International Journal of Business, Human and Social Sciences
ISSN: 2517-9411
Vol:13, No:6, 2019

The U.S. Missile Defense Shield and Global Security Destabilization: An Inconclusive Link

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***Abstract*—**Missile proliferation and global stability are intrinsically linked. Missile threats continually appear at the forefront of global security issues. North Korea's recently demonstrated nuclear and intercontinental ballistic missile (ICBM) capabilities, for the first time since the Cold War, renewed public interest in strategic missile defense capabilities. To protect from limited ICBM attacks from so-called rogue actors, the United States developed the Ground-based Midcourse Defense (GMD) system. This study examines if the GMD missile defense shield has contributed to a safer world or triggered a new arms race. Based upon increased missile-related developments and the lack of adherence to international missile treaties, it is generally perceived that the GMD system is a destabilizing factor for global security. By examining the current state of arms control treaties as well as existing missile arsenals and ongoing efforts in technologies to overcome U.S. missile defenses, this study seeks to analyze the contribution of GMD to global stability. A thorough investigation cannot ignore that, through the establishment of this limited capability, the U.S. violated longstanding, successful weapons treaties and caused concern among states that possess ICBMs. GMD capability contributes to the perception that ICBM arsenals could become ineffective, creating an imbalance in favor of the United States, leading to increased global instability and tension. While blame for the deterioration of global stability and non-adherence to arms control treaties is often placed on U.S. missile defense, the facts do not necessarily support this view. The notion of a renewed arms race due to GMD is supported neither by current missile arsenals nor by the inevitable development of new and enhanced missile technology, to include multiple independently targeted reentry vehicles (MIRVs), maneuverable reentry vehicles (MaRVs), and hypersonic glide vehicles (HGVs). The methodology in this study encapsulates a period of time, pre- and post-GMD introduction, while analyzing international treaty adherence, missile counts and types, and research in new missile technologies. The decline in international treaty adherence, coupled with a measurable increase in the number and types of missiles or research in new missile technologies during the period after the introduction of GMD, could be perceived as a clear indicator of GMD contributing to global instability. However, research into improved technology (MIRV, MaRV and HGV) prior to GMD, as well as a decline of various global missile inventories and testing of systems during this same period, would seem to invalidate this theory. U.S. adversaries have exploited the perception of the U.S. missile defense shield as a destabilizing factor as a pretext to strengthen and modernize their militaries and justify their policies. As a result, it can be concluded that global stability has not significantly decreased due to GMD; but rather, the natural progression of technological and missile development would inherently include innovative and dynamic approaches to target engagement, deterrence, and national defense.

***Keywords*—**Arms control, arms race, global security, GMD, ICBM, missile defense, proliferation.

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I. Introduction

PUBLIC opinion, for the first time since the end of the Cold War, took a major interest in U.S. missile defense capabilities due to North Korea's nuclear capability and the possibility of reaching the American mainland with ICBMs as proven by its latest missile tests. In March 2018, Russian President Vladimir Putin announced an array of Russian "super weapons" designed to overcome U.S. missile defenses [1]. Many experts predict that with the U.S. withdrawal from the Joint Comprehensive Plan of Action (JCPOA), Iran may increase and expand its missile program [2]. Missile capabilities, proliferation, and threats are emerging to the forefront of global security and appear to have replaced international terrorism as the "most urgent" threat to U.S. national security [3].

A. Origins of Missile Defense

Though the potential for missile attacks has renewed public and governmental interest, defense against such weapons is as old as ballistic missiles themselves. During World War II, the U.S. Army recognized the need for a defense system against the world's first ballistic missile, the German V2 [4]. Conventional weapons at that time were not capable of combating this threat, aside from ground targeting of related facilities. The first operational V2, with a range of approximately 320 kilometers, was fired against Great Britain in September of 1944 [4]. Although it was inaccurate and carried a limited payload, it was able to terrorize civilian populations across Europe. The U.S government concluded that high velocity guided counter-missiles should be developed at the earliest practicable date [4].

The advent of nuclear weapons and the potential of atomic projectiles on long-range missiles further accelerated research of possible defensive measures in the U.S. as well as the Soviet Union [5]. Both the U.S. and the USSR started missile research programs based on German wartime designs with the help of German scientists, captured at the end of the war. Due to successful U.S. nuclear tests and the immediate employment of atomic weapons, the Soviet leadership had been shaken [5]. A U.S. nuclear monopoly underscored the fundamental strategic reality for the Soviet Union: America

could obliterate Soviet cities, but the Soviet Union had no capacity to attack the American homeland [5]. To counter this threat, the Soviet Union tested its first atomic device in August 1949 [5]. With the Soviet atomic bomb, concern spread that U.S. nuclear superiority was being fundamentally challenged by Moscow, which was moving quickly to develop the next generation of nuclear weapons, known as thermonuclear, or hydrogen, bombs.

Soviet missile development was initially focused on the ability to attack European targets. According to Soviet logic, the USSR required a deterrent to neutralize U.S. strategic air and missile bases in Europe and a means to hold European countries hostage against U.S. threats of action against the Soviet Union. Missile technology offered the solution to perceived U.S. threats and American technological air superiority. The USSR emphasized the development of rockets and missiles as a new means for wielding nuclear power, as opposed to strategic attack aircraft [6]. By 1957, the Soviet Union had acquired the world's first ICBM, which also placed the first artificial satellite, Sputnik, in space. For the United States, this presented a substantial threat and challenge, amplifying fears about American weaknesses against a Soviet ICBM attack. This shaped the setting of political support for the creation of an American anti-ballistic missile (ABM) system [6], [7]. However, U.S. strategic thinking still gave primary emphasis to the employment of offensive forces to defend U.S. interests as part of a desired strong security posture. According to U.S. strategy, it was desirable to destroy an attacker as far from the U.S. homeland as possible [6]. With overwhelming air superiority and capable intercontinental bombers, the U.S. Air Force initially did not take the problem of ICBM development too seriously. As a result, the first American ICBM was declared operational a full two years after the first Soviet ICBM. According to the U.S. Air Force's viewpoint, missile defense was secondary in the strategic planning of the United States. Combined U.S. strategy, however, did not fully discourage the establishment of an integrated air and missile defense system [6]. A National Security Council position paper on continental defense, NSC 5802, called for an anti-ICBM weapons system as a matter of the highest national priority [4]. It was eventually the 1962 Cuban Missile Crisis and the immediate threat of Soviet missiles that ultimately prompted the U.S. Department of Defense to match the Soviets by launching a major ballistic missile development program that would become characteristic of the Cold War [4]. After heated debates between high-level U.S. and Soviet officials, Moscow finally withdrew its missiles from Cuba. In exchange, Washington publicly promised that the United States would not attempt to invade Cuba and secretly agreed to withdraw its Jupiter missiles near the Soviet border in Turkey [8]. The outcome of the Cuban Missile Crisis also inadvertently provided an impetus to the Soviets to aggressively improve their long-range ICBM program, following their forced withdrawal of medium and intermediate-range ballistic missiles from Cuba [4].

The 1960s saw Soviet and U.S. developments of various ABM systems with the intent to defend against incoming ICBM attacks. The missile defense concepts that the Soviet Union as well as the U.S. developed during this time were based on nuclear-armed missiles that were supposed to detonate in the atmosphere, destroying incoming enemy warheads. These defense concepts were highly inaccurate, counterintuitive, and unsecure, since the detonation of the defense system's nuclear warhead would blind its own radars. In addition, the costs of research, development, fielding, and maintenance were enormous. Although the U.S. and the Soviet Union were transfixed on developing national ABM systems, both countries understood the shortcomings.

In May 1972, the United States began arms control talks with the Soviets that produced the ABM Treaty. The treaty barred Washington and Moscow from deploying nationwide defenses against strategic ballistic missiles. The two sides asserted that effective limits on anti-missile systems would be a "substantial factor in curbing the race in strategic offensive arms" [9]. The treaty allowed both countries to deploy two fixed, ground-based defense sites of 100 missile interceptors each. One site could protect the national capital, while the second site could be used to protect an ICBM field of choice. However, in 1974, the two sides agreed to cut the number of permitted defenses in half. The Soviet Union chose to keep its existing missile defense system around Moscow, whereas the U.S. initially fielded its 100 permitted missile interceptors to protect an ICBM base near Grand Forks, North Dakota [9]. Moscow's defense still exists to this day, but its effectiveness is more than uncertain, since it still relies on the concept of nuclear warheads to destroy incoming missiles. In fact, Russian recently tested a modernized version of its Moscow missile defense interceptor, in April 2018 [10]. The United States shut down its originally permitted ABM defense that was based on the same concept as the Soviet one, only months after activating it, in October 1975. Financial costs of operating it were considered too high for the questionable protection it potentially offered [9].

The ABM Treaty was part of an effort to control the nuclear weapons arms race between the Cold War superpowers, reasoning that "limiting defensive systems would reduce the need to build more or new offensive weapons to overcome any defense system that the other might deploy" [9]. The superpowers would thus be defenseless to the other's offensive nuclear weapons, deterring them from launching an attack first because they faced a potential retaliatory strike that would then assure their own destruction [9].

B. SDI and GMD

In 1983, U.S. President Ronald Reagan declared a 20-year, $420 billion effort to develop defenses against a full-fledged Soviet attack by intercepting ICBMs in space. The interception would be carried out by technology not yet developed, including space- and ground-based laser stations and air- and ground-based missiles [11]. The goal of Strategic Defense Initiative (SDI), also known as "Star Wars," was to create a missile defense shield to "render nuclear weapons impotent and obsolete" [12]. It could be argued that the

announcement of the SDI program was in part responsible for the end of the Cold War [13]. However, the direct eventual consequence of the SDI proposal, the GMD system, appears to have worsened relations with Russia [14].

It has been asserted that U.S. attempts for a robust missile defense may make the world less safe by deteriorating international relations and stimulating other nations to increase their missile capabilities. To the contrary, U.S. missile defense advocates argue that the capability to render a ballistic missile attack on the United States as impossible or unlikely contributes to more security and eventually makes ICBMs obsolete and is thus supportive of overall global stability. To what extent does the so-called U.S. missile defense shield, specifically GMD, contribute to global security? A thorough investigation cannot ignore that through the establishment of this capability, the U.S. violated longstanding, successful weapons treaties and shaped the impression and concern among states possessing ICBMs that their weapons arsenals could become useless against the U.S. This created a perceived imbalance in favor of the United States, contributing to more global instability and tension. Currently, the U.S. GMD system is the only operational integrated missile defense system in the world designed to intercept ICBMs. With the introduction of GMD, under U.S. President George W. Bush in 2001, the U.S. technically violated existing agreements and withdrew from the historic ABM Treaty with Russia, which had been widely recognized as a milestone for international security [15].

The purpose of this study is to examine two opposing views: whether the U.S. missile defense system, born out of Reagan's aversion to the principle of mutually assured destruction and the intent to make nuclear weapons obsolete, contributed to a safer world, or has the U.S. missile defense shield directly amplified the research and production of weapons to overcome U.S. defense capabilities to balance the perceived imparity between offensive weapon systems and defenses.

II. Literature Review

Although there are a vast amount of studies and literature on missile defenses and proliferation and their influence on international relations and geopolitics, the actual study of the current operational American GMD system and its direct impact on global security, has been vastly overlooked in academic study. Most works that deal with the GMD missile defense system purely examine it from the technical standpoint of functionality, operability, and the economic cost-benefit ratio, either questioning its capabilities or confirming its ability of being a genuine defense against ballistic missile attacks. The question of GMD functionality and its economic pay off, originally rooted in space science, rocketry, and physics, has become political in its nature. Since GMD has never been proven in a real-world situation, its claim to perform as promised is based upon various flight tests, which according to its critics are not grounded in realistic scenarios. Some members of U.S. Congress have argued that these tests are highly scripted and simpler than what GMD would actually face in a crisis situation [16]. For example, the GMD system has only been tested against an ICBM-class target once, in a successful intercept test the U.S. Missile Defense Agency (MDA) conducted in May 2017. Previous tests, both successful and unsuccessful, were against shorter-range and slower-moving targets. Furthermore, its economic value is called into question, since GMD is only capable of defending against limited ICBM attacks and is not capable of shorter range, regional defense missions [14]. North Korea's short and medium range missiles threatening South Korea and Japan, for example, fall outside of GMD's engagement envelope and require alternate missile defense solutions [14]. In the past, the U.S. MDA repeatedly stated that the current GMD system provides defensive coverage for the U.S. against limited missile attacks from North Korea and projected future threats from Iran [17]. Nevertheless, U.S. Congress has taken the approach in recent years to increase interceptor inventory, as well as plan to build an additional continental interceptor site for the GMD system on an accelerated timeline on or near the East Coast to counter potential future threats from Iran, adding hundreds of millions of dollars to the budget to jumpstart the effort [17]. With this background and the political implications that any assessment of GMD and U.S. missile defense hold, it must be understood that studies on this particular subject may be clouded by political motivation and bias.

Based upon the available literature about missile defense and global security, it is evident that the United States and Russia need to closely coordinate and dialogue on their nuclear missile arsenals and defenses to prevent mutual suspicion and spur further arms reductions instead of an increase in ballistic missiles. The future of cooperative security arrangements depends largely on the U.S.-Russian, but also to a lesser extent, on the U.S.-Chinese relationship. Many caution that changes in U.S. defense strategy, its missile defense capabilities, as well as the emergence of space as a warfighting domain, could signal to Russia and China that their abilities are not enough to deter the United States from use of force. Such a shift could potentially cause Russia or China to reconsider their nuclear strategies and posture, further damaging the already weakened state of arms control and further increase the nuclear threat to the United States and the world.

One of the proponents of dialogue on nuclear missile arsenals and missile defenses is Steven Pifer. In [18], he advocates that U.S. administrations should reiterate a 2013 proposal for a U.S.-Russian executive agreement on missile defense transparency, under which both sides would annually exchange data on their numbers of interceptors, radars, and other key missile defense elements [18]. Pifer apparently believes that Russia may have misconceptions about U.S. missile defenses and feels sincerely threatened. He advocates that an agreement on missile defense transparency would allow Russia to judge whether U.S. missile defenses pose a real threat to its strategic forces [18]. However, he admits that the more belligerent approach that Russia has adopted toward the United States and the West comes paradoxically against the backdrop of a major Russian military modernization effort,

including modernization of its strategic nuclear forces [18]. According to Pifer, Putin and other Russian officials have engaged in nuclear saber-rattling of a kind not seen since the Cold War; ostensibly, the Kremlin seems to prefer an adversarial relationship, which Pifer thinks is driven in part by a sense of grievance against the United States and the West, but also largely by domestic political factors [18].

In accordance with the theoretical framework of the balance of power theory, which claims that the posture and policy of a nation protecting itself against another nation is characterized by matching its power through an engagement in an arms race, much of the available literature holds the GMD system responsible for increased competition with Russia [19]. Accepting the balance of threat theory, which would assume that GMD poses a threat to Russia, some authors also argue in accordance with the official Russian view that actions taken by Russia are a counterbalancing reaction [20].

Laura Grego's article "U.S. Ground-based midcourse missile defense: Expensive and unreliable," published by the Bulletin of Atomic Scientists, argues that in addition to the unreliability of the GMD system due to the high number of failed tests, the system also does not dissuade nations such as North Korea from developing ICBMs or deter them from attacking the United States [21]. But most of all, she maintains that Russia and China have legitimate reasons to perceive the GMD system as a potential threat, which in return provides both countries with incentives to improve or expand their nuclear capabilities as a counterbalance [21].

In their work about U.S. and Russian missile defense concepts, "Missile Defense: Confrontation and Cooperation," Arbatov and Dvorkin also conclude that Russia's reaction to U.S. missile defense is a counterbalancing act. In contrast to most other authors, they do not believe that the official Russian response to U.S. missile defense is necessary due to the GMD system itself, but a result of other factors as well [22]. Arbatov and Dvorkin emphasize that the policies of the United States and NATO have given numerous grounds for Russian suspicion and apprehension, especially during the end of the 1990s and the administration of George W. Bush, resulting in Russian counterbalancing [22]. They conclude that Russia felt threatened by NATO's expansion, attempts to diminish Russia's influence in the countries of the former Soviet Union, the use of force in Yugoslavia, Iraq, and Libya, and the dismantlement of the arms limitation system [22]. Arbatov and Dvorkin justify the Russian position by pointing out that the conceptual reasoning for the U.S. missile defense program following the U.S. withdrawal from the ABM treaty, has been inconsistent and often contradictory, and has thus not inspired trust with Russian leadership [22].

In addition to the balance of power and balance of threat theories, the limited amount of research that has actually been conducted specifically regarding the introduction of GMD and its influence on international relations is also defined by the concept of deterrence. However, most proponents of deterrence in regard to missile defense also admit that the classical deterrence theory, born out of the Cold War, is not very helpful in the case of current missile defense and point to "logical inconsistencies and empirical anomalies" [23]. In this context, General Kevin Chilton, a former commander of U.S. Strategic Command, noted in a congressional testimony that since the end of the Cold War, the serious study of deterrence theory and strategy has been inadequate and that in the changing global environment, modern deterrence challenges necessitate more complex approaches [24]. Quackenbush, who examines "the implications of national missile defense on international peace and stability from the vantage point of an alternative theory of deterrence," claims that according to his study, national missile defense actually increases global stability through deterrence [23]. He posits that the ultimate danger of missile defense lies in the fact that it could potentially cause discontent with competing nations. [23].

Brigadier General Gregory S. Bowen, a former commander of the 100th Missile Defense Brigade, the Army unit that operates the GMD system, as well as a former deputy commander of the U.S. Army Space and Missile Defense Command, points in his research, "Ballistic Missile Defense and Deterrence: Not Mutually Exclusive," that a fundamental pillar of deterrence theory is that the parties involved are rational actors [25]. According to Bowen, "in the post-Cold War era, 'rogue nations' and non-state actors may not be rational, and thus, may or may not be deterrable" [25]. This is important to note when considering that GMD is designed to defend against threats from North Korea and Iran, not Russia and China. Bowen believes that strategic missile defenses and classical nuclear deterrence can peacefully coexist provided that they are carefully managed, and that missile defense can enhance some aspects of deterrence. According to Bowen, where deterrence loses effectiveness against actors seen as less deterrable, defense gains effectiveness. Based on his analysis, he concludes that it is prudent to maintain a missile defense system as a hedge [25]. However, he also clarifies that, if the system's capabilities begin to encroach on China and Russia's perceived ability to deter the United States, "it creates another security dilemma, possibly leading to instability and another arms race" [25].

Despite all of this, there are quite substantial voices that advocate the opinion that the U.S. missile defense shield is vital for the national U.S. defense and should be maintained and even expanded at any cost, even if that goes against the wishes and interests of Russia. Heinrichs, Senior Fellow at the Hudson Institute, argues that rather than scaling back U.S. strategic missile defense, the United States should devote significant resources to current operational systems so that they can fulfill their technical potential, as well as toward next-generation technologies to work towards a more robust defensive capability [26]. Heinrichs promotes an increase the reliability of the current system as soon as possible by adding additional interceptors at current sites and developing an additional interceptor site [26]. Russia's objections to U.S. missile defense plans are merely a means to advance Russian strategic objectives, an example that China is now following as well [26]. Any U.S. acquiescence to their demands to limit U.S. defensive plans only encourages China and Russia to continue to object to future U.S. missile defense deployments

and leaves the United States unnecessarily exposed to missile threats and should therefore be absolutely avoided [26].

Many critical voices of missile defense have questioned, in addition to the supposed technical ineffectiveness of the GMD system, the actual need or threat for which the system was originally created. According to Dr. Frederick Lamb, a Professor of Physics and Astronomy at the University of Illinois, in 2017 it was very unlikely that North Korea would be able to develop a nuclear-armed long-range ballistic missile capable of reaching the continental United States within the next five years. Further, he declared that the long-range missiles North Korea had launched or attempted to launch to date did not have the characteristics needed to reliably and accurately deliver a nuclear warhead to a target in the continental United States. The only capability he believed North Korea could possibly achieve within five years was the development of "an inaccurate and unreliable missile that is capable of reaching Guam or islands in the Aleutian chain, but not a missile armed with a reliable nuclear warhead" [27]. Therefore, in Professor Lamb's conclusion, the threat for which GMD was originally created was nonexistent and purposely overestimated in disproportional ways to justify the procurement of the U.S. missile defense system. In the estimate of many GMD critics, the missile threat against the U.S. from so-called rogue states is not as crucial as officially presented and does not justify jeopardizing international arms control agreements and relations with Russia and China, and thus global stability by the introduction or enhancement of U.S. missile defense systems. By the end of 2017 however, this assessment was proven to be wrong, as North Korea did in fact demonstrate the possibility to reach the United States with an ICBM.

Keeping the highly politicized debate about GMD effectiveness, functionality, and cost-benefit ratio in mind, as well as the widespread view about international dialogue on missile proliferation and missile defense, it is peculiar that there are so few studies on the correlation between the introduction of GMD and the gradual deterioration of international cooperation regarding missile defense, missile proliferation, and the development of enhanced offensive missile capabilities.

III. Methodology

To determine and measure if the strategic U.S. missile defense shield has contributed to global security and stability or not, three different fields of interest were identified. Each field delivers data and context for a quantification of a potential increase or decrease of global security in regard to ballistic missiles and missile defense. This study focuses on whether or not GMD is a precursor to global instability. The variables considered are adherence to international missile treaties, the increase or decrease of missile arsenals, as well as efforts, research, and development of offensive missile technology specifically aimed at overcoming the GMD system.

As the independent variable in this study, roughly the same time periods before and after the introduction of GMD were examined. The dependent variable will be determined by international treaty adherence as well as missile arsenals and research in new missile technologies. If there is a visible decline in treaty adherence coupled with an increase in number and types of missiles as well as research in new missile technologies during the time frame after the introduction of GMD, this will be valued as a clear indicator that GMD is a contributor to global instability.

A. International Missile Treaties

Examining the current adherence to international missile treaties is a viable tool to measure ballistic missile cooperation in comparison to the time before the introduction of GMD. Many of these treaties have been hailed as milestones for global security. Non-compliance with these treaties and official statements expressing contempt for or irrelevance of such treaties is a substantial indicator for a deterioration of global security.

In the international discussion about the adherence of treaties, opinions of compliance vary considerably, with both the U.S. and Russia accusing each other of being the first to violate agreements, creating a situation where adherence to the treaty is no longer binding or desirable. Regardless of culpability pertaining to treaty violation, it is important to recognize that governments either accuse one another of breaking agreements or acknowledge that long-standing agreements on ballistic missiles are no longer suitable. Observance of international treaties is measured by examining official government statements about adherence or the willingness to continue abiding by such treaties. International increase in noncompliance or the officially expressed unwillingness to further comply with treaties is interpreted as a deterioration of global security. Measurement of the climate of global security in the context of ballistic missiles will thus be achieved through examining official press releases and official government statements.

B. Missile Arsenals

Any practical examination must also include increases in ICBM arsenals and developments within Russia, China, North Korea, and other U.S. adversaries, compared to their national missile inventories prior to the introduction of GMD. Numerical increases or decreases serve as indicators in determining if the U.S. missile defense shield is stabilizing for global security or if it is contributing to international destabilization and is thus counterproductive, promoting missile proliferation and production. If a correlation can be made between a visible growth in offensive missile inventories with the goal of overwhelming the limited number of interceptors used by GMD, it clearly serves as an indicator that the U.S. missile defense shield has not contributed to global security.

This study takes into account that available open source information regarding missile arsenals may not reflect actual numbers; however, publicly available information on missile arsenals represents a general trend and is therefore relevant for this study. Furthermore, information regarding a country's

inventory is, in many cases, based upon official statements made by governments and militaries. Many governments may inflate their numbers to project military capabilities they do not actually possess. Nevertheless, for this study, the claim of missile capabilities and numbers is sufficient to determine an effect on global security and stability, since the intentions of governments alone are an indicators for determining the state of global stability. If there is a visible historical trend that adversaries have increased their inventories or, expressed the intention to do so, this may be interpreted as a factor for a destabilization of global security. However, number of missiles alone may not illustrate the full narrative. Inevitable technological improvements may increase missile arsenals and capabilities, regardless of whether GMD exists or not.

C. Missile Technology

If a correlation can be made between the developments of specific missile technologies aimed at overpowering the GMD system, it is a clear an indicator that the U.S. missile defense shield has not contributed to global security but has actually driven research in offensive military technology and its proliferation. Similar to the consideration of missile arsenals and proliferation, this study will not and cannot focus on the actual development of missile innovation and technology. The intent or interest alone for developing means to overcome GMD is interpreted as an indicator of a deterioration of global security; intent alone is an expression of willingness to engage in a technological arms race. Efforts and official statements by U.S. adversaries in the fields of MIRVs and MaRVs, as well as HGVs will be analyzed. MIRVs are ballistic missile payloads containing several warheads, each capable of engaging different targets, whereas MaRVs are generally singular reentry vehicles with the ability to maneuver after separation in an attempt to evade defenses. By contrast, a unitary warhead is a single warhead on a single missile, unable to divert from its ballistic trajectory.

The U.S. GMD system is designed to identify and neutralize the warhead of an incoming ICBM. MaRV and MIRV technology, with their multiple warheads, can potentially overwhelm the capabilities of GMD. Increased research, advancements, and proliferation of these technologies could be an indicator of the U.S. missile defense shield acting as a destabilizing factor for global security.

The traveling altitude, accuracy, high-speed, and extreme maneuverability of an HGV limits the effectiveness of radar detection. HGVs have a vastly different profile in the air than a ballistic missile upon separation, as they can maneuver freely and unpredictably. Since all current missile defense systems are designed to detect and intercept missiles on a ballistic trajectory, countering HGVs will be challenge that has to be overcome in the future. Increased research and development by U.S. adversaries into these specific technologies, which could potentially render GMD in its current configuration obsolete, could be interpreted as a direct reaction to the U.S. missile defense shield and thus an indicator for a decrease of global security.

D. Analysis of Data

The three identified fields of interest, determining an increase or decrease of global security, concerning the U.S. missile defense shield will be weighted differently in the analysis of data. The qualitative adherence to international treaties will be the main criteria to determine the outcome of this study. This is especially significant if the justification for nonadherence is based on official statements in direct correlation to the creation of the GMD system. The quantitative aspect of missile treaties will also be examined and compared with emphasis on the period before and after the introduction of GMD.

The case can be easily made by proponents of the U.S. missile defense shield that an increase of international missile arsenals, as well as international efforts for research and development of offensive missile technology, is not necessarily a consequence of the establishment of GMD. It can certainly be argued that innovation and expansion are the result of a realist worldview where principal actors in the international arena are concerned with their security, national interests, and struggle for power, regardless of the U.S. GMD system. These quantitative aspects are weighted less in the analysis.

The qualitative adherence to international arms control measures as well as the quantitative results of missile treaties, missile inventory, types, and increases in research and development aimed at overcoming GMD since its introduction, is contrasted with analogous aspects before GMD was fielded. A qualitative decrease in adherence with arms control treaties, and the number of international missile treaties paired with a quantitative increase in missile production, proliferation, arsenals, types, and offensive missile research after GMD became operational, is viewed as directly proportional to the decline of global stability.

To have a balanced view on missile proliferation and international missile arsenals, different independent sources were utilized: The Missile Defense Advocacy Alliance, an advocate for increased U.S. missile defense; the Arms Control Association, an agency critical of U.S. missile defense; the Bulletin of the Atomic Scientists, a proponent of arms-control; and the Center for Strategic and International Studies.

IV. Findings & Analysis

Examination of the two decades before the implementation of the GMD system, in reference to arms control and strides toward global security, found an increase in positive and promising achievements between the U.S. and the Soviet Union, as well as its successor, the Russian Federation.

A. Arms Control Agreements

During one of the most extraordinary U.S.-Soviet summits, the October 1986 meeting between Ronald Reagan and Soviet leader Mikhail Gorbachev in Iceland, both sides tenuously agreed to abolish their complete offensive nuclear weapons arsenal within ten years. However, the agreement unraveled over differences regarding missile defense testing. The Soviet Union favored a strict interpretation of the ABM Treaty, confining research and development, whereas the United States argued for a broader interpretation, allowing the development and testing of space-based missile defense components. In spite of the failure to reach an agreement, the

actions discussed between the superpowers were widely interpreted as paving the way for possible subsequent treaties. The following year, Gorbachev and Reagan signed the Intermediate-Range Nuclear Forces (INF) Treaty, in which both countries agreed on the elimination of ground-launched, medium to intermediate range missiles (ranging from 500 to 5,500 kilometers). The treaty was the first historical agreement to reduce nuclear arms, as opposed to setting ceilings, and introduced comprehensive verification measures [8].

In 1989, the fall of the Berlin Wall and the culmination of the Cold War brought rapid progress in disarmament efforts by the U.S. and the Soviet Union, leading to the first Strategic Arms Reduction Treaty (START I) in 1991. START I, judged as another success, was indispensable in creating a framework that ensured predictability and stability for deep and substantial arms reductions [28].

In 1991, exactly 10 years before the announcement of the implementation of the GMD system, the U.S. Senate passed the Nunn-Lugar Bill, establishing the Cooperative Threat Reduction (CTR) program, which provided financial and technical assistance to the former Soviet Union states' efforts in securing and dismantling nuclear weapons and fissile material stockpiles. The Nunn-Lugar Bill aided in the removal of thousands of warheads from their territories and the civilian employment of nuclear scientists and missile experts. With CTR funding, Kazakhstan became a non-nuclear weapons state in 1995, followed by Ukraine and Belarus in 1996, continuing to further global stability [29].

In 1993, the Strategic Arms Reduction Treaty II (START II) was signed; however, it was never implemented. The Russian Duma conditioned its approval on the willingness of the U.S. to ratify two amendments to the 1972 ABM Treaty and to continue to abide by that treaty's provisions [30]. To redefine and reinforce certain aspects of the ABM Treaty, U.S. President Bill Clinton and Russian President Boris Yeltsin formulated a joint statement that defined strategic and nonstrategic (theater) missile defense systems in 1997. Russia ratified this agreement in May 2000. Nevertheless, the measure was never sent forward to the U.S. Senate and with the U.S. withdrawal from the ABM treaty in June 2002, the agreement eventually became meaningless and obsolete [8].

Based on fears identified in past arms control agreements and treaties, the United States and Russia proposed the creation of a Joint Data Exchange Center and a Pre-Launch Notification System for missile data sharing in June 2000. These systems were to be designed to considerably reduce the risk of an unintended ballistic missile launch based on false warnings of an attack or misinterpretation of missile events. Washington and Moscow eventually signed a memorandum of agreement for the construction of such a center, but it was never built, and a joint data exchange never became reality [8].

B. U.S. Missile Defense Shield

In June 2002, Washington unilaterally withdrew from the ABM Treaty with President George W. Bush arguing that the treaty limited U.S. ability to develop missile defenses against terrorists and rogue states [14]. However, the U.S. move did not come as a total surprise and was the conclusion of a process that started long before George W. Bush was in office, as the North Korean threat continued to develop.

With the Iraqi invasion of Kuwait in 1990 and the consequent Operation Desert Storm of 1991, defense against ballistic missiles gained popularity with the American public. Some strategists have hailed the Patriot ballistic missile defense system as the "great defender" of Israeli civilians and of U.S. forces in Saudi Arabia during the Gulf War [31]. Although there have also been some outspoken critics, the Patriot system's Gulf War performance has often been pointed to as a reason to pursue national, as well as theater, missile defense [31]. Operation Desert Storm reignited the debate on missile defense, as nations watched on television as Patriot missiles streaked through the air to intercept Iraqi Scud missiles [25]. These engagements emphaiszed the deadly truth about missile proliferation to U.S. officials. Thus, after perceiving the success of the Patriot missiles, the notion that an effective defense against ballistic missiles was possible began to spread [32].

The introduction of a real ballistic missile threat from so-called rogue states, the issue of missile proliferation, and the possibility of an effective missile defense became topics during the Clinton administration. In 1993, under President Clinton, the U.S. Department of Defense conducted a "Bottom-Up Review" to select the "strategy, force structure, and modernization" of America's defense in the post-Cold War era [4]. With the Soviet Union now defunct, a deliberate or accidental ballistic missile attack from Russia was highly unlikely. However, the ballistic missile threat from Third World countries was uncertain and emerging [4]. By 1996, new intelligence estimates of ballistic missile threats to the U.S., gave new incentive to strategic missile defense. By the end of Clinton's second term, the U.S. Congress pressed national missile defense with possible implications for altering the ABM Treaty. Consequently, President Clinton signed the National Missile Defense Act of 1999, which made it "the policy of the United States to deploy as soon as is technologically possible an effective national Missile Defense system" [4]. President Clinton pushed for development of a ground-based defense that would use "hit-to-kill" technology to destroy warheads in the exoatmosphere, although he made it clear that he ultimately wanted to leave the decision whether to deploy the defense system to his successor. Unlike the more ambitious SDI of the Reagan era, this system was intended to intercept no more than a couple of dozen warheads. The reasoning for this limited system was not the fear of a ballistic missile attack from the Soviet Union, as during the Reagan era, but that Iraq, Iran, or North Korea might soon present a long-range missile threat to the United States [30]. Despite its limited capabilities, the system envisioned by the Clinton administration, came under sharp attack internationally for potentially fueling a new arms race. Russia rejected the Clinton administration's original proposal to modify the ABM Treaty, allowing for the deployment of a national U.S. missile defense system, arguing that the treaty is a cornerstone of strategic stability. Beijing, a more outspoken critic, feared that if the system worked, it could potentially render China's long-range missiles almost obsolete [30]. Many U.S. allies in Europe were also hostile to the idea, dismissing the threat

from North Korea, fearing the start of a new arms race, and worrying that if the U.S. was protected from ballistic missiles from rogue states, adversaries may turn their attention toward Europe [30].

In December 2001, the Bush Administration announced that it would withdraw the United States from the ABM Treaty and in 2002, the White House issued National Security Presidential Directive 23 (NSPD-23), ordering the deployment of an initial limited homeland defense capability by 2004 [14]. Russia was enraged by the U.S. move and increasingly viewed U.S. policies post-September 11th as unilateral and uncooperative. Nevertheless, in May 2002, Bush and Putin signed the Strategic Offensive Reductions Treaty, also known as the Moscow Treaty, which promised to eliminate roughly two-thirds of the two countries' nuclear warheads over the next ten years (U.S.-Russia Nuclear Arms Control). Bush and Putin also released a joint declaration aimed at "strengthening confidence and increasing transparency in the area of missile defense" [8].

In 2004, U.S. Air Force Lt. Gen. Henry Obering, III, the Director of the MDA, declared limited defensive operations with five Ground-based Interceptors (GBIs) in silos at Fort Greely, Alaska, the upgraded Cobra Dane radar in Shemya, Alaska, and an upgraded early warning radar at Fylingdales in the United Kingdom. The GMD system was intended to eventually grow to 44 GBIs, with interceptors distributed between Fort Greely and Vandenberg Air Force Base, California [14]. In addition, the Bush Administration in 2007 proposed a European GMD site to counter a possible future development of Iranian long-range missiles. This European component of the GMD system, operated by the U.S. military, was to include an additional ten GBIs in Poland and an X-band radar in the Czech Republic [14].

The U.S. plan to place interceptors in Poland and a powerful radar in Czech Republic aggravated Moscow even further. Though the Bush administration claimed that the shield was needed to defend U.S. and European facilities against fast-developing Iranian capabilities, Russia viewed it as a threat to its national security. During a G8 summit in Germany in 2007, Russian President Vladimir Putin proposed to the U.S. to jointly develop a missile shield based on radar facilities in southern Russia and Azerbaijan to try to avert U.S. plans in Poland and the Czech Republic. However, the U.S. viewed joint Russian missile defense offers rather critically, given that the missile defense tensions came amid allegations of increasing Russian assistance to Iran's nuclear program [8].

C. European Phased Adaptive Approach and New START

In 2009, the Obama Administration announced the cancellation of the European GMD sites proposed by Bush in favor of the European Phased Adaptive Approach (EPAA). The Obama administration also capped the planned GBI deployments to 30, a reduction from the 44 planned under Bush [14]. Speculation surfaced that these measures were an attempt to convince Moscow to assist Washington in its efforts to counter Iran's nuclear ambition. President Obama denied offering a quid pro quo, but said the revisions were necessary to protect the U.S. and its allies from the more pressing threat of Iran's short to medium-range missiles [8]. Against the widespread belief that Obama was trying to appease the Russians, former U.S. Secretary of Defense Robert Gates in his memoirs writes that the decision to cancel the Bush GMD initiative for Europe had much more profound reasons. According to Gates, by the end of 2008, it looked increasingly certain that Czech political opposition to the radar would prevent its construction there. Poland had agreed to host the interceptors immediately following the Russian invasion of Georgia, after stalling for more than a year. However, Poland's growing demands for U.S. security guarantees, beyond the regular NATO commitment, as well as other disagreements brought the negotiations to a halt. By the time Obama took office, it was clear that the initiative was not progressing in neither Poland nor the Czech Republic. Even if a deal were to proceed, political wrangling would delay its initial operating capability by many years [33].

The United States established the EPAA with the background of an existing and emerging Iranian missile threat [34]. According to U.S. officials, the EPAA is no danger or threat to Russia and clearly intended to be used against missile threats from outside of Europe [34]. The defense systems of the EPAA do not negate nor undermine Russia's strategic deterrent capabilities [34]. Nevertheless, Russia repeatedly expressed dissatisfaction with the program, protesting that it presented a significant threat to Russia's nuclear deterrent. In 2013, the Obama administration canceled the proposed final phase of the EPAA, the incorporation of an advanced interceptor missile capability (SM-3 Block IIB interceptor) [35]. By withdrawing from this planned phase of the EPAA, the United States provided an opportunity to discuss additional nuclear arms reduction procedures and potentially paved the way to working with Russia on missile defense issues [34]. The Obama administration called for a "reset" in relations between Washington and Moscow and in July 2013. Obama and Russian President Medvedev agreed to reduce their respective nuclear arsenals by "up to one-third, to no more than 1,675 strategic warheads and 1,100 delivery vehicles" [8].

In 2010, Obama and Medvedev signed an arms reduction agreement in Prague, replacing the START I treaty that had expired in December 2009. This so-called "New START Treaty" committed Russia and the U.S. to a substantial limitation of offensive strategic arms. Per the agreement, both countries arranged for a 30 percent reduction on deployed warheads and lower caps on deployed and non-deployed ICBM launchers, missile-capable submarines, and heavy bombers equipped for nuclear weapons [8]. The U.S. Senate ratified the New START Treaty in a decisive bipartisan vote; the first arms control agreement to be ratified by Congress since 2002. U.S. Democrats and Republicans came together to approve the pact that Obama called "the most significant arms control agreement in nearly two decades" [36].

D. Arms Control Standstill

Over the past several years, significant differences emerged between U.S. and Russian approaches, contributing to the current standstill in arms control dialogue. The Obama administration sought further cuts in both U.S. and Russian nuclear weapons, but Moscow's focus was on the controversial issues of missile defense and advanced conventional strike systems. The relationship between

Washington and Moscow sank to a historic low point as issues emerged with existing arms control agreements [18]. In 2014, the U.S., for the first time, declared that Moscow had undermined the 1987 INF Treaty by testing a banned cruise missile. [18]. Putin had previously declared, in 2007, that the INF Treaty no longer served Russia's interests. Some observers believe this declaration was likely due to China developing more modern medium-range ballistic-missile systems [37]. However, the Russians officially blamed EPAA and the U.S. deployment of missile defense technology in Eastern Europe as the reason for their dissatisfaction with the INF Treaty.

As American and NATO officials celebrated the opening of the long-awaited Aegis Ashore missile defense system in Romania, the reaction in Russia suggested that the system had raised the risks of nuclear war. Russian officials restated their position that the American-built system endangered Russia's security. The public discussion in Russia was even gloomier, including online commentary of how a nuclear confrontation might play out in Europe and the prospect that Romania might be reduced to "smoking ruins" [38]. Russia's interpretation and complaints over U.S. violations of the INF Treaty are not completely unfounded – the Aegis Ashore defense system consists of the same missile launch system as Aegis warships, but on land. Aegis Ashore is, as the U.S. insists, a defensive weapons system, equipped with SM-3 interceptors. Nevertheless, Aegis cruisers use the same launchers as Aegis Ashore to launch offensive cruise missiles. Logically and consequently, the defensive Aegis Ashore could technically be equipped with cruise missiles and be used offensively, in Russia's view, a violation of the INF Treaty. Similarly, despite repeated U.S. objections, Russia continued to test and later deploy a new ground-launched cruise missile to a range beyond the INF Treaty limit of five hundred kilometers [38]. It is interesting to note that the former Secretary Gates writes in his memoirs about Moscow proposing a joint termination of the treaty in 2007 so it could deploy intermediate-range missiles in its south and east to "counter Iran, Pakistan, and China" [33]. The United States rejected the offer at the time [33].

In October 2018, President Trump announced U.S. plans to terminate the INF Treaty. However, German Chancellor Angela Merkel persuaded Trump to delay withdrawal for 60 days to give diplomacy one last chance. Thus, it came as no surprise when U.S. Secretary of State Mike Pompeo declared on February 2, 2019 that the United States would withdraw from the treaty and would suspend its obligations under the pact. Russia immediately countered, announcing that it too would suspend its treaty obligations in reaction to the U.S. abrogation of the agreement [39]. Vladimir Putin proclaimed the beginning of research and development of land-based modifications of naval missile launching systems and launchers for intermediate-range hypersonic platforms [39].

Despite ongoing tension between Russia and the United States, Russia did drastically reduce its quantity of ballistic missile warheads to meet the New START limit, with the Russian Foreign Affairs Ministry announcing "1,444 deployed strategic warheads attributed to 527 deployed strategic launchers" in February 2018 [40]. The numbers indicate that Russia had reduced the warhead loading on some of its missiles to below the general expectation, illustrating that the New START put actual constraints on Russia's deployed strategic forces [40]. As a result, Russia appears to rely more on a strategic reserve of non-deployed warheads that could be loaded onto missiles in a crisis to increase the size of its force when needed. The U.S. has used a similar strategy for several decades [40].

All of these developments occurred amid an ambitious Russian military modernization program. Overall, Russia's nuclear modernization effort presents the international arms control community with new challenges. Unless a new arms reduction agreement is reached soon, the declination of Russia's strategic nuclear arsenal, characterized by the past two decades, will likely end [40]. On March 1, 2018, Putin boldly emphasized several new weapon systems with the intent to demonstrate to the world – and especially the United States – that "nuclear forces are indispensable for Russia's security and status as a great power" [40]. Putin later announced a successful initial flight test of the Avangard (Vanguard) HGV on December 26, 2018 [41]. The Russian military modernization is motivated in part by Moscow's strong desire to maintain parity with the United States, but also by the Russian leadership's apparent belief that the U.S. ballistic missile defense system (BMDS) constitutes a sincere threat to the credibility of Russia's retaliatory capability [40]. With the collapse of the INF Treaty, the only remaining U.S.-Russian arms control agreement is the New START, which expires in 2021, but can be extended by up to five years by mutual agreement [39]. Asked about New START's future while in Moscow, John Bolton, President Trump's National Security Adviser, said the government was currently considering its position, adding that the administration was not yet prepared to negotiate [42]. Before joining the Trump administration, Bolton was a frequent and outspoken critic of New START, condemning it as unilateral disarmament [39]. In February 2017, Trump called the agreement "a one-sided deal" and a "bad deal" [42].

According to the current U.S. Nuclear Posture Review, Russia has significant "advantages in its nuclear weapons production capacity and in non-strategic nuclear forces" over the United States [43]. Furthermore, Russia is building a larger, more modern and diverse set of non-strategic systems that are capable of being armed with either nuclear or conventional weapons [43]. These theater and tactical-range systems are not accountable under the New START Treaty. Furthermore, Russia is in the process of significantly improving its delivery capabilities of its warheads to include "the production, possession, and flight testing of a ground launched cruise missile in violation of the INF Treaty" [43]. Moscow believes these systems will provide "useful options for escalation advantage" [43]. Finally, despite Russia's repeated denunciation of U.S. missile defense, Moscow is "modernizing its long-standing nuclear-armed ballistic missile defense system and designing a new ballistic missile defense interceptor" [43].

Regardless of the interpretation of Russia's nuclear strategy, its statements about nuclear weapons and threatening to potentially use them in situations not compatible with and well

beyond published official doctrine are significant and appear to be increasing in frequency. For example, Russian officials have openly threatened to use nuclear weapons, either to project power or reflecting a shift in Moscow's strategic doctrine. This includes against missile defense facilities and in scenarios not involving strikes with weapons of mass destruction or threatening to Russia's survival [40]. Further, in February 2019, Russian state television listed U.S. military facilities that would be targeted in the event of a nuclear strike, adding that a Russian hypersonic missile would be able to hit them in less than five minutes, amplifying its provocative rhetoric [44].

E. China's Missile Program

China is also modernizing its land-based nuclear-capable missile force. The National Air and Space Intelligence Center (NASIC) of the U.S. Air Force estimates that "China continues to have the most active and diverse ballistic missile development program in the world" [45]. However, the nuclear portion of China's missile force is significantly smaller than the arsenals of either Russia or the United States. Nevertheless, both the United States and Russia have become wary of China's missile capabilities [46]. In contrast to the U.S. and Russia, China was not bound by the INF Treaty. Its growing nuclear and conventional missile inventory is mostly composed of systems in the INF Treaty-prohibited range of 500 to 5,500 kilometers [46]. Both the United States and Russia have expressed concern, feeling at a disadvantage toward China due to the INF Treaty. Admiral Harry Harris, the former Commander of U.S. Pacific Command, recommended in April 2017 that the United States renegotiate the treaty with Russia because it limits its ability to "to counter Chinese and other countries' cruise missiles, land-based missiles" [46]. Russian military officials, too, have pointed to Moscow's perceived imbalance with China as a possible factor leading to the eventual demise of the treaty [46]. Some had recommended that the United States attempt to include China into the INF Treaty or seek a separate, similar agreement with Beijing. However, China expressed no interest or desire in joining the INF Treaty, [46]. This seems to promulgate the notion of less global stability as each nation is attempting to balance the power of the others. In his February 6, 2019 State of the Union address, Trump alluded to the possibility of negotiating a new intermediate-range missile agreement that would also include China. Joining such a treaty however, would mean that China would have to eliminate 95 percent of its missile arsenal [39].

China's missile program is not regulated by any arms control regimen since most major arms control treaties were the result of the arms race between the Soviet Union and the United States during the Cold War. During that time, China's missile force, as well as geopolitical importance, was less significant and less threatening, in comparison to that of the two superpowers. However, China's missile programs and its current missile capabilities are now remarkable and upcoming contenders with those of the U.S. and Russia. China not only has the most active ballistic missile program in the world, it also has a dubious track record of historically assisting states with nuclear and missile programs. In 2000, China, seeking to exude heightened global responsibility, made a public commitment not to assist "in any way, any country in the development of ballistic missiles that can be used to deliver nuclear weapons" [47]. Ironically, China has repeatedly aided Pakistan's nuclear and missile programs and Iran, Libya, Saudi Arabia, and even North Korea have been identified as recipients of sensitive technologies and materials from China [47]. The China Nuclear Energy Industry Corporation—with government authorization—has exported miniature neutron source reactors to Pakistan, Iran, Syria, Ghana, and Nigeria, which run on highly enriched uranium fuel, albeit only a fraction of what is necessary for a nuclear warhead. Much of this uranium fuel has also been supplied by China to recipient states [47]. Not surprisingly, China's 2004 bid to join the Missile Technology Control Regime failed due to concerns by the international community about Chinese missile and missile technology transactions and transfers. China officially maintains the position that it voluntarily abides by the Missile Technology Control Regime's guidelines [47]. Yet, a 2017 U.S. State Department Compliance report cited that "in 2016, Chinese entities continued to supply missile programs of proliferation concern" [47]. Although primarily focused on its offensive capabilities, China has also started to reassess its missile defenses. China is currently pursuing a wide range of mobile air and missile defense options, including the purchase of S-400 systems from Russia and the development of additional theater ballistic missile defense systems. It has also has announced that it is testing a new midcourse missile defense system [48].

F. Current State of International Arms Control Measures

The ABM Treaty, which was hailed as a historical "milestone for international security" [15] and a "cornerstone of strategic stability" [49], became obsolete with the announcement of the implementation of the GMD system. Alexei Arbatov, Vice-Chairman of the State Duma defense committee stated, in a 2002 radio interview, that the U.S. treaty withdrawal was an "extremely negative event of historical scale" [49]. However, it is difficult to determine if the establishment of GMD was the principal driving force leading to deterioration of the international arms control treaty framework. Unquestionably, other factors also played a role in this development.

Perhaps there is validity to President Bush's argument that the ABM Treaty was situationally outdated and unduly limiting based on established and emerging threats from terrorist groups and rogue states [50]. Surely, the GMD system changed the climate between Russia and the United States. It is evident that successful historical arms control measures, negotiated during the Cold War with the Soviet Union and later with the Russian Federation, no longer dictated global security as they had in the past. GMD is the direct reason for the ABM Treaty to be defunct. GMD has been specifically cited by Russia as the reason why START II was never ratified and indirectly why the INF Treaty was doomed.

It cannot be denied that the aforementioned arms control measures were the result of direct negotiations between the Soviet Union, Russia, and the United States, regarding a past era, and do not adequately represent the current state of global missile proliferation, technology, and threats. However, it is certainly convenient for Russia, and to a lesser extent China,

to solely blame the U.S. introduction of a national missile defense system for the deterioration of global security while simultaneously ignoring the shortcomings of the outdated Cold War arms control measures. Had these treaties, relics of a different global environment, been revisited and updated to the threats of the present, the fielding of GMD may not have become so controversial.

G.Russian Missile Arsenal

In 2017, NASIC predicted that "the number of missiles in the Russian ICBM force will continue to decrease because of arms control agreements, aging missiles, and resource constraints" [40]. However, Russia will also significantly improve its delivery capabilities [43]. Russia currently possesses the largest missile force in the world and is estimated to have the most nuclear warheads [51]. By numbers alone, the GMD system was never intended for defense against a Russian ICBM attack, with its current 44 GBIs, and even eventual 64 GBIs as approved during the Trump Administration [48]. By 2018, Russia was believed to possess approximately 4,350 nuclear warheads for its long-range strategic launchers as well as its shorter-range nuclear forces [40]. Of these, roughly 1,600 warheads are operationally deployed on strategic ballistic missiles and at heavy bomber bases, with another 920 in storage facilities [40]. Russia keeps approximately 1,830 non-strategic warheads in reserve for its operational forces [40]. It is further estimated that almost 2,500 largely intact, but retired, warheads are awaiting dismantlement bringing the total number of warheads to greater than 6,850 [40].

H. Chinese Missile Arsenal

According to NASIC, China is developing and testing offensive missiles, forming additional missile units, qualitatively upgrading missile systems, and developing methods to counter the BMDS. China's entire deployed ballistic missile force, both naval and land-based strategic systems, is growing in both missile types and quantity. Significantly, China fielded its first ICBM with MIRV capability, with plans to develop more [52]. According to NASIC, it is estimated that within the next three years, the amount of Chinese ICBMs with nuclear warheads that could range the United States may expand to over 100 [52]. The JL-2 submarine launched ballistic missile gave China its first truly successful long-range sea-based nuclear capability, capable of targeting nearly the entire U.S. from mid-sea, though China is expanding upon that capability by approximately 1,600 km with the development of the JL-3. China is also developing a new MIRV-capable road-mobile ICBM [45]. The size of the ICBM force has remained relatively stable over the past few years, but appears to be increasing again [43].

I. North Korea

North Korea has made incredible advances over the past two decades, notably the last two to three years, in developing a functional long-range nuclear weapons arsenal that was nearly nonexistent in 2016. It has detonated six nuclear devices – one with a yield of 160 kilotons – and tested a variety of new ballistic missiles that potentially puts the United States and Europe in range. Based on available information, it can be estimated that North Korea might have produced sufficient fissile material to build up to 60 nuclear weapons, and may have possibly assembled 10 to 20 warheads [53]. North Korea has developed at least three types of ballistic missiles that appear to have intercontinental range: the Taepo Dong-2 (TD-2), the Hwasong-14, and the Hwasong-15. The TD-2 is a three-stage, liquid-fuel, long range missile, generally denoted as a space launch vehicle (SLV), thought to be a militarized version of North Korea's Unha-3 SLV and is surprisingly similar to Iran's Simorgh SLV. The TD-2 placed a satellite in an unstable orbit in 2016. NASIC estimates that the TD-2, configured as an ICBM, could achieve a range of more than 12,000 kilometers and reach the United States, though it has never been tested with such a payload [53]. In 2017, North Korea successfully tested the Hwasong-14, and the Hwasong-15 missiles, on highly lofted trajectories, demonstrating the likely ability to engage the continental United States, as well as two provocative IRBM overflights of Japan [54].

North Korea's strategic weapons program has followed a noticeable path under three generations of Kim family rule: from early aspirations and initial development of scientific infrastructure under Kim Il-Sung; to the accumulation of requisite materials, experimentation and more robust testing under Kim Jong-Il; to the consummation and accelerated procurement under Kim Jong-Un [55]. The results of decades of North Korean undercover missile procurement, testing, and development have generated plentiful returns for Pyongyang, even if Western observers initially mocked North Korea's efforts. The astonishing acceleration of the missile testing programs under Kim Jong-Un and its recent breakthroughs are almost unparalleled in the history of weapons development [55].

Characterizing North Korea's missile testing programs only as "provocations" is misleading and highly inaccurate. The North Korean leadership sees the regime's survivability and strategic programs as its singular priority. Despite North Korea's economic constraints and increasing severe multinational sanctions, the weapons programs have advanced far beyond and far faster than what most analysts deemed possible only several years ago [55]. Pyongyang can now finally proclaim that it has fulfilled a principal strategic objective: the ability to reach American soil with a nuclear-armed missile. North Korea's missile program is not regulated by any arms control treaties and is in direct violation of various United Nations (UN) resolutions. However, due to its missile program, North Korea is able to wield much more direct international influence than its economic or diplomatic power would allow under normal circumstances. It was with this influence that Kim Jong-Un was able to hold three meetings with South Korean Prime Minister Moon Jae-in in 2018 and two highly publicized summits with U.S. President Trump, in June 2018 and February 2019. This is the first time an American leader met with a ruler of North Korea, attaining international recognition, and certainly one of the strategic goals that North Korea intended to attain though its ICBM and nuclear programs. Regime survival is the paramount outcome that North Korea perceives as a result of its missile program.

In recent years, North Korea has repeatedly argued that without nuclear weapons it would be vulnerable to U.S. decapitation and regime change akin to the fate of Saddam Hussein and Moammar Qaddafi [55].

One particular aspect, however, in connection with North Korean ICBM developments, that is constantly overlooked is the GMD system. GMD was introduced with the sole purpose of defending against a possible North Korean ICBM attack. The potential of North Korea one day developing an ICBM was the initiator for this limited capability, and that day has arrived. North Korea has ICBM capability and it has nuclear warheads. If North Korea wants its ICBM arsenal to be an actual deterrent to the U.S., its ICBMs must be able to overcome the GMD system. The North Korean regime is aware that GMD was designed in response to their missile program and is likely studying its capabilities and limitations.

One obvious limitation is the number of GBIs available for the GMD mission. North Korean strategists surely understand that in order to overwhelm U.S. missile defenses, it simply has to produce a greater number of missiles or produce enough ICBMs with advanced technology, such as MIRVs and MaRVs, or warhead decoys designed to confuse missile defenses. Many missile analysts in the U.S. may be of the opinion that North Korea has not yet adequately demonstrated the reliability of their missiles [56]. However, as long as North Korea has a large enough number of ICBMs to overwhelm GMD, it has attained a position in which any U.S. administration must take Kim Jong-Un and his demands more seriously. With this background, it is interesting that despite the recent improved dialogue between North Korea and the U.S., North Korea is still expanding its missile production [57]. International perception is that the supposed improved relations have halted North Korea's missile testing program. It is more likely that Pyongyang is simply halting further testing of missiles because it achieved their principal objective of a successful ICBM. An additional test risks embarrassment with the possibility of a failure.

In North Korea's situation, the case can be made that the GMD system has accelerated efforts and production of North Korean missiles. However, it would be wrong to assume that GMD was the reason and cause for the North Korean missile program. GMD was the U.S. response to an ongoing North Korean missile program that would eventually and inevitably develop ICBM capability.

J. Iran

Iran's missile program, today, is very similar to North Korea's, in 2016. It would be foolish not to envision a potential strategic threat from Iran to the U.S. in the future. Despite a significantly damaged economy, as well as conditions posed by the JCPOA, better known as the Iran Nuclear Deal, Iran has sustained its investment in the quality and quantity of its theater missile forces and has resisted any externally imposed limits on further development or production. Iran also continues to transfer missiles to its allies and proxies in Lebanon, Yemen, and Syria, thus deteriorating the region's stability [58]. Additionally, North Korea has historically aided Iran's missile program by providing technology and hardware, which in several cases, Iran has improved upon [59].

The topic of arms control and missile treaties concerning Iran is a highly politicized one. According to the 2010 UN Security Council Resolution 1929, "Iran shall not undertake any activity related to ballistic missiles capable of delivering nuclear weapons, including launches using ballistic missile technology, and that States shall take all necessary measures to prevent the transfer of technology or technical assistance to Iran related to such activities" [60]. Most nonproliferation experts would agree that Iran certainly defied the spirit of the UN resolution, but technically did not violate it. There is a strong possibility, however, that Iran will now accelerate its missile program since it no longer feels bound or restrained by the Iran Nuclear Deal. Nonetheless, Iran does not yet have ICBM capability, despite the ability to conduct space launches [61].

K. New Technologies and Tactics

As previously stated, the sheer number of Russian missiles alone could easily overwhelm the American GMD system. In addition to the extensive Russian missile arsenal, many Russian missiles have MIRV capability, which alone may challenge GMD. China and Russia are also in possession of HGVs, with the intent to field them. Once HGV technology becomes an operational reality, the basics of ballistic missile defense could be eroded; there would no longer be a predictable and calculable ballistic flight path of the incoming object. However, for the purpose of this study, HGVs are irrelevant. The extensive Russian or Chinese arsenals, with sufficient numbers to deplete GMD interceptor reserves, existed prior to the first interceptor emplacement. MIRV technology is a legacy from the Cold War era. Both Russia and China have had multiple missile systems, land and sea-based, capable of carrying more than a single warhead before inception of GMD. Though MaRV-capable missiles are a relatively new improvement on the unitary warhead, and HGV technology is arguably a method to render GMD useless, it does not change the fact that both Russia and China could have overwhelmed the system's current capability, long before it was introduced. MIRVs, MARVs, and HGVs are simply technological progressions that would normally occur for a technologically advanced nation.

The only U.S. adversary that may have been influenced in the development of its missile program by the introduction of GMD is, to a certain extent, North Korea. However, it should not be overlooked that North Korea had an extensive missile program long before George W. Bush announced the GMD system for the defense of the U.S. homeland. GMD was the result of a rapidly growing North Korean missile program, in anticipation of North Korean ICBM capabilities. North Korea's goal was the attainment of ICBM capability long before GMD was announced and became operational. It could be argued that GMD may have accelerated the production rate of North Korean ICBMs, so that North Korea could eventually overwhelm U.S. missile defenses. North Korea is not yet believed to possess MIRV capability, nor is it conducting any research in the field of HGVs [62].

V. Conclusion

It is commonly expected that a direct correlation between a

new arms race and GMD, in accordance with the balance of power theory, exists. Many, in accordance with the balance of power theory, had repeatedly warned of a new arms race with Russia and, to a lesser extent, with China due to the U.S. decision of fielding the GMD system. In the perception of many analysts, this new arms race has become a reality. However, this study reveals that with one possible (and very particular) exception, this is not the case.

According to the balance of power theory, the posture and policy of a nation protecting itself against another nation is characterized by matching its power through an engagement in an armaments race [19]. Still, despite expectations, this has not happened. Neither Russia nor China had the need to increase their numbers of ICBMs or develop new technology to balance the U.S. missile defense shield. In fact, due to the New START agreement, Russia's actual number of strategic missiles decreased. Modernization programs of the missile forces in Russia as well as China had been conceptualized and decided before the introduction of GMD. It is difficult to make the case that other technologies such as the HGV are in direct response to the GMD system, as they likely would have been developed due to maturing technology. Iran has currently not developed any systems to reach the U.S. homeland, although, since it has historically conducted space launches, it may possess the capability to develop ICBMs and may decide to do so in the future. Only in the case of North Korea, to a certain extent, may the balance of power theory be applicable. Due to the current capabilities of GMD, North Korea may be in the process of producing enough ICBMs to have an advantage over the number of GBIs, which could be interpreted as an armament race. However, it is important to remember that the North Korean missile program and its aggressive pursuit of technology and development of ICBMs to reach the U.S. homeland were in place long before the introduction of GMD.

It is true that the overall situation of global security and the state of international arms control measures has deteriorated since the introduction of GMD. Important arms control achievements from the Cold War era are no longer in place or no longer adhered by. However, though it initially seems that this is largely due to the introduction of GMD, a closer analysis reveals that other factors are also at play. The historic ABM Treaty became obsolete with the U.S. decision to field GMD; however, there were substantial voices in Russia that were discontent with the existing ABM treaty. It is also interesting to note that despite official protests from Russia against the U.S. decision to abandon the ABM Treaty, Putin's initial response was rather muted. Additionally, during the Obama administration, despite GMD, new and substantial arms control agreements with Russia like New START were signed. Despite both sides having accused each other of violating the INF Treaty prior to its subsequent dissolution, the treaty did not include ICBMs for which GMD was designed to defend against. The INF Treaty is not related to GMD and U.S. homeland defense, but is more of a concern for NATO and Europe. Other factors for the current state of affairs between the U.S. and Russia have to be considered in the context of global instability. Geopolitical tension arising from the Russian invasion of Georgia in 2008, its annexation of Crimea, its policies in Ukraine, and the engagement in Syria play a major role in the decline of Russia's relationship with the United States. GMD has been often cited as the reason for the deterioration of arms control measures and for the current state of relations between the U.S. and Russia. However, these allegations arise mostly out of Russia. This may be due to Russia perceiving GMD as a threat to its security, as often stated by Russian leadership. In assessing security threats, Russia seems to mistrust U.S. intentions. Russia's actions are presented in accordance with the balance of threat theory as counterbalancing measures to a U.S. threat, originating with the introduction of GMD. This perceived threat by the Russian government may be real, although the GMD system in its current form does not pose an actual threat to Russia. Vladimir Putin himself has previously stated that GMD does not pose a threat to Russia, negating the balance of threat theory, but validating the balance of power theory [63]. The Russian leadership, as well as the Chinese to a lesser extent, has used GMD as a successful propaganda tool and justification for their policies. Russia's aggressive behavior in Europe and its development of new offensive weaponry have all been justified directly or indirectly as necessary measures and reaction to the U.S. missile defense shield and the supposed threat it poses to Russia. Despite frequently criticizing the United States and its allies for developing and fielding missile defense systems, potential U.S. adversaries themselves have long made substantial investments in their own missile defense systems and capabilities.

More research about Russia's rearmament, its military modernization, and its foreign policies as a reaction to the U.S. missile defense shield needs to be conducted to determine if Russia essentially overestimates U.S. missile defense capabilities or is using the GMD system as a propaganda tool to justify its actions. Despite officially stated Russian and Chinese perceptions of a threat to the balance of power due to GMD, the current state of GMD and the missile inventories of both countries do not support this claim. GMD was originally designed and fielded to counter an ongoing and rapid, but limited, North Korean missile program that was believed to one day achieve ICBM capability to reach the U.S. mainland. In this respect, the fielding of GMD proved to be far-sighted, although its effectiveness and cost may be arguable. It is very likely that, in the case of the limited ICBM threat from North Korea, the development of GMD actually enhanced global security. In a scenario in which North Korea would have attained nuclear ICBM capability without the U.S. having the ability to intercept such an ICBM with the GMD system, it is very likely that the United States would have believed it necessary to preemptively militarily strike North Korea. It is hardly conceivable the United States would have tolerated a nuclear armed, ICBM-capable North Korea. This may very well have resulted in a war on the Korean peninsula. Overall, however, there is not enough evidence or correlation that the GMD system has directly contributed to less global security.

ACKNOWLEDGMENT

Michael A. Unbehauen, Gregory D. Sloan, and Alberto J. Squatrito thank WASET for the opportunity to discuss important missile defense issues of today in a professional forum. The authors additionally thank Acamar Analysis and

Consulting for its expertise and research in contribution to this study.

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