USAWC STRATEGY RESEARCH PROJECT

NUCLEAR HIGH ALTITUDE ELECTROMAGNETIC PULSE – IMPLICATIONS FOR HOMELAND SECURITY AND HOMELAND DEFENSE

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ABSTRACT

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The detonation of a nuclear weapon at an altitude of approximately 500 kilometers over the United States will generate a near-continental scale high altitude electromagnetic pulse (HEMP). The effects of such an attack may instantaneously destroy or disrupt substantial portions of the electrical and electronic systems that operate the critical infrastructure of the United States, as well as portions of Canada and Mexico. Those interested in the efforts to ensure an effective homeland defense and homeland security effort should understand the implications of a successful HEMP attack on the United States, the factors that influence the probability of an attack, and continuously seek innovative ways to prevent such an attack from ever occurring, and simultaneously, to prepare for it, if preventative efforts should fail.

This paper describes what an electromagnetic pulse (EMP) is and how a nuclear weapon creates a HEMP. Next, a brief description of the effect of a HEMP attack on electrical and electronic systems is followed by an overview of the implications of the failure of these systems on the nation's critical infrastructure and elements of national power. A discussion of the risks of such an attack caused by nuclear and ballistic missile proliferation will be followed by an overview of the on-going contributions of the existing National Security Strategy and National Strategy for Homeland Security to prevent and prepare for a HEMP attack. This paper will conclude with some broad recommendations to strengthen the United States' capabilities to prevent, and simultaneously prepare to mitigate and recover from, the effects of this ultimate form of asymmetric attack.

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PREFACE

The author wishes to acknowledge the on-going efforts of the House Armed Services Committee to raise the level of awareness of the susceptibility of the United States to a High Altitude Electromagnetic Pulse (HEMP) attack and to seek suitable ways to deal with the threat. The author undertook this paper as an attempt to contribute to the on-going national security dialogue that seeks to balance ends with appropriate ways and means while preserving an acceptable level of risk against this potentially devastating form of attack.

The author also gratefully acknowledges Doctor William J. Tedeschi, Sandia National Laboratories, for his continuing contributions to the security of the United States and for his exceptional patience while explaining the concepts and implications of electromagnetic pulse. Any errors, omissions, or oversimplifications are solely the responsibility of the author.

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NUCLEAR HIGH ALTITUDE ELECTROMAGNETIC PULSE – IMPLICATIONS FOR HOMELAND SECURITY AND HOMELAND DEFENSE

> The gravest danger to freedom lies at the perilous crossroads of radicalism and technology. When the spread of chemical and biological and nuclear weapons, along with ballistic missile technology -- when that occurs, even weak states and small groups could attain a catastrophic power to strike great nations. Our enemies have declared this very intention, and have been caught seeking these terrible weapons. They want the capability to blackmail us, or to harm us, or to harm our friends -- and we will oppose them with all our power.
>
> ? President Bush West Point New York June 1, 2002

The National Security Strategy (NSS) of the United States of America states that over the last ten years, "advances in technology and an increasingly globalized international environment have contributed to the proliferation of the means for new adversaries to organize and threaten great nations in ways that previously required the creation and maintenance of large armed forces and supporting industrial capabilities to achieve."[1] Specific emphasis is given to chemical, biological, radiological, and nuclear (CBRN) weapons and the means to deliver them because they are "coveted by rogue nations as tools of intimidation, military aggression, blackmail, and the means to overcome the conventional superiority of the United States."[2] The use of a single nuclear-armed ballistic missile offers an adversary the means to accomplish this objective.

Open hearings in the House of Representatives in 1997 and 1999 indicated that the detonation of a nuclear weapon at an altitude of approximately 500 kilometers over the United States would generate a high altitude electromagnetic pulse (HEMP), instantaneously disrupting or destroying electrical and electronic systems that operate the critical infrastructure of the United States, as well as portions of Canada and Mexico.[3] Largely as a result of the testimony presented during these hearings, Congress directed the Department of Defense to establish a "Commission to Assess the Threat to the United States from Electromagnetic Pulse Attack."[4] Although the interim efforts of the commission are not publicly available, consideration of the previous testimony, coupled with a review of on-going efforts to manage the current strategic environment, provides a suitable vantage point to consider what additional efforts are required.[5] Those interested in the efforts to ensure an effective homeland defense and homeland security effort should understand the implications of a successful HEMP attack on the United States, the factors that influence the probability of an attack, and continuously seek innovative ways to prevent such an attack from ever occurring, and simultaneously, to prepare for it, if preventative efforts should fail.[6]

This paper describes how a nuclear weapon would create a HEMP. Next, a brief description of the effect of a HEMP attack on electrical and electronic systems followed by an overview of the implications of the failure of these systems on the nation's critical infrastructure and elements of national power. A discussion of the risks of such an attack will be followed by an overview of the on-going contributions of the existing NSS and NSHS to prevent and prepare for a HEMP attack. This paper will conclude with some broad recommendations to strengthen the United States' capabilities to prevent, and simultaneously prepare to mitigate and recover from, the effects of this ultimate form of asymmetric attack. To properly appreciate the implications for homeland defense and homeland security however, it is first necessary to begin by defining what an electromagnetic pulse (EMP) is.

HIGH ALTITUDE ELECTROMAGNETIC PULSE

An electromagnetic pulse (EMP) is defined by the Technology Division of the National Communications System as a wide frequency range, high-intensity, extremely rapid, and short duration burst of electromagnetic energy which produces electric and magnetic fields which can couple to metallic conductors associated with electrical and electronic systems to produce damaging current and voltage surges.[7] A noted expert in the field of nuclear weapons and EMP effects, Dr. Lowell Wood, characterized EMP as being similar to "…very intense static electricity that is carried on radio-frequency electromagnetic waves."[8] Although EMP may be produced by both nuclear and non-nuclear means, this paper will concentrate on an EMP created by a high altitude nuclear detonation.[9]

In general, a nuclear EMP is caused by the interaction of high energy nuclear radiation with atoms in the atmosphere.[10] At altitudes above approximately 40 km, the EMP component becomes particularly significant due to the large volume of the atmosphere underneath the exploding weapon that is available to interact with the high energy nuclear radiation. According to Dr. Wood, the nuclear weapon's high energy nuclear radiations interact with the air molecules and essentially transform the atmosphere underneath the explosion into a gigantic radio-transmitter antenna.[11]

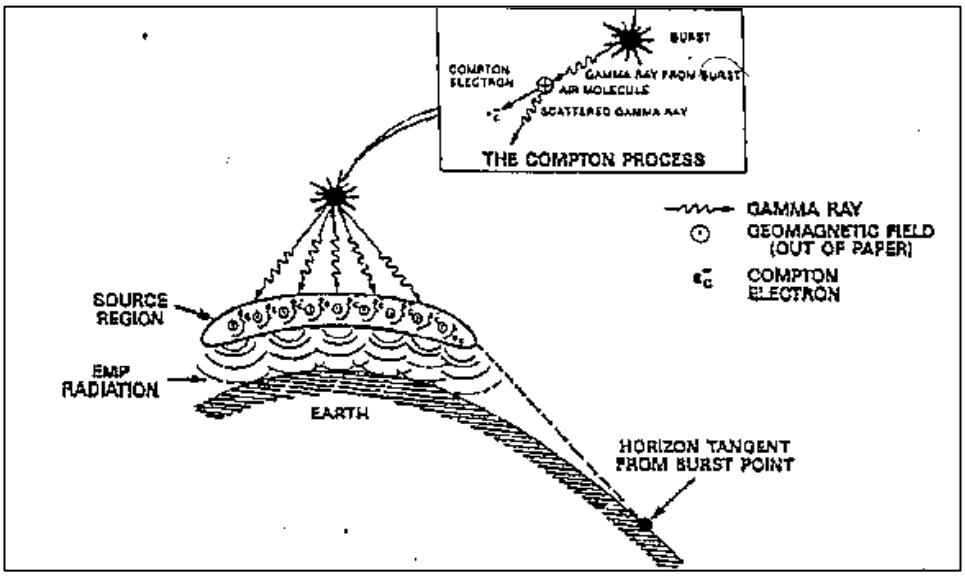


FIGURE 1. HEMP GENERATION MECHANISM[12]

Dr. Gary Smith, as the Director of the Johns Hopkins University Applied Physics Lab, testified that there are two overriding characteristics that make a HEMP attack unique.[13] These characteristics are of particular interest to those concerned with an effective homeland defense and homeland security. First, the area affected by the EMP signal can be continental in scope.

As the altitude of the detonation increases, the area in line of sight to the radiation and, therefore subjected to direct EMP effects, also increases.[14] For a detonation altitude of approximately 500 km, the entire continental United States, and portions of Canada and Mexico would be affected (although at the edges of the area, the field intensity would be about half of the peak levels and the field strength would not be uniform over the entire area). [15]

The second HEMP characteristic of interest is that the peak electromagnetic field amplitude and the speed at which it increases are extremely high.[16] Although EMP has often been compared to a lightning strike, this is only useful as an illustrative comparison to understand the scale of some of the effects. There are significant differences. For example, HEMP has several phases, each generated by different effects of the nuclear weapon.[17] Each of the phases has unique characteristics and poses different protection challenges. Also, EMP

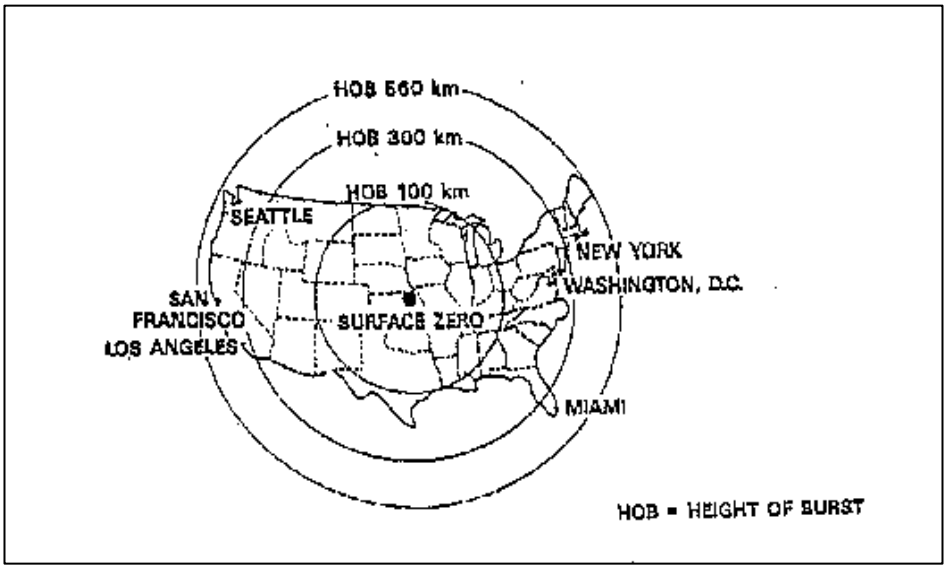


FIGURE 2. HEMP SURFACE COVERAGE [18]

generated by an exoatmospheric nuclear explosion develops its peak electrical field much faster than lightning, making it harder to protect against.[19] Finally, lightning is a localized event while the implications of a continental-sized electromagnetic field create unique propagation effects.

Since an electromagnetic field interacts with a metallic conductor to induce currents to flow through them, any metallic object (such as power lines, local area network cables, or even plumbing) can act as an antenna which gathers in the EMP signal and converts it to current flow.[20] Long-line conductors such as power lines and metallic communication cables can further extend these currents throughout and beyond the area illuminated by the line-of-sight HEMP effects. The direct and indirect electromagnetic coupling effects are the means by which an EMP signal generated by a high altitude nuclear detonation can cause near-instantaneous, potentially damaging voltages and currents in unprotected electronic circuits and components throughout an entire continental-sized area.[21]

Modern electronics and computer systems are extensively based on semiconductor-based integrated circuit technology, and various other circuits and devices. Due to the exceptional sensitivity of modern electronics to relatively small amounts of energy, the extreme voltages and/or current spikes produced by an EMP event can upset and even create

irreversible damage to unshielded or specially designed electronic and computer devices. This is why a HEMP attack is so potentially catastrophic for the United States – it is the most electronically dependent nation in the world.

CONSEQUENCES OF A HEMP ATTACK ON THE UNITED STATES HOMELAND

A detailed prediction of all of the potential effects of a successful HEMP attack is very difficult due to the complexity of the interdependent systems, the diverse environments throughout the effected areas, and the uncertainties associated with the manner of nuclear weapon employment. While EMP and its associated effects on various devices and equipment have been the subject of intense scrutiny for over forty years, much of the earlier testing and analysis was focused on Department of Defense nuclear command and control and strategic weapons systems. As a result, much of the material produced about EMP was highly classified. A great deal of the publicly available information regarding the effect of EMP on military and civilian infrastructure has resulted from several open hearings held by the House of Representatives in 1997 and 1999. Those hearings form an excellent foundation to understand the potential severity of the effects of a successful HEMP attack on the United States homeland.

The results of a successful HEMP attack was broadly described by Doctor Wood, in a hearing before the 1997 Military and Research Sub-committee of the House Armed Services Committee:

> "…[a successful HEMP attack]…is a continental scale time machine. We essentially….move it back in time by about one century and you live like our grandfathers and great grandfathers did in the 1890s until you rebuild. You do without telephones. You do without television, and you do without electric power…and if it happens that there is not enough fuel to heat with in the winter time and there is not enough food to go around because agriculture has become so inefficient and so on, the population simply shrinks to meet the carrying capacity of the system."[22]

Taking into account the increasing interdependence of the critical infrastructure of the United States, the picture is particularly grim.[23] The critical infrastructure of the United States is utterly dependent on information age technologies.[24] Indeed, of the thirteen interdependent critical infrastructure sectors (Agriculture, Food, Water, Public Health, Emergency Services, Government, Defense Industrial Base, Information and Telecommunications, Energy, Transportation, Banking and Finance, Chemical Industry and Hazardous Materials, Postal and Shipping[25]), each is inextricably reliant on the proper functioning of electrical power, electronic

devices, and computer systems. Virtually all of the technology that operates each of these critical infrastructures is completely vulnerable to the effects of EMP.[26]

In addition to the immediate disruptions caused by the loss of extensive portions of the information age infrastructure, the cumulative effects of such an attack on the United States would have long term consequences on restoration efforts. Unlike the relatively localized effects of a hurricane or even a "traditional" low altitude nuclear weapon detonation, the instantaneous, continental scope and infrastructure-wide effects of a HEMP attack would make any recovery attempts an exceptionally difficult and very lengthy process. Essentially post-attack America would remain stuck in the 19th Century until replacement electrical equipment and components were available (most likely having to be brought in from abroad) and installed.[27] Of course, this assumes that the vast variety of skills required to conduct such a recovery could be located and efficiently employed in a population attempting merely to survive the anarchy that would inevitably result from the long-term disruption of essentially every portion of the nation's infrastructure.

Additionally, the military forces of the United States have been increasingly based in the continental United States (CONUS) and would also be affected. Although the strategic nuclear forces (and portions of their supporting infrastructure) were designed to resist the effects of EMP, the general purpose forces have not received the same focus. After a successful HEMP attack, the posts, camps, bases, and stations throughout the country might not be able to provide the services necessary to function as power projection platforms. Although some military programs have incorporated EMP resistance as part of the design and acquisition process, increasingly, the military forces have turned to commercial-off-the-shelf equipment that has little or no EMP protection.

To jump start national recovery efforts would likely require significant portions of the remaining overseas military resources of the United States to focus their efforts on domestic recovery. The resulting lack of a viable forward presence, coupled with an American government intently focused on internal recovery, could result in numerous regional conflicts as nations attempted to gain advantage or to redress old grievances. Several of these regional conflicts (India-Pakistan, Israel-Syria, China-Russia, China-India) certainly have the potential to involve further use of WMD.

Additionally, the worldwide economy has grown increasingly interdependent. The economic disruptions that occurred in the wake of the 2001 attacks provided a clear demonstration of this interdependence. The disruption of the interdependent critical infrastructure of the United States would likely produce worldwide economic disruption. The

extended loss of the American consumer markets, disruption of domestic manufacturing capability, and chaotic financial institutions would contribute to an extended period of worldwide economic disruption.

Clearly, the United States is vulnerable and the consequences of such an attack are unacceptable. However, the existence of exceptional vulnerability does not necessarily equate to risk. An assessment of the probability of a HEMP attack on the homeland of the United States is required to determine the relative degree of risk that exists.

ASSESSING THE RISK

When considering potential threats, a risk assessment must be conducted to gain an appreciation for the likelihood of the event of concern occurring. This is necessary to provide a basis to ensure the correct amount of national resources are provided to reduce the likelihood of the event occurring or the severity of its impact. The following paragraphs will first evaluate the current nuclear proliferation environment and provide a broad assessment of the availability of suitable delivery capabilities. This will provide a basis to judge the likelihood of a HEMP attack.

NUCLEAR PROLIFERATION

Although it is a gross generalization, for the purposes of this estimate, the reader can assume that essentially every nuclear weapon will produce infrastructure-significant EMP effects when detonated at high altitude. This section of the assessment will provide a brief overview of known and suspected nuclear powers and conclude with a discussion of on-going proliferation developments to frame the potential threat.

The Institute for Science and International Security estimates that approximately 30 countries have either sought to develop nuclear weapons or indicated their intentions to do so over the last 50 years. Other than the United States, the following countries have successfully developed nuclear weapons: Great Britain, France, Russia, China, Pakistan, and India. Israel is suspected of possessing nuclear weapons as is North Korea.[28] In a June 2003 report to Congress, the Director of Central Intelligence (DCI) stated that although Syria is a signatory to the nonproliferation treaty, broader access to foreign expertise warrants concern about Syria's nuclear intentions.[29] Of the remaining nations that either had established programs, or had advocated the development of nuclear weapons, only three were widely considered to be actively seeking nuclear weapons: Iraq, Libya, and Iran.[30]

There have obviously been substantial developments over the last year in the arena of nuclear proliferation with regard to these three nations. Two of the nations that have been regarded as actively seeking nuclear weapons, Iraq and Libya, have been interdicted. Analysis of the intentions and methodologies of their programs is on-going and will likely provide valuable knowledge about other nation's weapons efforts and nuclear technology proliferation in general. However, some other recent proliferation developments warrant particularly careful attention. First, Iran has confirmed the existence of a substantial uranium weapons-grade material processing capability. [31] Although the International Atomic Energy Agency trumpeted the announcement that Iran has signed the additional protocol on nuclear safeguards in December 2003, doubts remain as to the extent of Iran's future cooperation with full verification measures (as well as the efficacy of those inspections).[32] Thus, the full extent and the maturity of Iran's nuclear weapons program remain unknown.

The second proliferation development that warrants careful attention is the exposure of a highly efficient and organized international "proliferation for profit" effort. The acknowledged extent and activities of the Pakistani "Kahn Network" is particularly troubling.[33] Although President Musharraf has publicly disavowed the knowledge or involvement of the Pakistani government or military (supported by the prepared statement of Dr. Kahn) with this international proliferation effort, there are troubling indicators that the government of Pakistan has been actively supporting the spread of nuclear weapons technology throughout the Islamic world.[34] The interception while enroute from Malaysia to Libya of equipment (of Pakistani specification) destined to be used for uranium refinement is just one example.[35]

The final area of significant proliferation concern remains the access to existing nuclear weapons and nuclear weapons-grade material by nations and others interested in possessing nuclear weapons. A recent article in the New York Times reiterates the fact that the refinement of weapons-grade material is not a simple matter and that the production of atomic weapons was still a complex undertaking.[36] This creates an extensive demand for states and others with nuclear ambitions to obtain complete nuclear weapons or weapons-grade materiel. Although any nation with fissile materials or nuclear weapons is potentially a source, Russia, the Newly Independent States of the former Soviet Union (NIS), and her former satellite nations remain a particularly significant proliferation concern due to the economic turmoil, massive stockpiles of fissile materials, inadequate nuclear storage security, and continuing susceptibility to demand-side diversion.[37]

The inadequate security surrounding Russian fissile stockpiles and nuclear weapons storage facilities, the proliferation of nuclear technologies by organized networks (like that created by Dr. Kahn), and the nuclear programs of states such as Iran, North Korea, and potentially, Syria are clearly of significant concern to United States policy makers and strategists. However, to successfully conduct a HEMP attack, possession of a weapon must be matched to a suitable delivery means.

NUCLEAR WEAPON DELIVERY

To conduct a successful HEMP attack on the United States, the significant challenge is to get the weapon to the desired altitude and location. Due to the tremendous area affected by a HEMP attack, exact geographic accuracy need not be a primary requirement. Obviously, an Intercontinental Ballistic Missile (ICBM) with sufficient payload capacity to carry the weapon would suffice. Similarly, weapons traditionally considered as either short, medium, or intermediate range ballistic missiles (SRBM or MRBM, IRBM) would also be suitable, if of sufficient payload capacity and positioned at a launch point close enough to the United States.

The 1998 Commission to Assess the Ballistic Missile Threat to the United States (the Rumsfeld Commission) observed that using old patterns of ballistic missile development as guides to evaluating current threats are misleading.[38] Approaches to ballistic missile development and deployment that were not used by the major Cold War powers for reasons of inefficiency, safety, or quality control may be perfectly acceptable to a nation or group seeking the means to threaten the United States.[39] The transfer of operational missile systems was also cited as a specific concern. Similarly, the Rumsfeld Commission specifically identified several countries that were pursuing a sea launch capability (a troubling aspect of this development is the increased difficulty of correctly assigning responsibility for such an attack).[40] This development was recognized as expanding the potential threat envelope to shorter range missiles such as the Scud series.[41] Within this framework of missile proliferation uncertainty, an overview of nations assessed to possess nuclear capable ballistic missiles is in order.

Of the existing nuclear armed nations that are currently of concern, Russia and China both possess both land and sea based ballistic missile systems capable of conducting a HEMP attack on the United States.[42] In the June 2003 report to Congress, the DCI assessed that North Korea, Iran, and Pakistan possessed a range of nuclear capable ballistic missiles, with North Korea finalizing a limited range ICBM capability. [43] The report also cited Syria as having a domestic Scud production program as well as a development program to produce longer range Scud variants.[44]

Possession of nuclear weapon and ballistic missile capability are the entry level requirements to threaten the United States with a HEMP attack. Sufficient technical expertise must be available to integrate the systems together with a degree of confidence that the system will perform as required. Countries that possess a domestic ballistic missile manufacturing program undoubtedly possess sufficient technical expertise to do so. Having briefly discussed the risk posed by the proliferation of both nuclear and ballistic missile technologies, an assessment of the effectiveness of the dual security strategies of the United States will determine if current prevention and preparedness measures to prevent a HEMP attack are adequate.

UNITED STATES NATIONAL SECURITY STRATEGIES

The mutually supporting National Security Strategy (NSS) and National Strategy for Homeland Security (NSHS) provide an integrated, comprehensive, strategic framework that simultaneously seeks to create and seize opportunities that strengthen national security and prosperity as well as provide a secure foundation for on-going global engagement.[45] Central features of both of these strategies either directly contribute to the prevention of a HEMP attack on the United States homeland or establish suitable frameworks to enable national preparedness, should a HEMP attack occur. A brief review of the elements of the NSS and NSHS supports this assertion.

NATIONAL SECURITY STRATEGY CONTRIBUTIONS

Two of the central objectives of the NSS are to "strengthen alliances to defeat global terrorism" and "work to prevent attacks against the United States and its friends and to prevent the enemies of the United States from threatening it or its allies and friends with WMD."[46] Many of the initiatives that support these objectives directly and indirectly contribute the prevention of a HEMP attack on the United States homeland.

Strengthen Alliances to Defeat Global Terrorism and Work to Prevent Attacks

The NSS recognizes the dangers created by the nexus between terrorists, state sponsors of terrorism, and WMD.[47] The Al-Qaeda organization was widely understood to be seeking WMD and remains a target of particular interest to the United States.[48] The continued interdiction of their sanctuaries, the United States' explicit elimination of the distinction between terrorists and those who knowing aid or harbor them, and the emphasis on the prevention of the

transfer of WMD and their means of delivery to terrorist organizations are contributing directly to the prevention of a HEMP attack on the United States by state-supported terrorists.

The NSS framework also seeks to prevent the use of WMD through the execution of three broad elements: counter-proliferation, non-proliferation, and effective consequence management. There have been substantial developments in the execution of each that contribute to the efforts to prevent a HEMP attack on the United States.

Counter-proliferation

Ongoing proactive nuclear and ballistic missile counter-proliferation efforts are providing substantial dividends that contribute to the prevention of a HEMP attack. First, the intelligence efforts to unmask the extent of the nuclear proliferation network created by Dr. Kahn provide an excellent example of on-going initiatives to strengthen counter-proliferation efforts through a more robust and effective set of detection capabilities.[49]

Similarly, the decision to implement an earlier deployment of an initial ground-based interceptor and improved ballistic missile tracking capabilities will support the improved passive and active defenses called for in the NSS. [50] Also, the convincing demonstration of the continuing efficiency and effectiveness of America's global precision strike capabilities during Operation IRAQI FREEDOM is a clear indication that multi-dimensional counterforce capabilities remain a viable element of America's counter-proliferation capabilities that may be used if required to prevent a HEMP attack on the United States. Finally the United States' demonstrated willingness to conduct preemptive strikes to neutralize WMD under the concept of imminent defense adds an unmistakable dimension to the concept of deterrence for those seeking to acquire weapons of mass destruction.[51]

Non-proliferation

Another initiative specified in the NSS that is contributing to the prevention of a HEMP attack on the United States homeland is the continuing emphasis on strengthened non-proliferation efforts. For example, although the Bush administration initially decreased the emphasis and associated funding of threat reduction assistance to Russia in 2002, the funding was replaced and increased by Congress and the following year fully supported by the Bush administration. [52]

Strengthened non-proliferation diplomatic efforts have also been successful. One particularly promising multilateral diplomatic initiative has been the development of the Proliferation Security Initiative (PSI).[53] The PSI combines the efforts of eleven countries to

combat trafficking to and from states and non-state actors of proliferation concern of WMD, their delivery means, and related materials.[54]

The PSI provides the multilateral framework that supports another non-proliferation initiative identified in the NSS: interdiction. The countries participating in the PSI agree to interdict the transfer or transport to and from states (and non-state actors) of proliferation concern of WMD, their delivery systems or related materials, either domestically or internationally.[55] Although aimed at the entire range of WMD, this interdiction protocol contributes to the prevention of a HEMP attack by seeking to curb the free transport of nuclear technologies, weapons and ballistic missile systems.

Consequence Management

The final portion of the NSS framework that seeks to prevent the use of WMD on the United States, its allies, or its friends is effective consequence management.[56] Effective consequence management, although primarily a preparedness concept, also contributes to the prevention of a HEMP attack. By seeking to minimize the effects of WMD on its people and those of allied and friendly nations, consequence management contributes to deterrence by demonstrating to the enemies of the United States that their WMD acquisition and employment strategies will not be worth the risks.[57]

The most significant contribution to the concept of an effective consequence management strategy has been the creation of the Department of Homeland Security (DHS) and the implementation of a comprehensive national homeland security strategy. A brief review of some of the on-going DHS initiatives will illuminate some of the efforts that are underway and which are creating an effective framework to pursue national preparedness from the effects of a HEMP attack.

NATIONAL STRATEGY FOR HOMELAND SECURITY CONTRIBUTIONS

The July 2002 NSHS is the first-ever national homeland security strategy and it provides the initial framework to secure the homeland from terrorist attacks.[58] The three strategic objectives of this strategy are to prevent terrorist attacks within the United States, reduce America's vulnerability to terrorism, and minimize the damage and recover from attacks that do occur.[59] Since the DHS is a relatively new organization and is faced with an immense task of avoiding the expectation that it must try and defend everything, everywhere, all at once, it is reasonable to find that its on-going initiatives do not specifically concentrate on direct protection against a HEMP attack. However, of the six critical mission areas created by the strategy, two

of them offer a promising framework to reduce the vulnerability of the United States to HEMP attacks. The following paragraphs will provide an overview of these two particular mission areas and highlight on-going initiatives that may contribute now and in the future to a more effective preparedness against a HEMP attack.

Protecting Critical Infrastructure And Key Assets

The NSHS recognizes that the United States' society and its modern way of life are dependent on networks of physical and virtual infrastructures.[60] Of the eight major initiatives to protect these assets, systems, and functions, five develop organizational or procedural frameworks that will contribute to the preparedness of the United States against the effects of a HEMP attack. The following paragraphs highlight some of the contributions made in each of these areas.

The creation of the Department of Homeland Security (DHS) resulted in the assignment of a single accountable official to ensure the United States addresses vulnerabilities that involve more than one infrastructure sector.[61] This step integrated the assessment of threats and vulnerabilities for the range of interdependent critical infrastructures that support the United States.[62] While the NSHS does not specifically reduce the vulnerability of the critical infrastructure to HEMP, it makes the Secretary of Homeland Security responsible to specifically assess and reduce critical infrastructure vulnerabilities to the effects of HEMP.

The NSHS also specifies that a key role of the DHS will be to build and maintain a complete critical infrastructure assessment.[63] This comprehensive, up-to-date analysis of the vulnerabilities and preparedness of key points across the critical infrastructure centers is designed to permit the DHS to match current threat information against current vulnerabilities to efficiently direct the appropriate actions.[64] As with the initiative to unify critical infrastructure responsibilities, this framework will enable DHS personnel to determine the appropriate critical infrastructure systems that need to be protected against HEMP effects as well as a means to track the accomplishment of vulnerability reduction.

Another key initiative that supports preparedness to mitigate and recover from the effects of a HEMP attack is the effort by the DHS to enable effective partnerships with state and local governments and the private sector.[65] As with the other elements, this initiative does not provide direct improvements in the effort to prepare the United States homeland against the effects of a HEMP attack. However, by establishing effective mechanisms for the federal, state and local governments to effectively partner with the private sector, the groundwork through which specific HEMP-related infrastructure improvements may be introduced, has been laid.

The next homeland security critical mission area that creates a mechanism that will be essential to the preparation to reduce infrastructure vulnerabilities to a HEMP attack is the development of a national infrastructure protection plan. This plan provides the methodology for "…identifying and prioritizing critical assets, systems, and functions, and for sharing protection responsibility with state and local government and the private sector."[66] The effort to establish standards and benchmarks for the protection of critical infrastructure will be invaluable as the mechanism for the prioritization of appropriate HEMP hardening measures.

The final initiative to protect critical infrastructures is the on-going effort to develop effective protective solutions through effective modeling and analysis.[67] Specifically, advanced simulations can assist in the determination which assets, systems and functions are particularly important in a series of interdependent infrastructures. This will support the efficient use of scarce resources to harden "high payoff" portions of the infrastructure to the effects of a HEMP attack.

Emergency Preparedness And Response

As with protecting critical infrastructures, there are several initiatives underway to support the critical mission area of emergency preparedness and response. This mission area seeks to minimize the damage and recover from terrorist attacks.

The DHS has made significant progress in the effort to consolidate multiple existing federal response plans under a single all-discipline incident management plan. The Initial National Response Plan, 30 September 2003, represents a "…significant first step toward integrating the current series of federal prevention, preparedness, response, and recovery plans into a single, all-discipline, all-hazards plan."[68] Due to the cross-infrastructure, continental-scope effects of a HEMP attack, the development of an effective, integrated plan to synchronize the national response to mitigate the effects and guide national recovery is especially critical.

A related initiative that directly supports the execution of the national response effort is the creation of a national incident management system (NIMS). This system seeks to define common terminology, provide a unified command structure, and is scaleable to manage incidents of all sizes.[69] According to Homeland Security Presidential Directive (HSPD)-5, the NIMS will provide "…a consistent nation-wide approach for federal, state, and local governments to work effectively and efficiently together to prepare for, respond to, and recover from domestic incidents, regardless of cause, size, or complexity."[70] Along with the creation of a National Response Plan, the NIMS will be absolutely essential to managing the consequences

and organizing the national recovery from the continental-wide, sustained collapse of substantial portions of the interdependent infrastructures that a HEMP attack would cause.

A supporting initiative for the emergency preparedness and response critical mission area is to enable seamless communications among all responders.[71] In the aftermath of a HEMP attack, reliable communications among federal, state, and local responders will be a key enabler of the prolonged national recovery effort. The development of the national emergency communications plan will establish protocols, processes, and national standards for technology acquisition. Incorporation of suitable EMP hardened communications must be a key component of this plan.

The DHS recognizes that it must carefully plan for military assistance to civil authorities (MACA) to ensure that, when duly authorized by the President, military forces (which remain under the command of the Secretary of Defense) are efficiently and effectively used.[72] MACA may take the form of technical support and assistance to law enforcement (Military Support to Civilian Law Enforcement Agencies; MSCLEA), assisting in the restoration of law and order (Military Assistance for Civil Disturbances; MACDIS), and assisting in incident management. United States Northern Command (NORTHCOM) is responsible for both homeland defense and for assisting civil authorities when directed by the President (through the Secretary of Defense).[73] During the massive societal upheaval that will follow the comprehensive, extended disruption of the nation's critical infrastructure after a HEMP attack, substantial portions of the Department of Defense will be required to manage the consequences, maintain civil order, and to support the national recovery effort. For this reason, the planning and training efforts between the DHS and the Department of Defense must include the effects of a HEMP attack as a critical scenario.

RECOMMENDATIONS

Although the HEMP phenomenon grew out of the Cold War, the threat of this form of attack exists as long as there are nuclear weapons and delivery systems that may be targeted against the United States. However, the psychological tendency is to shrug off the implications of a HEMP attack because the consequences are so enormous.[74] Nevertheless, the threat and the vulnerabilities are real and must be acknowledged, prioritized, and planned for by both the homeland defense and homeland security communities. While the EMP Commission will present a thoroughly comprehensive list of recommendations in the near future, some broad recommendations are worthwhile presenting here.

As the Rumsfeld Commission warned, and the events of 11 September tragically demonstrated, our enemies will seek to attack in ways we are not prepared for using methodologies that have not been previously tried.[75] The on-going effort to improve the extremely impressive intelligence apparatus of the United States must continue. Emphasis should continue to be placed on identifying idiosyncratic methods through adaptive red teaming. Specifically, the intelligence community must remain particularly vigilant against the threat of a HEMP attack against the United States homeland.

The inevitable tension between homeland defense and homeland security creates a potential seam that must be recognized and eliminated or minimized. The efforts by NORTHCOM to craft a joint operating concept to close this seam are particularly promising. Similarly the proactive relationships at multiple levels between the DHS and the DoD indicate that both organizations are diligently seeking to mature their relationship. One specific area that should be developed as a matter of some urgency however, is a mandated series of planning sessions and simulations to determine the most effective and efficient way to employ DoD resources in the aftermath of a HEMP attack. Specific care should be paid to the incorporation of the reserve component and returning overseas based military capabilities. Planning and prioritization of MACA/MACLEA/MACDIS in a post HEMP attack scenario should be of particular emphasis.

Another area of concern is that many of the remaining nuclear physicist personnel, specifically those associated with EMP, are retiring without a next generation to follow their lead.[76] Similarly, the physical plant to conduct EMP testing and simulation has atrophied almost to the point of non-existence.[77] Building upon a suggestion originally proposed by Doctor Wood, Congress should mandate and oversee the creation of an interagency, DoD-DHS led organization to champion the revitalization of both of these resources.[78]

Finally, as indicated earlier in the paper, the NSHS has made a good organizational start in several areas. Congress should mandate DHS specifically incorporate HEMP into the appropriate initiatives in emergency preparedness and critical infrastructure protection. Specifically, DHS must conduct an analysis of the detailed vulnerabilities of various portions of the critical infrastructure to HEMP and, as a matter of priority, integrate selected initiatives to minimize critical infrastructure vulnerabilities. DHS should also seek to inform the public as to the nature of the threat and seek innovative ways to partner with industry to identify opportunities to reduce our susceptibility to HEMP.

CONCLUSION

Increasing proliferation of nuclear and ballistic missile technology, continued insecurity of fissile stockpiles, and the presence of capable adversaries dedicated to the destruction of the United States make a HEMP attack an increasingly likely scenario. A successful HEMP attack would severely damage the critical infrastructure that the supports national elements of power of the United States for an extended period of time. As such, the consequences of a HEMP attack are unacceptable.

Implementation of the concepts contained in the NSS and the NSHS are achieving successes synchronizing the diplomatic, informational, economic, and military elements of national power to prevent a HEMP attack, while simultaneously establishing promising organizational frameworks which may help to prepare the United States for the consequences of such an attack. The approaching report of the Commission to Assess the Threat to the United States from Electromagnetic Pulse Attack will provide extensive recommendations to prevent and mitigate the risks to the United States from a HEMP attack. This much is certain: The threat has not diminished; the vulnerabilities to a HEMP attack exist; there is much that can and must be done.

The challenge will be for the nation and its leaders to hear the report, to objectively evaluate the recommendations, and effectively implement them. In the end, the United States must ensure that, in the words of Colin Gray, it does not lose the only strategic resource that can never be regained: *the time to act*.[79]

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ENDNOTES

[1] George W. Bush, *The National Security Strategy of The United States of America* (Washington, D.C.: The White House, September 2002), 13.

[2] Ibid., 15.

[3] Congress, House of Representatives, Committee on National Security, Military Research and Development Subcommittee, Doctor Gary Smith, Prepared Testimony, *Threat Posed by Electromagnetic Pulse (EMP) to U.S. Military Systems and Civil Infrastructure,* 105th Congress, 1st Session, 16 July 1997; available from <http://www.fas.org/spp/starwars/congress/1997_h/h970716s.htm>; Internet; accessed 3 Feb 2004.

[4] Establishment of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack; August 14, 2001; Available from < http://armedservices.house.gov/reports/2001executivereports/01-08-14electromagnetic.pdf>; Internet; Accessed 31 January 2004. Specifically, the commission has been chartered to: "assess the nature and magnitude of potential high-altitude EMP threats to the United States from all potentially hostile states or non-state actors that have or could have or could acquire nuclear weapons and ballistic missiles enabling them to perform a high-altitude EMP attack against the United States within the next 15 years; the vulnerability of the United States military and especially civilian systems to EMP attack, given special attention to the vulnerability of the civilian infrastructure as a matter of emergency preparedness; the capability of the United States to repair and recover from damage inflicted on United States military and civilian systems by an EMP attack; the feasibility and cost of hardening select military and civilian systems against EMP attack."

[5] Mike Frankel, Executive Director, EMP Commission, <mfrankel@empc.org>, "HEMP" electronic mail message to Thomas Riddle <thomas.c.riddle@us.army.mil>, 27 January 2004. Mr. Frankel stated that the EMP Commission was not releasing any interim reports prior to its report to Congress.

[6] The National Strategy for Homeland Security defines Homeland Security as: "…a concerted national effort to prevent terrorist attacks within the United States, reduce America's vulnerability to terrorism, and minimize the damage and recover from attacks that do occur." The Defense Planning Guidance defines Homeland Defense as: "The protection of United States sovereignty, territory, domestic population and critical defense infrastructure against external threats and aggression."

[7] National Communications System, Technology and Standards Division, *Telecommunications: Glossary of Terms*, 7 August 1996; available from <http://www.its.bldrdoc.gov/fs-1037/dir-013/_1938.htm>; Internet; accessed 19 October 2003.

[8] Congress, House of Representatives, Committee on National Security, Military Research and Development Subcommittee, Doctor Lowell Wood, Prepared Testimony, *Threat Posed by Electromagnetic Pulse (EMP) to U.S. Military Systems and Civil Infrastructure,* 105th Congress, 1st Session, 16 July 1997; available from <http://commdocs.house.gov/committees/security/has 197010.000/ has197010_0f.htm>. Internet, accessed 19 October 2003.

[9] Carlo Kopp, *The Electromagnetic Bomb – a Weapon of Electrical Mass Destruction*, 1996; available from < http://www.airpower.maxwell.af.mil/airchronicles/ kopp/apjemp.html>; Internet; accessed 22 September 2003, 2. Kopp has written extensively on the subject of EMP and how it may be used against a technologically dependent adversary such as the United States. Due to the relative ease with which such attacks may be resourced and conducted, localized, non-nuclear EMP attacks are a subject of increasing concern among security professionals.

[10] Samuel Glasstone, and Philip Dolan, eds., *The Effects of Nuclear Weapons*, (Department of Defense, 1997), 518. This book has an excellent chapter on the EMP effects generated by nuclear weapons and is one of the foundation references on the overall effects of nuclear weapons.

[11] Congress, *Threat Posed by Electromagnetic Pulse (EMP) to U.S. Military Systems and Civil Infrastructure,* 16 July 1997, 6. Interestingly, the explosive yield of a nuclear weapon is not as critical as the design – a device of less than 10 kilotons (optimized for the production of particular characteristics) can have much more of an EMP effect than a crudely designed weapon in the megaton range.

[12] Image Source: Congress, Doctor Gary Smith, Prepared Testimony, *Threat Posed by Electromagnetic Pulse (EMP) to U.S. Military Systems and Civil Infrastructure,* 2.

[13] Congress, Doctor Gary Smith, Prepared Testimony, *Threat Posed by Electromagnetic Pulse (EMP) to U.S. Military Systems and Civil Infrastructure,* 3.

[14] Ibid., 3.

[15] Congress, House of Representatives, Committee on National Security, Military Research and Development Subcommittee, T*hreat Posed by Electromagnetic Pulse (EMP) to U.S. Military Systems and Civil Infrastructure,* 105th Congress, 1st Session, 16 July 1997; available from <http://commdocs.house.gov/committees/security/has 197010.000/ has197010_0f.htm>; Internet, accessed 19 October 2003, 14. Refer to Radasky, "High Altitude EMP (HEMP) Environments and Effects," *NBC Report* (Spring/Summer 2002) and Samuel Glasstone, and Philip Dolan, *The Effects of Nuclear Weapons*, for additional detail on the factors that influence the specific distribution of the HEMP-created electrical fields on the surface of the earth.

[16] Congress, Doctor Gary Smith, Prepared Testimony, *Threat Posed by Electromagnetic Pulse (EMP) to U.S. Military Systems and Civil Infrastructure,* 3.

[17] Dr. William A. Radasky, "High Altitude EMP (HEMP) Environments and Effects," *NBC Report* (Spring/Summer 2002): 24 – 27. This is an extremely informative article and is highly recommended for those interested in gaining an initial understanding of the E1, E2, E3 components of a HEMP pulse and the generation mechanism for each.

[18] Image Source: Congress, Doctor Gary Smith, Prepared Testimony, *Threat Posed by Electromagnetic Pulse (EMP) to U.S. Military Systems and Civil Infrastructure,* 3.

[19] U.S. Congress, Threat Posed by Electromagnetic Pulse (EMP) to U.S. Military Systems and Civil Infrastructure. 16 July 1997, 15.

[20] Congress, Doctor Gary Smith, Prepared Testimony, *Threat Posed by Electromagnetic Pulse (EMP) to U.S. Military Systems and Civil Infrastructure,* 4.

[21] Congress, *Threat Posed by Electromagnetic Pulse (EMP) to U.S. Military Systems and Civil Infrastructure,* 16.

[22] Congress, House of Representatives, Committee on Small Business, Subcommittee on Government Programs and Oversight, *Electromagnetic Pulse (EMP): Should This be a Problem of National Concern to Private Enterprise, Businesses Small and Large, As Well As Government?* , 106th Cong. 1st Session, 7 June 1999, available from <http://www.house.gov/smbiz/hearings/106th/1999/990601/transcript.html>; Internet, accessed 22 September 2003.

[23] George W. Bush, *The National Strategy for The Physical Protection of Critical Infrastructures and Key Assets* (Washington, D.C.: The White House, February 2003), 6. "Critical Infrastructures are systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters."

[24] Congress, *Threat Posed by Electromagnetic Pulse (EMP) to U.S. Military Systems and Civil Infrastructure,* 20.

[25] Bush, *The National Strategy for The Physical Protection of Critical Infrastructures and Key Assets*, 6.

[26] Congress, *Threat Posed by Electromagnetic Pulse (EMP) to U.S. Military Systems and Civil Infrastructure,* 35

[27] Ibid., 34.

[28] Institute for Science and International Security, *Nuclear Weapons Programs Worldwide: An Historical Overview*; available from <http://www.isis-online.org/mapproject/introduction.html>; Internet; accessed 10 February 2004, 1. South Africa remains the only country to have succeeded in developing a nuclear weapon and then subsequently dismantling its weapons program. Three members of the former Soviet Union (Belarus, Kazakhstan, and Ukraine) inherited nuclear weapons but have claimed to have returned the weapons to Russia and declared themselves to be non-nuclear states.

[29] Director of Central Intelligence, *Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 January Through 30 June 2003*; available from <http://www.cia.gov/cia/reports/721_reports/jan_jun2003.htm>; Internet; accessed 24 February 2003, 6.

[30] Institute for Science and International Security, "Nuclear Weapons Programs Worldwide: An Historical Overview"; available from <http://www.isis-online.org/ mapproject/introduction.html>; Internet; accessed 10 February 2004, 1.

[31] Natural Resources Defense Council, “Iran Develops Nuclear Technologies in Secret for 18 Years,” 12 December 2003; available from <http://www.nrdc.org/nuclear/iaeaairan.asp>; Internet; accessed 10 February 2004.

[32] International Atomic Energy Agency, “Iran Signs Additional Protocol on Nuclear Safeguards,” 18 December 2003; available from <http://www.iaea.org/NewsCenter/News2002/iranap20031218.html>; Internet; accessed 10 February 2004.

[33] Bernard Levy, “Abdul Qadeer Khan,” *Wall Street Journal*, 17 February 2004; sec. A, p. 20.

[34] Washington Post, “Pakistan’s Nuclear Crimes,” *Washington Post*, 5 February 2004, sec. A, p. 20.

[35] Ibid.

[36] Greg Easterbrook, “The Atomic Club: If the Bomb is so Easy to Make, Why Don’t More Nations Have It?,” *New York Times*, 4 January 2004, sec. 4, p. 1.

[37] Rensselaer Lee, “Nuclear Smuggling: Patterns and Responses,” *Parameters* (Spring 2003); available from <http://carlisle-www.army.mil/usawc/parameters/03spring/ lee.htm>; Internet; accessed 10 November 2003

[38] Commission to Assess the Ballistic Missile Threat to the United States, “Executive Summary, Report of the Commission to Assess the Ballistic Missile Threat to the United States,” 15 July 1998; available from <http://www.fas.org/irp/threat/ missile/rumsfeld/index.html>; Internet; accessed 1 February 2004.

[39] Ibid.

[40] Congress, House of Representatives, Committee on Armed Services, Military Research and Development Subcommittee, *Electromagnetic Pulse Threats to U.S. Military and Civilian Infrastructure,* 106th Cong. 1st Session, 7 October 1999. Available from <http://commdocs.house.gov/committees/security/ has280010.000 /has280010_0.htm>; Internet, accessed 22 September 2003, 68.

[41] Congress, House of Representatives, Committee on Small Business, Subcommittee on Government Programs and Oversight, *Electromagnetic Pulse (EMP): Should This be a Problem of National Concern to Private Enterprise, Businesses Small and Large, As Well As Government?* , 106th Cong. 1st Session, 7 June 1999. Available from <http://www.house.gov/smbiz/hearings/106th/1999/990601/transcript.html>; Internet; accessed 22 September 2003.

[42] National Intelligence Officer for Strategic and Nuclear Programs, “Foreign Missile Developments and the Ballistic Missile Threat Through 2015 (Unclassified Summary of the National Intelligence Estimate),” December 2001; available from <http://www.fas.org/irp/nic/bmthreat-2015.htm>; Internet; accessed 10 January 2004.

[43] Director of Central Intelligence, *Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 January Through 30 June 2003*; available from <http://www.cia.gov/cia/reports/721_reports/jan_jun2003.htm>; Internet; accessed 24 February 2003, 6.

[44] Ibid.

[45] George W. Bush, *The National Strategy for Homeland Security (*Washington, D.C.: The White House, July 2002), 5.

[46] George W. Bush, *The National Security Strategy of The United States of America,* 1.

[47] Ibid., 6.

[48] Ibid.

[49] George J. Tenet, "Iraq and Weapons of Mass Destruction," 5 February 2004; available from <http://www.cia.gov/cia/public affairs/speeches/2004/tenet georgetownspeech 02052004.html>; Internet; accessed 24 February 2004. Also, George W. Bush, "President Announces New Measures to Counter the Threat of WMD," 11 February 2004; available from <http://www.whitehouse.gov/news/releases/2004/02 /print/20040211-4.html>; Internet; accessed 24 February 2004.

[50] Bradley Graham, "U.S. Missile Defense Set To Get An Early Start," *Washington Post*, 2 February 2004. Also: George W. Bush, *The National Security Strategy of The United States of America,* 15.

[51] George W. Bush, *The National Security Strategy of The United States of America,* 15.

[52] Rensselaer Lee, "Nuclear Smuggling: Patterns and Responses," *Parameters* (Spring 2003); available from <http://carlisle-www.army.mil/usawc/parameters/03spring/ lee.htm>; Internet; accessed 10 November 2003.

[53] White House, "Fact Sheet on Proliferation Security Initiative," (4 September 2003); available from <http://www.defense-aerospace.com/cgi-bin/client/ modele.pl? session=dae.1024958.1064417927&modele=jdc_34>; Internet; accessed 24 September 2003.

[54] Ibid. The PSI is cited by the White House as being consistent with the statement of the United Nations Security Council Presidential Statement of January 1992 and recent statements of the G-8 and the European Union that more consistent and coherent efforts are needed to prevent the proliferation of WMD.

[55] Ibid.

[56] George W. Bush, *The National Security Strategy of The United States of America,* 14.

[57] Ibid.

[58] George W. Bush, *The National Strategy for Homeland Security (*Washington, D.C.: The White House, July 2002), iii – iv, vii. The NHS broadly defines terrorism as "…any premeditated, unlawful act dangerous to human life or public welfare that is intended to intimidate or coerce civilian populations or governments." The NSHS definition covers the use of nuclear weapons and "foreigners, acting in concert with others, on their own, or on behalf of a hostile state." Presumably then, any HEMP attack conducted by persons other than the regular military of a hostile state could be considered a terrorist attack.

[59] Ibid., vii.

[60] Ibid., ix.

[61] Ibid., 31.

[62] Ibid.

[63] Ibid., 33.

[64] Ibid.

[65] Ibid., ix.

[66] Ibid., 33.

[67] Ibid.

[68] Department of Homeland Security, Initial Response Plan Fact Sheet, (Washington, D.C.: 10 October 2003); available from <www.dhs.gov/dhspublic/display?theme=43&content=1936&print=true>; Internet; accessed 24 February 2004.

[69] Bush, *The National Strategy for Homeland Security, 43.*

[70] George W. Bush, *Homeland Security Presidential Directive/HPSD-5* (Washington D.C.: 28 February 2003), available from <www.dhs.gov/dhspublic/display?theme=42& content=4961> ; Internet; accessed 20 January 2004.

[71] Bush, *The National Strategy for Homeland Security*, 43.

[72] Ibid., 44.

[73] Ibid., 44.

[74] Colin S. Gray, "Thinking Asymmetrically in Times of Terror," *Parameters* (Spring 2002): 9.

[75] Montgomery C. Meigs. "Unorthodox Thoughts about Asymmetric Warfare*"*; *Parameters* (Summer 2003): 8. Meigs posits that the Al Qaeda attacks on September 11, 2001 demonstrated the terrorist's ability to combine asymmetry (techniques lacking a common basis of comparison) with an unorthodox approach to apply a capability (idiosyncrasy). Specifically, Meigs describes the terrorist attacks as the use of an asymmetric weapon combined with an

idiosyncratic approach: "…the use of unique, one-time cellular teams and support structure formed for this particular operation, combined with stealth and surprise and culminating in an idiosyncratic approach by terrorists inserting themselves into the cockpits of airliners." Meigs also observes that standards of living worldwide depend on technical systems that are susceptible to idiosyncratic threats and suggests that the operational patterns of Al Qaeda indicate further attacks using idiosyncratic techniques and asymmetric means.

[76] Doctor Lowell Wood, Prepared Testimony, Threat Posed by Electromagnetic Pulse (EMP) to U.S. Military Systems and Civil Infrastructure.

[77] Ibid.

[78] Ibid.

[79] Colin S. Gray, *Modern Strategy*, (New York, New York: Oxford University Press, 1999), 16.

BIBLIOGRAPHY

Allgood, Brian D. *DoD and the Biological Weapons Domestic Response Plan: Does it Contribute?* Strategy Research Project. Carlisle Barracks: US Army War College, 9 April 2002.

Becker, Howard G., DoD Committee Management Officer. "Establishment of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack." Letter for Honorable Bob Stump. August 14, 2001. Available from < http://armedservices.house.gov/reports/2001executivereports /01-08-14electromagnetic.pdf>. Internet. Accessed 31 January 2004.

Brennan, Richard. *Protecting the Homeland: Insights From Army Wargames*. Santa Monica, CA: Rand Corporation, 2002.

Burnett, Peter L, Jr. *Information Operations.* Strategy Research Project. Carlisle Barracks: US Army War College, 9 April 2002.

Bush, George W. *National Strategy for Homeland Security*. Washington, D.C.: The White House, July 2002.

_____. *National Strategy to Combat Weapons of Mass Destruction* . Washington, D.C.: The White House, December 2002.

_____. *The National Security Strategy of the United States of America.* Washington, D.C.: The White House, September 2002.

_____. "Homeland Security Presidential Directive/HPSD-5." *28* February 2003. Available from <www.dhs.gov/dhspublic/display?theme=42& content=4961>. Internet. Accessed 20 January 2004.

_____. "President Announces New Measures to Counter the Threat of WMD." 11 February 2004. Available from <http://www.whitehouse.gov/news/ releases/2004/02 /print/20040211-4.html>. Internet. Accessed 24 February 2004.

_____. *The National Strategy for the Physical Protection of Critical Infrastructures and Key Assets*. Washington D.C.: The White House, February 2003.

_____. *The National Strategy for The Physical Protection of Critical Infrastructures and Key Assets.* Washington, D.C.: The White House, February 2003.

Cerami, Joseph R. and Holcumb, James F. Jr. eds. *U.S. Army War College Guide to Strategy*. Carlisle, PA.: Strategic Studies Institute, 2001.

Commission to Assess the Ballistic Missile Threat to the United States, "Executive Summary, Report of the Commission to Assess the Ballistic Missile Threat to the United States." 15 July 1998. Available from <http://www.fas.org/irp/threat/ missile/rumsfeld/index.html>. Internet. Accessed 1 February 2004.

Cordesman, Anthony H., *Terrorism, Asymmetric Warfare, and Weapons of Mass Destruction: Defending the Homeland*. Westport, CT: Praeger Publishers, 2002.

Department of Homeland Security. “Initial Response Plan Fact Sheet.” Available from <www.dhs.gov/dhspublic/display?theme=43&content=1936&print=true>. Internet. Accessed 24 February 2004.

Director of Central Intelligence. “Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 January Through 30 June 2003.” Available from <http://www.cia.gov/cia/reports/721_reports/jan_jun2003.htm>. Internet. Accessed 24 February 2003.

Donahue, Patrick J., II. *Homeland Security: A Primary Army Function.* Strategy Research Project. Carlisle Barracks: US Army War College, 9 April 2002.

Easterbrook, Greg. “The Atomic Club: If the Bomb is so Easy to Make, Why Don’t More Nations Have It?” *New York Times*, 4 January 2004, sec. 4, p. 1.

Frankel, Mike. Executive Director. EMP Commission. <mfrankel@empc.org>. “HEMP.” Electronic mail message to Thomas Riddle <thomas.c.riddle@us.army.mil>. 27 January 2004.

Gilmore, James S. III. *Fourth Annual Report to the President and the Congress of the Advisory Panel to Assess Domestic Response Capabilities for Terrorism Involving Weapons of Mass Destruction: IV. Implementing the National Strategy*. Arlington, Virginia: Rand Corporation, 15 December 2002.

Glasstone, Samuel, and Philip Dolan, eds. *The Effects of Nuclear Weapons.* U.S. Government Printing Office,1997.

Graham, Bradley. “U.S. Missile Defense Set To Get An Early Start.” *Washington Post*, 2 February 2004, sec. A, p. 3.

Gray, Colin S. “Thinking Asymmetrically in Times of Terror.” *Parameters* (Spring 2002): 4-14.

_____. *Modern Strategy*. New York, New York: Oxford University Press, 1999.

Healy, Richard J. *Emergency and Disaster Planning*. New York, NY: John Wiley & Sons, Inc., 1969.

Institute for Science and International Security. “Nuclear Weapons Programs Worldwide: An Historical Overview.” Available from <http://www.isis-online.org/ mapproject/ introduction.html>. Internet. Accessed 10 February 2004.

International Atomic Energy Agency. “Iran Signs Additional Protocol on Nuclear Safeguards.” 18 December 2003. Available from <http://www.iaea.org/ NewsCenter/News 2002/iranap20031218.html>. Internet. Accessed 10 February 2004.

Keeney, Douglas L. *The Doomsday Scenario*. St. Paul, MN:MBI Publishing Co., 2002.

Klippstein, Daniel M., “Homeland Security: The Department of Defense, The Department of Homeland Security, and Critical Vulnerabilities.” In *National Security Challenges for the*

21st Century, ed. Williamson Murray, 271-310. Carlisle Barracks, PA: Strategic Studies Institute, 2003.

Kopp, Carlo. "The Electromagnetic Bomb – a Weapon of Electrical Mass Destruction." 1996. Available from < http://www.airpower.maxwell.af.mil/airchronicles/ kopp/ apjemp.html>. Internet. Accessed 22 September 2003.

Lavoy, Peter R., and Scott D. Sagan, and James J. Wurtz, eds. *Planning the Unthinkable: How New Powers Will Use Nuclear, Biological, and Chemical Weapons*., Ithaca, NY: Cornell University Press, 2000.

Lee, Rensselaer. "Nuclear Smuggling: Patterns and Responses." *Parameters* (Spring 2003). Available from <http://carlisle-www.army.mil/usawc/parameters/03spring/ lee.htm>. Internet. Accessed 10 November 2003.

_____. *Smuggling Armageddon: The Nuclear Black Market in the Former Soviet Union and Europe*. New York, NY: St. Martins Press, 1998.

Levy, Bernard "Abdul Qadeer Khan," *Wall Street Journal*, 17 February 2004; sec. A, p. 20.

McKenzie, Kenneth F. *The Revenge of the Melians: Asymmetric Threats and the Next QDR.* Washington D.C.: Institute for Strategic Studies, National Defense University, 2000.

Meigs, Montgomery C. "Unorthodox Thoughts about Asymmetric Warfare." *Parameters* (Summer 2003): 4-18.

National Communications System. Technology and Standards Division. *Telecommunications: Glossary of Terms*, August 7 1996. Available from <http://www.its.bldrdoc.gov/fs-1037/dir-013/_1938.htm>. Internet. Accessed 19 October 2003.

National Intelligence Officer for Strategic and Nuclear Programs. "Foreign Missile Developments and the Ballistic Missile Threat Through 2015 (Unclassified Summary of the National Intelligence Estimate)." December 2001. Available from <http://www.fas.org/irp/nic/bmthreat-2015.htm>. Internet. Accessed 10 January 2004.

Natural Resources Defense Council. "Iran Develops Nuclear Technologies in Secret for 18 Years," 12 December 2003; available from <http://www.nrdc.org/nuclear/ iaeaairan.asp>. Internet. Accessed 10 February 2004.

Patterson, LaWarren V. *Information Operations and Asymmetric Warfare…Are We Ready?* Strategy Research Project. Carlisle Barracks: US Army War College, 9 April 2002.

Radasky, Doctor William A. "High Altitude EMP (HEMP) Environments and Effects." *NBC Report* (Spring/Summer 2002): 24 – 29.

Rumsfeld, Donald H. *Transformation Planning Guidance.* Washington, D.C.: The Department of Defense, April 2003.

Seiple, Chris. *Consequence Management: Domestic Response to Weapons of Mass Destruction.* Parameters (Autumn 1997): 119 – 34.

Smith, Doctor Gary L., Prepared Testimony. Congress. House of Representatives. Committee on National Security. Military Research and Development Subcommittee. "Threat Posed by Electromagnetic Pulse (EMP) to U.S. Military Systems and Civil Infrastructure." 105th Cong., 1st sess., 16 July 1997. Available from <http://www.fas.org/spp/starwars/congress/ 1997_h/h970716s.htm>. Internet. Accessed 3 February 2004.

Tenet, George J. "Iraq and Weapons of Mass Destruction," 5 February 2004. Available from <http://www.cia.gov/cia/public affairs/speeches/2004/tenet georgetownspeech 02052004.html>. Internet. Accessed 24 February 2004.

Townes, Richard C. *The U.S. Army's Role In Homeland Security: What Changes Are Needed?* Strategy Research Project. Carlisle Barracks: US Army War College, 9 April 2002.

U.S. Congress. House of Representatives. Committee on Armed Services. Military Research and Development Subcommittee. *Electromagnetic Pulse Threats to U.S. Military and Civilian Infrastructure.* 106th Cong., 1st sess., 7 October 1999. Available from <http://commdocs.house.gov/committees/security/has280010.000 /has280010_0.htm>. Internet. Accessed 22 September 2003.

U.S. Congress. House of Representatives. Committee on National Security. Military Research and Development Subcommittee, *Threat Posed by Electromagnetic Pulse (EMP) to U.S. Military Systems and Civil Infrastructure.* 105th Cong., 1st sess., 13 July 1997. Available from <http://commdocs.house.gov/committees/ security/has 197010.000/ has197010_0f.htm>. Internet. Accessed 19 October 2003.

U.S. Congress. House of Representatives. Committee on Small Business. Subcommittee on Government Programs and Oversight. *Electromagnetic Pulse (EMP): Should This Be a Problem of National Concern to Private Enterprise, Businesses Small and Large, as well as Government?* 106th Cong., 1st sess., 1 July 1999. Available from <http://www.house.gov/smbiz/hearings/106th/ 1999/990601/ transcript.html>. Internet. Accessed 22 September 2003.

Washington Post. "Pakistan's Nuclear Crimes." *Washington Post,* 5 February 2004, sec. A, p. 20.

Waugh, William L., Jr., and Ronald John Hy, eds. *Handbook of Emergency Management: Programs and Policies Dealing With Major Hazards and Disasters*. Westport, CT: Greenwood Publishing Group, Inc., 1990.

White House. "Fact Sheet on Proliferation Security Initiative." 4 September 2003. Available from <http://www.defense-aerospace.com/cgi-bin/client/ modele.pl? session=dae.1024958.1064417927&modele=jdc_34>. Internet. Accessed 24 September 2003.

Wood, Doctor Lowell. Congress. House of Representatives. Committee on National Security. Military Research and Development Subcommittee. Prepared Testimony. *"Threat Posed by Electromagnetic Pulse (EMP) to U.S. Military Systems and Civil Infrastructure."* 105th Cong., 1st sess., 16 July 1997. Available from

<http://commdocs.house.gov/committees/security/has 197010.000/ has197010_0f.htm>. Internet. Accessed 19 October 2003