PRIORITIZED SPACE-RELATED GROUND TARGETS
IN THE SOVIET UNION**

TARGET SETS

- (1) Co-orbital ASAT Command, Control and Launch Support Facilities.**
- (2) Laser ASAT Facilities at Sary Shagan and Dushanbe**
- (3) Potentially Dual-Purpose ABM/ASAT RADARS at Sary Shagan**
- (4) General Attack on Satellite Launch Facilities at Tyuratam, Plesetsk, and Kapustin Yar**
- (5) Wider Attack on other Space-Related Ground Facilities including satellite & launch production, space surveillance & tracking, satellite command & control, major electronic warfare, and space support ships.**

TOTAL NNSW Required: ~550

NNSW FOR PRIORITY ASAT TARGETS: ~70

and pads used to launch the Soviet coorbital ASAT also launch other Soviet satellites, apparently including Soviet naval reconnaissance systems which could play a critical role in a future conflict.* Therefore, strikes on these ASAT launch sites should also damage Soviet satellite launch capability.

Given the importance of space to all military efforts, relatively few weapons against Soviet space-related facilities can have very wide effect, even in a Central European conflict. Moreover, many of the targets are quite soft and complex systems which would be extremely difficult to replace or repair after even a conventional strike (presuming we have the range and accuracy to reach them in the first place which NNSW can now provide).

Of course, we also depend heavily on space systems for support of military operations and our space systems may be subject to attack both on the ground, by Soviet NNSW, and in space by Soviet ASATs. This is a major problem which the United States must do a better job of facing. However, given persistent Congressional refusal to fund a U.S. ASAT system, NNSW may remain the only direct active means of countering Soviet ASAT attacks. Even if we had an ASAT capability, however, that alone would not even-up matters. The Soviet "style" in space has been to replace satellites much more frequently and routinely than does the United States. If both sides' satellites in orbit are knocked out, but both sides' launch facilities are left undamaged, the Soviets could recreate their critical satellite constellations far more quickly than we could.

*DoD, Soviet Military Power, 1988, pp. 63, 65; and Nicholas L. Johnson, The Soviet Year in Space, 1985, p. 7, 39ff.

MAIN MESSAGES OF THE STUDY

Several major points emerged from this study of nonnuclear strategic weapons. First, NNSW's most important role will be for extending the strike options of both sides during conventional conflict. They will open opportunities to hit "new" targets, such as space launch sites, traditionally seen as only subject to nuclear attack. They will also allow rapid concentration of firepower by maldeployed forces in response to a surprise attack. While both of these NNSW capabilities will create useful options for the Soviets, options that we must prepare against (including conventional attacks on selected targets in CONUS), they arguably should make NNSW more valuable to the West. In the most important contingencies, the West will be on the defensive in a theater adjacent to the Soviet Union.

Second, NNSW could also have a useful, if lesser, role supplementing nuclear weapons in a strike. Very deep nuclear cuts due to arms control may make it impossible to "cover" many targets within the allowed nuclear arsenal. More importantly, however, any such nuclear arms control agreement will raise the question of spillover limits on NNSW. The INF Treaty has a blanket ban on conventional as well as on nuclear intermediate-range ground-launched missiles, largely for verification reasons. Among the most important matters in a future START accord will be developing a "least bad" means of reconciling NNSW with deep strategic nuclear cuts.

Third, the critical role of intelligence and target analysis for effective NNSW use cannot be overemphasized. Exploiting precision guidance requires precision target information on functions, as well as on locations, so that targeteers can choose specific vulnerable points. A key role must be played by external C3I systems (including space) to provide navigation and targeting support, and these need to endure. The

expense of NNSW and their limited effect will require specific coordination of NNSW strikes with campaigns, rather than blanket, SIOP-style coverage of generic target categories. Ironically, perhaps the most lucrative class of deep targets for NNSW will be enemy C3I (including space and ASAT facilities). These have long been critical to theater battle but unattackable by traditional conventional means. Now, in addition, strikes on deep C3I would have the particular effect of disrupting enemy NNSW use.

Fourth, in viewing contingencies against which to measure the role and effectiveness of NNSW, Central Europe is not typical nor is it the likely first area in which NNSW will be important. Outside the Center, lack of infrastructure makes fixed targets more lucrative and movable targets easier to find. NNSW can play a special role to make up for the lack of standing tactical forces in SWA. Further, extremely limited numbers of NNSW, used as "Silver Bullets," may be useful for strikes on certain specific Third World targets (e.g., terrorist camps and nuclear or chemical weapons facilities).

Fifth, there are a variety of issues related to weapons design and targeting. There appear to be two basic classes of NNSW munitions to be improved:

- Hard-structure penetrating munitions for shallow buried targets (command centers, weapons storage sites, hangerettes, etc.)
- Anti-equipment area munitions that can go against large relocatable targets (especially parked aircraft, soft C3I, and mobile missiles).

For use against relocatable targets, it will be important to develop Autonomous Target Recognition (ATR) sensors to use against large items, such as parked aircraft and satellite terminals, as well as the tanks and

armored vehicles against which current ATR efforts more commonly focus.

A critical related issue is that available target lethality data is inadequate to support the employment or development of NNSW in light of higher accuracies, new nonnuclear warhead designs, and new targets for nonnuclear attack. This is especially true for complex targets where it is necessary to identify not only the immediate physical effects of an individual strike but also to evaluate the extent of disruption to the functions of a larger facility through damage to specific vulnerable subelements.

In addition, there are a set of variant weapons with technologies or roles useful to consider in thinking about NNSW. Long-range precision weapons will be critical for ASAT, wide-area air defense, and over-the-horizon antiship missiles. Unconventional warheads, such as chemical, EMP, and high-power-microwave, may be placed on NNSW. A related class of nuclear weapons is also worth noting here. Nuclear-driven EMP or high-power-microwave weapons may be used for very-low-collateral-damage selective nuclear strikes in support of ongoing, mainly conventional, operations, especially for wide-area counter-C3I and counter-air-defense strikes.

Finally, sixth, certain other critical issues for NNSW emerged from this study, but there was not adequate opportunity to address them. Two important examples are the the role of stealth systems in NNSW operations, and the interactions between nuclear forces and NNSW. Research on the latter issue should include considerations of nuclear force and C3 endurance under sustained NNSW attack as well as the role of dual-capable vehicles for NNSW.

Appendix A

**TABLE A.1: TARGETING REQUIREMENTS FOR CONVENTIONAL
STANDOFF WEAPONS**

TARGET CLASS	TARGET CHARACTERIZATION	NUMBER OF TARGETS WITHIN MISSILE RANGE		NUMBER OF TARGETS ATTACKED ¹		TOTAL NUMBER OF WEAPONS EMPLOYED WITH RANGE LESS THAN ²	
		600 km	1,400 km	600 km	1,400 km	600 km	1,400 km
A. EUROPEAN THEATER							
<u>Fixed Targets</u>							
Major Airfields	Runways	150	300	20	30	540	810
Railroad Bridges	Point	250	400	80	130	2,400	3,900
Key Highway Bridges	Point	300	450	90	130	1,350	1,950
Tactical Command Bunkers	Point	300	?	300	300	1,500	1,500
POL Pumping Station	Area/Multiple Point	20	70	10	30	100	300
TOTAL (Fixed)		1,020	≥1,220	500	620	5,890	8,460
<u>Mobile Targets</u>							
Maneuver Units (Artillery and Maneuver Battalions)		1,700	1,700	1,700	1,700	22,000	22,000
Mobile Missiles		700	800	700	800	3,800	4,200
TOTAL (Mobile)		2,400	2,500	2,400	2,500	25,800	26,200
TOTAL (Fixed and Mobile)		3,420	3,720	2,900	3,120	31,690	34,660
B. SOUTHWEST ASIA - EXAMPLE: IRAN							
Airfield Runways		-	6	-	6	-	162
Highway		-	80	-	80	-	1,200
TOTAL			86		86		1,362

¹ Authors' assumptions, based on prior investigations.

² Assumes a 1,000 lb. unitary warhead with a 3-meter CEP or, if appropriate, an equivalent load of submunitions; system reliability = 80%; system survivability = 80%; system availability = 95%; confidence of destruction = 80%.

APPENDIX B

POINTS OF CONTACT IN RESEARCH ON NONNUCLEAR STRATEGIC WEAPONS

International Security Policy:

Mr. Frank Miller
Col. Gerry Patterson

- OSD policy concerning nonnuclear strategic weapons; Role of intelligence and targeting; NNSW and the Competitive Strategies Initiative; NNSW and the allies.

DDRE:

Col. Ron Henderson

- Status of "DSB Implementors" coming out of the Adm. Wertheim Chaired DSB study of NNSW

DARPA:

Dr. George Donohue

- DARPA support of R&D for NNSW

Joint Staff and Agencies:

Col. William Hubbard, J-7

- Joint Staff studies of NNSW missions and requirements

Dr. Raymond Sauer, DIA

- Target effectiveness studies for NNSW

Dr. Arthur LaGrange, Joint Tactical Coordination Group/Munitions Effectiveness

- Planning for developing munitions effectiveness manuals to guide target planning for NNSW

Navy:

Mr. William Smith, OASN(RES)
Cdr. Dave Miller, OP-354
Mr. Pat Palomar, Cruise Missile Program Office
Capt. James Lynch, Strategic Think Tank
Dr. Andrew Borden, Strategic Think Tank
Dr. Diane Thompson, China Lake NWC

- Navy planning for Advanced Sea-Launched Cruise Missile (ASLCM) and improved Tomahawk SLCM.

SAC

BG Stephen Crocker, Plans and Programs
MG Charles May, Requirements

- SAC planning and requirements for nonnuclear strategic strikes and NNSW.

Non-Government Researchers:

Dr. Ken Kennedy, Center for Naval Analysis

- Soviet infrastructure targets for NNSW attack

Dr. Myron Hura, Rand Corp.
Dr. David Lempert, Rand Corp

- Analysis of alternate NNSW attacks on the Soviet Union in a global conflict

Dr. Allan Connor, LANL

- LANL program to develop advanced nonnuclear warheads

DATE

FILMED

7/7/94

END