

## Electromagnetic Pulse Attack: Achilles Heel of Homeland Defense

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## Abstract

An Electromagnetic Pulse (EMP) created by a man-made nuclear device or natural occurring geomagnetic storm would have devastating effects on the highly vulnerable electrical power grid of the United States. The United States is a modern electric-dependent society, relying heavily on just-time logistics and communications to support basic societal functions. An EMP has the potential to shut down this electrical backbone, therefore collapsing the nation's life sustainment systems. As future potential adversaries of the United States, to include violent extremists groups, have sought the technology and practiced the execution of an EMP attack, it is imperative the United States prepare and defend against such an event. This paper will examine historical examples of the impact of EMP events on American society, the posture of the United States Homeland Security to defend against an EMP attack, and identify possible gaps in the planning and recovery assumed in current doctrine.

## **Electromagnetic Pulse Attack: Achilles Heel of Homeland Defense**

The history of the failure of war can almost be summed up in two words: too late. Too late in comprehending the deadly purpose of a potential enemy. Too late in realizing the mortal danger. Too late in preparedness. <sup>1</sup>

-General Douglas MacArthur

In opening remarks before the House of Representatives' Joint Hearing of the Subcommittee on National Security and Subcommittee on the Interior (May 2015), Representative Ron DeSantis (Republican, FL) stated: "Because of the ubiquitous dependence of the U.S. society on electrical power systems, its vulnerability to an Electromagnetic Pulse (EMP) attack, coupled with EMP's particular damage mechanisms creates the possibility of a long-term catastrophic consequence."<sup>2</sup> Congressman DeSantis noted the historical examples of the 1977 New York City blackout and August 2003 blackout that affected Ohio, New York, Maryland, Pennsylvania, and Michigan. Though these events were regional and short in duration, both had catastrophic human and economic impacts with over 10 billion dollars lost from food spoilage and production. Additionally, in the case of New York City, there was wide spread looting and an overall breakdown of law enforcement capabilities.<sup>3</sup>

Dr. Peter Vincent Pry, National and Homeland Security Task Force Executive Director and former staff member of the Commission to Assess the Threat to the United States from an EMP attack (EMP Commission), also provided testimony to the committee.<sup>4</sup> According to Dr. Pry: "No other threat can cause such broad and deep damage to all critical infrastructures as a nuclear EMP attack. A nuclear EMP attack would collapse the electric grid, blackout and directly damage transportation systems,

industry and manufacturing, telecommunications and computers, banking and finance, and infrastructures for food and water.”<sup>5</sup>

As for the threat of attack to the United States, Dr. Pry provided conclusions from the EMP commission that Russian, Iran, China and North Korea are practicing and formulating the doctrine of a new Lightning War in what Moscow calls a “Revolution in Military Affairs.”<sup>6</sup> Similar to Nazi Germany’s *Blitzkrieg*, this new Lightning War would aim to attack the electrical grid and infrastructure, through coordinated cyber, sabotage, and EMP attack. These attacks are designed to cripple a modern society by disrupting what they see as the “Achilles Heel” of an electronic civilization.<sup>7</sup> The military texts of Russia, China, and Iran specifically mention this option to address a U.S. threat. Further, as recently as 2013 and 2014, both Iran and North Korea have practice the very launch technology, to include correct altitude for an EMP missile attack over the continental United States for a maximum EMP affect.<sup>8</sup> Dr. Pry finished by noting the EMP Commission believed the United States electronic grid is not prepared to withstand such an EMP attack.<sup>9</sup>

As the United States is a modern electronic-dependent society, it relies on just in time logistics and associated electronic communication to maintain societal functions such as water and food supplies. Therefore, it is imperative to prepare for the possibility of an EMP attack, as one would shut down the very backbone of the nation’s life sustainment. This observation is supported by several Congressional and Presidential Directives, including the creation of the EMP Commission (2001-2008) and Presidential Directives 5 and 8 (2003) that created a unified strategy via the National Response Plan (NRP) and implemented within the National Incident Management System (NIMS).<sup>1011</sup>

The NRP and NIMS were mainly created after the events of September 11, 2001 to coordinate the nation's whole of government response to a multitude of possible terrorist attacks or natural disasters, including mitigation of an EMP event.<sup>12</sup> As these events involve domestic issues, the Department of Homeland Security (DHS) and the Federal Emergency Management Agency (FEMA) are the lead agencies for coordination and recovery. However, after major natural disasters such as Hurricane Katrina and Sandy, the reliance and utilization of Department of Defense (DoD) assets via the Defense Support to Civil Authorities (DSCA) have become critical to success.<sup>13</sup> Specifically, after action reports indicate DHS/FEMA lack the logistical capacity and manpower to quickly respond to major incidents. Subsequently, DoD support was codified in Joint Publication (JP) 3-28 and NORTHCOM CONPLAN 3500 that provide procedures for quick response and coordination for DSCA. Pursuant to the creation of these plans, DoD support to DHS/FEMA has been greatly improved and essential to the successful response to recent hurricane relief efforts in Texas and Puerto Rico.<sup>1415</sup>

However, a critical thread prevails throughout the joint publications, NIMS, and NRP on how DHS/FEMA, now heavily relying on DOD, will respond to a disaster such as an EMP attack. All documents are built around an available electronic communications system which will not be available in a post EMP world.

This paper examines EMP (natural and man-made) and provides historical examples of their impact. Further, the paper identifies not only the likely threats presented by State and Non-state actors for an EMP attack, but also the impact an EMP attack will have on the electrical grid and the basic functions of society within the United States. This paper then identifies the flawed doctrinal assumptions associated with the

Federal government's response to an EMP attack: specifically, DHS/FEMA assumes DoD will fill the gaps in logistics, transportation, and communications in a post EMP environment. Finally, the paper identifies what can be done to correct these weaknesses and avoid General MacArthur's fear: "Too late in preparedness."<sup>16</sup>

### Understanding an Electromagnetic Pulse

According to the January 2017 Department of Energy (DOE) Electromagnetic Pulse Resilience Action Plan, an EMP can be caused by two sources. The first source is from the sun in the form of a solar geomagnetic disturbance (GMD), and the second is a man-made nuclear device.<sup>17</sup> The most threatening one of these EMP events is the man-made Nuclear-EMP as it has the potential for the greatest impact on the modern electricity-dependent society. In particular, a man-made nuclear detonation at an altitude of 30 kilometers or higher (also known as high-altitude EMP or HEMP) would have devastating effects on electrical equipment and long-haul communications lines.<sup>18</sup>

A HEMP caused by a nuclear weapon creates three separate waveforms or components referred to as E1 (fast pulse), E2 (intermediate), and E3 (slow pulse). The E1 waveform is the fastest and occurs within a nanosecond of detonation. The E1 pulse is created by gamma ray interaction with the stratosphere, releasing a broad-band pulse of electricity in the 1000s of amperes. This "electromagnetic shock" permanently destroys exposed electronic systems such as computers, sensors, and cell phones.<sup>19</sup> Below in Figure (1) is a map of the estimated E1 pulse impact area after a simulated HEMP detonation over Chicago:

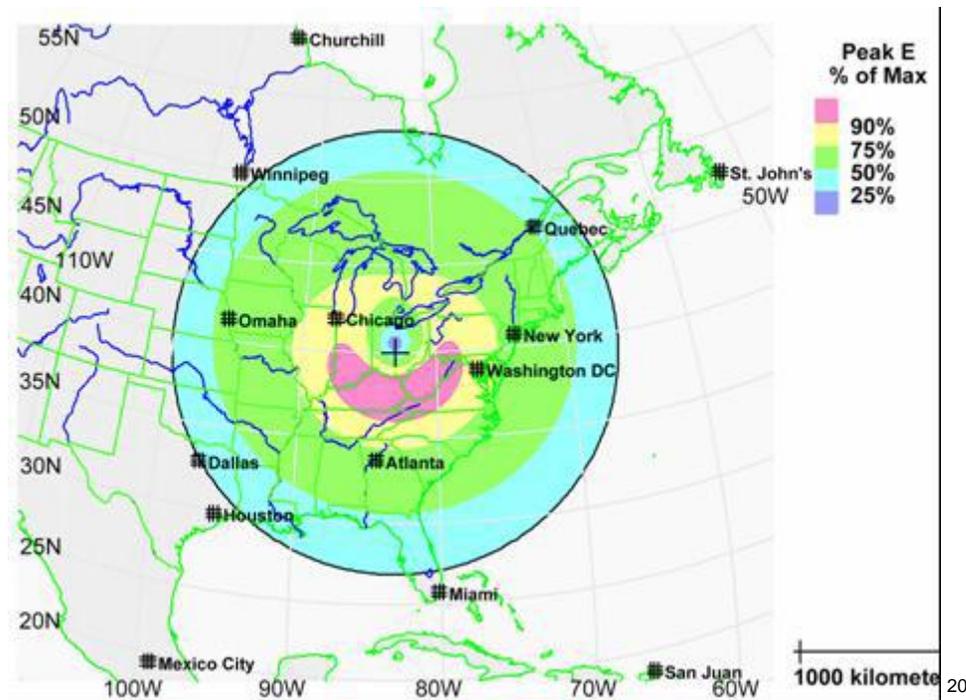


Figure 1. EMP (E1) Affected Area

The second pulse is the E2 which is longer in duration and lower in amplitude, that occurs immediately (millisecond) after the E1. The E2 pulse has the effects on electronics similar to that of devices exposed to a lightning strike. Most modern electronic equipment and systems are protected against such damage in the form of surge protectors. However, the E2 pulse follows immediately after the E1 pulse which will likely damage the components of the surge protection device, thus making it vulnerable to the effects of the follow-on pulse.<sup>21</sup>

The third and final pulse is the E3 which has characteristics similarly to an E2 as it is long in duration and low amplitude. An E3 pulse can be caused by a GMD event as well as HEMP. The E3 pulse persists for hundreds of seconds and induces strong currents along power and communications lines. The power and communication lines act as receivers or antenna by absorbing the electric pulse and damaging transformers

along the entire grid. This is one of the major concerns or weak points for the electric grid, as an E3 pulse would have a “cascading effect”.<sup>22</sup> Specifically, as one transformer fails, the electrical load will transfer to another node and eventually cause failure, and so on. Thus, elements of the electrical grid that survived the initial impact of an HEMP event would eventually be overwhelmed and shutdown in the cascading flow of current.<sup>23</sup>

Thus, one HEMP event could have the overall effect of shutting down the entire electrical grid of the United States. This statement is supported by a series of studies commissioned by the Megatech Corporation, which concluded that a single HEMP would remove the United States as a major state actor on the world stage. Specifically, an HEMP attack would have a cascading effect on all critical electrical functions for between four to ten years.<sup>24</sup>

### Historical Examples

The challenge of understanding the effects of an HEMP denotation on the United States is the lack of testing or evidence. Since the ban on above ground nuclear testing was signed in 1963, no major powers have tested a nuclear weapon above ground or at altitude to properly study the effects.<sup>25</sup> Consequently, researchers on the subject have had to review information from historical events to draw possible conclusions of HEMP.

However, in 1859 the world experienced the strongest EMP or GMD event ever recorded. The sun released a huge solar flare which was the equivalent of 10 billion atomic bombs. Around the world telegraph equipment sparked electricity, sending “streams of fire” from equipment and causing burn injuries to operators before then setting telegraph paper on fire.<sup>26</sup> The resulting EMP wave penetrated deep into the Atlantic Ocean and destroyed the intercontinental telegraph cable.<sup>27</sup> Witnesses

throughout the northern hemisphere reported the sky turning bright red, similar to the aurora lights normally seen near the Arctic. The light was bright enough to be seen as far south as Cuba, and a newspaper later reported brick layers in South Carolina woke up and began working before realizing it was still night.<sup>28</sup>

In 1962 the United States military, as part of a classified project code name Starfish Prime, detonated a nuclear bomb 250 miles above the Pacific. This was in the early years of the nuclear age and scientists were just beginning to understand the effects of these weapons. Subsequently, they were surprised when electrical service on Hawaii, 1000 miles away, was knocked out. Telephone service stopped and street lights burned out.<sup>29</sup> That same year, the Soviet Union began testing nuclear weapons in the atmosphere over an industrialized area of Kazakhstan. In 1994 former Soviet scientists shared the results with U.S. counterparts and indicated the detonations completely collapsed the electrical grid by destroying transformers and all components. The combined HEMP detonations by the United States and Soviet Union in 1962 resulted in permanent damage to a half dozen satellites, making them inoperable.<sup>30</sup>

#### Impact on Electrical Grid

A nuclear detonation or HEMP over the United States would have no physical impact but would devastate the electrical grid. Specifically, the U.S. electrical grid is composed of two critical components which are highly vulnerable to the E1 and GMD produced E3 pulses. The two components are the Extra-High Voltage (EHV) transformers and the smaller Supervisory Control and Data Acquisition Systems (SCADAS).<sup>31</sup>

EHV transformers are approximately the size of a house and have to be custom made in order to meet the requirements of their location on the electrical grid. These

EHV transformers weigh tons and costs millions of dollars. Worldwide only 200 EHV transformers are produced every year. The United States currently does not have domestic capacity to produce an EHV transformer and must order them from overseas builders. Currently, only Germany and South Korea build EHV transformers for export. There are approximately 2000 EHV transformers that make up the U.S. electrical grid. They are particularly vulnerable to the effects of the E3 pulse associated with both a HEMP and natural occurring GMD. In either scenario, if only nine EHV transformers fail on the entire grid, the likely cascading effect of the electric load pushing to the next transformer would eventually cause the remaining transformers to fail or shutdown. This event could cause a nationwide blackout for months or years as the United States would struggle to acquire the replacement transformers.<sup>32</sup>

SCADAS are small computers which monitor and control the flow of electrically through EHV transformers. They are also utilized to monitor and control the flow of water in pipelines or data through financial institutions and communications equipment. SCADAS provided critical control of refrigeration systems in regional food storage locations and make them essential for the United States just-in-time food supply system. SCADAS number in the millions throughout the United States and are essential to life support functions.<sup>33</sup> SCADAS are uniquely vulnerable to the E1 pulse of a HEMP and would not likely survive the initial electrical wave or subsequent E2 wave, amplifying the cascading effect through the electrical grid.<sup>34</sup>

In his statement before the House of Representatives' Joint Hearing of the Subcommittee on National Security and Subcommittee on the Interior (May 2015), Professor Emeritus George Baker provided an example of how this cascading event

would occur. Professor Baker noted, in 2003, there was a massive blackout in the northeast. The blackout covered most of the northeast and parts of Canada. The blackout was caused by a single tree falling onto a high power voltage line. The cascading effect knocked out power for several days, as the electrical power load cascaded down the line shutting down systems over a massive area. Professor Baker stated, "When you extend this concept to a wide area of failures and infrastructure networks, including the Internet, you can see that an EMP is an existential threat that we must take very seriously."<sup>35</sup>

#### Impact on Basic Societal Functions

The United States is a modern electricity-driven and dependent society. From cellphones and personal computers, its citizens and residents are directly connected to a steady and reliable supply of electricity on a daily basis. Further, the life blood of the economy, the free flow of cash, credit, and debit is reliant on a functioning electrical grid. So, what would be the effect of an HEMP on U.S. society if one were to occur?

At any given time, over 500,000 people are traveling aboard approximately 1000 aircraft over the skies of the United States. Depending on the distance of the aircraft from the initial E1 pulse, the effects on the modern computer driven jetliner would be devastating. Basically the aircraft would be flying without navigation from satellites or communications with ground control. Further, on board computers (SCADAS) used to control the flow of fuel to the engines would be destroyed.<sup>36</sup> Those planes which did not initially crash due to loss of fuel would fly blindly, likely leading to midair collisions and/or uncontrolled landings at congested airports or roadways.

The impact of an EMP on modern vehicles is still not completely understood. However, even if most vehicles survived after the initial impact of an EMP event, they

would eventually need refueling. As refueling stations and associated gas lines are control by SCADAS, refueling would become impossible. Within days the ability to drive a vehicle would become non-existent. Further, the first response from a blackout event would be for most businesses and industries to shut down, sending millions streaming onto roads in attempts to return home. The lack of functioning traffic lights or traffic control systems would lead to traffic jams and crashes, quickly overwhelming local law enforcement and Emergency Medical personnel. As has been the case in recent major catastrophes like the terrorist's attacks of 9-11 or Hurricane Katrina, people eventually abandon their vehicles, thus adding to the already congested roadways. Eventually, ground transportation will grind to a halt throughout large cities and local towns.

According to the American Trucking Association, 80 percent of all goods and associated services are supplied by commercial trucking. If trucking stops due to congested roadways, so does the U.S. economy. As demonstrated after the attacks of September 11<sup>th</sup> and Hurricane Katrina when commercial trucking in those areas halted, multiple plants that had to shut down for lack of parts and emergency supplies became unattainable. The overall cost from the shutdown of commercial trucking was estimated by the automobile industry to be at 1.5 million dollars per hour.<sup>37</sup> Most notable in these examples, however, was the lack of emergency supplies and the risk this placed on the health of citizens of the United States.

The American economy, including food, healthcare, waste removal, and banking industries, relies on just-in-time logistical support. Commercial trucking is the method by which this logistic system works. Under current conditions, without a daily delivery of food most grocery stores and convenience stores will run out of supplies within three

days. This does not account for the likely loss of electrical power which will lead to spoilage of all refrigerator required items. In particular, within 72 hours of an EMP event, emergency generators supporting regional food storage facilities will run out of fuel and cause spoilage of the nation's food supply.<sup>38</sup> Further, as noted in previous disasters (Katrina), there will be a rush on food stores, essentially draining the remaining items from store shelves in short order. Most concerning, however, will be the loss of chlorine cylinder deliveries to water treatment plants. Water treatment plants receive a delivery of chlorine cylinders approximately every 14 days. Assuming somehow the water treatment plant still functioned on generators after an EMP, the water supply will no longer be clean after two weeks.<sup>39</sup> The lack of clean drinking water will cause intestinal problems and other illnesses and tax the healthcare system.

Within 24 hours most hospitals and clinics will begin to run out of critical supplies. Syringes, catheters, and cleaning supplies are normally delivered daily. Critical items such as oxygen tanks and radiopharmaceutical supplies will quickly be exhausted. Food supplies at hospitals and nursing homes, based on a 24-hour resupply system, will no longer be available. Further, hospitals and pharmacies maintain only a seven-day supply of critical items such as antibiotics and cancers drugs. These supply timeframes are based on a normal usage rate of critical items and pharmaceuticals.<sup>40</sup> However, as noted before, after an EMP event there will likely be mass injuries throughout the United States that require major use of medical supplies. Consequently, the on-hand supplies will likely be exhausted within a day or two.

The loss of commercial trucking will also lead to a disastrous waste removal problem. As the effects of the EMP event on the electric grid caused secondary food

spoilage, water treatment plant failure, and medical waste associated with a mass injury event, the need for waste removal will be paramount. However, without commercial trucking or free flow of traffic, the ability to remove the waste will be nonexistent. The piles of unremoved medical waste and spoiling food will lead to the spread of disease and other illnesses. Without ability to remove the pooling contaminants, the rural and agricultural areas associated with food processing and animal slaughter will become toxic to anyone in the area. In the cities the mass amounts of garbage and other waste will serve to block proper drainage in the streets and add even more to the unsafe environment.

The banking industry relies on a functioning electrical system and a steady supply of hard cash to operate. Without available transportation or electricity, ATMs and banks will run out of money in two or three days under normal consumption rates. The blackout conditions after an EMP event and a need for food and water supplies will likely cause a run on banks. In the event of a lack of electronic communication to confirm transactions or balances, banks will no longer be able to supply customers with currency<sup>41</sup>. According to the Congressional EMP Commission, the U.S. economy will be reduced to a barter system within days of a major EMP event. The mass injuries, lack of electricity, and disease will quickly overwhelm local and federal agencies, thus causing a collapse of basic societal function. Most concerning was the EMP Commission conclusion that a blackout from an EMP event lasting a year will likely lead to the death of 9 to 10 million Americans from a general collapse of society.<sup>42</sup>

#### The Threat from State and Non-State Actors

In a speech before the National Defense University in 2016, Chairman of the Joint Chiefs of Staff, General Joe Dunford stated, "The baseline threat to the United

States is the four plus one model: Russia, China, Iran, North Korea and violent extremist organizations.”<sup>43</sup> With two of those threats, the EMP Commission noted: “China and Russia have considered limited nuclear attack options that, unlike the Cold War plans, employ EMP as a primary or sole means of attacks.” Even more disturbing was a remark made by a high-ranking member of the Russian Duma to a U.S. Congressional delegation, referencing how an EMP attack would “paralyze the United States.”<sup>44</sup> Further, all four of the state actors identified by General Dunford have military doctrine on how to utilize an EMP attack to defeat a nation by blacking out the country's electric grid and other infrastructures.<sup>45</sup>

Evidence of Russian doctrine for an EMP attack is found in a military textbook written by General Vladimir Slipchenko entitled “No Contact War”. In this text, Slipchenko describes a new type of combined arms strategy in which a nation is attack simultaneously with cyber, physical, and EMP assault on the electrical grid. This new Revolution in Military Affairs (RMA) is associated with the Nazi Germany tactic of Blitzkrieg or Lightning War. Similar to the effects Blitzkrieg had on German advisories in World War II, nations are quickly overwhelmed by the effects on society due to the EMP attack and are quickly defeated. General Slipchenko believes this new RMA, using an EMP to attack the electrical grid of modern nations, makes obsolete the modern militaries of today.<sup>46</sup>

Additionally, in the Chinese People’s Liberation Army (PLA) textbook entitled *World War, the Third World War—Total Information Warfare*, Shen Weiguang describes how China must be prepared to defend against an EMP attack and develop countermeasures. Though the document does not speak specifically of EMP as an

attack option for the PLA against the United States, it clearly indicates EMP as a current threat.<sup>47</sup> As China is a nuclear power and spacefaring nation, the ability to deliver such an EMP countermeasure or attack is understood.

As for the Iranian threat, recent translations of their military documents indicate they have fully embraced the concepts of Russian General Slipchenko in reference to the use of an EMP attack. Iranian military planners understand the heavy reliance the United States and its allies have on the use of satellites and communications to dominate the battlefield. They are also aware of the vulnerability the reliance has on the force, and see it as a weakness to be exploited. As Iranian military theorists Nashriyeh-e Siasi Nezami described in his book *Electronics to Determine Fate of Future Wars*:

Advanced information technology equipment exists which has a very high degree of efficiency in warfare. Among these we can refer to communication and information gathering satellites, pilotless planes, and the digital system. Once you confuse the enemy communication network you can also disrupt the work of the enemy command and decision making center. Even worse, today when you disable a country's military high command through disruption of communications you will, in effect, disrupt all affairs of the country. If the world's industrial countries fail to devise effective ways to defeat themselves against dangerous electronic assaults, then they will disintegrate within a few years. American soldiers would not be able to find food to eat nor would they be able to fire a single shot.<sup>48</sup>

The implied threat to the United States is clear. Most concerning is that the Iranian military has practice the methods required for an EMP attack by utilizing their Shahab 3 medium range ballistic missile.<sup>49</sup>

The most menacing of the threats is coming from the North Korean government. In September of 2017, the North Korean state news agency declared the military had a nuclear weapon specifically designed to carry out an EMP attack.<sup>50</sup> As early as April 9, 2013, it would appear North Korea actually practiced the technology for such an attack:

North Korea launched its KSM-3 satellite which followed a trajectory from the South Pole, designed to evade the U.S. National Missile Defense radar systems. Further, the KSM-3 satellite orbited at the correct altitude and optimum location for an EMP attack over the United States. If there had been a nuclear device on board designed for an EMP attack, it would have successfully knocked out at least 75 percent of the electrical grid.<sup>51</sup> In February of 2016 a second satellite KSM-4 was launched and maintained the same trajectory and altitude (see Figure 2). Both satellites followed the path set in a once secret Soviet Union-era missile attack called Fractional Orbital Bombardment System (FOBS). FOBS was designed to avoid U.S. radar detection by launch via the South Pole by fracturing over the target to evade missile defense systems aimed to shoot down the weapon. In 2004 Russian scientists warned the Congressional EMP Commission that this very technology was accidentally transferred to North Korea.<sup>52</sup>

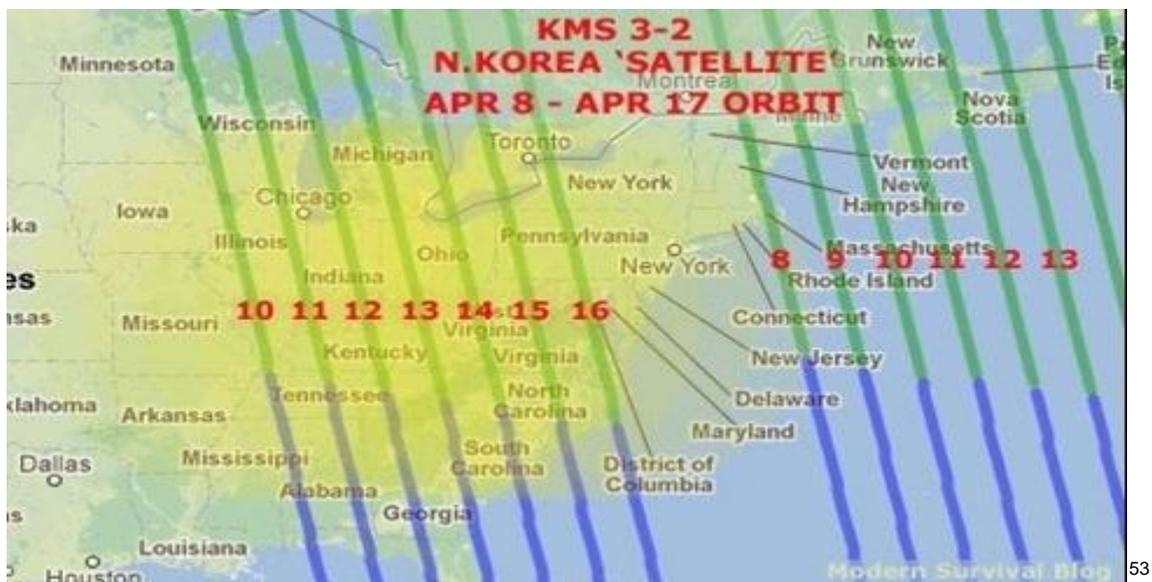


Figure 2. KSM-3 Orbital Track over United States April 2013

The Congressional EMP Commission also warned of a scenario in which a Violent Extremist Organization (VEO), sponsored by a supporting state (Iran, North

Korea), could get their hands on this type of EMP technology. The EMP Commission concluded a VEO could mount a crude EMP weapon on a scud or SA type missile and launch them from a ship off the coast of the United States. This type of attack would be un-defendable from detection and anonymous in nature. The United States would be crippled and unable to determine whom to strike back. This scenario became close to reality in July 2013 when a North Korean ship Chong Chon Gang was discovered to be carrying two nuclear capable SA-2 missiles inside the cargo container. The cargo containers of the ship were covered by tons of bags of sugar in order to hide them from detection. The Chong Chon Gang had been traversing the Gulf of Mexico from Cuba at the time.<sup>54</sup>

#### Government Response

Since early 2000 the United States has been studying the possible threat of an EMP attack in the form of the Congressional EMP Commission. In 2004 and 2008 the EMP Commission produced reports indicating the vulnerabilities of the U.S. electrical grid and the potential adversaries who have the ability and intent to utilize such a weapon. In response, the U.S Federal Energy Regulatory Commission (FERC) published reports acknowledging the threat of an EMP, but claimed no authority to take action on privately owned utilities. Specifically, the North American Electric Reliability Corporation (NERC) and its associated utilities are neither government-controlled entities nor obligated legally to follow FERC guidance.<sup>55</sup>

Subsequently, the U.S. Congress has attempted to pass two bipartisan bills, the GRID Act and SHIELD Act. Both bills are designed to mandate protection of the grid but are highly opposed and lobby against by NERC. NERC claims the bills give too much authority to the FERC over privately owned utilities and the cost of the actions needed

to be taken are too high. NERC president and CEO Gerry Cauley stated in 2011, defending against an EMP attack is the “government’s responsibility, not industry[‘s].” Both bills remain in congressional grid lock.<sup>56</sup>

However, as described earlier in this paper, the U.S. government has prepared multiple documents providing guidance to federal agencies and DoD assets on how to respond to a national disaster. The plans lay out the responsibility of FEMA and DHS to lead the way in recovery, with DoD in support. As noted before, recent disasters have demonstrated FEMA and DHS shortcomings in logistics and manpower with which to address regional emergencies without DoD support. The gap or weak point in these plans is the assumption of some level of electrical power and communications. This assumed level of electricity is paramount to the establishment of coordination centers and chains of authority. However, DoD facilities receive the majority of their power from private industry which is currently ill prepared for an EMP attack. Thus, an EMP attack makes these actions plans completely worthless. Further, without guidance or reliable communications, ad-hoc DoD attempts to respond via active component or Reserve force activation to fill the gap would only serve to congest roadways and use up needed fuel and electricity.

### So What Now?

There are currently approximately 3000 independently owned and operated electric utilities throughout the United States. As noted earlier in this paper, NERC is the lobbying arm of this industry and has opposed mandatory upgrades to protect against an EMP attack. The U.S. Congress is grid-locked on passing legislation to provide FERC authority to override NERC objections. However, the Department of Energy’s Electromagnetic Pulse Resilience Action Plan 2017 has created multiple industry and

government teams to address over nineteen action items to coordinate a solution to the EMP vulnerability. The teams are set to submit reports over the next three years.<sup>57</sup>

Three years to receive reports and possible years of implementations, however, would not only seem to ignore the immediacy of the threat, but also rely heavily on the assumption government and industry will agree on a solution.

The problem calls for Federal government leadership. After 9-11, there were several Presidential Directives which directed the continuation of operations (COOP) of the government after a major disaster. Similarly, there should be a Presidential Directive establishing COOP actions after an EMP attack, specifically authorizing DoD to lead the response. An EMP attack may give rise to conditions that allow the President powers associated with the Insurrection Act. If so, it would no longer be a domestic issue but a federal one. FEMA and DHS would not be in the lead. As shown in this paper and in accordance with recent updates to FEMA and DHS plans, DoD is already the major player in disaster recovery thus making DoD the lead for an EMP would be a small step.

Per a Presidential Directive, DoD could begin stockpiling critical components such as SCADAS, generators, and even EHV transformers throughout the United States by using DoD bases and facilities. Components would need to be protected by Faraday Cages which shield devices from the effects of an EMP. The DoD bases would serve as islands of recovery, shielded from the impact of the EMP and ready to deploy to re-establish some form of electricity. The directive would need to set short term goals for component purchase and stock pills, with follow on nationwide exercises coordinated with local utilities to determine areas of coordination and set expectations.

This would be a short term preventative action rather than a solution to provide the United States an opportunity to avoid complete disaster. The long term solution would be for all 3000 utilities to upgrade defenses against an EMP. Media attention associated with the nationwide exercises could serve to stimulate local citizen interest and subsequent action by local utilities. As an example, after the blackouts connected to Hurricane Sandy, both New York and Massachusetts in response to public outcry have spent 500 million and one billion dollars, respectively, to protect their grids.<sup>58</sup> Citizens questioning why local utilities are not protected from EMP could serve to bypass the gridlock of Washington and spur state-directed action. The bottom-line is that the federal government must act to provide some recovery capability while educating the public about the threat in order to stimulate industry action.

## Endnotes

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