



MISSILE DEFENSE REVIEW



2019



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OFFICE OF THE SECRETARY OF DEFENSE

EXECUTIVE SUMMARY

I. Introduction

The 2017 *National Security Strategy* (NSS) states, “Our fundamental responsibility is to protect the American people, the homeland, and the American way of life.” Missile defense is an essential component of U.S. national security and defense strategies. It contributes to the deterrence of adversary aggression and the assurance of allies and partners. It also strengthens U.S. diplomacy, protects against missile attacks to limit damage, supports U.S. military operations if deterrence fails, hedges against future uncertainties and risks, and helps to preserve U.S. and allied freedom of action to meet and defeat regional adversary aggression.

This 2019 *Missile Defense Review* (MDR) is consistent with the 2017 NSS, the 2018 *National Defense Strategy* (NDS), and the 2018 *Nuclear Posture Review* (NPR). It describes the policies, strategies, and capabilities that will guide the Department of Defense (DoD) missile defense programs to counter the expanding missile threats posed by rogue states and revisionist powers to us, our allies, and partners, including ballistic and cruise missiles, and hypersonic vehicles. It recognizes and highlights the important changes that have taken place in the security environment since the previous 2010 *Ballistic Missile Defense Review* was conducted, as well as the considerable uncertainties about the future threat environment.

This 2019 MDR is based on recognition that the threat environment is markedly more dangerous than in years past and demands a concerted U.S. effort to improve existing capabilities for both homeland and regional missile defense. This effort will include a vigorous science and technology research program in addition to the exploration of innovative concepts and advanced technologies that have the potential to provide more cost-effective U.S. defenses against expanding missile threats.

This 2019 MDR also emphasizes that the missile threat environment now calls for a comprehensive approach to missile defense against rogue state and regional missile threats. This approach integrates offensive and defensive capabilities for deterrence, and includes active defense to intercept missiles in all phases of flight after launch, passive defense to mitigate the effects of missile attack, and attack operations during a conflict to neutralize offensive missile threats prior to launch.

II. The Evolving Threat Environment

The 2018 NDS emphasizes that today’s security environment is “more complex and volatile than any we have experienced in recent memory.” Potential adversaries are investing substantially in their missile capabilities. They are expanding their missile capabilities in three

different directions simultaneously: increasing the capabilities of their existing missile systems; adding new and unprecedented types of missile capabilities to their arsenals; and, integrating offensive missiles ever more thoroughly into their coercive threats, military exercises, and war planning.

New ballistic missile systems feature multiple independently targetable reentry vehicles (MIRV) and maneuverable reentry vehicles (MaRV), along with decoys and jamming devices. Russia and China are developing advanced cruise missiles and hypersonic missile capabilities that can travel at exceptional speeds with unpredictable flight paths that challenge existing defensive systems. These are challenging realities of the emerging missile threat environment that U.S. missile defense policy, strategy, and capabilities must address.

Current and Emerging Missile Threats to the American Homeland

North Korea. While a possible new avenue to peace now exists with North Korea, it continues to pose an extraordinary threat and the United States must remain vigilant. In the past, North Korea frequently issued explicit nuclear missile threats against the United States and allies, all the while working aggressively to field the capability to strike the U.S. homeland with nuclear-armed ballistic missiles. Over the past decade, it has invested considerable resources in its nuclear and ballistic missile programs, and undertaken extensive nuclear and missile testing in order to realize the capability to threaten the U.S. homeland with missile attack. As a result, North Korea has neared the time when it could credibly do so.

Iran. Iran views U.S. influence in the Middle East as the foremost barrier to its goal of becoming the dominant power in that region. One of Iran's primary tools of coercion and force projection is its missile arsenal, which is characterized by increasing numbers, as well as increases in accuracy, range, and lethality. Iran has the largest ballistic missile force in the Middle East and continues the development of technologies applicable to intercontinental-range missiles capable of threatening the United States. Its desire to have a strategic counter to the United States could drive it to field an ICBM, and progress in its space program could shorten the pathway to an ICBM.

Russia. Russia considers the United States and the North Atlantic Treaty Organization (NATO) to be the principal threat to its contemporary revisionist geopolitical ambitions and routinely conducts exercises involving simulated nuclear strikes against the U.S. homeland. Russian strategy and doctrine emphasize the coercive and potential military uses of nuclear weapons, particularly including nuclear-armed, offensive missiles, and has sought to enable this strategy through a comprehensive modernization of its strategic and theater missile arsenals. As counted under the 2010 New START Treaty, Russia is permitted a total of 700 deployed ICBMs, sea-launched ballistic missiles (SLBM), and heavy bombers, and 1,550 deployed strategic nuclear warheads. Russian leaders also claim that Russia possesses a new class of missile, the hypersonic glide vehicles (HGV), which maneuver and typically travel at velocities greater than Mach 5 in or just above the atmosphere.

China. China seeks to displace the United States in the Indo-Pacific region and reorder the region to its advantage. Offensive missiles play an increasingly prominent role in China's military modernization, its coercive threats, and efforts to counter U.S. military capabilities in the Indo-Pacific. It has deployed 75-100 ICBMs, including a new road-mobile system and a new multi-warhead version of its silo-based ICBM. Beijing also now possesses 4 advanced JIN-class ballistic missile submarines (SSBN), each capable of carrying 12 new submarine-launched ballistic missiles (SLBM), the CSS-N-14. Consequently, China can now potentially threaten the United States with about 125 nuclear missiles, some capable of employing multiple warheads, and its nuclear forces will increase in the coming years. Beijing also is developing advanced technologies, such as MaRVs and HGVs.

While the United States relies on deterrence to protect against large and technically sophisticated Russian and Chinese intercontinental ballistic missile threats to the U.S. homeland, U.S. active missile defense can and must outpace existing and potential rogue state offensive missile capabilities. To do so, the United States will pursue advanced missile defense concepts and technologies for homeland defense.

Missile Threats to U.S. Forces Abroad, Allies, and Partners

Potential adversaries are also fielding an increasingly diverse, expansive, and modern range of regional offensive missile systems that can threaten U.S. forces abroad, allies, and partners. These include multiple types of short-, medium-, and intermediate-range missiles intended to provide coercive political and military advantages in regional crises or conflict. Expanding and modernizing U.S. regional missile defenses is an imperative to meet these ongoing adversary advancements in their regional offensive missile systems.

North Korea. Over the past decade, North Korea accelerated its efforts to field missiles capable of threatening deployed U.S. forces, allies, and partners in the region. Since 2015, North Korea test-launched, from numerous locations throughout North Korea, over two dozen regional missiles. It has fielded more regional missiles and diversified its already large regional ballistic missile force, including delivery systems with road-mobile and submarine launching platforms.

These wide-ranging North Korean offensive missile systems have given North Korea the capability to strike U.S. territories, including Guam, U.S. forces abroad, and allies in the Pacific Ocean. They are the tools North Korea has used to issue coercive nuclear preemptive threats, and potentially could use to employ nuclear weapons in the event of conflict in Asia.

Iran. Iran continues to develop more sophisticated missiles with improved accuracy, range, and lethality. It fields an array of increasingly accurate short- and medium-range ballistic missile systems capable of threatening deployed U.S. forces, allies, and partners. Iran's medium-range systems can threaten targets from Eastern Europe to South Asia, and Iran has transferred missile systems to terrorist organizations, which in turn have used Iranian-supplied

missiles against U.S. Middle East allies and partners. It has also flight-tested a short-range ballistic missile (SRBM) in an anti-ship role that can threaten U.S. and allied naval vessels in the Arabian Gulf and Strait of Hormuz, and has displayed a land-attack cruise missile (LACM) that has a claimed range of 2000 kilometers (km).

Russia. Moscow is fielding an increasingly advanced and diverse range of nuclear-capable regional offensive missile systems, including missiles with unprecedented characteristics of altitude, speed, propulsion type, and range. These missile systems are a critical enabler of Russia's coercive escalation strategy and nuclear threats to U.S. allies and partners. It is developing a new generation of advanced regional ballistic and cruise missiles that support its anti-access/area denial (A2/AD) strategy intended to defeat U.S. and allied will and capability in regional crises or conflicts. Since 2015, Russia has demonstrated its advanced cruise missile capability by repeatedly conducting long-range precision strikes into Syria, and has fielded a ground-launched, intermediate-range cruise missile, the SSC-8, in violation of the Intermediate-Range Nuclear Forces (INF) Treaty.

China. China is also developing missile capabilities intended to deny the United States the capability and freedom of action to protect U.S. allies and partners in Asia. A key component of China's military modernization is its conventional ballistic missile arsenal designed to prevent U.S. military access to support regional allies and partners. China is improving its ability to strike regional targets, such as U.S. bases and naval assets, at greater ranges with the addition of the growing number of medium- and intermediate-range ballistic missiles. This includes sophisticated anti-ship ballistic missiles that pose a direct threat to U.S. aircraft carriers.

China also has ground- and air-launched LACMs, and is developing HGVs and new MaRVs. These and other wide-ranging developments in China's expansive offensive missile arsenal pose a potential nuclear and non-nuclear threat to U.S. forces deployed abroad, and are of acute concern to U.S. allies and partners in the Indo-Pacific region.

Potential Adversary Missile Defense and Antisatellite (ASAT) Advancements

Despite frequently criticizing the United States and allies for developing and fielding missile defense systems, potential adversaries have long made substantial investments in their own missile defense systems. Russia and China are also developing ASAT capabilities that could threaten U.S. space-based assets.

For example, Russia maintains and modernizes its longstanding strategic missile defense system deployed around Moscow, including 68 nuclear-armed interceptors, and has fielded multiple types of shorter-range, mobile missile defense systems throughout Russia. In addition, Russia is developing a diverse suite of ground-launched and directed-energy ASAT capabilities, and continues to launch "experimental" satellites that conduct sophisticated on-orbit activities to advance Russian counterspace capabilities.

China is aggressively pursuing a wide range of mobile air and missile defense capabilities, including the purchase of S-400 systems from Russia, each with four interceptor missiles, and is developing additional theater ballistic missile defense systems. China also has announced that it is testing a new mid-course missile defense system. Further, China is developing a suite of antisatellite weapons, continues to launch “experimental” satellites that conduct sophisticated on-orbit activities to advance counterspace capabilities, and has conducted multiple ASAT tests using ground-launched missiles.

North Korea has acquired Russian missile defense technology and is developing its own mobile missile defense capabilities, specifically, a mobile air and missile defense system. While indigenously produced, its interceptors and radar system share similarities with Russian systems.

Russia has been instrumental in Iran’s development of a mobile air and missile defense capability. In 2016 Russia delivered 16 S-300 launch vehicles to Iran, each armed with four interceptors. Iran also is developing its own missile defense system, the Bavar 373, to provide additional missile defense capability.

III. Roles, Policy, and Strategy

Diverse Roles of Missile Defense

The diverse roles of missile defense advance the national strategy and goals articulated in the 2017 NSS, 2018 NDS, and 2018 NPR:

The protection of the U.S. homeland, forces abroad, allies, and partners. If potential adversaries miscalculate and deterrence fails, missile defense limits the number of adversary missile warheads that strike their targets. This is critical to defending the territorial integrity of the United States, saving lives, limiting damage to critical infrastructure, and enabling operational success in regional conflict. Today’s U.S. missile defenses provide significant protection against potential North Korean or Iranian ballistic missile strikes against the U.S. homeland, and will improve as necessary to stay ahead of missile threats from rogue states.

The deterrence of attacks against the United States, allies, and partners. Missile defense contributes directly to tailored U.S. deterrence strategies for regional missile threats and for rogue state ICBM threats to the U.S. homeland. Missile defenses can undermine potential adversaries’ confidence in their ability to achieve their intended political or military objectives through missile threats or attacks. An adversary’s uncertainty regarding the effectiveness of its attack plans, combined with the prospect of an effective U.S. response to aggression, provide strong incentives for adversary restraint if ever contemplating missile attacks. By shaping an adversary’s decision calculus in this way, missile defense diminishes the perceived value of missiles as tools of coercion and aggression, thus contributing to deterrence. Missile defense

also provides additional time and options for U.S. leaders when considering their options for responding to aggression, and thus contribute to the U.S. ability to respond to and stabilize crises or conflicts.

The assurance of allies. Missile defense plays an increasingly important role in assuring allies and partners, and reinforcing the indivisibility of U.S. and allied security. It does so by helping to protect allied territory, strengthening U.S. military operations in support of allies and partners abroad, and, by helping to counter adversary strategies attempting to coerce the United States, allies and partners with missile threats. U.S. missile defense deployments and cooperative missile defense activities strengthen relations with allies and partners and reduce their vulnerability to coercive threats and attacks. They also provide opportunities for cooperative allied burden-sharing and defense collaboration.

Strengthening U.S. diplomatic efforts in peacetime and crises. The United States is committed to diplomatic efforts that advance U.S., allied, and partner security. Missile defenses provide U.S. leaders a position of strength from which to engage potential adversaries diplomatically in peacetime or crises. This was important in the past, and likely will be so in the future.

The United States also is committed to non-proliferation. Rogue states seek to develop missile delivery systems through illicit procurement pathways for the acquisition of critical technologies and components, often in violation of United Nations Security Council resolutions. The proliferation challenge posed by potential adversaries may worsen in the future and lead to diverse unanticipated missile threats to the United States, allies, and partners.

As U.S. missile defense capabilities improve to stay ahead of missile threats, they may also help dissuade missile proliferation among potential adversaries by reducing the political and military value of their missiles. And, by supporting the credibility of U.S. assurance commitments, missile defense can contribute to U.S. nonproliferation goals by assuring allies and partners of their security in the absence of their own independent nuclear capabilities.

Missile Defenses are Stabilizing. Missile defense capabilities provide the U.S., allies, and partners the ability to prevent or limit damage from an adversary offensive missile strike. They provide an additional option to offensive strikes to prevent damage to the United States, deployed forces, allies, and partners.

Hedging against future risks. The pace and scale of proliferation and future missile threats is uncertain. U.S. missile defense capabilities and planning must take into account the potential for continuing missile proliferation among potential adversaries, including the proliferation of advanced missile capabilities. Hedging strategies incorporating missile defense help reduce risk and mitigate offensive missile threats that emerge over time, both geopolitical and technical. The U.S. capacity to hedge contributes to deterrence and to the U.S. diplomatic position of strength by helping to reduce potential adversary confidence of a political or military advantage via an expansion or even “breakout” of its missile capabilities. This hedging

against possible future missile threats also contributes to the assurance of allies and partners by strengthening their confidence that U.S. missile defense capabilities will not be overtaken by adversary offensive threat developments.

Enabling Regional and Transregional Military Operations. Missile defense supports U.S. and coalition military operations across multiple regions. It helps preserve U.S. freedom of action by limiting adversary capabilities to inhibit or disrupt U.S. regional military operations abroad through missile attacks on U.S. forward deployed forces, allies, or critical in-theater infrastructure. Indeed, missile defense is an element of the U.S. capability to counter A2/AD strategies that seek to deter or prevent the United States from supporting allies in contested regions. This role for missile defense also provides critical support for the deterrence of attacks and the assurance of allies and partners.

Principles Governing U.S. Missile Defense

U.S. Homeland Missile Defense Will Stay Ahead of Rogue States' Missile Threats. It is imperative that U.S. missile defense capabilities provide effective, continuing protection against rogue state missile threats to the homeland, now and into the future. The United States is technically capable of doing so, and has adopted an active missile defense force-sizing measure for protection of the homeland. DoD will develop, acquire, and maintain the U.S. homeland missile defense capabilities necessary to effectively protect against possible missile attacks on the homeland posed by the long-range missile arsenals of rogue states, defined today as North Korea and Iran, and to support the other missile defense roles identified in this 2019 MDR.

This force-sizing measure for active U.S. missile defense will require the examination and possible fielding of advanced technologies to provide greater efficiencies for U.S. active missile defense capabilities, including space-based sensors and boost-phase defense capabilities. It calls for a missile defense architecture that can adapt to emerging and unanticipated threats, including by adding capacity and the capability to surge missile defense as necessary in times of crisis or conflict.

Consequently, the United States will not accept any limitation or constraint on the development or deployment of missile defense capabilities needed to protect the homeland against rogue missile threats. Accepting limits now could constrain or preclude missile defense technologies and options necessary in the future to effectively protect the American people.

U.S. missile defense capabilities will be sized to provide continuing effective protection of the U.S. homeland against rogue states' offensive missile threats. The United States relies on nuclear deterrence to address the large and more sophisticated Russian and Chinese intercontinental ballistic missile capabilities, as well as to deter attacks from any source consistent with long-standing U.S. declaratory policy as re-affirmed in the 2018 NPR.

Missile Defense Will Defend U.S. Forces Deployed Abroad and Support the Security of Allies and Partners. Defending U.S. forces abroad, allies, and partners, and helping them better defend themselves against the full range of regional missile threats is a vital element of U.S. regional security strategy in Europe, Asia, and the Middle East. The United States will strengthen regional missile defense capabilities and cooperative relationships with allies and partners on a broad range of missile defense activities, and encourage additional allied investments in missile defense, including co-development and co-production efforts to better share the burden of common defense. The United States will not accept any limitations on the development or deployment of missile defense capabilities.

The United States Will Pursue New Concepts and Technologies. Modernization and innovation are critical to ensure the continuing effectiveness of missile defenses. The United States will invest in advanced technologies to meet the increasingly complex threats posed by larger missile inventories and improved countermeasures. Successful science and technology initiatives may lead to operational prototypes that will be evaluated outside the standard acquisition process in order to develop successful technologies more quickly, while also ensuring that unsuccessful efforts are avoided before consuming scarce funding.

Elements of Missile Defense Strategy

Comprehensive Missile Defense Capabilities. Effective deterrence is the preferred strategy to prevent missile attack. However, a broader approach is required to address the increasingly complex missile threat environment. The United States will field, maintain, and integrate three different means of missile defense to identify and exploit every practical opportunity to detect, disrupt, and destroy a threatening missile prior to and after its launch. These include: first, active missile defense to intercept adversary missiles in all phases of flight; second, passive defense to mitigate the potential effects of offensive missiles; and third, if deterrence fails, attack operations to defeat offensive missiles prior to launch.

This multi-layered approach to preventing and defeating missile attacks will move the United States towards a more flexible and balanced overall defense posture that provides the broadest set of options in a crisis or conflict and improves the overall likelihood of countering offensive missile attacks successfully. To do so, the United States will integrate active missile defenses with intelligence, surveillance, and reconnaissance (ISR) and strike capabilities to counter regional offensive missile threats and rogue missile threats to the homeland.

Flexibility and Adaptability. With more than 20 states possessing offensive missile technology, and many expanding and modernizing their capabilities, it is clear that future adversary offensive missile threats and U.S. defensive goals will be diverse and dynamic. Flexibility and adaptability will enable the United States to tailor its missile defense strategy to potential adversaries to deny them the benefits they seek from offensive missile threats or employment. Consistent with an emphasis of the 2018 NDS, this MDR emphasizes the need for flexibility and adaptability in U.S. missile defense design, research, and acquisition programs. Because

the U.S. missile defense posture must be capable of being flexibly deployable and adaptable to meet future threats as they emerge, DoD will continue to seek ways to shorten the time required to develop and field responsive missile defense systems.

Tighter Offense-Defense Integration and Interoperability. The United States must maintain the ability to deploy rapidly and sustain its operational plans in an A2/AD environment in which adversaries seek to use ballistic and cruise missiles to coerce both in peacetime and crisis, and to overwhelm U.S. forces in the event of conflict. Integrated missile defense plans, force management, and operations support will emphasize global coordination and enable engagement from the best interceptor using the best sensor data. Toward that end, it is necessary to pursue more integrated approaches to the missile defense mission that leverage the full range of assets available.

The United States will pursue greater integration of attack operations with active and passive missile defenses, and homeland and regional missile defense assets. In addition, as allied and partner missile defense capabilities grow in size and sophistication, a strong commitment to interoperability will maximize their contribution to the missile defense mission and enable a more effective collective response to missile attacks.

Importance of Space. The exploitation of space provides a missile defense posture that is more effective, resilient and adaptable to known and unanticipated threats. Space-based sensors, for example, can monitor, detect and track missile launches from locations almost anywhere on the globe – they enjoy a measure of flexibility of movement that is unimpeded by the constraints that geographic limitations impose on terrestrial sensors, and can provide “birth to death” tracking that is extremely advantageous.

As rogue state missile arsenals develop, the space-basing of interceptors may provide the opportunity to engage offensive missiles in their most vulnerable initial boost phase of flight, before they can deploy various countermeasures. Space-basing may increase the overall likelihood of successfully intercepting offensive missiles, reduce the number of U.S. defensive interceptors required to do so, and potentially destroy offensive missiles over the attacker’s territory rather than the targeted state. DoD will undertake a new and near-term examination of the concepts and technology for space-based defenses to assess the technological and operational potential of space-basing in the evolving security environment.

IV. U.S. Missile Defense Programs and Capabilities

The Ballistic Missile Defense System (BMDS) provides active defense of the U.S. homeland and deployed forces, allies, and partners. The BMDS is an integrated, layered ballistic missile defense architecture that provides multiple opportunities to destroy missiles and their warheads before they can reach their targets. The architecture includes land-, sea-, and space-based elements to track, target, and destroy offensive ballistic missiles of different ranges,

speeds, and sizes after their launch. Some elements of the BMDS also have capabilities to defend against cruise missiles.

The United States will develop innovative approaches and new technologies that stay ahead of the rapid advances in rogue states' offensive missile threats to the U.S. homeland and provide the needed defense against regional missile threats. To do so, DoD will increase investments in and deploy new technologies and concepts, and adapt existing weapons systems to field new capabilities rapidly at lower cost. In addition, DoD will leverage investments in existing defensive systems and the knowledge gained from prior missile defense research and development to expand U.S. defensive capabilities to new domains, achieve greater integration, and strengthen U.S. capabilities for attack operations to destroy offensive missiles prior to their launch.

U.S. Homeland Defense

Defending the U.S. homeland against missile attack helps to deter adversaries, assure allies and partners, and provide U.S. leaders with a position of strength to engage adversaries and project power in support of national objectives. The United States is protected against a limited ICBM attack as a result of investments made in the Ground-Based, Mid-Course Defense (GMD) system. The GMD system is designed to defend against the existing and potential ICBM threat from rogue states such as North Korea and Iran, but in the event of conflict, it would defend, to the extent feasible, against a ballistic missile attack upon the U.S. homeland from any source.

The GMD system engages adversary long-range ballistic missiles in the mid-course phase of flight using Ground-Based Interceptors (GBI). GBIs destroy attacking missiles by striking them at high speeds with a kinetic kill vehicle. Forty GBIs are deployed at Ft. Greely, Alaska, and four at Vandenberg Air Force Base, California.

DoD is investing in the expansion and modernization of current U.S. homeland missile defense capabilities to help counter advanced offensive missile threats for the next decade. This decision is in line with Congressional intent as expressed in the 2017 National Defense Authorization Act that we will “maintain and improve an effective, robust layered missile defense system capable of defending the territory of the United States, allies, deployed forces, and capabilities against the developing and increasingly complex ballistic missile threat.” We are now improving the reliability and lethality of current missile defense forces and enhancing the ability of U.S. active missile defenses to track, target, and destroy adversary offensive missiles with greater precision. These efforts and priorities are reflected in the Administration's recent budget requests and actions. For example, Congress appropriated approximately \$15.3 billion in FY18 for homeland and regional missile defense, including an emergency appropriation of \$4 billion to further expand and enhance U.S. missile defense capabilities against North Korean missile threats to the U.S. homeland, forces abroad, allies, and partners.

DoD programs to improve the capability and reliability of the GMD system include equipping recently-deployed GBIs with an advanced booster and a more capable Exoatmospheric Kill Vehicle (EKV). DoD is also building a new GBI interceptor field in Ft. Greely, Alaska, and will increase the number of deployed GBIs from 44 to 64 beginning as early as 2023, and is strengthening the performance of existing missile defense sensors and fielding new sensors for even greater discrimination capability. Taken together, these enhancements will result in improved performance, reliability, and lethality against offensive ballistic missile threats to the U.S. homeland.

More complex offensive missile threats to the homeland, such as HGV and advanced cruise missiles, are on the horizon. DoD is enhancing ways to collect and process information from existing space-based and terrestrial sensors to track current and emerging cruise missile and HGV threats. Enhancing our ability to track these emerging threats will make defending against cruise missile and HGV threats possible.

The North American Aerospace Defense Command (NORAD) is a combined Command of the United States and Canada that provides aerospace warning and protection for North America. It is pursuing a three-phase plan to improve the defense against cruise missiles for the United States and Canada. In addition, NORAD and the U.S. Air Force are upgrading aircraft that monitor the U.S. airspace with new sensors capable of tracking and targeting challenging offensive air threats like advanced cruise missiles.

Regional and Transregional Missile Defense

Potential adversaries continue to expand the capability and capacity of their regional offensive missile inventories. The United States will strengthen its efforts to deter and counter them. The global offensive missile threat environment represents a sea-change in the operational setting that U.S. forces will have to navigate in future regional conflicts. The United States and allies can no longer assume the capacity to concentrate forces in secure, forward locations and launch military operations against adversaries from these secure locations. Defending effectively against offensive missile threats will help deter adversaries, assure allies and partners, preserve U.S. and allied freedom of action, limit the potential for coercive adversary missile threats, and reduce the effects of potential adversary regional missile strikes.

Strengthening U.S. regional defenses in this environment is not only an *active* missile defense challenge. Given the large inventory of adversary regional missiles relative to our more limited inventory of active defenses, the United States will leverage investments in platforms, weapons, and military expertise to develop complementary attack operations. U.S. Combatant Commanders will plan and conduct active missile defense and attack operations as an overall joint campaign employing the full range of U.S. capabilities. In addition, the United States will seek to integrate U.S., allied, and partner capabilities for active missile defense and, as appropriate, attack operations capable of striking the entire range of infrastructure supporting adversary offensive missile operations.

Regional Active Defenses

The United States continues to make significant progress in the development, deployment, and modernization of regional active missile defense capabilities. DoD currently fields a number of regional active defense systems to intercept potential adversary regional offensive missiles, including mobile sensors and interceptors that can be surged to zones of crisis or conflict and, if they are interoperable with allied and partner assets, can support combined defensive operations. The regional missile defense posture is increasingly flexible and adaptable to meet evolving threats and new classes of offensive missiles as they emerge, including advanced, extended-range cruise missiles and HGVs.

Terminal High Altitude Area Defense (THAAD): The THAAD system engages short-, medium-, and intermediate-range ballistic missiles using hit-to-kill technologies. At this time, the United States possesses seven THAAD batteries, including one in Guam and one in the Republic of Korea (ROK). DoD is continuing to develop software upgrades for THAAD to provide advanced capability against emerging threats. These activities will enable the expansion of both THAAD system interoperability with air and missile defense systems and its defended area against future threats.

Aegis Sea-based Missile Defense: The Aegis Weapon System for active missile defense provides protection at sea and ashore against regional ballistic missiles. The United States is testing improved variants of both the Aegis SM-3 and SM-6 missiles, and fielding a new sensor, to significantly increase Aegis missile defense capabilities. Multi-mission Aegis BMD-capable ships are highly maneuverable and survivable, and will be surged as needed during crisis and conflict. The combination of increased ship numbers and capability will result in a more flexible and resilient Aegis force with significantly greater missile defense capability.

Aegis Ashore: The Aegis Ashore is the land-based version of the Aegis Weapon System and is operated by the U.S. Navy as part of the European Phased Adaptive Approach (EPAA). An Aegis Ashore site in Romania is operational, armed with the SM-3 interceptor, and provides continuous defense of European NATO territory against Middle East missile threats. It is currently operating under NATO command and control. An Aegis Ashore site in Poland is under construction and will become part of NATO ballistic missile defense upon completion. These Aegis Ashore sites will soon be equipped with the SM-3 Blk IIA, significantly strengthening their defense of NATO territory.

Patriot Advanced Capability-3 (PAC-3): The Patriot air and missile defense system has a proven combat record. It can launch several interceptor variants, and is now deployed with U.S., allied, and partner forces in multiple theaters to defend against SRBMs and cruise missiles. Since the initial deployment of Patriot in 1982, the United States has continuously improved the system.

Congress provided funding in FY17 and FY18 to procure additional Patriot, THAAD, and SM-3 interceptors. These missile procurements are part of an emergency funding request by the Administration to take immediate measures to protect the U.S. homeland, forces deployed abroad, allies, and partners. They are additive to the current program, and will increase the growing inventory of U.S. missile defense interceptors available in a crisis.

Preparing for Emerging Offensive Missile Threats and Uncertainties

DoD is taking steps consistent with the annual budget process to improve or adapt existing systems, relocate or surge mobile systems, and, build new systems, including some on a relatively short timeline. These steps advance the goals of staying ahead of rogue state offensive missile threats to the homeland, meeting the diverse range of regional offensive missile threats, and hedging against future threats. Developing and fielding the means to defend against emerging HGVs, for example, will be critical to address concern over the erosion of U.S. regional military advantages expressed in the 2018 NDS.

Improve or adapt existing systems. The SM-3 Blk IIA interceptor is intended as part of the regional missile defense architecture, but also has the potential to provide an important “underlay” to existing GBIs for added protection against ICBM threats to the U.S. homeland. This interceptor has the potential to offer an additional defensive capability to ease the burden on the GBI system and provide continuing protection for the U.S. homeland against rogue states’ long-range missile capabilities. The Missile Defense Agency (MDA) will test the SM-3 Blk IIA against an ICBM-class target in 2020.

Adapting existing capabilities to perform new missions for homeland and regional missile defense also will be necessary. For example, DoD’s newest tactical aircraft, the F-35 Lightning II, can track and destroy adversary cruise missiles today, and, in the future, can be equipped with a new or modified interceptor capable of shooting down adversary ballistic missiles in their boost phase. Another repurposing option is to operationalize, either temporarily or permanently, the Aegis Ashore Missile Defense Test Center in Kauai, Hawaii, to strengthen the defense of Hawaii against possible North Korean missile attack.

The Multi-Object Kill Vehicle (MOKV) is a next generation kinetic kill vehicle for the GBI designed to improve the ability to engage ICBM warheads, decoys, and countermeasures using a single defensive interceptor. While the number of GBIs is limited, MOKV could improve the performance of the GMD system by increasing the probability of successfully intercepting the warhead.

Relocating/surging mobile systems. DoD will surge missile defense capabilities promptly in a crisis or conflict, as needed, and ensure that doing so is featured in operational planning. For example, Patriot and THAAD systems, and multi-mission Aegis BMD-capable ships armed with the SM-3 Blk IIA interceptor will be moved into position quickly in a crisis to strengthen the defense of the homeland against rogue state missile threats. In the future, additional missile

defense capabilities, such as the F-35 and boost-phase defenses could also contribute to U.S. mobile capabilities to be surged as necessary in crisis or conflict.

Building new systems. The United States may decide to increase further the capacity of the GMD force beyond the currently planned force size of 64 GBIs. The missile base in Ft. Greely, Alaska, has the potential for up to an additional 40 interceptors. In addition, building a new GBI interceptor site in the continental United States would add interceptor capability against the potential expansion of missile threats to the homeland, including a future Iranian ICBM capability. The decision to do so, and site selection, will be informed by pertinent factors at the time, particularly emerging threat conditions.

Intercepting offensive missiles in their boost-phase would increase the likelihood of successfully countering missile threats, complicate an aggressor's attack calculus by reducing its confidence in its missile attack planning, and reduce the number of midcourse or terminal active defense interceptors needed to destroy the adversary's remaining offensive missiles.

Developing scalable, efficient, and compact high energy laser technology holds the potential to provide a future cost-effective capability to destroy boosting missiles in the early part of the trajectory. Doing so would leverage earlier technological advances, including for example advances in beam propagation and beam control. DoD is developing a Low-Power Laser Demonstrator to evaluate the technologies necessary for mounting a laser on an unmanned airborne platform to track and destroy missiles in their boost-phase.

Space-basing for sensors provides significant advantages. Such sensors take advantage of the large area viewable from space for improved tracking and potentially targeting of advanced threats, including HGVs and hypersonic cruise missiles.

The space-basing of interceptors also may provide significant advantages, particularly for boost-phase defense. As directed by Congress, DoD will identify the most promising technologies, and estimated schedule, cost, and personnel requirements for a possible space-based defensive layer that achieves an early operational capability for boost-phase defense.

Attack Operations for Missile Defense

If deterrence fails and conflict with a rogue state or within a region ensues, U.S. attack operations supporting missile defense will degrade, disrupt, or destroy an adversary's missiles before they are launched. Such operations are part of a comprehensive missile defense strategy and increase the effectiveness of active missile defenses by reducing the number of adversary missiles to be intercepted. DoD will invest in the capabilities necessary for attack operations, such as improved attack warning intelligence, ISR, time-sensitive targeting, as well as the long-range precision and air-, land-, and sea-strike capabilities necessary for destroying mobile missiles prior to their launch.

V. Missile Defense Management and Testing

In 2002, DoD directed MDA to use flexible acquisition approaches to develop capabilities quickly and directed the Services to field missile defense elements as soon as practicable. This decision to pursue missile defense systems on an accelerated timeline enabled the United States to field an initial operational homeland missile defense system by the fall of 2004, prior to North Korea's Taepodong-2 ICBM/SLV test in 2006.

Given the worsening missile threat environment, DoD must prioritize speed of delivery, continuous adaptation, and deliver enhanced performance at the speed of relevance. To do so, DoD must adopt processes and cultures that enable MDA and the Services to streamline and refine acquisition processes, ensure flexibility in the development, testing, and fielding of missile defense, and swiftly adapt systems once fielded. Services and Combatant Commanders should be involved early in the missile defense capability development process to identify needed system performance requirements and to establish the conditions and timeline for transferring the program from MDA to a Service. In addition, as transregional missile threats increase, missile defense planning will be global in nature and coordinated across geographic combatant commands.

DoD and MDA will pursue a rigorous test program that enables us to counter evolving offensive missile threats, to include increasing the frequency of test events given the speed of adversary innovation. Ground and flight tests provide data needed for highly advanced modeling and simulation activities that allows DoD to measure and predict the performance of all missile defense technologies. They provide learning opportunities to characterize and potentially optimize the performance of each element. Even tests that are not fully successful may be useful by providing valuable information to assess the performance of the system. We must not fear test failure, but learn from it and rapidly adjust.

VI. Working with Allies and Partners

The 2017 NSS emphasizes that strengthening our alliances and long-term security partnerships is a top U.S. priority. As offensive missile capabilities continue to proliferate, missile defense cooperation with allies and partners has gained increasing importance to advance missile defense architectures for our common protection, deterrence and assurance. This cooperation will leverage our joint contributions and focus on expanding opportunities for collaboration on missile defense programs; deepening interoperability in missile defense systems and operations; expanding burden sharing among the United States and its allies and partners; and limiting the proliferation of advanced offensive missile technologies and components.

Allied and Partner Interoperability

The United States will pursue enhanced missile defense cooperation with allies and partners, place a renewed emphasis on interoperability, and seek to integrate capabilities as appropriate. Successfully operating in today's complex missile threat environment demands that we detect launches as soon as possible, track them, and intercept them as early in flight as feasible. This requires interoperability among various missile defense capabilities to include command and control networks, sensors, and Integrated Air and Missile Defense (IAMD) systems. Moving towards networks of interoperable IAMD systems can take advantage of cost-sharing and help distribute the burden of common defense to better address adversary A2/AD strategies.

For our common defense, DoD will encourage allies and partners to invest in their own air and missile defense capabilities that are interoperable with U.S. capabilities. DoD will also prioritize requests for U.S. military equipment sales, accelerating foreign partner modernization and the ability to integrate with U.S. forces. The United States has already taken steps to streamline procedures for our allies and partners to acquire U.S. defense capabilities.

Indo-Pacific

The cornerstone of our security and diplomacy in the Indo-Pacific region is our strong bilateral alliances with Japan, South Korea, and Australia, and emerging security relationships with others such as India. Japan and South Korea are each working with the United States to build missile defense systems that are increasingly interoperable with U.S. defenses and increasingly capable against regional offensive missile threats and coercion. This cooperation includes bilateral missile defense training exercises with the United States. Australia participates in a trilateral discussion on missile defense with the United States and Japan. The United States and Australia meet annually to discuss bilateral missile defense cooperation. New areas of focus include joint examination of the challenges posed by advanced missile threats.

Europe and NATO

Missile defense plays a critical role in the NATO Alliance's defense of Europe from coercion and aggression. Interoperable NATO active missile defense systems will improve the Alliance's collective defense capabilities. The United States is committed to completing the deployment of EPAA, which is the U.S. contribution to NATO ballistic missile defense and will expand defensive coverage against medium- and intermediate-range ballistic missile threats from the Middle East.

In addition to these EPAA capabilities against medium- and intermediate-range threats, individual NATO Allies are also fielding national air and missile defense systems designed to defend against shorter-range ballistic and cruise missiles. These allied active defenses will play a crucial role in countering missile strikes that underpin potential adversaries' A2/AD

operations. The Alliance is also making progress towards enhanced missile defense interoperability among national systems and integration of missile warning to support combined missile defense operations. A “deepening of interoperability” will enable the Alliance’s forces to act together more coherently and effectively to counter missile strikes.

The Middle East – Gulf Cooperation Council

The United States is working closely with Gulf Cooperation Council (GCC) partners to encourage them to acquire and deploy missile defense capabilities that, when integrated over time, would provide the basis for a networked, layered defense across the region. U.S. Central Command maintains a series of regular engagements with GCC air and missile defense forces. These important exchanges are establishing the foundation for joint missile defense planning and operational cooperation.

The Middle East – Israel

The United States will sustain its strong missile defense partnership with Israel, underpinned by a new U.S.-Israel Memorandum of Understanding (MOU) that includes a commitment of \$500 million for Israeli missile defense each year beginning in Fiscal Year (FY) 2019 through FY 2028. Under this MOU, DoD will sustain extensive cooperation with Israel, and seek increased opportunities to take advantage of Israeli research and development efforts for similar U.S. defense missions.

South Asia

A number of states in South Asia are developing an advanced and diverse range of ballistic and cruise missile capabilities. Within this context, the United States has discussed potential missile defense cooperation with India. This is a natural outgrowth of India’s status as a Major Defense Partner and key element of our Indo-Pacific Strategy.

North America

Since NORAD’s establishment in 1958, significant progress has been made toward countering evolving air and missile threats to the United States and Canada. NORAD routinely maintains forces on alert for homeland air defense, including cruise missile defense. The United States will continue to work with Canada to modernize NORAD’s ability to counter cruise missile threats and detect, track, warn and defend against advanced missile threats. The United States and Canada are conducting a joint examination of options to renew or replace the North Warning System, a bilateral integrated network, and adapt this capability to new threats.

VII. Conclusion

For the past 17 years, the United States has devoted significant effort to developing and deploying a layered missile defense system. These efforts have enabled the continued improvement in U.S., allied, and partner missile defense performance and affordability. With further planned investments, these improvements will continue well into the future.

This 2019 MDR establishes a policy framework for U.S. missile defense that is responsive to new threats and exploits new approaches to the defensive mission. It adopts a balanced and integrated approach to countering missile threats through a combination of deterrence, active and passive missile defenses, and attack operations. This framework emphasizes the priority of protection for the American homeland against emerging and future rogue states' missile threats, in addition to robust regional missile defense for U.S. forces abroad, allies, and partners against all potential adversaries.

Moving forward, the United States, allies, and partners will pursue a comprehensive missile defense strategy that will deliver integrated and effective capabilities to counter ballistic, cruise, and hypersonic missile threats. Doing so will sustain and strengthen our capabilities to protect the homeland, deter adversaries, protect and assure allies and partners, and hedge against future threats in all domains. It will also help enable the United States to project power into contested environments in support of allies and partners and provide U.S. leaders with a position of strength in their diplomatic engagements to reduce tensions and limit security challenges.

The U.S. BMDS must be continuously strengthened and expanded given the growing challenges posed by potential adversaries, particularly rogue states, who are contesting the established international order and deploying greater numbers of increasingly sophisticated offensive missiles. The men and women of the Defense Department and our Armed Forces stand ready to meet this challenge, both today and in the future.

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