PERSPECTIVE:
Is North Korea's Nuclear Test Moratorium a Harbinger of Growing EMP Threat?

June 17, 2018 Mitchell Simmons

Author's Note: This article is not to advocate North Korea conducting an atmosphere nuclear test, but simply to illustrate the possible unintended consequences of an alternative attack that actually has a much greater likelihood of success and far dire consequences to the United States.

Introduction

In September 2017, North Korea conducted an underground nuclear detonation of a hydrogen-bomb[1] reported to be in the 100-150 kiloton range, which is over 10 times larger than the pure fission-bomb dropped on Hiroshima, Japan, in 1945.[2] [3] North Korea also successfully tested a much larger intercontinental ballistic missile (ICBM) in November 2017, known as the Hwasong-15, which is believed to be capable of delivering a nuclear weapon anywhere in the continental United States (U.S.).[4] Despite threats from North Korea's foreign minister at the 72nd United Nations General Assembly in September 2017, what has not occurred is the integration of these two systems in an operational live-fire test resulting in a successful launch, re-entry, and detonation over the Pacific Ocean.[5] Such a test would be essential to ensure its operational worthiness by proving a successful lower-flight trajectory, precision missile navigation, atmospheric re-entry, lower-altitude warhead initiation, and the detonation at the desired nuclear yield.

It goes without saying that an atmospheric test would receive the world's condemnation and may even result in U.S. military action, which are things the North Korean regime wants to avoid.[6] Although no other singular test can fully ensure the technical maturity of its integrated nuclear ICBM system, North Korea's leader Kim Jong-un suspended future nuclear testing and ordered the "dismantling" of the regime's nuclear test facilities at Punggye-ri complex.[7] [8] At face value the world is much safer because of this test moratorium and reported dismantlement of its nuclear test facilities, but in reality these actions may foreshadow a grimmer nuclear threat to the U.S.

The lack of a full-scale operational nuclear test lowers the probability of success of a North Korean ICBM targeted against a U.S. city. As such, Kim Jong-un might opt to exploit the weapon effects of a space-based nuclear detonation above the continental U.S. to mitigate the need for precise missile navigation and warhead re-entry. Such an attack could potentially achieve more cataclysmic damage to the U.S., which is caused by an electromagnetic pulse (EMP), than the blast, thermal, and radiation effects of destroying a U.S. city.[9] A space-based nuclear detonation, even with a small nuclear yield, will cause an EMP that travels outward along line-of-sight over most of the U.S. depending on the altitude. Unless intentionally shielded against EMP effects, this pulse could overwhelm the majority of common integrated circuitry within electronics today. Such electronics are pervasive across every aspect of everyday life, to include those that operate America's critical infrastructure, the lifeblood of the nation.

Such an EMP could thrust most of the U.S. into the 17th century in an instant, from which recovery could take months to years. The highly integrated nature of the country's critical infrastructure makes the degradation or destruction of one infrastructure sector have a cascading effect on most, if not all, other sectors. Degraded or destroyed functionality of power systems, water treatment facilities, waste removal systems, transportation systems, financial systems, public healthcare systems, oil refinement systems and other sectors would be devastating to a modern society like the U.S., which has a population that has grown less self-sufficient in the past 100 years to face such a calamity. The author contends that over the course of a year following a broad EMP attack, many more Americans would die from famine, disease, exposure, and societal collapse than what could have been achieved by destroying a single or possibly multiple U.S. cities. The grim reality is that the U.S. can absorb and recover over time from the loss of a major city, however, it is unlikely to recover from the potential devastating effects of a broad EMP attack from a nuclear detonation in space over the middle of the country.

North Korea is aware of this vulnerability and an EMP attack would serve as an asymmetric means to break a more formidable foe like the U.S.[10]

Background

The significance of the EMP phenomena came to light in 1962 when the U.S. launched a missile to an altitude of approximately 240 miles over the Pacific Ocean and detonated a 1.4 megaton nuclear warhead to investigate the effects of nuclear explosions in space.[11] The effects of this test were seen in Hawaii over 800 miles away in the form of burned out street lights, malfunctioning electrical systems, and other odd electrical behavior.[12] Not to be outdone, and to understand for itself the EMP effects, the Soviet Union in 1962 detonated a nuclear weapon of unknown yield over Kazakhstan at an altitude of 180 miles.[13] The effects of this test were more significant in that it was over a populated land mass. The documented impacts to infrastructure included burned-out power generation stations, overheated transmission lines, fused underground power cables, burned-out above-ground cable insulators, tripped safety devices, failure of long-distance telephone components and the degradation or destruction of numerous electronics.[14] Over the past 55-plus years, electronics evolved from the analog devices using vacuum tubes to digital devices using complex integrated circuitry. Of all the vast benefits that integrated circuitry has had on the world, the one major downfall is that they are orders of magnitudes more vulnerable to EMP effects.[15] Similar tests conducted today over U.S. population centers would be crippling due to the significant degradation and destruction of its highly interdependent critical infrastructure.

EMP effects are dependent on detonation altitude (above 20 miles[16]) and nuclear yield, but even low-yield nuclear weapons can cause significant degradation and destruction to critical infrastructure over vast regions of the U.S. EMP is caused by gamma rays generated from a nuclear detonation, which stream out impacting sparse air molecules knocking lose **free electrons that are then captured by the Earth's magnetic field lines**.[17] This process results in the most damaging of three distinct types of pulses: **the E1 pulse**. The E1 pulse is composed of current and voltage spikes magnitudes of levels higher, and over a much shorter duration, than a lightning strike. As such, common household surge protectors will not protect energized or non-energized electronics with integrated circuitry. An E1 pulse arcs across integrated circuity, shortening it out and degrading or destroying its functionality; **E2 pulses are similar to lightning strikes** and can cause similar damage. Lastly, E3 pulses are similar to the ground-induced currents caused by solar events from the sun but are still strong enough to overwhelm common lighting arrestors.[18] [19] All of these pulses, **especially E1,** can degrade or destroy electronics with integrated circuitry, which form the very backbone of America's modern society, specifically the country's highly interdependent critical infrastructure.

Due to the high interdependence of the 16 critical infrastructure sectors in the U.S., most of these sectors would cease to operate due to the severe degradation and destruction of the electrical grid. Particularly vulnerable are the customized high-voltage transformers that take years to build and replace. It would be a daunting challenge to rebuild the U.S. power grid from a broad EMP attack. The **following is a fictional account** of the immediate effects after an EMP attack due to a nuclear detonation in space over the middle of the U.S.

This Winter

The crewman of the mobile missile launcher sat within the protected confines of the hardened crew cabin. He sat stoically but very proud of his country's ability to field such an impressive system. Over three hours had been dedicated to this exercise in the bitterness of winter. He sat and thought of America's recent acts of aggression as discussed on numerous smoke breaks during the preceding days. He was hoping the exercise would end soon so he could return to the warmth of his barracks and go to sleep. The crewman

listened to the instructions that came through the headset and noted they were following pre-scripted launch protocols. The crew commander snapped opened the authentication code holders to reveal inner cards. Two long digit codes were punched into the commander's terminal. Green indicator lights flashed and a system behind him on the launcher made a sound he had not heard before, and a sense of something new and different rushed over him. He was experiencing part of the exercise that had gone several steps further than he had ever experienced before. His commander verified a verbal code and then yelled to those in the cabin ***to brace for launch*.** Within seconds, a great force pushed down on the vehicle as it sunk back on its rear axles.

The roar of the missile washed over them and he felt a thumping as if a great beast was beating the crew cabin. Heat, light, sound, and confusion overtook him but he felt a sense of peace as the missile cleared its launcher and was flying away. A sense of pride burst in his chest as he sat upright. He felt so proud to be one of the few missile crews to actually be part of an operational test. The vehicle commander looked at his watch and said the missile would be over America at 10 minutes past the hour. The sense of pride was replaced by a knot in his stomach as he realized that this was not a test. The missile gained speed and arced over as it gained altitude. Everyone gathered around the empty launcher, looking skyward as it slowly became a dim and dying light. Cigarettes were lit, a bottle appeared, and broad smiles broke across faces. Men began to sing loudly as the bottle was passed around. Forgotten was the cold bitterness of the night as they continued to sing song after song about their great leader. The commander, who had been standing on the edge of the clearing, approached the men with his hand held high. Somewhere a great distance from where they stood the missile was nearing the end of its flight approximately 180 miles above Kansas. The men stopped singing and turned their attention to the commander as he held his hand in the air while staring down at a stop watch. The commander dropped his hand while screaming "It is done."

The Moment

The hydrogen bomb erupted to life. A brief but bright flash occurred behind the canvas of a blue afternoon sky in most parts of the U.S. Many questioned what they had just experienced. There was no warning, no siren, no rumble, no movement of air, no heat, no sound, and nothing that people could point to as a nuclear detonation. Those in the U.S., at that instant, forever shared a common experience that would later be coined as "The Moment." Over time, they all would realize the ramification of that shared moment and the life-changing effects it would have for each of them in the coming weeks and months.

Financial Sector: At that moment in Boston, a 28-year-old stocbroker had just reviewed key numbers on financial exchanges and was submitting a $200,000 purchase order on behalf of a client over the phone. The fluorescent lights went abruptly out with several exploding above the large trading floor with a loud pop that caused several women to scream, computer screens went black, and the sound of the slightly unbalanced air handler shuddered to a stop. The phone fell silent. Expletives filled the room from traders who were in the middle of processing a bid that soon would have no significance. Emergency lighting failed to come on. As people grumbled and stood, a faint pounding and yelling emerged from the elevator banks beyond the receptionist's desk. People were trapped. The smell and haze of smoke and burning plastic soon followed.

Transportation Sector: At that moment in Tampa, a 44-year-old airline pilot had just applied the engine brakes as her wide-body commercial aircraft screamed down the runway after touchdown. Applying a slight nose wheel correction to keep the aircraft centered on the runway produced no results as the aircraft moved further to the left edge of the runway. She and the co-pilot desperately tried to bring the aircraft in alignment with the engine controls when the landing gear caught the soft shoulder and spun the aircraft and dropped the starboard wing tip to the ground. Onboard lights flickered and alarms shrilled briefly before going silent as capacitors discharged. The cockpit fell dark as the aircraft came to a spinning stop. They were lucky the aircraft did not break in two. Screams turned into applause when the plane stopped but then turned into panic as smoke began to waft in the plane. The pilots scurried from their seats as the evacuation slides were deployed. The crew and passengers all escaped but not a single emergency vehicle was in sight as the plane was soon engulfed in flames. Over 3,500 commercial aircraft with digital fly-by-wire technology were airborne at that moment over the U.S. They were not so lucky. Within seconds to

minutes, the noses of a majority of these aircraft would be dipping over and impacting the Earth far from any runway.

Nuclear Sector: At that moment in the Susquehanna Steam Electric Station in Berwick, Pa., a 52-year-old watch officer was returning from a coffee break near Reactor 2's control room. The sound of alarms and switches suddenly filled the control room before it went pitch black, flickered on twice, and then went completely out. Operators spoke with stern, confident voices honed from years of contingency training for such events. Flashlights came to life as switches were thrown to energize backup systems. Nothing was responding. It became quickly apparent that the main cooling pumps to the reactor were not flowing and emergency backup systems were not responding. Control rods were also frozen and the temperature of the reactor had begun its unabated steady climb upward. Similar scenarios were repeated at nuclear power plants across the U.S.

Public Health Sector: At that moment in Oklahoma City, a 68-year-old grandmother was being rolled out of the surgical recovery ward to her room for further observation following the placement of a pacemaker under the skin of her chest. Suffering from a life-threatening irregular heartbeat, she felt reassured of a brighter and more active future. Her husband followed the hospital bed as it rolled down the hall past the nurse's station, which was buzzing with people entering prescription data, printing out diagnostic charts, and remotely monitoring vitals of patients across the ward. The lights flickered, uninterruptable power systems kicked on then off, and dozens of alarms from monitoring systems across the ward made a dying plea for attention, never to be heard from again. Seconds passed by when family members of patients on ventilators and oxygen realized that the life-sustaining equipment had stopped and screams burst from their throats. Nurses and doctors ran in every direction. The grandmother of two clutched her chest as the pacemaker arced and failed, causing immediate ventricular fibrillation leading to death. This scenario was repeated in living rooms, hospitals, nursing homes, and hospices across the U.S.

Government: At that moment in Washington, D.C., two Secret Service agents rushed into the small conference room and pried the vice president away from the table and almost literally carried her downstairs. Rushing past the White House Situation Room, she noticed many of the screens in the room were dark as they headed to the bunker. Emergency lighting flickered and the vice president thought to herself, "Now what?" The president, who was in the EMP-hardened Air Force One, was over the Atlantic Ocean approaching Nova Scotia following a European summit. Made aware of the EMP attack, the communications experts on the aircraft began to scan frequencies and were eerily stunned by the lack of air control chatter.

Industry: At that moment in Tucson, the six-degree milling machine just began its final cutting pass of the military aircraft component when the operator heard a loud, distant explosion outside the building. The building lights went dark as a cacophony of machine sound became silent. The milling machine whirled to a stop in mid-pass and the operator knew the component was merely scrap now. Down the processing line, the lack of power forced the chemical etcher to use a mechanical hoist system to raise the part out of the bath, but the required freshwater rinse lacked pressure and another piece of metal scrap would be added to the pile. In fact, across the facility, if not the region, water pressure had dropped significantly or had stopped completely.

Power sector: At that moment in Los Angles, a 17-year-old high school student sat on the top of a picnic table at a skateboard park built overlooking the valley. He was reading a text from a girl he was getting to know in his government class. Next to him were three more teens all gazing deeply into their smartphones. Their screens went suddenly black and they each tried to troubleshoot their phones. A canned transformer on a utility pole suddenly exploded into a shower of sparks and its loud humming stopped, a background sound they had not really paid attention to before. The world suddenly seemed much quieter. One of the teen boys pointed to the valley at a distant petroleum storage facility as a fireball plumed upward. Closer to them they noticed about a hundred cars and trucks on that highway had stopped in various directions of final repose.

The Aftermath

The bottom line is **that if such an EMP** event were to occur, resulting is a significant loss of the electrical grid, the U.S. would see "catastrophic civilian casualties"[20] within the first weeks and months due to massive food shortages, waterborne disease, exposure, and widespread societal collapse caused by those seeking dwindling resources to sustain life or gain power. The U.S. government would simply be unable to respond effectively or quickly enough with humanitarian support or protection due to the breadth and depth of the crisis.

Ambassador Henry Cooper, known mostly as the former director of Strategic Defense Initiative program in the 1980s and as a prolific writer on the EMP threat, was recorded in congressional testimony as having stated that up to 90 percent of Americans could die off within the first year.[21] Many have argued about the legitimacy of this number but one only has to stop and think about the monumental shift the U.S. has made in the past 100-plus years from a mostly agrarian society to a mostly consumer society. Few people know how to sustain themselves if food and clean water become scarce in an environment of growing social unrest. Even if the percentages were reversed and 10 percent, 8 percent or 5 percent of Americans died off, it would still be an unprecedented event in U.S. history.

[1] A hydrogen-bomb is a two stage device that uses a fission device to initiation a nuclear fusion device resulting in a significantly larger nuclear yield.

[2] Lee, Michelle Ye Hee, North Korea's latest nuclear test was so powerful it reshaped the mountain above it," *Washington Post*, September 14, 2017, accessed on June 6, 2018, **https://www.washingtonpost.com/news/worldviews/wp/2017/09/14/orth-koreas-latest-nuclear-test-was-so-powerful-it-reshaped-the-mountain-above-it/?noredirect=on&utm_term=.ab582e7b56c2**

[3] Cohen, Z., Browne, R., Gaouette, N., Lee, T, "New missile test shows North Korea capable of hitting all of US mainland," *CNN*, November 30, 2017, accessed on May 31, 2018, **https://www.cnn.com/2017/11/28/politics/north-korea-missile-launch/index.html.**

[4] **"**North Korea nuclear tests: What did they achieve?" *BBC*, accessed on 31 May 2018, **http://www.bbc.com/news/world-asia-17823706.**

[5] Joshua Berlinger and Zahra Ullah, "North Korea could test hydrogen bomb over Pacific Ocean, says foreign minister" *CNN*, September 22, 2017, accessed on June 6, 2018, **https://www.cnn.com/2017/09/21/politics/kim-jong-un-on-trump-comments/index.html**

[6] **Shin, H.,** Sieg, L, "A North Korea nuclear test over the Pacific? Logical, terrifying" *Reuters*, September 22, 2017, accessed on 6 Jun 2018**, https://www.reuters.com/article/us-northkorea-missiles-atmospheric-test/a-north-korea-nuclear-test-over-the-pacific-logical-terrifying-idUSKCN1BX0W5**

[7] Bicker, Laura, "Kim Jong-un's warning shot to the US over nuclear talks," *BBC*, accessed on May 31, 2018**, http://www.bbc.com/news/world-asia-44142046.**

[8] Sang-Hun, Choe, "We No Longer Need' Nuclear or Missile Tests, North Korean Leader Says," *The New York Times*, 20 April, 2018, accessed on May 31, 2018, ***https://www.nytimes.com/2018/04/20/world/asia/kim-jong-un-hotline-korea.html*.**

[9] Electromagnetic Pulse (EMP): Threat to Critical Infrastructure. Hearing before the Subcommittee on Cybersecurity, Infrastructure Protection, and Security Technologies of the Committee on Homeland Security, House of Representatives 113th Congress, Serial No. 113-68, May 8, 2014, pg. 1, accessed on June 7, 2018, **https://www.gpo.gov/fdsys/search/searchresults.action?sr=179&originalSearch=&st=What+Does+The+Term+%27Blended+Threat%27&ps=10&na=&se=&sb=re&timeFrame=&date**

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[10] Ibid, pg. 8.
[11] Plait, Phil**, "The 50th anniversary of Starfish Prime: the nuke that shook the world," *Discover*, July 9, 2012. As accessed on 15 May 2018, http://blogs.discovermagazine.com/badastronomy/2012/07/09/the-50th-anniversary-of-starfish-prime-the-nuke-that-shook-the-world/#.Wvw470xFyUk.**
[12] Ibid.
[13] "Report: USSR Nuclear EMP Upper Atmosphere Kazakhstan Test 184", Electric Infrastructure Security (EIS) Council, accessed on 16 May 2018, file:///C:/Users/Mitch/Desktop/EMP%20Archive%20Folder/EIS%20USSR%201962%20EMP%20Test%20Analysis.pdf.
[14] Ibid.
[15] Electromagnetic Pulse (EMP): Threat to Critical Infrastructure. Hearing before the Subcommittee on Cybersecurity, Infrastructure Protection, and Security Technologies of the Committee on Homeland Security, House of Representatives 113th Congress, Serial No. 113-68, May 8, 2014, pg. 16, accessed on June 7, 2018, **https://www.gpo.gov/fdsys/search/searchresults.action?sr=179&originalSearch=&st=What+Does+The+Term+%27Blended+Threat%27&ps=10&na=&se=&sb=re&timeFrame=&dateBrowse=&govAuthBrowse=&collection=&historical=false&granuleId=CHRG-108shrg97272&packageId=CHRG-108shrg97272&fromState=&bread=true**
[16] Ibid, pg. 3.
[17] Mosher, David, "Nuclear bombs trigger a strange effect that can fry your electronics — here's how it works," *Business Insider,* June 7, 2017, accessed on Jun 5, 2018, **http://www.businessinsider.com/nukes-electromagnetic-pulse-electronics-2017-5**
[18] Ibid.
[19] Electromagnetic Pulse (EMP): Threat to Critical Infrastructure. Hearing before the Subcommittee on Cybersecurity, Infrastructure Protection, and Security Technologies of the Committee on Homeland Security, House of Representatives 113th Congress, Serial No. 113-68, May 8, 2014, pg. 15, accessed on June 7, 2018, **https://www.gpo.gov/fdsys/search/searchresults.action?sr=179&originalSearch=&st=What+Does+The+Term+%27Blended+Threat%27&ps=10&na=&se=&sb=re&timeFrame=&dateBrowse=&govAuthBrowse=&collection=&historical=false&granuleId=CHRG-108shrg97272&packageId=CHRG-108shrg97272&fromState=&bread=true**
[20] Electromagnetic Pulse (EMP): Threat to Critical Infrastructure. Hearing before the Subcommittee on Cybersecurity, Infrastructure Protection, and Security Technologies of the Committee on Homeland Security, House of Representatives 113th Congress, Serial No. 113-68, May 8, 2014, pg. 7-8, accessed on June 7, 2018, **https://www.gpo.gov/fdsys/search/searchresults.action?sr=179&originalSearch=&st=What+Does+The+Term+%27Blended+Threat%27&ps=10&na=&se=&sb=re&timeFrame=&dateBrowse=&govAuthBrowse=&collection=&historical=false&granuleId=CHRG-108shrg97272&packageId=CHRG-108shrg97272&fromState=&bread=true**
[21] North Korea Nuclear EMP Attack: An Existential Threat. Statement for the Record Dr. William R. Graham, Chairman Dr. Peter Vincent Pry, Chief of Staff Commission to Assess the Threat to the United States from electromagnetic Pulse (EMP) Attack to U.S. House of Representatives Committee on Homeland Security Subcommittee on Oversight and management

Efficiency Hearing "Empty Threat of Serious Danger: Assessing North Korea's Risk to the Homeland." Washington D.C., October 12, 2017.

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A chart from WikiPedia on the W76 & W76-2 is below

V · T · E	United States nuclear devices	
Fission	World War II bombs	Little Boy · Thin Man · Fat Man
	Post-war bombs	Mark 3 · Mark 4 · Mark 5 · Mark 6 · Mark 7 · Mark 10 · Mark 12 · Mark 13 · Mark 18 · Mark 20
	Depth bombs	Mark 90
	Bunker Busters	Mark 8 · Mark 11
	Post-war warheads	W4 · W5 · W7 · W8 · W12 · W13 · W25 · W42 · W44 · W45
	Artillery shells	W9 · W19 · W23 · W33 · W48 · W74 · W79 mod 1 · W82 mod 1
	Primaries	Robin
	Atomic demolition munitions (mines)	T-4 · MADM
Boosted fission	Primaries	RACER IV · Swan · Python · Tsetse · Kinglet
	Depth bombs	Mk 101
	Warheads	W30 · W31 · W34 · W37 · W40 · W51 · W54 · W72 · **W76** Mod 2
	Artillery shells	W54
	Atomic demolition munitions (mines)	SADM · TADM
Thermonuclear	Bombs	Mark 14 · Mark 15 · TX-16 · Mark 17 · Mark 21 · TX-22 · Mark 24 · Mark 26 · Mark 27 · B28 · M B53 · B57 · B61 · B77 · B83 · B90
	Depth bombs	B57 · B61 · B90
	Bunker Busters	B53 · B61
	Warheads	W15 · W27 · W28 · TX-29 · XW-35 · W38 · W39 · W41 · W46 · W47 · W49 · W50 · W52 · W53 W63 · W67 · W68 · W69 · W70 · W71 · W73 · **W76** · W78 · W80 · W81 · W84 · W85 · W86 · W
	Enhanced radiation warheads	W64 · W65 · W66 · W70 Mod 3
	Enhanced radiation artillery shells	W79 Mod 0 · W82 Mod 0