



# MISSILE DEFENSE REVIEW



2019

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# 2019 MISSILE DEFENSE REVIEW

OFFICE OF THE SECRETARY OF DEFENSE





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# SECRETARY'S PREFACE

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Over the course of the past half-century, the armed services of the United States have made material contributions to international stability and global prosperity. While the costs and burden of that role were not insignificant, the benefits in terms of peace and prosperity have been enormous, both for ourselves and all who share our values and ideals.

Yet, we must remind ourselves that our technological advantages can be fleeting. Military superiority is not a birthright granted to us; it is the product of diligence, creativity, and sustained investment. We must now apply the same level of effort and ingenuity to pass on to future generations the same relative security and military advantages that have been the bedrock of peace and prosperity.

The 2018 *National Defense Strategy* (NDS) states that the Defense Department's "enduring mission is to provide combat-credible military forces needed to deter war and protect the security of our nation." This 2019 *Missile Defense Review* (MDR) is fully aligned with the NDS. It was conducted pursuant to public law and executed in order to support the clear national interests defined by the President in the 2017 *National Security Strategy*.

The 2019 MDR sets the guidelines for the Department-wide effort to strengthen the defense of our homeland and the Joint Force's posture. It presents the policies, strategies, and capabilities that will guide the Department's missile defense initiatives and programs over the coming decade to enhance the protection of the American people, defend our sovereignty, and meet our international obligations and commitments to our allies and partners. We must anticipate the evolution of adversary offensive missile capabilities, and develop and field the U.S. missile defenses that fit the needs of this era.

As noted in the 2018 NDS, sharpening the competitive edge of our Joint Force is a must. By this I mean enabling our force to deploy and employ in the face of the developing missile threat. This requires thinking creatively and acting with greater urgency. We will generate innovative solutions that expand the competitive space, and create vulnerability gaps and dilemmas for future adversaries. In the face of rising competition, we must proactively work to better defend the homeland, and enhance deterrence to adapt to the needs of this era. We need institutional processes to generate lethal capabilities with greater affordability at the speed of relevance. These guidelines for U.S. missile defense are particularly critical today given the continuing proliferation of offensive missile technology and the dynamics of an increasingly competitive strategic environment.

The logic of the 2018 NDS is simple; a more lethal and agile Joint Force, coupled with a more robust system of allied and partner capabilities that are designed to be interoperable with ours, will preserve an international order that is most conducive to peace and prosperity. The defense strategy stresses the readiness of today's armed forces and prioritized development of future capabilities.

Missile defense is accorded a high priority in our investment plans because the need to do so is evident from our rigorous diagnosis of the strategic environment and detailed intelligence forecast of potential adversaries' emerging and projected offensive missile developments. They seek to use offensive missile threats to coerce us, our allies and partners, and are adding new and unprecedented types of offensive missile capabilities to their arsenals.

In the past several years, for example, North Korea rapidly advanced and expanded its intercontinental ballistic missile (ICBM) program. Iran extended the range of its ballistic missile systems and may seek to field an operational ICBM. While Russia and China pose separate challenges and are distinct in many ways, both are enhancing their existing offensive missile systems and developing advanced sea- and air-launched cruise missiles as well as hypersonic capabilities.

Missile defenses are a key element of our strategy given this proliferation of offensive ballistic and cruise missiles and emerging hypersonic weapons technologies that markedly raise threats to regional balances and to our major allies and partners. Our missile defense systems constitute a cornerstone of our efforts to deter a missile attack by a rogue state on the U.S. and make a clear contribution to our alliances. They must be robust, ready, and fit for our times.

The 2019 MDR presents a comprehensive and layered approach to prevent and defeat adversary missile attacks through a combination of deterrence, active and passive missile defenses, and attack operations to destroy offensive missiles prior to launch. This comprehensive approach to missile defense strengthens our ability to protect the U.S. homeland, U.S. forces abroad, allies, and partners; deters adversary threats and attacks; assures allies and partners; engages in diplomacy from a position of strength; hedges against future risk; and preserves our freedom of action to conduct regional military operations in defense of our interests.

The scale and urgency of change required to renew our conventional and missile defense overmatch should not be underestimated. To protect the American people and secure our forward deployed forces with our allies and partners, we will redouble our efforts in this domain. Failure to do so would erode deterrence, undermine U.S. credibility, and cede influence to the coercive pressure of competitors who seek to exploit gaps in our capabilities and those of our allies and partners.

This will not happen on our watch. Our research and development community, acquisition agencies, and the Joint Staff and Services will work together in a concerted manner to ensure success. I have every confidence in the superb men and women of our armed forces and their ability to preserve our security and pass the freedoms we enjoy intact to the next generation.



Patrick M. Shanahan  
Acting Secretary of Defense

# EXECUTIVE SUMMARY

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## I. Introduction

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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

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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

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#### *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

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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

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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

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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

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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.

# I. INTRODUCTION

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*“The Secretary shall initiate a new Ballistic Missile Defense Review to identify ways of strengthening missile defense capabilities, rebalancing homeland and theater defense priorities, and highlighting priority funding areas.”*

- President Donald Trump, 2017



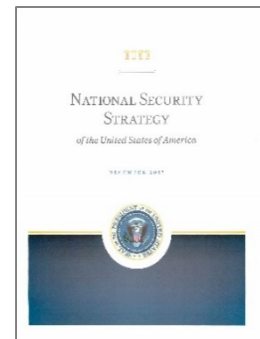
Missile defense is an essential component of U.S. national security and defense strategies. It contributes to the deterrence of adversary aggression and the assurance of allies and partners. It also strengthens U.S. diplomacy, protects against missile attacks to limit damage, supports U.S. military operations if deterrence fails, hedges against future uncertainties and risks, and helps to preserve U.S. and allied freedom of action to meet and defeat the regional aggression of potential adversaries.

*“The United States and our allies have the demonstrated capabilities and unquestionable commitment to defend ourselves from an attack.”*

- Then-Secretary of Defense, James Mattis  
Press Statement, August 9, 2017

This 2019 *Missile Defense Review* (MDR) describes the policies, strategies, and capabilities that will guide Department of Defense (DoD) missile defense programs over the next decade. It provides a roadmap 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 highlights priority areas and provides guidance to strengthen both current missile defense programs and future capabilities.

Consistent with the 2017 *National Security Strategy* (NSS), the 2018 *National Defense Strategy* (NDS), and the 2018 *Nuclear Posture Review* (NPR), an emphasis in this 2019 MDR is the need for flexible and adaptable U.S. missile defense capabilities that enable tailored deterrence and responses to aggression. U.S. missile defense strategy has evolved over decades in response to shifts in the security environment and corresponding shifts in U.S. missile defense goals, developments in the offensive missile capabilities of potential adversaries, and advances in technologies. Because the strategic context is not static, U.S. missile defense policies, priorities and programs must also be dynamic.



This MDR looks at, and beyond, the contemporary threat environment to consider emerging missile challenges and their implications for U.S. missile defense roles and requirements. It recognizes and highlights the important changes that have taken place in the security environment since the previous *Ballistic Missile Defense Review* was conducted in 2010, as well as the considerable uncertainties about the future threat environment. Those changes and uncertainties shape the direction of this MDR for U.S. missile defense policies, strategies, and capabilities.

The expanding military capabilities of revisionist powers, particularly including their offensive missile capabilities, now challenge our ability to deter or defeat aggression and coercion in key

strategic regions. Russia illegally occupies territory outside its borders, seeks to coerce and destabilize its neighbors, and flouts treaty obligations. China has adopted an increasingly assertive posture in disputes with its neighbors, many of whom are U.S. allies or partners. These include disputes over territorial boundaries, claims to contested island territory, and a campaign to build and militarize islands in the South China Sea. The military forces and doctrines of these and other states feature offensive missile capabilities that are growing rapidly in size, sophistication and prominence.

Of particular concern are advances and investments by rogue states such as Iran and North Korea in offensive missile systems with the potential to strike the U.S. homeland. Iran, through its Space Launch Vehicle (SLV) program, has established the technical foundation to shorten the timeline to acquire an ICBM capability. North Korea has launched 17 long-range ballistic missiles since the beginning of 2016, including three intercontinental-range ballistic missile (ICBM) tests, and has also conducted six nuclear weapons tests since 2006.

This MDR focuses on improving U.S. capabilities to protect the homeland against potential missile attacks from rogue states, while also continuing to invest in fiscally sustainable and rigorously tested missile defense capabilities to project power in support of national objectives and protect U.S. forces deployed abroad, allies, and partners. The United States will increase its overall investment in missile defense, and, after a significant decline over much of the past decade, U.S. missile defense investment will once again place increasing emphasis on homeland defense for the American people. The increase in the Missile Defense Agency’s (MDA) budget for homeland defense is illustrated in Figure 1 below.



Figure 1. Homeland Defense Budget FY01-19 appropriations for Missile Defense Agency.



This MDR is based on recognition that the threat environment the United States, our allies, and partners now face is markedly more dangerous than in years past, and as such, demands a concerted U.S. effort to improve existing capabilities for both homeland and regional missile defense. This effort will include a thorough exploration of innovative concepts and advanced technologies that have the potential to provide more cost-effective U.S. capabilities to defend against expanding missile threats. It also emphasizes that the missile threat environment now calls for a comprehensive approach to missile defense against rogue states and regional missile threats. This approach must integrate offensive and defensive capabilities for deterrence, and include 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.

The fundamental starting point and guidelines for the 2019 *MDR* follow from principal emphases found in the 2017 NSS, the 2018 NDS, and the 2018 NPR:

- The threat environment faced by the United States has become more complex and volatile, marked by the return of Great Power competition, including Chinese and Russian revisionism and military expansion, in addition to the destabilizing ambitions of rogue states.
- The United States will protect the American people and defend the homeland against missile threats, and restore a position of strength from which our diplomats can negotiate.
- The United States will not allow potential adversary threats of escalation to prevent us from defending our deployed forces abroad, allies, and partners.
- The United States will tailor deterrence as necessary to best protect against a range of potential adversaries and threats.
- The DoD will prioritize the flexibility, adaptability, and integration of U.S. missile defense capabilities, and the exploitation of advanced technologies to hedge against future risks and uncertainties.
- The United States will strengthen existing alliances and attract new partners, deepening interoperability, increasing resiliency, and bolstering partners against coercion.
- The United States will work with NATO and other key allies and partners to improve integrated air and missile defense capabilities.
- The DoD's acquisition processes will reform to deliver performance at the speed of relevance, rapidly deploying and integrating innovations.

## II. THE EVOLVING THREAT ENVIRONMENT

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*“State efforts to modernize, develop, or acquire weapons of mass destruction (WMD), their delivery systems, or their underlying technologies constitute a major threat to the security of the United States, its deployed troops, and allies.”*

- Director of National Intelligence,  
Daniel Coats  
2018 Worldwide Threat Assessment





The United States, allies, and partners confront a security environment that is, as emphasized in the 2018 NDS, “more complex and volatile than any we have experienced in recent memory.” In today’s emerging threat environment, U.S. missile defense capabilities have taken on an even greater importance than in the past. Today, over 20 states possess offensive missiles and potential adversary missile capabilities are becoming increasingly complex and lethal. Potential adversaries are investing substantially in their missile capabilities, enhancing their ground- and sea-launched missile arsenals with short-, intermediate-, and intercontinental-range systems, in addition to fielding mobile missiles to challenge the U.S. ability to detect their launch preparations. To further complicate our capability to identify and respond to missile threats, Russia, China, and North Korea have each developed and deployed dual-capable offensive missile systems able to employ conventional or nuclear warheads.

Potential adversaries are expanding their missile capabilities in three different directions simultaneously. They are 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 – all intended to challenge U.S. missile defense capabilities. Russia and China are developing advanced cruise missiles and hypersonic missile capabilities that can travel at exceptional speeds with unpredictable flight paths that challenge our existing defensive systems. And finally, Russia has threatened nuclear first-use strikes against U.S. allies and partners. These are the challenging realities of the emerging missile threat environment that U.S. missile defense policy, strategy and capabilities must address.

*“Russia already possesses such [hypersonic] weapons.”*

- President, Russian Federation, Vladimir Putin  
Presidential Address to the Federal Assembly,  
1 March, 2018

*“China has also tested a hypersonic glide vehicle.”*

- Director of National Intelligence, Daniel Coats  
2018 Worldwide Threat Assessment

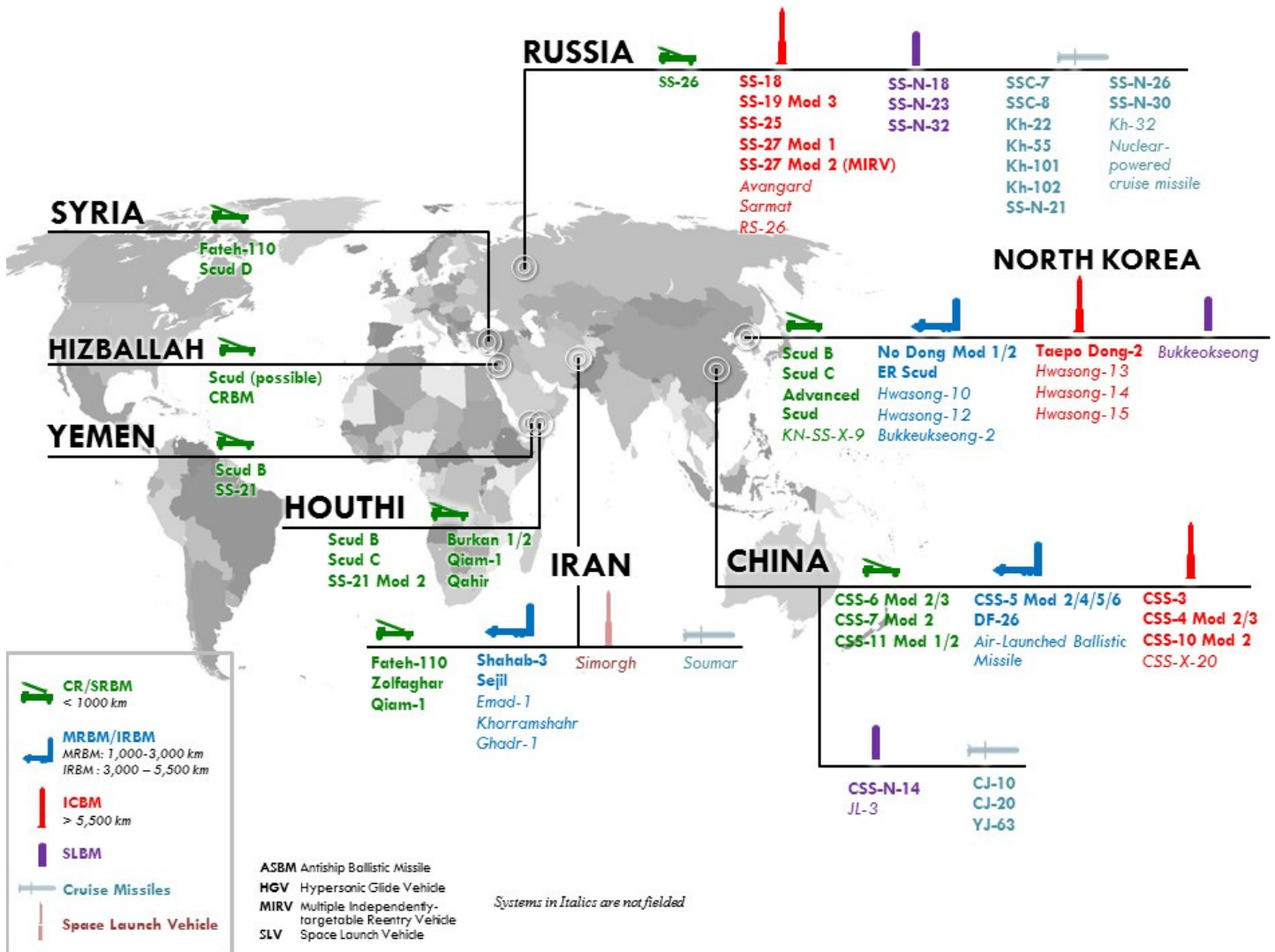


Figure 2. Current and Future Potential Adversary Offensive Missile Capabilities.

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## Current and Emerging Threats to the Homeland

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The 2017 NSS states, “our fundamental responsibility is to protect the American people, the homeland, and the American way of life.” In the past, North Korea issued explicit nuclear missile threats against the United States and allies, and worked aggressively to field the capability to strike the U.S. homeland with nuclear-armed ballistic missiles. Further, Iran’s 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 as space launch vehicles use inherently similar technology. Noting this, it is increasingly evident that U.S. homeland missile defense must both outpace rogue state offensive missile capabilities and hedge against possible future threat developments. To do so, the United States will pursue advanced missile defense concepts and technologies for homeland defense.

While a possible new avenue to peace with North Korea now exists, North Korea continues to pose an extraordinary threat to the national security, foreign policy, and economy of the United States. The United States must remain vigilant, especially concerning ICBM threats to the homeland. The intentions of potential adversaries can change directions unexpectedly and more rapidly than we can develop and field defensive capabilities.

Russia and China also are expanding and modernizing their strategic offensive missile systems, including the development of advanced technologies. The United States relies on nuclear deterrence to prevent potential Russian or Chinese nuclear attacks employing their large and technically sophisticated intercontinental missile systems.



Figure 3. Intercontinental Ballistic Missiles. Select missiles shown for illustrative purposes.

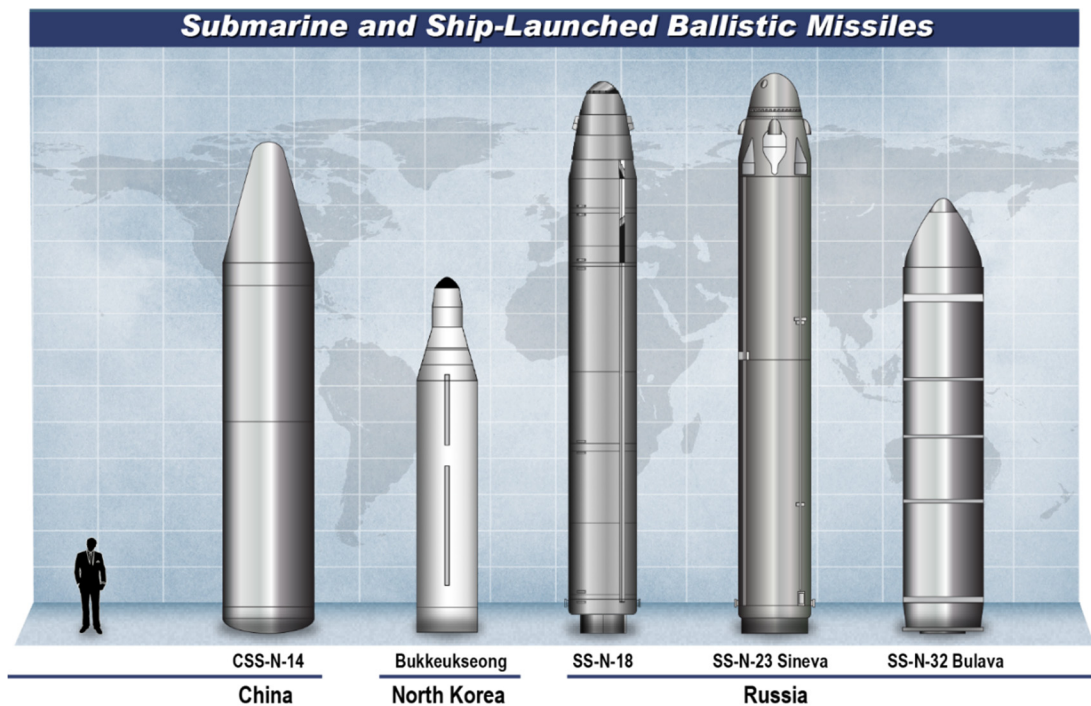


Figure 4. Submarine-Launched Ballistic Missiles. Select missiles shown for illustrative purposes.

## North Korea

In the past, North Korea engaged in highly provocative actions and undertook extensive nuclear and missile testing over the past decade. It invested considerable resources, much to the detriment of its long-suffering population in order to realize the capability to threaten the U.S. homeland with missile attack. It may even mistakenly have believed that by threatening the U.S. homeland with nuclear missile attack it could prevent the United States from supporting its Asian allies in a crisis or conflict.

On September 3, 2017, North Korea conducted its sixth and most powerful nuclear test to date, in violation of five United Nations (U.N.) Security Council Resolutions specifically prohibiting its nuclear program. In addition, over the past several years, North Korea rapidly accelerated its ICBM development program and showcased several ICBM variants. On July 28, 2017, North Korea flight-tested its new road-mobile ICBM, the Hwasong-14. Only months later, on November 28, 2017, it tested the Hwasong-15, which may have the potential to range the entire United States. As a result of these test programs, North Korea now has the capability to threaten the U.S. homeland with a nuclear-armed missile attack. The United States will remain vigilant, while also seeking to address this potential threat diplomatically.

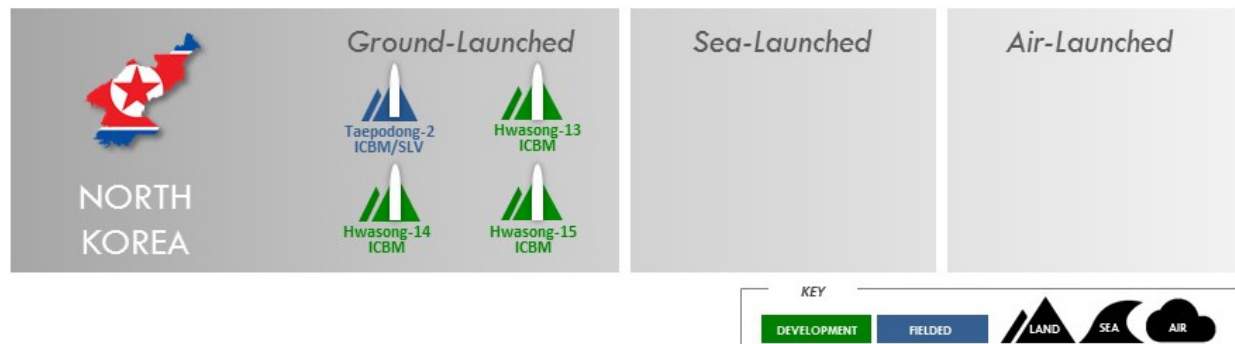


Figure 5. North Korean Strategic Missile Systems.

## Iran

Iran's Supreme Leader, Ayatollah Ali Khamenei, stated that, "America is the number one enemy of our nation." Iran views U.S. influence in the Middle East as the foremost barrier to its goal of becoming the dominant power in that region, a goal it is pursuing through the use of terrorism, coercion and armed force to destabilize and attack its neighbors, including U.S. allies and partners. One of Iran's primary tools of coercion and force projection is its missile arsenal, which is characterized by increasing numbers of deployed missiles, as well as increases in their accuracy, range, and lethality.

Iran has the largest ballistic missile force in the Middle East and continues the development and fielding of a wide range of missile capabilities, including development of the technologies applicable to intercontinental-range missiles capable of threatening the United States. In July 2017, Iran launched the *Simorgh* SLV, which could help Iran to achieve ICBM range.

*"Tehran's desire to deter the United States might drive it to field an ICBM. Progress on Iran's space program, such as the launch of the Simorgh SLV in July 2017, could shorten a pathway to an ICBM because space launch vehicles use similar technologies."*

- Director of National Intelligence, Daniel Coats  
2018 Worldwide Threat Assessment

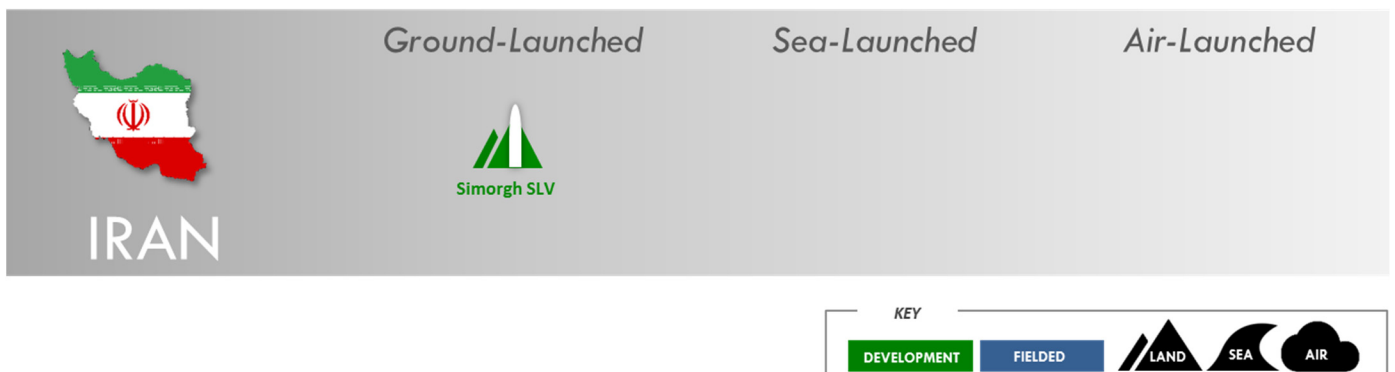


Figure 6. Iranian Strategic Missile Systems.



## 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. In a televised speech on March 1, 2018, President Vladimir Putin included animation of a nuclear strike on the United States. 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. Russia mistakenly assesses that its threat of nuclear first use or actual nuclear first use could compel the United States and NATO to capitulate in a crisis or conflict on terms favorable to Russia. This mistaken Russian perception increases the prospect for dangerous Russian miscalculations and escalation.

As counted under the 2010 New START Treaty, Russia is permitted a total of 700 deployed ICBMs, submarine-launched ballistic missiles (SLBM), and heavy bombers, and 1,550 deployed strategic nuclear warheads. With its robust warhead production infrastructure and the substantial payload of its ICBM force, Russia has the ability to expand the number of its deployed missile warheads.

Russian leaders also claim that Russia possesses a new class of missile, the hypersonic glide vehicle (HGV), that enables Russian strategic missiles to penetrate missile defense systems. HGVs challenge missile defense capabilities because they are maneuvering vehicles that typically travel at velocities greater than Mach 5 and spend most of their flight at much lower altitudes than a ballistic missile.

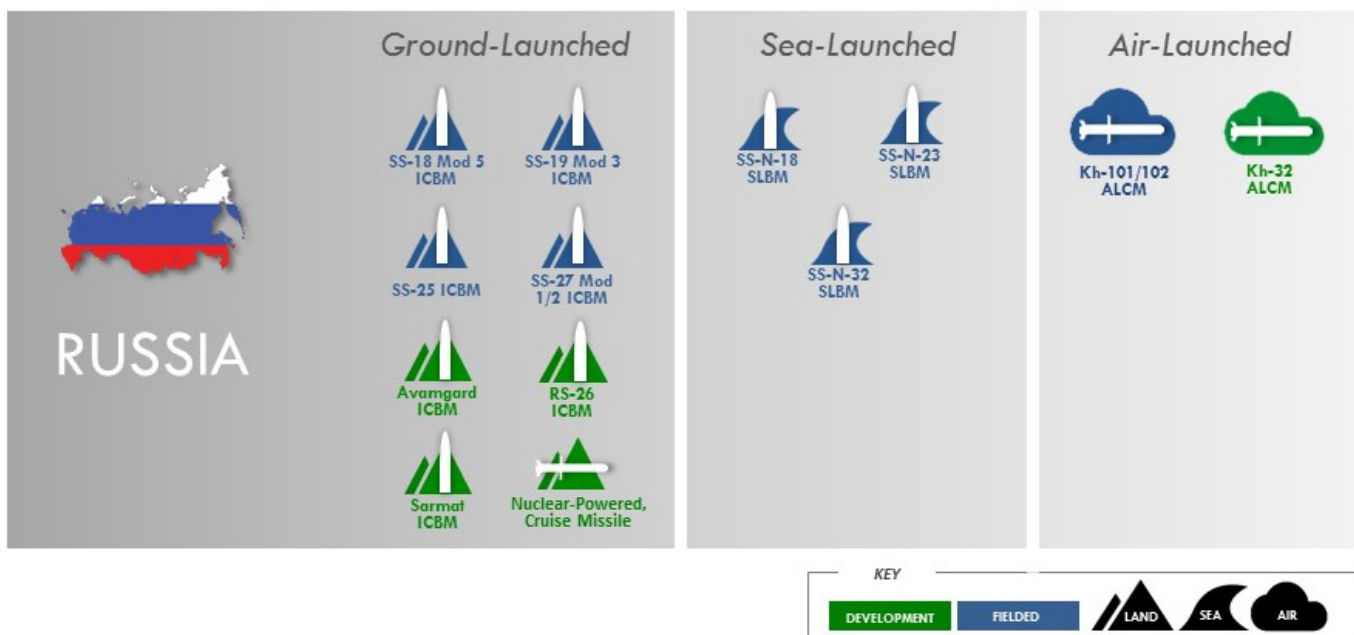


Figure 7. Russian Strategic Missile Systems.



## China

China seeks to displace the United States in the Indo-Pacific region and reorder the region to its advantage. China's missiles play an increasingly prominent role in its military modernization, its coercive threats, and efforts to counter U.S. military capabilities in the Indo-Pacific.

China continues to have one of the most active and diverse ballistic missile development programs in the world. It has deployed 75-100 ICBMs, including a new road-mobile system and a new multi-warhead version of its silo-based ICBM. Beijing now possesses four advanced JIN-class ballistic missile submarines (SSBN), each capable of carrying 12 new SLBMs, 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 is also developing advanced technologies such as MaRVs and HGVs.



Figure 8. Chinese Strategic Missile Systems.

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

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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. Their regional offensive missile systems include multiple types of short-, medium-, and intermediate-range missiles intended to provide coercive political and military advantages vis-à-vis the United States, allies, and partners in regional crises or conflict. Expanding and modernizing U.S. regional missile defenses is an imperative to meet ongoing adversary advancements in their regional offensive missile systems.

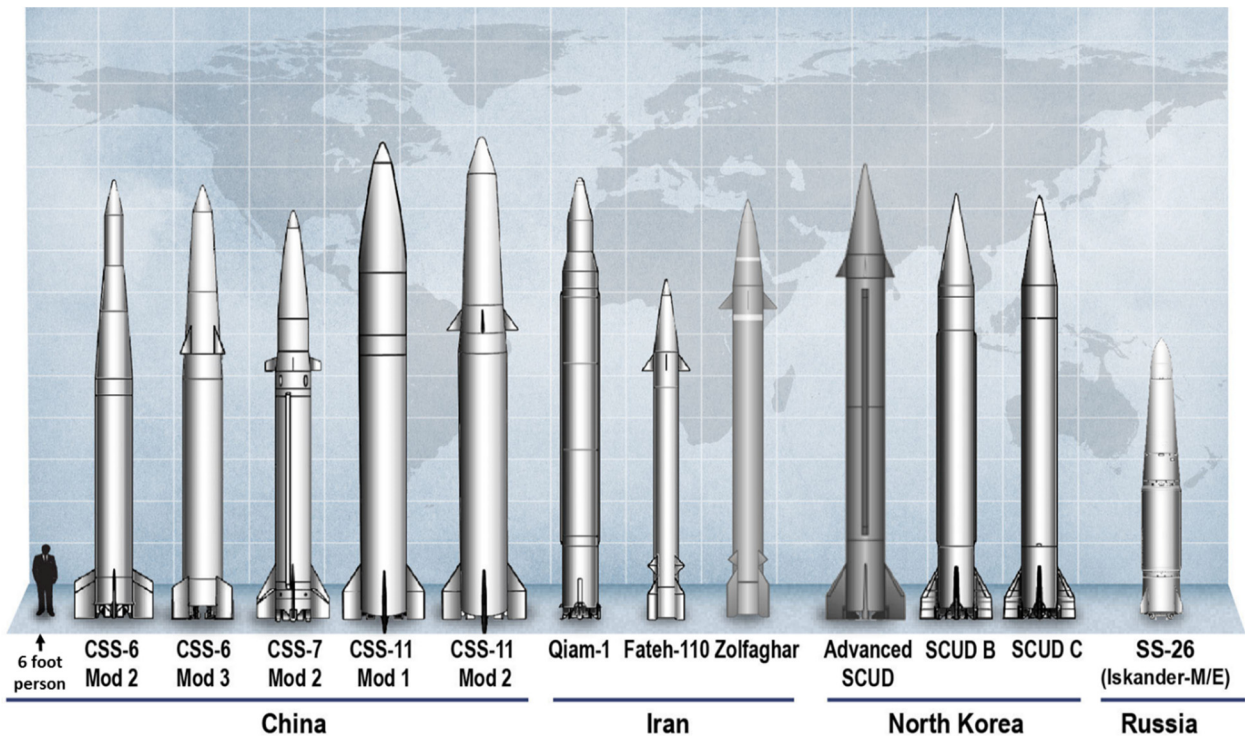


Figure 9. Short-Range Ballistic Missiles. Select missiles shown for illustrative purposes.

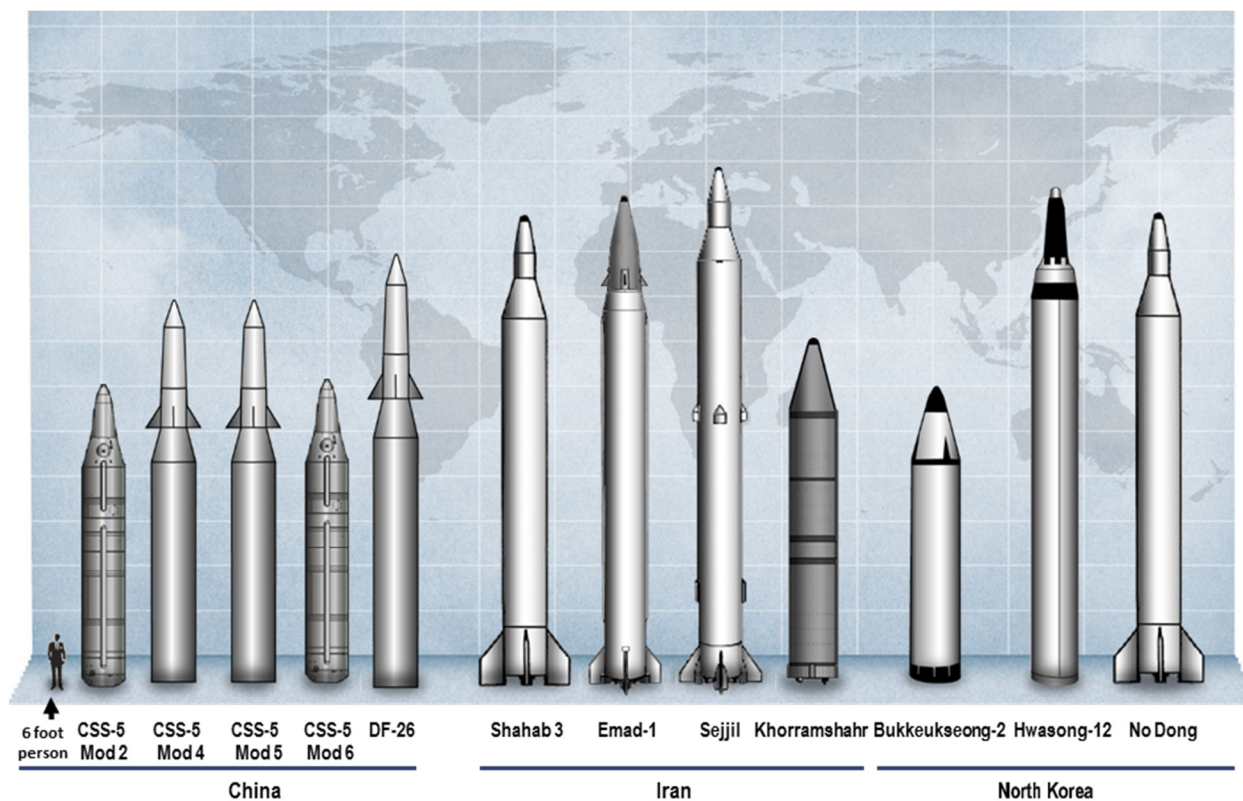


Figure 10. Medium- and Intermediate-Range Ballistic Missiles. Select missiles shown for illustrative purposes.

### North Korea

Over the past decade, North Korea accelerated efforts to field missiles capable of threatening deployed U.S. forces, allies, and partners in the region. It not only fielded more such missiles, but also improved the performance of existing systems and developed new capabilities. It diversified its already large regional ballistic missile force that includes delivery systems with road-mobile and submarine launching platforms. Since 2015, North Korea has test-launched, from numerous locations throughout North Korea, over two dozen regional missiles capable of targeting U.S. forces, allies, and partners in Asia, including several launches of SCUD, No Dong, and new missile systems. In 2017, North Korea conducted a near-simultaneous ballistic missile salvo launch of five missiles, including four into the Sea of Japan, and announced that the missiles simulated the mission of targeting U.S. bases in Japan. North Korea has also conducted multiple missile launches over Japan and into Japan’s Exclusive Economic Zone. Taken together, these provocative activities highlighted North Korea’s commitment to diversifying and improving its regional offensive missile forces, strengthening their survivability, and engaging in coercive regional nuclear threats.

North Korea has augmented these forces through an aggressive intermediate-range ballistic missile (IRBM) testing campaign. These efforts have included numerous Hwasong-10 (“Musudan”) test launches and, in 2017, two Hwasong-12 IRBM launches over northern Japan. In addition to these liquid-fueled systems, in February 2017, North Korea launched a new solid-propellant medium-range ballistic missile (MRBM) that appears to be a land-based variant of its SLBM. This SLBM, Bukkeukseong, is a relatively recent development, having first been tested in 2016.

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

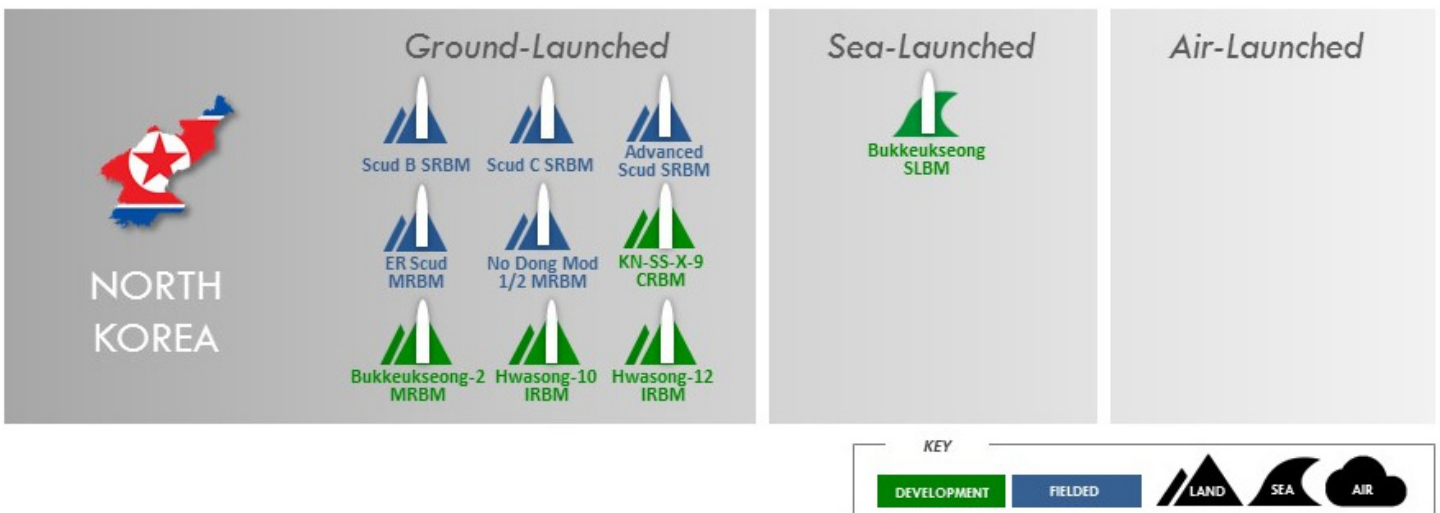


Figure 11. Selected North Korean Regional Missile Systems.

## Iran

Iran is accelerating efforts to field missiles capable of threatening deployed U.S. forces, allies, and partners. It is continuing to develop more sophisticated missiles with improved accuracy, range, and lethality.

Iran is increasing its ballistic missile force with next-generation short-range ballistic missiles (SRBM) and MRBMs. It fields an array of increasingly accurate short- and medium-range ballistic missile systems, including Fateh-110 class SRBMs and Shahab-3 MRBMs. In late 2015, Iran announced it successfully test-fired the Emad, a new precision-guided MRBM. Iran’s medium-range systems can threaten targets from Eastern Europe to South Asia. It has also flight-tested a Fateh-110 ballistic missile in an anti-ship role that can threaten U.S. and allied naval vessels in the Arabian Gulf and Strait of Hormuz.

Iran also has a ground-launched land attack cruise missile (LACM), the Soumar, that can target U.S., allied, and partner interests in the region. Iran claims the Soumar has a 2000 kilometer (km) range. Iran could develop alternate launch modes for this missile, including aircraft or naval platforms.

In its quest for hegemony in the Middle East, Iran has devoted major resources to develop and deploy a spectrum of missile capabilities, which, in addition to the use of terrorism and proxy forces, threaten U.S. allies, partners, and interests in the Middle East and beyond. Iran has launched missile strikes in the ongoing Syrian conflict.

*“In the Middle East, Iran is competing with its neighbors, asserting an arc of influence and instability while vying for regional hegemony, using state-sponsored terrorist activities, a growing network of proxies, and its missile program to achieve its objectives.”*

- 2018 National Defense Strategy of the United States of America

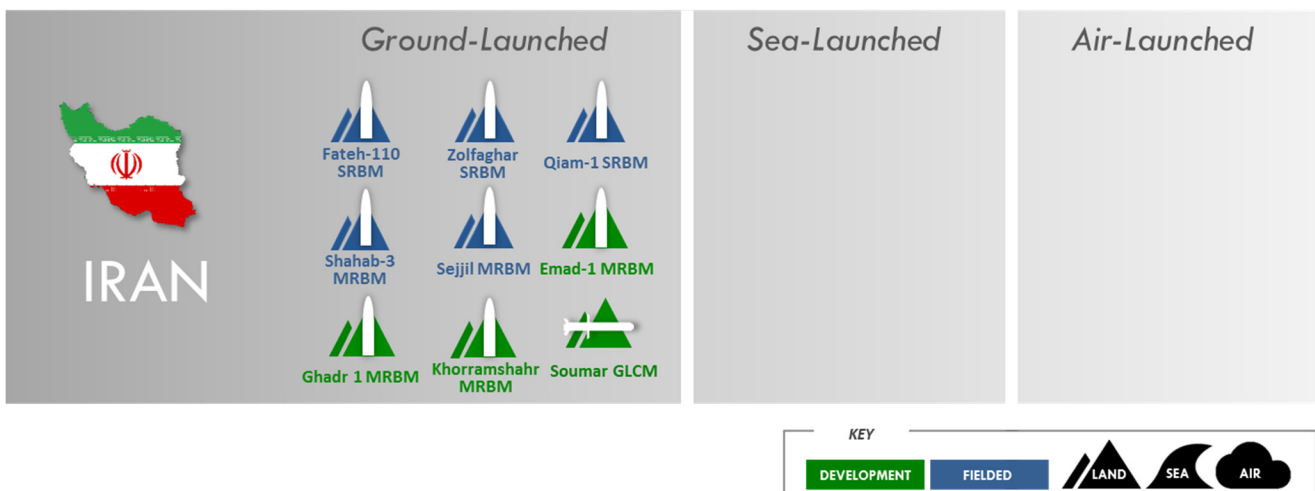


Figure 12. Selected Iranian Regional Missile Systems.

## Russia

Not only is Moscow expanding and modernizing its strategic offensive missile forces, it also is fielding an increasingly advanced and diverse range of nuclear-capable regional offensive missile systems that threaten deployed U.S. forces, allies, and partners. These missile systems are a critical enabler of Russia's coercive escalation strategy and nuclear threats to U.S. allies and partners.

Russian offensive missile modernization programs go well beyond traditional ballistic missiles, to include missiles with unprecedented characteristics of altitude, speed, propulsion type, and range. Russia 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. Indeed, Russia has demonstrated its advanced cruise missile capability since 2015 by repeatedly conducting long-range precision strikes into Syria.

Russia has also fielded a ground-launched, intermediate-range cruise missile, the SSC-8, in violation of the Intermediate-Range Nuclear Forces (INF) Treaty. These highly effective LACMs fly at low altitudes below a radar's line-of-sight, which presents a potentially major threat to U.S. regional military operations and deterrence goals. While the majority of LACMs presently fly at subsonic speeds, in the future it appears that some will be able to reach hypersonic speeds.

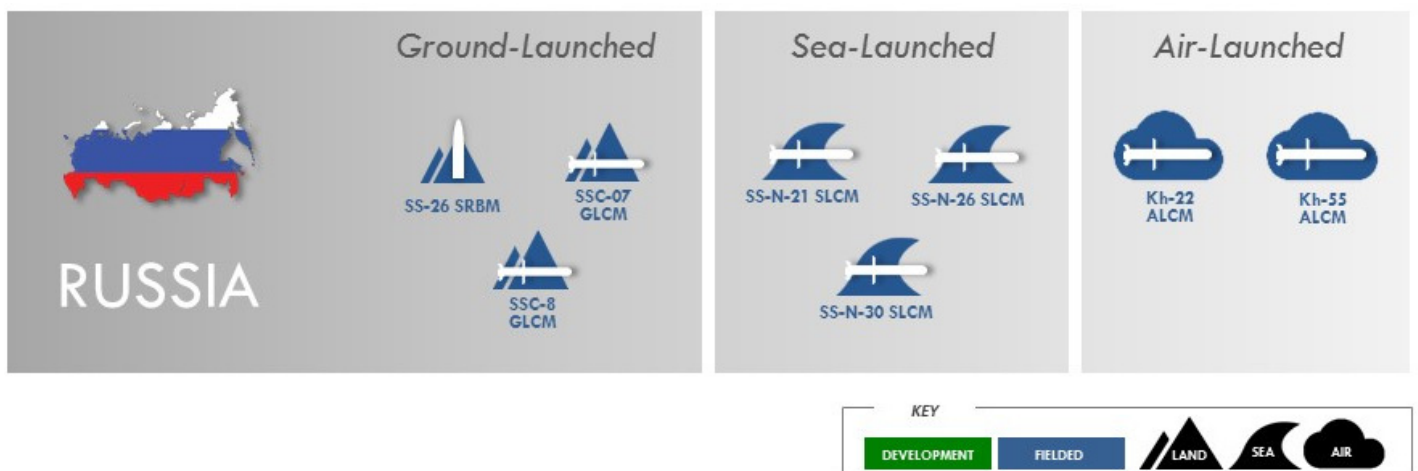


Figure 13. Selected Russian Regional Missile Systems.



## 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 augmenting its SRBM force as well as improving its ability to strike regional targets, such as U.S. bases and naval assets, at greater ranges with the addition of a 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 the U.S. forces deployed abroad, and are of acute concern to U.S. allies and partners in the Indo-Pacific region.

*“A simple comparison of missile ranges with geography suggests where Chinese missiles would most likely be targeted – SRBMs against Taiwan and U.S. carrier strike groups operating at sea, IRBMs against U.S. bases in Japan and Guam, and ICBMs against the continental U.S. China’s pursuit of advanced hypersonic missile technologies portends even greater challenges over the next few years.”*

- Then-Commander, U.S. Pacific Command, Admiral Harry Harris  
Statement before the House Armed Services Committee, February 14, 2018

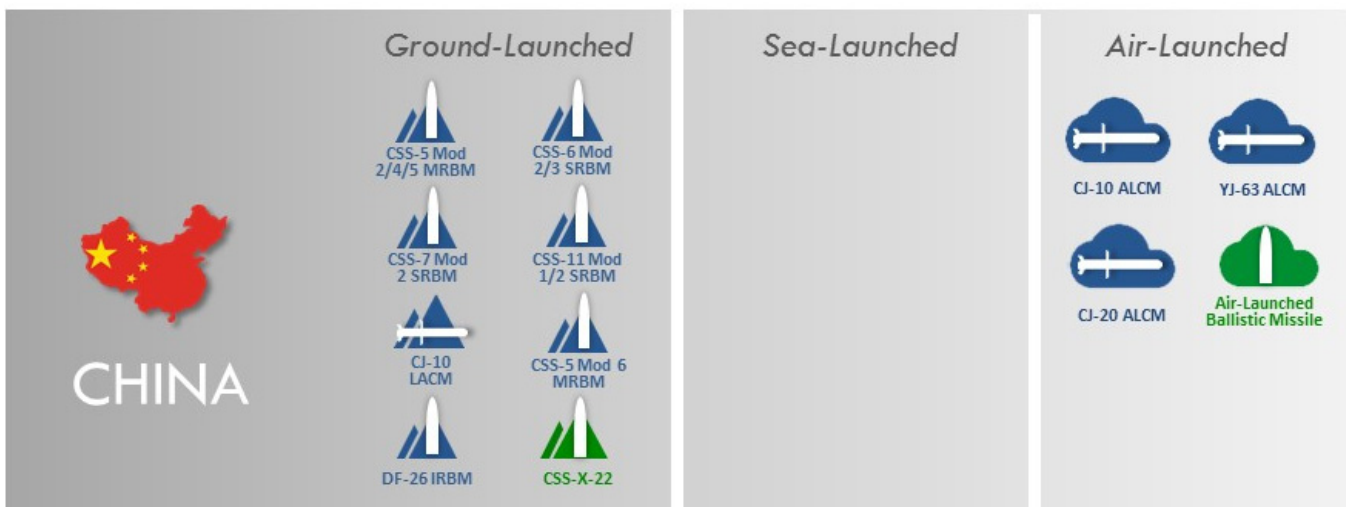


Figure 14. Selected Chinese Regional Missile Systems.



## Potential Adversary Missile Defense and Antisatellite (ASAT) Advancements

Despite frequently criticizing the United States and allies for deploying missile defense systems, potential adversaries have 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, including sensors that support U.S. missile defense.

### Russia

Russia maintains and modernizes its longstanding silo-based strategic missile defense system deployed around Moscow, which includes 68 nuclear-armed interceptors, and has fielded multiple types of shorter-range, mobile missile defense systems throughout Russia. These include hundreds of S-300 and S-400 launch vehicles, each capable of firing four interceptor missiles. Russia also is developing the S-500 as an even more modern and technologically advanced air and missile defense system to augment the S-300 and S-400. In addition, Russia has transferred missile defense technology to China and Iran, both of which are expanding and modernizing mobile missile defense capabilities. Finally, Russia is developing a diverse suite of ASAT capabilities, including ground-launched missiles and directed-energy weapons, and continues to launch “experimental” satellites that conduct sophisticated on-orbit activities to advance counterspace capabilities.



Figure 15. Russian Missile Defense Systems.

### China

China is aggressively pursuing a wide range of mobile air and missile defense capabilities, including the S-300 and domestically produced HQ-9 missile defense systems. China has 64 S-300 missile defense launchers, each with four interceptor missiles. It is modernizing and expanding its missile defense capabilities with the purchase of S-400 systems from Russia, each

with four interceptor missiles. These are expected to be delivered to China in 2018. China also has announced that it is testing a new mid-course missile defense system with plans to develop sea-based mid-course ballistic missile defense, and is developing additional theater ballistic missile defense systems. Since July 2017, China has conducted at least two tests of its mid-course missile defense system. Further, China is developing a suite of ASAT weapons, including ground-launched missiles and directed-energy weapons, and continues to launch “experimental” satellites that conduct sophisticated on-orbit activities to advance counterspace capabilities. China has conducted multiple ASAT tests using ground-launched missiles, and, in fact, destroyed a satellite in orbit in 2007.



Figure 16. Chinese Missile Defense Systems.



*North Korea*

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.



Figure 17. North Korean Missile Defense Systems.

Iran

*“The S-300 is a very powerful system and plays a very important role in the security of the country...we are also moving along this path [of self-sufficiency] and developing our systems for use at various altitudes.”*

- Defense Minister, Iran, Amir Khatami  
April 5, 2018

Similar to Russian-Chinese missile defense cooperation, 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.

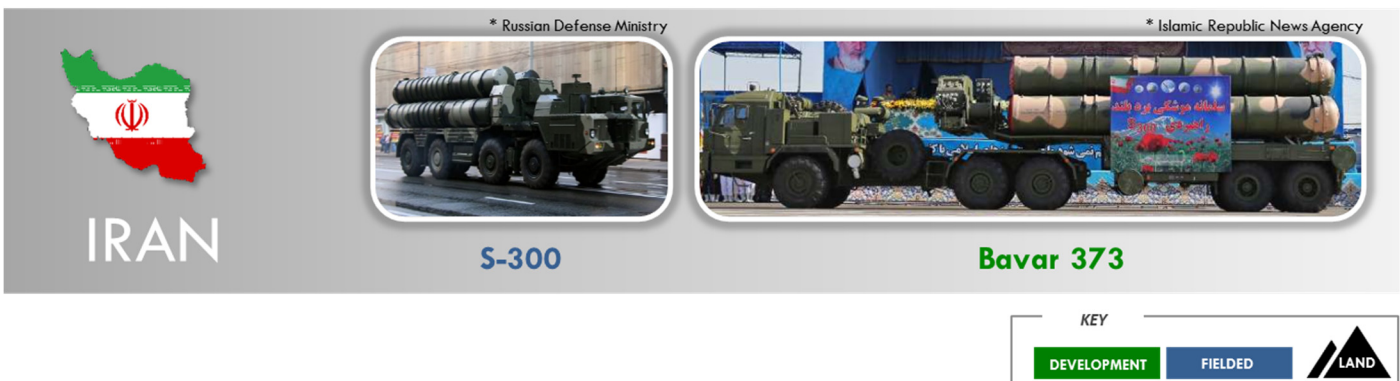


Figure 18. Iranian Missile Defense Systems.

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## Missile Proliferation Concerns

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*“Ballistic missile proliferation and lethality continues to increase as more countries acquire greater numbers of ballistic missiles and are increasing their technical sophistication to specifically defeat U.S. ballistic missile defense systems. In the past year, we continue to see missile tests from North Korea and Iran that cause us and our allies continued concerns.”*

- Commander, U.S. Strategic Command, General John Hyten  
Statement before the Senate Committee on Armed Services, April 4, 2017

U.S. missile defense capabilities and efforts for the future must consider and hedge against the potential for continuing missile proliferation, including the proliferation of advanced missile capabilities. Rogue states may continue to pursue missile delivery systems through illicit procurement pathways for acquisition of critical technologies and components in violation of U.N. Security Council resolutions. The proliferation challenge may worsen and lead to diverse unanticipated missile threats to the United States, allies, and partners.

Since the Soviet era, Moscow and Russia-based entities have provided offensive missile strike expertise and technology to China, North Korea, Iran, and Syria. They also have provided missile defense expertise and technology to China and Iran. In some cases, their arms transfers violated U.N. sanctions and international norms. In many cases, the Soviet-exported offensive missile systems provided the basis for today’s missile capabilities fielded by China, North Korea, and Iran. Russian-made offensive missile systems, and those derived from Russian technology, are now fielded globally and employed in multiple conflicts around the world. In addition, Russia markets cruise missiles in standard shipping containers to foreign buyers.

Chinese entities have assisted Iran, North Korea, and others in developing their missile programs. For example, the wheeled chassis used by North Korea for its mobile ICBM launchers were originally obtained in 2011 from Chinese sources. In turn, expertise and technology provided to these states by Chinese sources could be transferred to additional state and non-state actors.

The North Korean missile program – which over decades has benefitted from expertise and technological assistance from abroad – also presents a significant proliferation threat. North Korea has been the source of ballistic missile-associated sales to numerous countries, particularly in the volatile Middle East. It has assisted Iranian and Syrian missile programs, and it may well attempt further sales of its missile technology in the future. North Korea also provided fissile material production technology needed for nuclear weapons to Syria. Effective

U.S., allied, and partner missile defenses will help protect against the potential consequences of the North Korean missile proliferation network, and could possibly undercut demand for North Korean missile sales.

Iran, like North Korea, also is proliferating its offensive missile technology, presenting additional threats to the U.S., allies, and partners. U.N. reports describe repeated instances of Iranian weapons transfers and ballistic missile activity in violation of U.N. Security Council Resolution 2231. Iran has made extensive use of smuggling networks, managed both by its security forces and proxies, to provide advanced missile delivery systems to its clients. It has transferred rockets and guided ballistic missiles, including close-range ballistic missiles (CRBM) and SRBMs, to Hizballah in Lebanon and Syria, and to the Houthis in Yemen. The Houthis have launched over 100 missiles at Saudi Arabia. Iran's emerging missile proliferation network poses a growing threat to U.S. forces, allies, and partners in the Middle East and beyond.

*“Aid from Iran’s Revolutionary Guard to dangerous militias and terror groups is increasing. Its ballistic missiles and advanced weapons are turning up in warzones across the region. It’s hard to find a conflict or a terrorist group in the Middle East that does not have Iran’s fingerprints all over it.”*

- Former U.S. Permanent Representative to the U.N., Ambassador Nikki Haley  
Remarks at a Press Conference on Iranian Arms Exports, December 14, 2017



# III. ROLES, POLICY, AND STRATEGY

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*“U.S. missile defence can critically reduce an attacker’s confidence in the prospects for success in its offensive strike planning. Given the inherent and irreducible uncertainties of war that should fuel doubt in such plans, the additional uncertainty imposed by U.S. missile defence should prove decisively deterring in the attacker’s calculations.”*

- Professor Colin Gray, 2018



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## The Diverse Roles of U.S. Missile Defense

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Missile defense provides critical support for U.S. national security and defense strategies by contributing to:

- The protection of the U.S. homeland, forces abroad, allies, and partners against the spectrum of adversary missile strikes;
- The deterrence of attacks against the United States, allies, and partners;
- The assurance of allies, which also strengthens U.S. nonproliferation efforts;
- U.S. diplomatic efforts in peacetime and crises;
- Greater stability and options other than offensive strikes;
- The U.S. capacity to hedge against future risks; and,
- The effectiveness of U.S. and allied regional military operations.

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

*Protection.* If potential adversaries miscalculate and deterrence fails, missile defense limits the number of 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. The single greatest loss of life during Operation DESERT STORM in 1991 occurred when a conventionally-armed Iraqi SCUD missile struck a U.S. barrack in Saudi Arabia, killing 27 U.S. service members. If adversary missiles are armed with nuclear warheads, missile defense may help prevent or mitigate the worst outcomes. Today’s U.S. missile defenses provide significant protection against potential North Korean or Iranian ballistic missile threats to the U.S. homeland, and will improve as necessary to stay ahead of missile threats from rogue states.

*“Over the next two decades, there will be a significant evolution in long-range strike weapons capable of ranging the U.S. homeland. . . The purpose of state adversary investments in global strike assets capable of reaching North America is to threaten key targets within the United States during a conflict. . . Adversaries will threaten the homeland not to physically destroy the United States, or even in anticipation of materially hindering its economic or military potential, but rather to change the decision calculus of leaders or the public’s appetite for foreign military operations.”*

- Joint Chiefs of Staff,  
*Joint Operating Environment 2035*



*Deterrence.* Missile defense contributes directly to tailored U.S. deterrence strategies to prevent attacks on the United States, and extended deterrence to prevent attacks on U.S. forces abroad, allies, and partners. Missile defenses, in concert with other U.S. conventional forces, and with U.S. nuclear forces, support both deterrence and extended deterrence. They undermine potential adversaries' confidence in their ability to achieve their intended political or military objectives through missile threats or attacks, including by contributing to the survivability and effectiveness of potential U.S. responses to aggression. 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 aimed at the United States, allies, and/or partners. 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 conventional deterrence. Missile defense also provides additional time and options for national 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.

*Assurance.* Missile defense plays an increasingly important assurance role in combination with other means for assuring allies and partners facing growing threats. 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 and our allies and partners with missile threats. Correspondingly, missile defense helps to reinforce the indivisibility of U.S. and allied security.

U.S. missile defense deployments and cooperative missile defense activities also are concrete expressions of U.S. security commitments; they 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.

By so supporting the credibility of U.S. assurance commitments, missile defense also contributes to U.S. nonproliferation goals by assuring allies and partners of their security in the absence of their own independent nuclear capabilities.

*“Our missile defense forces here, are vital to our national defense and the world should know that they’re ready.”*

- Vice President Michael Pence  
Elmendorf Air Force Base, Alaska, 2018

*Strengthening U.S. Diplomacy.* U.S. missile defenses provide U.S. leaders a position of strength from which to engage potential adversaries in peacetime or crises. For example, missile defenses enable U.S. leaders to engage North Korea diplomatically, confident that U.S. missile defense capabilities help sustain effective deterrence of aggression, provide protection for the United States, allies, and partners in the event of conflict, and help protect against non-compliance with any potential agreement. The importance of this missile defense role is reflected in then-Secretary of Defense Mattis’ emphasis that the United States must, “ensure our diplomats who are working to solve problems do so from a position of strength,” and that, “Our response to this [North Korean] threat remains diplomacy-led, backed up with military options available to ensure that our diplomats are understood to be speaking from a position of strength.”

*“The United States will seek areas of cooperation with competitors from a position of strength, foremost by ensuring our military power is second to none and fully integrated with our allies and all of our instruments of power. A strong military ensures that our diplomats are able to operate from a position of strength.”*

- 2017 National Security Strategy of the United States of America

The United States is committed to diplomatic efforts that advance U.S., allied, and partner security, including the U.S. diplomatic initiative with North Korea. Some Russian officials, including President Putin, assert that U.S. missile defense is an obstacle to further arms control success. However, there is ample evidence that U.S. missile defenses can contribute to, rather than undermine, U.S. efforts to negotiate arms control agreements or other diplomatic initiatives.

For example, in 2001, when the United States announced its withdrawal from the 1972 Anti-Ballistic Missile (ABM) Treaty to facilitate the U.S. deployment of homeland defense against rogue state missile threats, Russian President Putin explicitly said: “This step has not come as a surprise to us...I can say with full confidence that the decision made by the President of the United States does not pose a threat to the national security of the Russian Federation.” This point was repeated by numerous Russian officials. Closely following the U.S. withdrawal from the ABM Treaty and the subsequent U.S. announcement of its decision to deploy homeland missile defense, Russia and the United States ratified the 2002 Moscow Treaty, which mandated the most extensive strategic nuclear force reductions of any such treaty. Following the subsequent initial U.S. deployment of homeland missile defense, they further negotiated and ratified the 2010 New START Treaty.

The United States also remains committed to non-proliferation, the Missile Technology Control Regime that is intended to help limit offensive missile proliferation, and the Nuclear Non-proliferation Treaty. There is bipartisan recognition of the potential role missile defense can play in dissuading rogue states from pursuing ICBMs. The 2010 BMDR noted that through the U.S. commitment to missile defense, “the United States seeks to dissuade [rogue] states from developing an intercontinental ballistic missile.” 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 value of their investments in ballistic and cruise missiles as effective instruments of coercion or war. If so, this dissuasive effect, together with other counterproliferation measures such as sanctions, will contribute to U.S. diplomatic efforts to limit proliferation, assure allies, and hedge against future missile threats.

*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.* The pace and scale of future proliferation and missile threats to the United States, U.S. forces abroad, allies, and partners is uncertain. The potential ease with which missile expertise and technology can move across borders creates significant concerns that offensive missile threats will rapidly expand and become more complex. Hedging strategies help reduce risk and mitigate offensive missile threats that emerge over time, both geopolitical and technical. Consequently, developing and integrating where possible multiple U.S., allied, and partner missile defense capabilities, and the ability to quickly modify those capabilities to hedge against emerging and unanticipated missile challenges, is essential to U.S. security and that of our allies and partners.

For example, U.S. missile defense capabilities provide an important hedge against evolving rogue state missile threats to the United States, allies, and partners, such as Iran seeking to acquire nuclear weapons and ICBM capabilities absent continued U.S. participation in the Joint Comprehensive Plan of Action. 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. The U.S. capacity to hedge against future missile threat developments also 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 the expansion of, or even an unexpected “breakout” of, their offensive missile capabilities.

*Enabling Regional and Transregional Military Operations.* Missile defense supports U.S. and coalition military operations across multiple regions. It also 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. effort to counter A2/AD

strategies that seek to deter or prevent the United States from supporting allies in contested regions. Again, this role for missile defense provides critical support for the deterrence of attacks and the assurance of allies and partners.

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## Principles Governing U.S. Missile Defense

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### *U.S. Homeland Missile Defense will Stay Ahead of Rogue States' Missile Threats*

Technology trends point to the possibility of increasing rogue state missile threats to the U.S. homeland. Vulnerability to rogue state missile threats would endanger the American people and infrastructure, undermine the U.S. diplomatic position of strength, and could lead potential adversaries to mistakenly perceive the United States as susceptible to coercive escalation threats intended to preclude U.S. resolve to resist aggression abroad. Such misperceptions risk undermining our deterrence posture and messaging, and could lead adversaries to dangerous miscalculations regarding our commitment and resolve.

*“Our fundamental responsibility is to protect the American people, the homeland, and the American way of life. . . . A layered missile defense system will defend our homeland against missile attacks.”*

- 2017 National Security Strategy of the United States of America

It is therefore imperative that U.S. missile defense capabilities provide effective 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 MDR.

This force-sizing measure for active U.S. missile defense is fully consistent with the 2018 NPR, and in order to keep pace with the threat, DoD will utilize existing defense systems and an increasing mix of advanced technologies, such as kinetic or directed-energy boost-phase defenses, and other advanced systems. It is technically challenging but feasible over time, affordable, and a strategic imperative. It 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. Further, because the related requirements will evolve as the long-range threat posed by rogue states evolves, it does not allow a static U.S. homeland defense architecture. Rather, 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.

In coming years, rogue state missile threats to the U.S. homeland will likely expand in numbers and complexity. There are and will remain inherent uncertainties regarding the potential pace and scope of that expansion. 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.

*“In 2035, the United States will confront an increasing number of state and non-state actors with the will and capabilities to threaten targets within the homeland and U.S. citizens with the ultimate intention to coerce.”*

- Joint Chiefs of Staff,  
*Joint Operating Environment 2035*

As U.S. active defenses for the homeland continue to improve to stay ahead of rogue states’ missile threats, they could also provide a measure of protection against accidental or unauthorized missile launches. This defensive capability could be significant in the event of destabilizing domestic developments in any potential adversary armed with strategic weapons, and as long-range missile capabilities proliferate in coming years.

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. Consequently, 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 over time. Consequently, the United States will invest in advanced technologies to meet the increasingly complex threat posed by larger missile inventories and improved countermeasures. Successful science and technology initiatives may lead to operational prototypes. These prototypes could be evaluated outside the standard acquisition process in order to develop successful technologies more quickly while ensuring that unsuccessful efforts are avoided before consuming scarce funding.

*“I am confident the Ground-based Midcourse Defense system can currently defend the United States from the threats posed by North Korea, but we must take prudent steps to remain in a position of relative technological advantage... Together with our allies and partners, I am confident we will continue to adapt, innovate, and fulfill the sacred responsibility of defending our great nations.”*

- Then-Commander, U.S. Northern Command, General Lori Robinson  
Statement before the Senate Committee on Armed Services, February 15, 2018

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## Elements of Missile Defense Strategy

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### *Comprehensive Missile Defense Capabilities*

Effective deterrence is the preferred strategy to prevent missile attack. To address the increasingly complex missile threat environment, however, a broader approach is required. The United States will also field, maintain, and integrate three different means of missile defense. These include: first, active missile defense to intercept adversary missiles in all phases of flight; second, passive defenses 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 improve the overall likelihood of countering offensive missile attacks successfully.

The goal of this comprehensive strategy is to identify and exploit every practical opportunity to detect, disrupt, and destroy a threatening missile, prior to and after its launch, and to maximize the combined missile defense effort. 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.

Given the increasing scale of potential adversary regional missile threats, and their integration of offensive missiles with other military capabilities, U.S. missile defense systems must be more tightly integrated to other U.S. capabilities in the Joint Force. The fusion of ISR, air and missile defenses, and offensive strike systems will be key. During future conflicts it will be necessary for missile defense systems to counter the initial missiles launched at the U.S. forces, allies, and partners -- while our offensive systems strike remaining adversary missile systems before additional missiles are launched.

This comprehensive approach to U.S. missile defense reflects the Joint Chiefs of Staff's Joint Integrated Air and Missile Defense (IAMD) doctrine to prevent an adversary from effectively using its offensive air and missile weapons through the integrated combination of deterrence, active and passive defenses, and attack operations. It takes greater advantage of weapon system investments, reduces potential seams and gaps in the defense architecture, enables allied and partner participation, in addition to complicating and undermining adversary missile attack planning. A more integrated set of offense and defense capabilities will also 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.

If deterrence fails and the United States must enter into regional armed conflict, attacking adversary missiles prior to their launch would be a part of ongoing combat operations and fall under a Combatant Commander's mission authorities pursuant to the President's or Secretary of Defense's orders. Attack operations to locate, target, and destroy mobile missiles prior to launch as well as their supporting infrastructure can reduce the burden on U.S. active defenses for post-launch intercept -- thereby helping reduce the likelihood that an adversary's offensive missile attack will succeed. The capability to destroy mobile ballistic missile threats prior to their launch requires additional emphasis on prompt strike capabilities; persistent overhead coverage and all-weather ISR; and rapid processing, exploitation, and dissemination of targeting information.

DoD efforts to reduce vulnerability to regional missile strikes will also include investments in the passive defense elements of hardening, dispersal, deception, redundancy, and enhanced resilience of bases, logistics, and other key facilities and functions. These passive measures will contribute to the defense of key bases and facilities in allied and partner nations in the face of adversary A2/AD strategies. DoD is also working with the Department of Homeland Security to improve the Federal Emergency Management Agency's notification process for missile attack against the U.S. homeland.

In addition, the United States is pursuing counterproliferation efforts in conjunction with our allies and partners to prevent rogue states from acquiring the technology and components necessary to develop advanced missile delivery systems, collaborating with other rogue states

on such programs, or proliferating such systems as they are developed. These measures contribute to countering rogue states' efforts to threaten the United States, allies, and partners with offensive ballistic missiles.

Without sustained investments in active and passive missile defenses, capabilities for more integrated and effective attack operations supported by integrated ISR, and counterproliferation efforts, the United States risks being outpaced by the continuing expansion of adversary offensive missile capabilities.

### *Flexibility and Adaptability*

From the Cold War until today, the United States has had diverse missile defense goals. Over past decades, these goals have occasionally been revised more rapidly than the corresponding adjustments in programs. Moving forward, 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. 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.

*“Develop a lethal, agile, and resilient force posture and employment. Force posture and employment must be adaptable to account for the uncertainty that exists in the changing global strategic environment.”*

- 2018 National Defense Strategy of the United States of America

Adaptability enables U.S. missile defenses to adjust to changes in the threat environment and possible shifts in missile defense missions, such as addressing the emerging threat posed by HGVs and advanced cruise missiles. This may include the need to counter potential geopolitical or technological surprises, such as unanticipated increases in the number of adversaries and the quantity or quality of their offensive missile systems. Flexibility applies to near-term challenges and conflict, including missile defense mobility, the capacity to surge capability as needed, and the ability to integrate rapidly with allied and partner systems.

Because the U.S. missile defense posture must be capable of being flexibly deployed and adaptable to meet future threats as they emerge, consistent with rigorous testing, DoD will continue to seek ways to shorten the time required to develop and field responsive missile defense systems. Together, the policies and capabilities needed for 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. Doing so will strengthen the deterrence of attack and the assurance of allies, and also provide the most effective basis for responding to a missile attack if deterrence fails. Missile defense flexibility

and adaptability also are key components of the U.S. capacity to hedge against geopolitical and technological risks that emerge in unpredictable ways.

### *Tighter Offense-Defense Integration and Interoperability*

Potential adversaries are making advances across a broad range of offensive missile capabilities that threaten the ability of U.S. forces to project power and respond to aggression in contested environments. 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, but will be regionally executed and designed to 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. For example, addressing emerging transregional offensive missile threats requires interoperable missile defense systems comprised of networked sensors, shared intelligence, interceptors, and a command and control structure coordinated among multiple combatant commands.

Enhanced integration will proceed in at least three ways:

*Integrating Offenses and Defenses.* The United States will pursue greater integration of attack operations with active and passive missile defenses. The United States will seek to use the same sensor network to both intercept adversary missiles after their launch, and, if necessary, strike adversary missiles prior to launch. Improvements in Indications & Warnings (I&W) will enhance the effectiveness of both attack operations and active defense capabilities.

*Homeland-Regional Integration.* The integration of homeland and regional missile defense assets will improve both missions and reduce overall system costs by leveraging the range of U.S., allied, and partner assets. Missile defense sensors that operate overseas can provide earlier or additional tracking information on missiles directed at the United States, allies, and partners. For example, the U.K.'s Fylingdales Upgraded Early Warning Radar can support the defense of the United States against Iranian long-range missile threats while also supporting the defense of Europe from potential IRBM threats. Earlier detection and tracking of incoming offensive missiles allows the Ground-based Midcourse Defense (GMD) system to engage threats earlier in their flight, improving the likelihood of destroying incoming offensive missiles. The missile defense radars the United States has deployed in Japan provide enhanced early warning and tracking of missiles launched from North Korea toward the United States or Japan. Going forward, DoD will work with allies and partners to prioritize these types of missile defense integration opportunities that contribute to more effective protection of the United States, its allies and deployed forces.

*Missile Defense Interoperability.* Fielding a more integrated missile defense system depends on continued progress in achieving greater interoperability between U.S. forces and those of our allies and partners. As our allied and partner missile defense capabilities grow in size and sophistication, complementary capabilities, and fielding schedules, a strong commitment to interoperability will maximize their contribution to the missile defense mission and enable a more effective collective response to missile attacks.

Given the growing complexity of the threat, isolated systems for information sharing and command and control cannot provide required levels of capability. DoD will work towards fusing and exploiting available sources of information and data, including early warning and intelligence systems to create an integrated air and missile threat picture. This will enable effective operations against combined attacks involving aircraft, cruise and ballistic missiles, and hypersonic vehicles.

Sharing information and data among U.S. and allied missile defense systems will strengthen the combined military coordination necessary to negate missile threats while minimizing gaps and seams in U.S. led regional defense architectures. The United States tailors its missile defense cooperation strategy and investments to the unique geopolitical situation of our allies and partners, and encourages them to invest in missile defense capabilities – sensors, interceptors and command and control systems – that can be networked together with U.S. systems.

### *Importance of Space*

As rogue state missile arsenals develop, space will play a particularly important role in support of missile defense. 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.

In addition, unlike land-based sensors, space sensors do not require basing rights or agreements with foreign states. This enables them to be placed where necessary to achieve the ideal viewing geometry for launch detection, missile tracking, threat discrimination, and intercept detection/kill assessment of missile threats to the U.S. homeland, our forces abroad and to our allies and partners. Such “birth to death” tracking of incoming missile threats from space is extremely advantageous. Missile defense sensors in space also possess inherent capabilities for other essential missions, including theater missile warning and technical intelligence.

The unique benefits and attributes of space sensors, including persistent and global access to missiles launched from almost any location, may extend to the basing of defensive interceptors in space. For example, 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.

Much has changed since the United States last considered space-based interceptors in a potential architecture, including major improvements in technologies applicable to space-basing and directed energy. Given the rapid advancement and diffusion of offensive missile threats and technology, and in response to the 2018 National Defense Authorization Act (NDAA), DoD will undertake a new and near-term examination of the concepts and technology for space-based defenses. This examination may include on-orbit experiments and demonstrations. New DoD analysis will evaluate the possible effectiveness of space-based interceptor technologies and their cost-effectiveness when compared to other systems based on land, sea, and in the air. This examination will provide an informed contemporary foundation for assessing the technological and operational potential of space-basing in the evolving security environment.

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## IV. U.S. MISSILE DEFENSE PROGRAMS AND CAPABILITIES

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*“We are committed to protecting and defending our nation, its warfighters, friends and allies against all ranges of ballistic missiles in all phases of flight.”*

- Director, Missile Defense Agency, Lt Gen Samuel Greaves, 2018



Today, the Ballistic Missile Defense System (BMDS) provides active defense of the U.S. homeland and deployed forces, allies, and partners, particularly against rogue states. 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.

The recent increases in MDA’s budget for active missile defense appear in Figure 19 below.



Figure 19. Missile Defense Agency Budget. Total Obligation Authority FY 2001 through 2019 actuals.

## U.S. Homeland Defense

### Current Posture

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 employment of which is planned and executed by U.S. Northern Command (USNORTHCOM). The GMD system is designed to defend against a limited ICBM attack from rogue states such as North Korea (see Figure 20) and potentially Iran, but in the event of conflict, it would be used to defend, to the extent feasible, against a ballistic missile attack upon the U.S. homeland from any source. The GMD system engages long-range ballistic missiles in the mid-course phase of flight using Ground-Based Interceptors (GBI). This system destroys attacking missiles by striking them at high speeds with a kill vehicle. This is referred to as “hit-to-kill.”

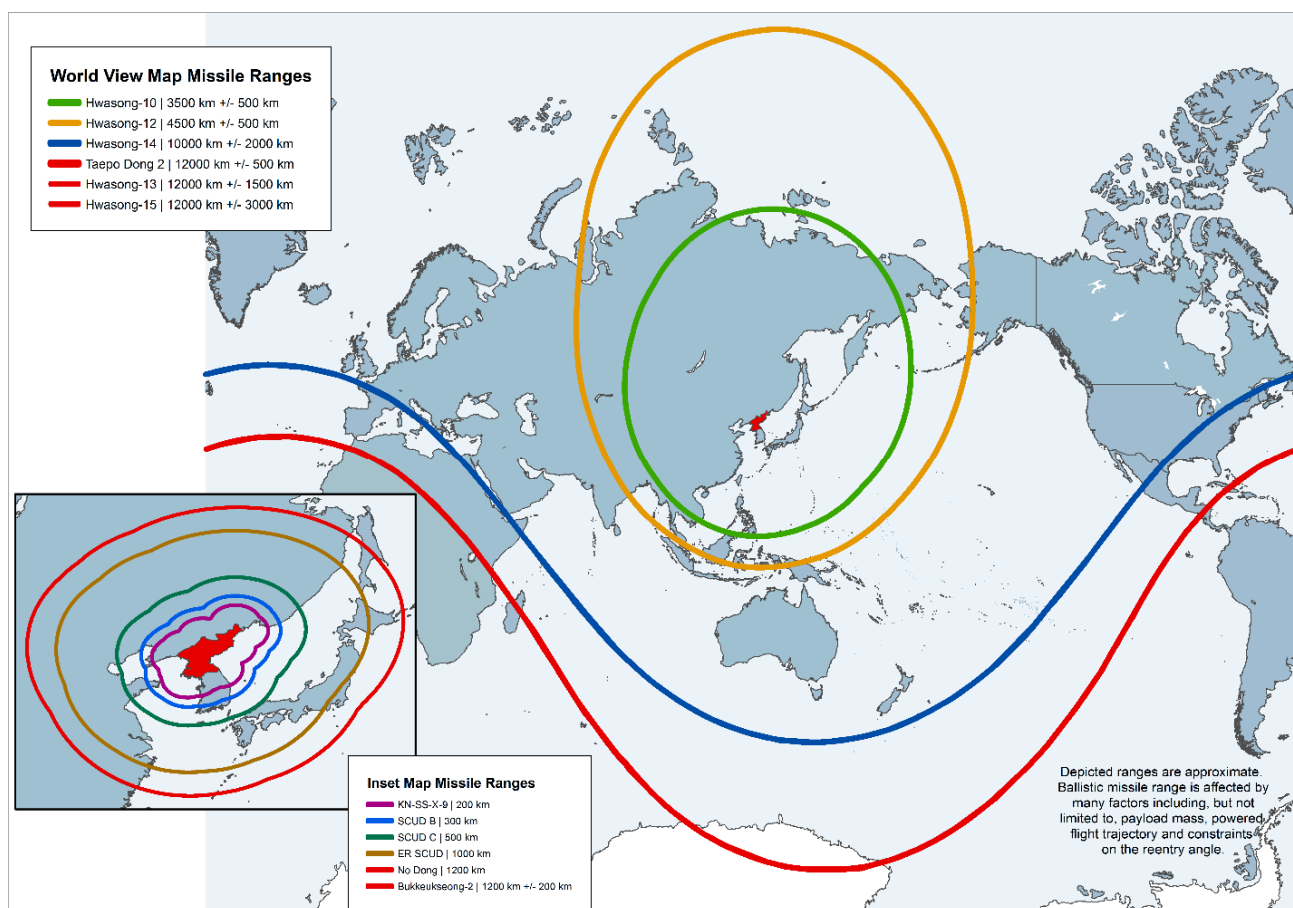


Figure 20. North Korean Offensive Missile Range Rings. Provided by the National Air and Space Intelligence Center.



Today’s GMD system consists of a globally-integrated network of sensors, interceptors, and command and control centers. Forty GBIs are deployed at Ft. Greely, Alaska, and four at Vandenberg Air Force Base, California. An extensive network of terrestrial and space-based sensors provides launch detection, tracking, and discrimination information to the GMD system to enable GBIs to find and destroy their targets. This sensor network includes launch detection satellites; the COBRA DANE radar at Shemya, Alaska; Early Warning Radars in California, the United Kingdom, and Greenland; forward-based X-band radars in Japan; Aegis Ballistic Missile Defense (BMD) destroyers; and a Sea-Based X-band radar in the Pacific Ocean. U.S. military personnel operate the GMD system 24/7 at command and control centers in Ft. Greely, Alaska, and Colorado Springs, Colorado. Two existing Early Warning Radars will be upgraded for missile defense operations in the near future, one at Clear Air Force Station, Alaska and the other in Cape Cod, Massachusetts. DoD is also conducting an analysis-of-alternatives (AoA) to determine how best to modernize the national early warning architecture.

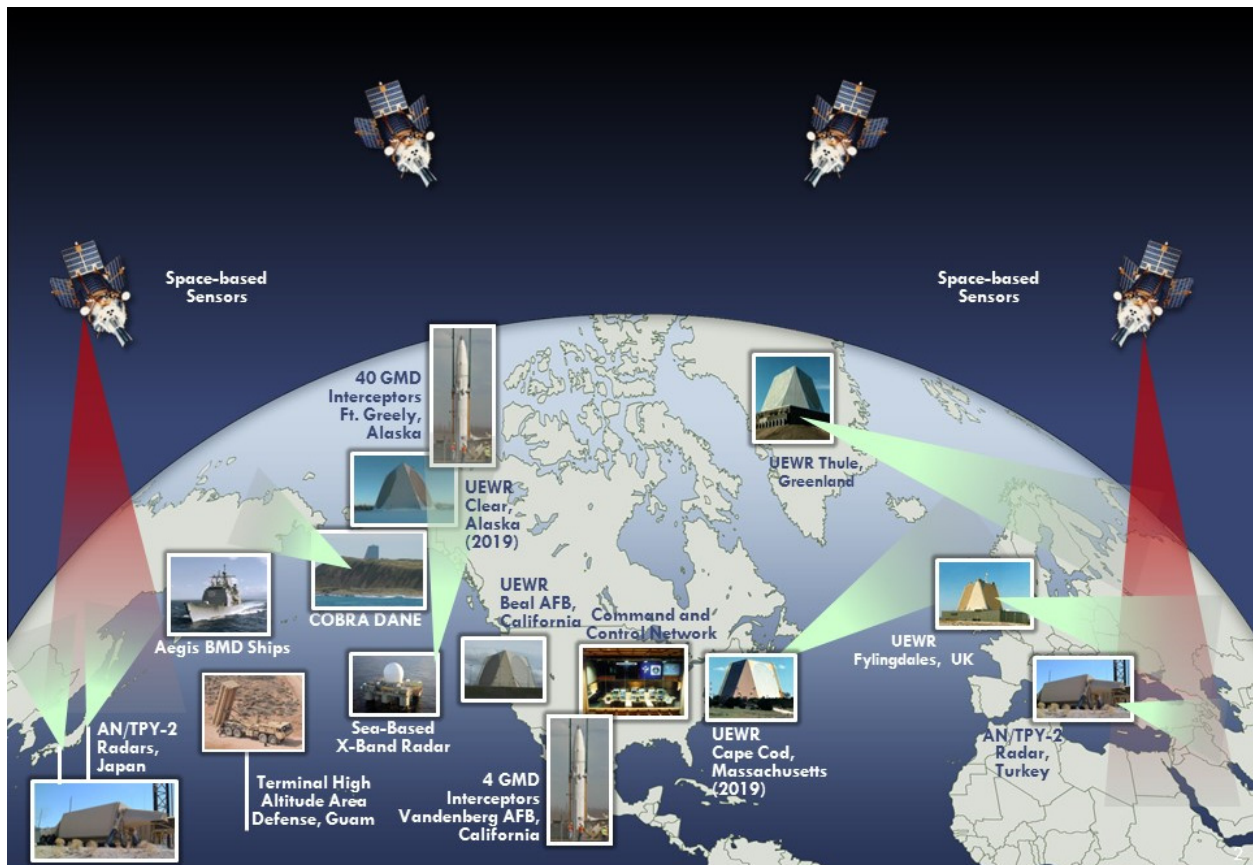


Figure 21. Current Homeland Defense Architecture.

In addition, DoD is investing in the expansion and modernization of current U.S. homeland missile defense capabilities. It is 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. DoD is also investing in the technology needed to counter advanced offensive missile threats for the next decade.

These efforts and priorities are reflected in the Administration’s recent budget requests and actions. In September 2017, Congress approved a DoD request to reprogram almost \$400 million in FY 2017 funds to provide an initial increase in U.S. near-term capabilities to defend against North Korean missile capabilities. Congress appropriated approximately \$14 billion in FY 2018 for homeland and regional missile defense, including an emergency appropriation of \$4 billion to further expand and enhance U.S. missile defense capabilities against rogue state potential missile threats to the U.S. homeland, forces abroad, allies, and partners.

DoD programs to improve the capability and reliability of the current homeland defense system include equipping recently-deployed GBIs with an advanced booster and a more capable Exoatmospheric Kill Vehicle (EKV) to improve system reliability and performance. Both the upgraded booster and EKV were successfully tested against an ICBM-class target in 2017.

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. The new GBIs will consist of an upgraded booster and will carry a new kill vehicle called the Redesigned Kill Vehicle (RKV) that is more effective, reliable, and affordable. These new interceptors will undergo flight testing prior to deployment to demonstrate their improved operational capability and reliability. DoD is also investing in the infrastructure required to maintain the operational fleet of 64 GBIs into the future.



Ground-Based Interceptor

These improvements will enable the United States to defend against an increased number of rogue state ICBMs.

DoD is also strengthening the performance of existing missile defense sensors and fielding new sensors for even greater discrimination capability. The service life of the multi-mission COBRA DANE radar will be extended into the next decade and the Sea-Based X-band (SBX) radar will receive software upgrades. Software algorithms in existing sensors will be modified to improve their discrimination capabilities and their capacity to determine if the attacking offensive missile has successfully been destroyed.

The Long-Range Discrimination Radar under construction at Clear Air Force Station, Alaska, is a multi-mission radar that will strengthen U.S. homeland defense and be available in the 2020 timeframe. This radar will provide persistent long-range mid-course discrimination, precision tracking, and hit assessment. Additionally, a homeland defense discrimination radar in Hawaii, projected to be operational in the 2023 timeframe, will provide increased protection for the defense of Hawaii. The United States also plans to deploy a new missile

defense radar in the Pacific region by 2025. Taken together, these enhancements will reduce the number of identified offensive targets for each defense interceptor launched, and the quantity of interceptors required to ensure intercept, increasing missile defense efficiency and effectiveness.

Sensors used for missile defense increasingly support multiple missions. DoD must work to ensure that the necessary command and control relationships exist to support the optimal use of these sensors for multiple missions.

DoD is also investing in and deploying improved capabilities to confirm that a U.S. missile defense interceptor has destroyed the attacking warhead, a process called “kill assessment.” With the Space-based Kill Assessment (SKA) program, DoD is deploying a network of space-based infrared sensors that will provide an improved kill assessment capability to the missile defense system. Adding a reliable post-intercept assessment capability will enable USNORTHCOM to examine alternate engagement strategies, such as “shoot-assess-shoot,” and will assist in consequence management efforts if needed. A network of SKA sensors will be placed on orbit by the end of 2018.

More complex offensive missile threats to the homeland, such as HGVs and advanced cruise missiles, are on the horizon. Early warning, detecting and tracking of emerging HGVs and advanced cruise missiles that threaten North America are essential to providing timely warning of attack to the U.S. leadership. DoD is pursuing enhanced ways and options to collect and process information from existing space-based and terrestrial sensors to track current and emerging cruise missile and HGV threats, and warn of an impending attack. This effort, which is now regionally focused, is a first step toward modernizing the U.S. early warning system against advanced missile threats to the homeland. *Commander U.S. Strategic Command (USSTRATCOM), as DoD Enterprise Lead for Nuclear Command, Control, and Communications (NC3), shall, in coordination with Air Force and MDA, lead an assessment of the command and control capabilities and concepts of operation needed to provide early warning and attack assessment for advanced ballistic missile, cruise missile, and HGV threats. This assessment will be delivered to Under Secretary of Defense for Research and Engineering (USDR&E), Under Secretary of Defense for Policy (USDP), Director Cost Assessment & Program Evaluation (CAPE), and the Joint Staff within nine months of the release of the MDR. At the completion of the study, Director CAPE will initiate an Analysis of Alternatives for materiel solutions to provide early warning and attack assessment against these advanced threats, and their integration into the NC3 architecture.*

In addition, the United States and Canada will evaluate alternative options jointly to replace the North Warning System. This new system will be designed to enhance the U.S. capability to maintain effective air surveillance of missile threats approaching North America.



The North American Aerospace Defense Command (NORAD), a combined Command of the United States and Canada, is responsible for defending key North American targets and vital infrastructure against air-breathing threats, including cruise missiles. NORAD is analyzing efforts to meet the increasingly sophisticated offensive cruise missile threat to North America. NORAD's efforts will improve defenses in the approaches to North America and within the United States and Canada.

NORAD has a three-phase program to strengthen the defense of North America against cruise missiles. Under the first phase now underway, NORAD is improving defensive coverage of the National Capital Region (NCR) by incorporating advanced sensors into the existing architecture. In Phase 2, also underway, NORAD is expanding surveillance capabilities around the NCR. Phase 3, which is in the early planning stages, will incorporate emerging technology and explore new options to expand surveillance and tracking of cruise missiles for the rest of North America. 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.

The FY 2017 NDAA requires the Secretary of Defense to designate a Service or Defense Agency with acquisition authority with respect to the capability to defend the homeland against offensive cruise missiles. *To meet this requirement, the USDR&E and the Under Secretary of Defense for Acquisition and Sustainment (USDA&S), in coordination with the USDP, and the Chairman of the Joint Chiefs of Staff (CJCS), shall recommend the organization to be designated by the Secretary of Defense to have this acquisition authority within six months of the release of the MDR. The designated organization will be responsible for acquiring U.S. capabilities to defend the homeland against cruise missiles using the existing requirements generation process.*

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## Regional and Transregional Missile Defense

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*“By working together with allies and partners we amass the greatest possible strength for the long-term advancement of our interests, maintaining favorable balances of power that deter aggression and support the stability that generates economic growth. When we pool resources and share responsibility for our common defense, our security burden becomes lighter.”*

- 2018 National Defense Strategy of the United States of America

The United States, allies, and partners face complex regional offensive missile threats. Potential adversaries present a broad array of missile threats that, if left unaddressed, would significantly undermine the U.S. ability to deter aggression and assure allies in Europe, Asia, and the Middle East. Defending effectively against these offensive missile threats will help deter adversaries, assure allies and partners, provide U.S. leaders with a diplomatic position of strength, and also provide the United States with freedom of action to project power in support of national objectives.

*“We have observed Russia and China operating hypersonic missiles...testing hypersonic capability”.*

- Commander, U.S. Strategic Command, General John Hyten  
34<sup>th</sup> Space Symposium, April 17, 2018

Potential adversaries continue to expand the capability and capacity of their regional offensive missile inventories. Russia, for example, has developed and fielded ballistic missiles and land-attack cruise missiles that can strike targets throughout Eurasia. China has the world’s most active ballistic missile development program, and is developing HGVs capable of striking targets across multiple regions. The United States will continue to strengthen its efforts to deter and counter these rapidly advancing regional offensive missile capabilities, and those of North Korea and Iran.

This increasing 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. When combined with other U.S. capabilities, however, active missile defenses can help 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. Active missile defenses provide U.S. commanders time and space to bring other capabilities to bear, but alone are not adequate to enable U.S. or coalition forces to prevail in a conflict. Given the existing advantage potential adversaries have with their large inventory of missiles relative to our current more limited inventory of active defenses, the United States will leverage investments in platforms, weapons, and military expertise to develop complementary attack operations to counter growing regional offensive missile threats.

Potential adversary offensive missiles may be launched from one geographic region to attack targets in a distant region (see Figure 22). 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. To do so, the United States must integrate attack operations, active and passive defensive measures, and a common air and missile threat picture. 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.

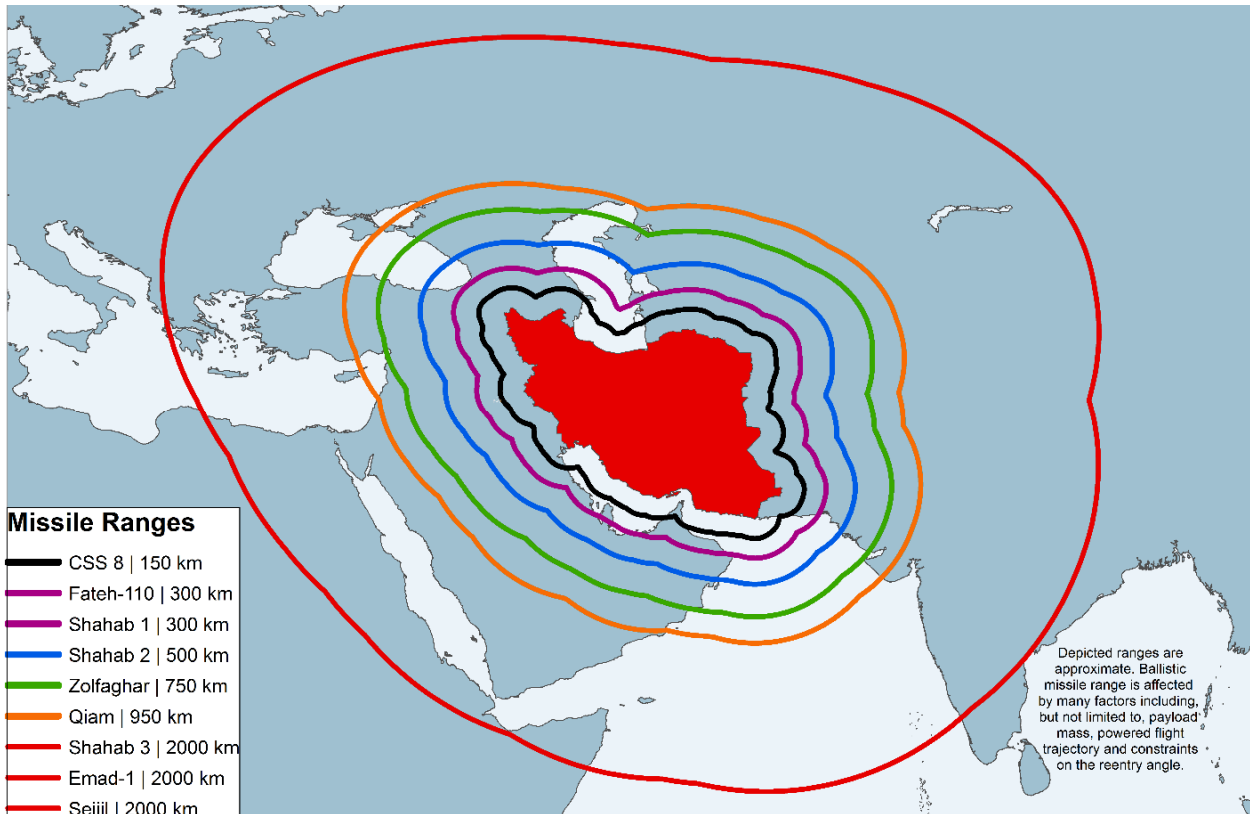


Figure 22. Iranian Offensive Missile Range Rings. Provided by the National Air and Space Intelligence Center.

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## Regional Active Defenses

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The United States currently fields a number of regional active defense systems to intercept potential adversary regional offensive missiles, including cruise missiles. U.S. regional active missile defense systems that are relocatable and mobile offer the benefit of being able to shift locations and regions as needed. Mobile sensors and interceptors can be surged to zones of crisis or conflict and, if they are interoperable with allied and partner assets, support combined defensive operations. For example, the interoperability of U.S. and Japanese mobile and fixed missile defense capabilities enable combined operations in times of crisis or conflict. Mobility

also makes it more difficult for an adversary to observe the locations of U.S. and allied missile defense assets to target them.

The United States continues to make significant progress in the development, deployment, and modernization of regional active missile defense capabilities as summarized below:

*Terminal High Altitude Area Defense (THAAD):* The THAAD system engages SRBMs, MRBMs, and IRBMs using hit-to-kill technologies in the terminal phase of flight in either the endoatmosphere or the exoatmosphere. 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.



Terminal High Altitude Area Defense Launcher

The current Army-validated requirement for THAAD was established two decades ago. Given missile threat developments since then, the need for THAAD batteries deployed abroad on an enduring basis may well demand more than the current force of seven batteries. *The U.S. Army, Joint Staff, and MDA will prepare a report to be delivered to CJCS, USDR&E, USDA&S, and USDP within six months of the release of the MDR that provides a current assessment of the required number of THAAD batteries to support needed worldwide THAAD deployments, including potential deployment timelines, and basing and deployment options.*

*Aegis Sea-based Missile Defense:* The Aegis Weapon System (AWS) for active missile defense uses the SM-3 and SM-6 guided missiles to provide protection at sea and ashore against regional ballistic missiles. The United States is testing improved variants of both the SM-3 and SM-6 missiles and fielding a new sensor. These new missiles and sensor will significantly increase Aegis missile defense capabilities. Multi-mission Aegis BMD-capable ships are also highly maneuverable and survivable, and will be surged as needed during crisis and conflict.



Aegis Ballistic Missile Defense ship

Today there are 38 operational multi-mission Aegis BMD-capable ships divided between the Pacific and Atlantic Fleets, with plans to increase that number to 60 by the end of FY 2023. Some of these multi-mission Aegis BMD-capable ships will be upgraded with new software,

and thereby provide greater missile defense capability. The combination of increased ship numbers and capability of each ship will result in a more flexible and resilient Aegis force with significantly greater missile defense capability.



Figure 23. Notional Aegis Defensive Areas. Notional depiction of the area that can be defended by Aegis vessels.

The United States and Japan are collaborating closely to develop the SM-3 Blk IIA interceptor, which will provide a new missile defense capability against MRBMs and IRBMs. Japan is developing key components of the SM-3 Blk IIA. The integration of the SM-3 Blk IIA into land- and sea-based platforms will provide greater regional defense coverage against threats to U.S. forces, and allies and partners. Initial fielding is planned for the 2018 timeframe. The United States will deploy the SM-3 Blk IIA to the fleet and will also deliver this interceptor and AWS upgrades to support the U.S. contribution to NATO ballistic missile defense.



*Aegis Ashore* is similar to the sea-based version of the AWS 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 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 missile defense system has a proven combat record, as demonstrated in 2003 during Operation Iraqi Freedom. It is capable of launching several interceptor variants and is now deployed with U.S., allied, and partner forces in multiple theaters to defend against SRBMs and cruise missiles. Currently, eight battalions with 33 batteries are stationed in the United States while seven battalions with 27 batteries are stationed overseas.



Patriot System Missile Launcher.

Since the initial deployment of Patriot in 1982, the United States has continuously improved the system. The original missile designed to engage air-breathing threats was redesigned to be effective against short-range ballistic missiles using hit-to-kill technologies, which is the Patriot PAC-3 missile that is now deployed globally. The latest variant, called Missile Segment Enhancement (MSE), has a more powerful rocket motor and larger fins for increased range and lethality. The Patriot radars have been upgraded to provide greater power and survivability, and the ground control and launching stations have been modified to enable increased operational flexibility.

The Army continues to make qualitative upgrades to the Patriot system, including the development of a new Lower Tier air and missile defense sensor and upgrading older PAC-2 launchers to enable them to launch newer PAC-3 and MSE missiles.



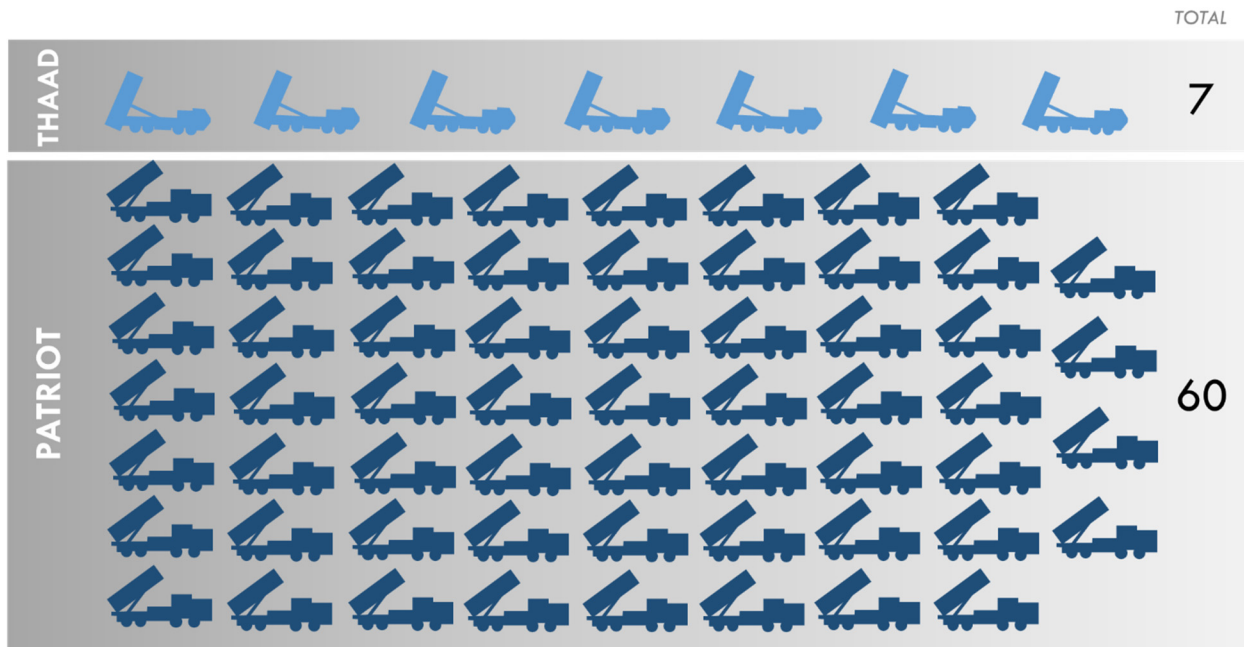


Figure 24. Current THAAD and Patriot Batteries. THAAD and Patriot Batteries are equipped with a variable number of interceptors.

Congress provided funding in FY 2017 and FY 2018 to procure additional GBI, Patriot, THAAD and SM-3 interceptors. These missile defense procurements are additive to the current program and will increase the growing inventory of U.S. missile defense interceptors available in a crisis to protect the U.S. homeland, forces deployed abroad, allies, and partners.

*Army Navy/Transportable Radar Surveillance and Control Model 2 (AN/TPY-2) Radars:* The United States has designed and fielded the AN/TPY-2 for ballistic missile defense. The AN/TPY-2 is capable of tracking all classes of ballistic missiles and identifying small objects at long distances. In the forward-based mode, this radar plays a vital role in the BMDS by acting as a forward-based sensor, detecting ballistic missiles early in their flight and providing precise tracking information for use by the system. In the terminal mode, the AN/TPY-2 can provide surveillance, tracking, discrimination and fire control support for THAAD. There are five AN/TPY-2 radars deployed to the Indo-Pacific and Southwestern Asia. This capability can quickly detect foreign missile launches, helping the U.S. and its allies respond with active missile defenses.



AN/TPY-2 Transportable Radar

Figure 25. Select U.S. Missile Defense Assets in Europe (2018).



Figure 26. Select U.S. Missile Defense Assets in East Asia (2018).

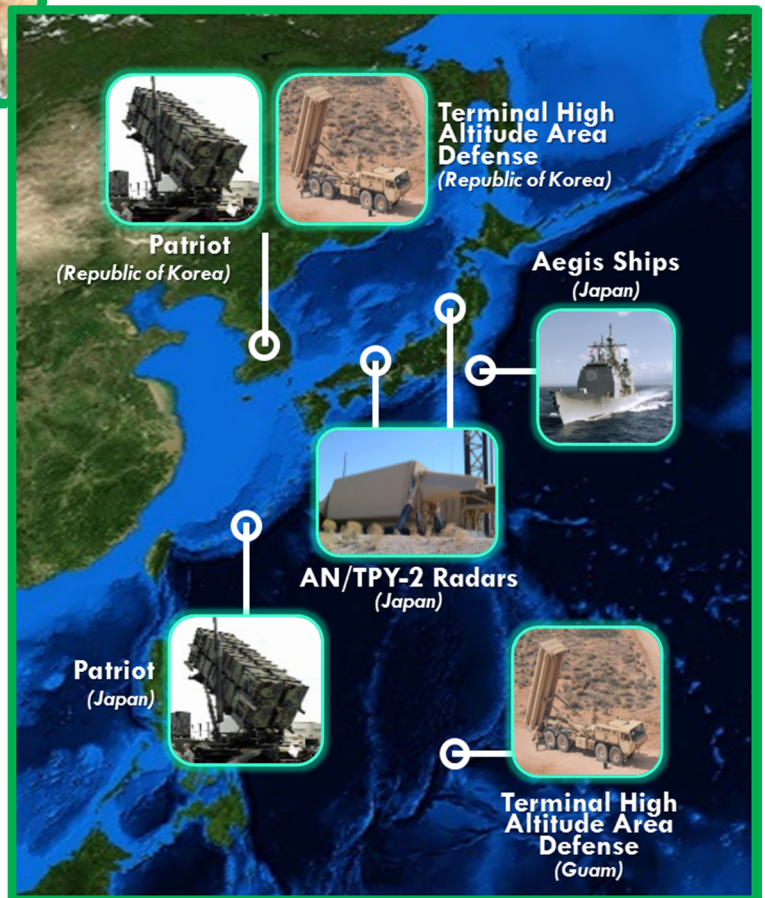




Figure 27. Select U.S. Missile Defense Assets in the Middle East (2018)

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## Regional Active Defenses Against Cruise Missile Threats

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The regional U.S. 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. Current cruise missile defense capabilities for regional conflict span land, air, and maritime domains. At sea, Aegis platforms are capable of intercepting current cruise missile and aircraft threats with the SM-2, SM-6, Evolved Sea Sparrow Missile (ESSM), and the Close-In Weapon System. U.S. combat aircraft can independently target cruise missiles with Advanced Medium-Range Air-to-Air Missiles (AMRAAM) and Sidewinder missiles.

Army Patriot systems also are capable of intercepting cruise missiles and the Army is developing the Indirect Fire Protection Capability (IFPC) for additional defense against air threats, including cruise missiles. IFPC Increment 1 will include one or more interceptor types, a fire control system, and a multi-mission launcher. The Army will explore adding more capability in Increment 2, including additional interceptor types.



## Preparing for Emerging Offensive Missile Threats and Uncertainties

Meeting emerging missile threats and hedging against future uncertainties are essential elements of our missile defense strategy. To do so, DoD is taking steps consistent with the annual budget process to improve or adapt existing systems, relocate mobile systems, and build new systems, including some on a relatively short timeline to counter North Korean and potential Iranian ICBM capabilities. These broad efforts reflect DoD’s commitment to advanced capabilities and maintaining the science and technology foundation necessary to push the boundaries of active missile defense. They will support the goals of staying ahead of rogue states’ offensive missile threats to the homeland, meet the diverse range of regional offensive missile threats, and contribute to the U.S. capability to hedge against future threats.

### Improve or Adapt Existing Systems

*“I believe [GMD is] adequate for the threat we face today, but I think that much more needs to be done for the threat that we’ll face in two to three years.”*

- Then-Commander, U.S. Pacific Command, Admiral Harry Harris, February 14, 2018

Today there are 38 operational multi-mission Aegis BMD-capable ships, with plans to increase that number to 60 by the end of FY 2023. *The Navy and MDA will jointly develop a plan to convert all Aegis destroyers to be fully missile defense capable, including against ballistic missiles, within 10 years. This plan will be delivered to USDA&S, USDR&E, and USDP within six months of the release of the MDR.*

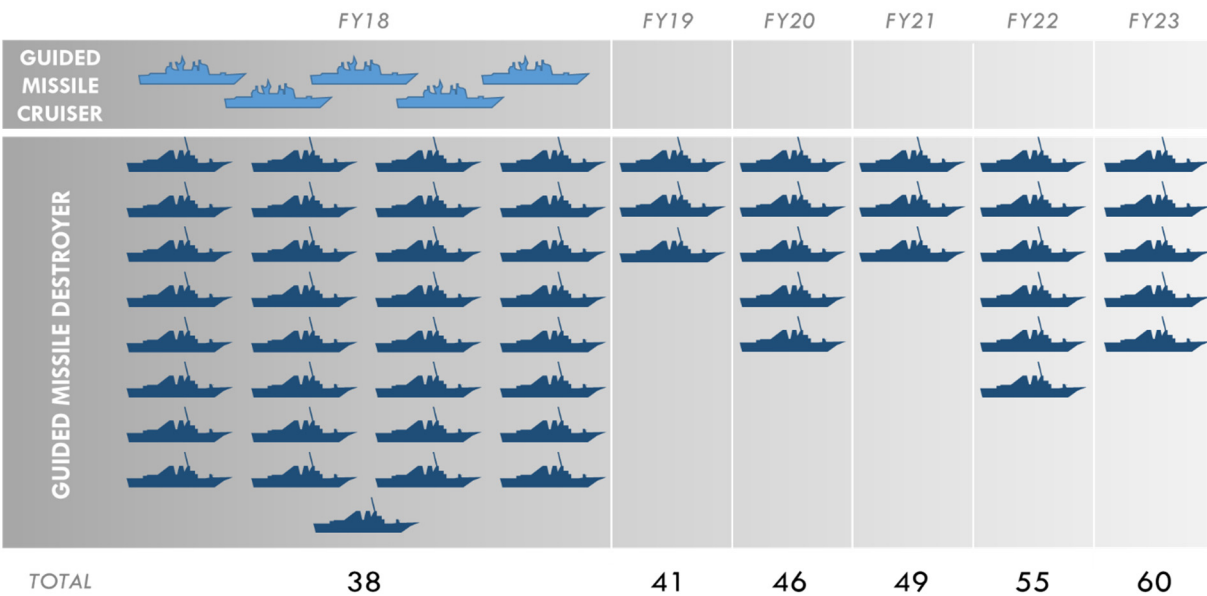


Figure 28. BMD-Capable Aegis Ship Count.

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 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 evolving rogue states’ long-range missile capabilities.

Congress has directed DoD to examine the feasibility of the SM-3 Blk IIA against an ICBM-class target. MDA will test this SM-3 Blk IIA capability in 2020. Due to the mobility of sea-based assets, this new underlay capability will be surged in a crisis or conflict to further thicken defensive capabilities for the U.S. homeland. Land-based sites in the United States with this SM-3 Blk IIA missile could also be pursued.

U.S. missile defense tracking and discrimination sensors for homeland defense could hedge against expected and unanticipated missile threat developments. *MDA, in coordination with USNORTHCOM, will prepare a plan, to be delivered to the USDR&E and USDP within six months of the release of the MDR, to accelerate efforts to enhance missile defense tracking and discrimination sensors, to include addressing advanced missile threats.*

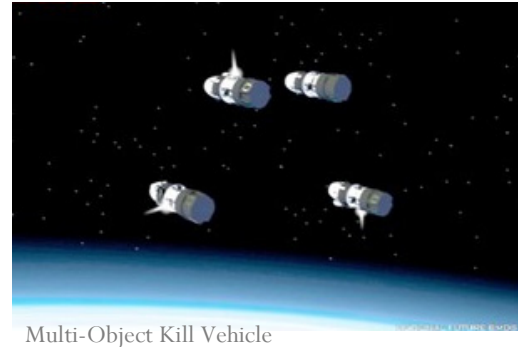
Adapting existing capabilities to perform new missions for homeland and regional missile defense also will be necessary. The SM-6 guided missile is an example of an existing capability originally developed as an air and missile defense weapon, but has since been adapted to also perform tactical strike operations. Similarly, existing intelligence-gathering sensors have a demonstrated capability to track offensive missiles precisely and may be incorporated into both U.S. homeland and regional missile defense architectures.

DoD’s newest tactical aircraft, the F-35 Lightning II, has a capable sensor system that can detect the infrared signature of a boosting missile and its computers can identify the threatening missile’s location. The F-35 also can transmit tracking data to the Joint Force for network centric warfighting. It 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 and could be surged rapidly to hotspots to strengthen U.S. active defense capabilities and attack operations. *To this end, the U.S. Air Force and MDA will deliver a joint report to the USDA&S, USDR&E, USDP, and the CJCS within six months of the release of the MDR, on how best to integrate the F-35, including its sensor suite, into the BMDS for both regional and homeland defense.*

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 North Korean missile capabilities. DoD will study this possibility to further evaluate it as a viable near-term option to enhance the defense of Hawaii. The United States will augment the defense of Hawaii in order to stay ahead of any possible North Korean missile threat. *MDA and the Navy will evaluate the viability of this option and develop an Emergency Activation Plan that would enable the Secretary of Defense to operationalize the Aegis Ashore test site in Kauai within*

30 days of the Secretary’s decision to do so, the steps that would need to be taken, associated costs, and personnel requirements. This plan will be delivered to USDA&S, USDR&E, and USDP within six months of the release of the MDR.

The Multi-Object Kill Vehicle (MOKV) program 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.



*“Pacing the threats we face in the region is not an option in my playbook. We must work hard and invest the money to outpace the competition by developing and deploying the latest technology...”*

- Then-Commander, U.S. Pacific Command, Admiral Harry Harris Statement before the House Armed Services Committee, February 14, 2018

### *Relocating 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. Repositioning existing sensors, such as an AN/TPY-2 radar or the SBX, will enhance radar coverage on short notice by strengthening U.S. capabilities to track adversary missile launches. In the future, additional missile defense capabilities, such as the F-35 and boost-phase defenses could also contribute to U.S. mobile capabilities that will be surged as necessary in crisis or conflict.



Sea-Based X-Band Radar

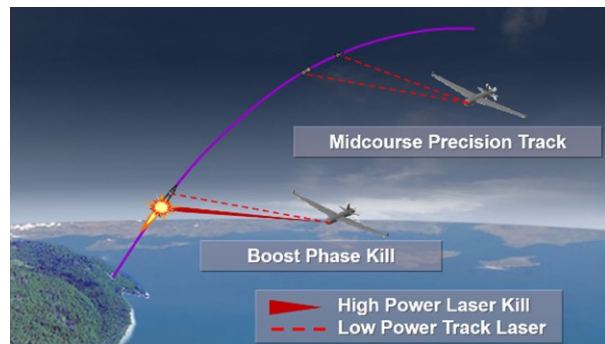


## Building New Systems

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.

Building a new GBI interceptor site in the continental United States is also an option for added homeland defense capability. This new site, known as the CONUS Interceptor Site (CIS), would add interceptor capability against the potential expansion of missile threats to the homeland, including a future Iranian ICBM capability. DoD has already prepared an Environmental Impact Statement evaluating candidate locations in the eastern United States. The completed Environmental Impact Statement will enable DoD to shorten the deployment timeline should the United States determine that threat conditions warrant building a new interceptor site. In the event of such a decision, the location selected for the site will be informed by multiple pertinent factors at the time.

Intercepting offensive missiles in their boost-phase (before the re-entry vehicle separates from the booster) using kinetic interceptors and/or directed energy would increase the likelihood of successfully countering the threat, 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.



UAV-mounted lasers for boost phase intercept and midcourse tracking

Developing scalable, efficient, and compact high energy laser technology, and integrating it onto an airborne platform 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 technological advances made earlier in DoD's Airborne Laser Program, including for example advances in beam propagation and beam control. MDA 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.

In accordance with the FY 2017 NDAA, DoD is preparing a strategic roadmap for the development and fielding of directed energy weapons and key enabling capabilities. When completed, this roadmap will inform high-energy laser investments in the preparation of the President’s Budget Request for FY 2020.

*“It was feasible to deploy boost-phase defenses, particularly against a nation with the geography of North Korea, it was feasible many years ago to do it. What we have lacked in the missile defense arena, until recently, is the will, not the technology and not the means.”*

- Under Secretary of Defense for Research and Engineering, Michael D. Griffin  
Nomination Hearing with the Senate Armed Services Committee, 2018

*Given the significant advantages of space-basing for sensors, and potentially interceptors, particularly for boost-phase defense, MDA will study development and fielding of a space-based missile intercept layer capable of boost-phase defense and provide a report to USDR&E, and USDP within six months after the release of the MDR. It 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. This examination and a boost-phase study directed by the Deputy Secretary of Defense will inform DoD considerations, including budgetary, with regard to the pursuit of a space-based missile intercept layer for boost-phase defense.*

DoD also is taking steps to build a new ground-based radar in the Asia-Pacific region to strengthen active defense of the homeland against any potential North Korean missile threat. In addition, Congress has directed by the end of 2020 DoD will deploy a long-range discrimination radar, or other appropriate sensor capability, optimized to defend against Iranian missiles. MDA is evaluating the optimal sensor and site.

DoD is examining the value of existing missile defense systems as well as emerging new technologies and concepts for defense against the potential threats posed by adversary HGVs. As with defenses against today’s ballistic and cruise missiles, developing the means to defend against HGVs deployed regionally will be critical in the future to address concern over the erosion of U.S. regional military advantages expressed in the 2018 NDS.

Building on this success, DoD has established a HGV defense program led by MDA. DoD has successfully demonstrated a limited capability to defend against HGVs in the terminal phase, and is pursuing new capabilities for early warning and tracking of HGVs. MDA is now conducting an AoA to assess defensive architectures to defeat hypersonic threats. Phase one of this effort evaluates the efficacy of existing sensors and weapons systems to address this

threat. As required by Sec. 1687 of the FY 2017 NDAA, the Director of MDA is assigned the responsibility of Executive Agent for the development of capabilities to counter HGV and conventional prompt strike threats. *In addition, MDA will provide a plan identifying the resources, testing, and personnel requirements necessary for defense against hypersonic threats to USDR&E and USDP, within six months of the release of the MDR. MDA will leverage the hypersonic work taking place at the Defense Advanced Research Projects Agency and the U.S. Air Force.*

Space-based sensors provide enhanced capability to track, discriminate, and target more complex missile threats and enable more effective and efficient use of interceptors. DoD is undertaking initiatives to explore new space sensors to take advantage of the large area viewable from space. The wider view from space allows for improved tracking and potentially targeting of advanced threats such as HGVs, which fly at lower altitudes than ballistic missiles and can maneuver throughout their trajectories to avoid some radar coverages. This capability would also provide the ability to track the dim upper stage of some ballistic missiles. This capability will be necessary to provide the tracking information needed for defense against HGV threats in the future.

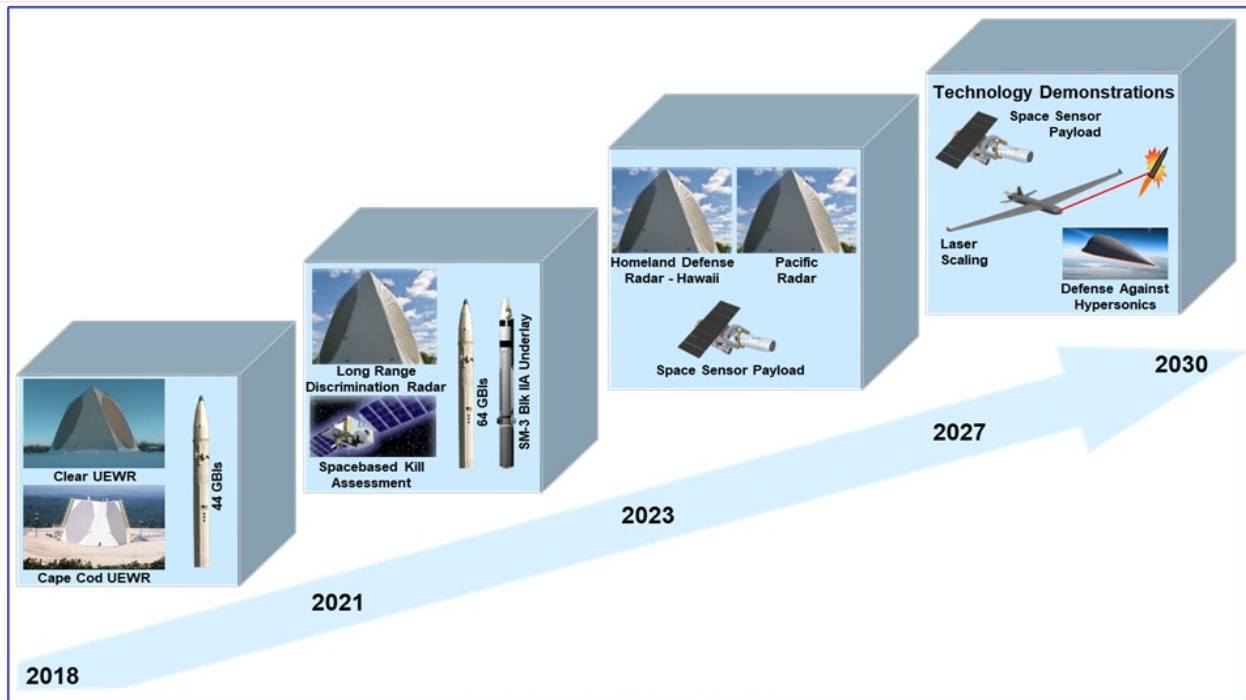


Figure 29. United States Homeland Missile Defense Growth.

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## Attack Operations for Missile Defense

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If deterrence and diplomacy fail, 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. They help to ensure that the United States has the broadest set of options available to counter adversary missile attack. They also increase the effectiveness of active missile defenses by reducing the number of adversary missiles to be intercepted. DoD is placing added emphasis on the capabilities needed for such attack operations.

Congress approved additional funding in FY 2017 and FY 2018 focused on the North Korean missile threat. More than \$700 million of these funds were for new or ongoing capabilities to rapidly locate, target, and destroy North Korea's mobile missiles and for use in other regional operations. The President designated this added funding, reflecting the Administration's commitment to rapidly and effectively address the North Korean missile capabilities.

This funding request is a beginning. DoD will sustain investments 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 prompt strike capabilities necessary for destroying mobile missiles prior to their launch. To this end, DoD will continue to investigate options to promptly strike fleeting targets at stand-off ranges, including currently available capabilities and new concepts.

# V. MISSILE DEFENSE MANAGEMENT AND TESTING

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*“As adversaries continue to pursue credible and advanced capabilities, we too must evolve our missile defense capabilities to outpace increasingly complex threats...Foundational to our confidence in the Ballistic Missile Defense System, and how we operationally employ it, are robust test and sustainment programs.”*

- Then-Commander, U.S. Northern Command, General Lori Robinson, Statement before the Senate Committee on Armed Services, April 6, 2017



In 2002, then-Secretary of Defense, Donald Rumsfeld, changed the name of the Ballistic Missile Defense Organization to the Missile Defense Agency, and directed it to develop and field a layered missile defense system to meet the emerging rogue state ballistic missile threat. The then-Secretary 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 meant that the United States had an initial operational homeland missile defense system in place by the fall of 2004, prior to North Korea's Taepodong-2 missile test in 2006.

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## Accelerate Missile Defense Acquisition Timelines

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As discussed in the 2018 NDS, given the challenging and dynamic missile threat environment, DoD must prioritize speed of delivery, continuous adaptation, and frequent modular upgrades, 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 deliver missile defense capabilities faster, learn from failure and rapidly adjust, and swiftly adapt systems once fielded. DoD cannot meet this goal by returning MDA to the standard acquisition and requirements generation processes. DoD must instead continue to streamline and refine acquisition processes and ensure flexibility in the development, testing, and fielding of missile defenses.

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 programs from MDA to a Service. Missile defense requirements are determined through the Warfighter Involvement Process (WIP). The WIP effectively sets initial capability standards and engages the participation of warfighters early and throughout the development process. *To ensure that Service and Combatant Commanders involvement occurs as early as possible in the capabilities development process, USDR&E, USDA&S, USDP and CJCS, in coordination with Commander, U.S. Strategic Command (USSTRATCOM), will review the current process within six months of the release of the MDR and determine if there is a need for improvements to this process.*

Potential adversaries have missiles that can be launched in one geographic region and threaten U.S. interests and territory in another, even distant region. As these transregional threats evolve, U.S. missile defense planning will be global in nature and coordinated across geographic combatant commands. Today, multiple regional Combatant Commanders are involved in defending against transregional missile threats. In times of escalating tensions or conflict, allocation of limited missile defense resources and prioritization of missile defense efforts across regions must occur rapidly and effectively. DoD must ensure the management and testing of these programs is aligned with policy objectives and supports operational needs in a timely manner. Missile defense roles, responsibilities, and authorities must be clearly aligned to achieve greater optimization and integration of U.S. missile defense capabilities.



*Therefore, the CJCS in coordination with the Commander, USSTRATCOM, in accordance with Strategic Command's missile defense responsibilities under the Unified Command Plan; the USDP; and other Combatant Commanders, will examine and make recommendations regarding optimal roles, responsibilities, and authorities for achieving greater transregional missile defense integration within six months of the release of the MDR.*

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## Managing Pre-Launch Attack Operations Capabilities

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The FY 2017 NDAA contains a requirement for the Secretary of Defense to designate a Service or Defense Agency with acquisition authority pertaining to pre-launch attack operations capabilities for missile defense. To ensure institutional focus on the resources, technologies, and capabilities needed to provide more effective and lethal attack operations, DoD will examine and clarify roles and responsibilities among its components and identify an entity to take lead responsibility for attack operations capability development, employment concepts, and operational integration. *USDR&E, USDP, and the CJCS, in coordination with the Commander USSTRATCOM, will identify the organization to take this lead responsibility and report their recommendations to the Secretary of Defense within six months after the release of the MDR. The organization so designated will work with the Joint Staff, Services, and Combatant Commanders to review and update, where required, operational doctrine regarding the role of pre-launch attack operations in Joint IAMD doctrine.*

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## Rigorous Testing

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Rigorous testing is a DoD priority because testing is a crucial part of the development and fielding of effective missile defense capabilities. DoD and MDA will respond to the increasingly sophisticated offensive missile threat to the United States, allies, and partners with 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. Successful flight tests in particular give the U.S. military greater confidence in the system's capabilities. Testing new missile defense capabilities is essential to characterize performance and demonstrate reliability in support of the fielding of effective, suitable, and survivable missile defense systems.

MDA's test program provides critical data to demonstrate the operational effectiveness, suitability, survivability and security of the BMDS elements. Successful testing can also contribute to both deterrence and U.S. nonproliferation goals by sending a very credible message to the international community of our ability to intercept ballistic missiles in flight,

thus reducing their value to potential adversaries. 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.

The MDA's missile defense test program uses cost effective models and simulations in all aspects of testing. Models and simulations allow repeated assessments of performance, provide a statistical determination of effectiveness, and satisfy assessment objectives that cannot be accomplished in ground or flight tests due to safety issues and cost constraints.

Missile defense tests are planned and conducted in partnership with the Director of Operational Test and Evaluation (DOT&E), the Director of Developmental Test and Evaluation, and with the Army, Navy, and Air Force Operational Test Agencies to embed operational test and military requirements in the test program. The U.S military, which operates the deployed system, ensures that tests use operational doctrine and real world constraints while evaluating new concepts of operations and exercising tactics, techniques, and procedures. Testing provides U.S. military commanders with confidence in the basic design of the BMDS, its hit-to-kill effectiveness, and its inherent operational capability and value.

MDA will use consistent, disciplined, and collaborative engineering and test processes to ensure all missile defense capabilities are rigorously tested in ground tests and flight tests. It will employ accredited modeling and simulation to support testing and produce operationally realistic assessments of BMDS performance. MDA, in coordination with DOT&E and Combatant Commanders, will annually update and execute a test program that supports military assessment needs and MDA program decisions. Finally, MDA will annually evaluate software and algorithms to meet the increasingly complex and maneuverable flight paths of potential adversary missiles, updating them as necessary.

## VI. WORKING WITH ALLIES AND PARTNERS

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*“There are two things that make the United States’ military unique and make us able to say we have a competitive advantage. The first is at the strategic level and it’s the network of allies and partners that we have around the world and we’ve built up since World War II.”*

- Chairman, Joint Chiefs of Staff,  
General Joseph Dunford, July 22, 2017



The 2018 NDS affirms that alliances and partnerships are crucial to U.S. security, providing a durable, asymmetric strategic advantage that no competitor or rival can match. It states, “By working together with allies and partners, we amass the greatest possible strength for the long-term advancement of our interests, maintaining favorable balances of power that deter aggression and support the stability that generates economic growth.”

As offensive missile capabilities continue to proliferate, missile defense cooperation has gained increasing importance. The United States will pursue cooperative relations with allies and partners to reinforce and advance missile defense architectures for our common protection, deterrence, and assurance. This cooperation will 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 to confront shared threats, and limiting the proliferation of advanced offensive missile technologies and components. Together, these efforts will enhance our defenses against regional offensive missile threats by leveraging our joint contributions to effectively expand our defensive capabilities.

As is emphasized in the 2017 NSS, strengthening our alliances and long-term security partnerships in these key regions is a top U.S. priority.

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## Indo-Pacific

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*“It is not an exaggeration to say that the security environment surrounding Japan is at its severest since World War Two. I will protect the people’s lives and peaceful living in any situation.”*

- Prime Minister, Japan, Shinzo Abe  
New Year’s News Conference, 2018

*“I highly appreciate the fact that President Trump has made clear that the United States will take every necessary measure to protect its allies...”*

- Prime Minister, Japan, Shinzo Abe, 2017

The cornerstone of our security and diplomacy in 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 offensive missile threats and coercion. This cooperation includes bilateral missile defense training exercises with the United States.

Japan is one of our strongest missile defense partners, and works together with the United States to strengthen cooperative missile defenses against regional missile threats. Japan's current layered ballistic missile defense system includes Aegis BMD ships with SM-3 interceptors, PAC-3 batteries, early warning radars, and command and control systems. It is also expanding its missile defense capability by upgrading additional ATAGO-class Aegis destroyers to BMD capability with certification scheduled for FY 2019 and is building additional Aegis BMD ships, which would increase its inventory of BMD-capable ships. Two Aegis Ashore systems are also scheduled for fielding in the 2023 timeframe which will add to Japan's layered defense posture and provide greater flexibility in deploying mobile missile defense systems. As noted earlier, one of the most significant cooperative efforts with Japan, and an example of mutually beneficial burden sharing, is the co-development of an advanced version of the SM-3 interceptor, the SM-3 Blk IIA. Japan also hosts two U.S. AN/TPY-2 X-Band radars that are fully interoperable in a manner that supports both Japanese and U.S. regional missile defense operations as well as U.S. homeland missile defense.



Japan destroyer JS ATAGO (DDG-177) launches a Standard Missile -3 Block IB Threat Upgrade during Japan Flight Test Mission-05, September 12, 2018. (Missile Defense Agency photo)

To strengthen defense against potential offensive missile threats, South Korea is enhancing its sea- and land-based ballistic missile defense systems. DoD is working with South Korea to upgrade its PAC-2 batteries to the more advanced PAC-3 system. We are also examining together how South Korea's future active missile defense systems can be capable of operating with U.S. systems to defend South Korean territory. South Korea and the U.S. already share warning data from their respective ground- and space-based sensors in accordance with an agreement concluded on data sharing.

The United States and South Korea also have recently taken steps to strengthen missile defense of the Korean Peninsula. In 2017, U.S. Indo-Pacific Command implemented the joint U.S.-South Korean decision to deploy a THAAD battery to South Korean territory to



The first elements of the Terminal High Altitude Area Defense (THAAD) system arriving in the ROK, fulfilling the Republic of Korea - U.S. Alliance decision to install a THAAD system on the Korean Peninsula. (Seventh Air Force Public Affairs photo)



complement U.S. PAC-3 units already on the peninsula. This adds an important new layer to defend against missile attack.

In addition, the United States and Australia are long-term allies with a history of close missile defense consultation. Annual discussions on missile defense offer new possibilities for bilateral cooperation as the offensive missile threats in the region expand and threaten deployed military forces. New areas of focus include joint examination of the challenges posed by advanced missile threats. Australia also participates in a trilateral discussion on missile defense with the United States and Japan.



Figure 30. Select Foreign Missile Defense Assets in East Asia (2018).



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## Europe and NATO

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*“We will work with NATO to improve its integrated air and missile defense capabilities to counter existing and projected ballistic and cruise missile threats, particularly from Iran.”*

- 2017 National Security Strategy of the United States of America

Missile defense plays a critical role in NATO’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. EPAA has three phases intended to address threats to NATO Europe originating from Iran. EPAA Phase 1 and Phase 2 include the stationing of four multi-mission Aegis BMD-capable ships in Rota, Spain, positioning of a forward-based AN/TPY-2 radar in Turkey, and deployment of the first operational Aegis Ashore system in Romania, equipped with the SM-3 Blk IB interceptor. Implementation of Phase 3 of EPAA, which features an Aegis Ashore system in Poland, is underway. Using the SM-3 Blk IIA missile, it will expand defensive coverage against medium- and intermediate-range ballistic missile threats.



Naval Support Facility Poland – Construction. European Phased Adaptive Approach Phase 3 will enhance the defensive coverage against medium- and intermediate-range threats will be enhanced with the delivery of an Aegis Ashore capability to Poland. The ground-breaking ceremony for Aegis Ashore-Poland was conducted on May 13, 2016. On October 1, 2016, Naval Support Facility (NSF) Redzikowo, Poland was established. (Missile Defense Agency photo)

## NATO Missile Defense Progress

*“Ballistic missile proliferation poses an increasing threat to Allies’ forces, territory and populations. Missile defence forms part of a broader response to counter this threat... Bearing in mind the principle of the indivisibility of Allied security as well as NATO solidarity, we task the Council in Permanent Session to develop options for a comprehensive missile defence architecture to extend coverage to all Allied territory and populations not otherwise covered by the United States system for review at our 2009 Summit, to inform any future political decision.”*

- 2008 Bucharest Summit

*“As missile defence forms part of a broader response to counter this threat, we have decided that the Alliance will develop a missile defence capability to pursue its core task of collective defence. The aim of a NATO missile defence capability is to provide full coverage and protection for all NATO European populations, territory and forces against the increasing threats posed by the proliferation of ballistic missiles...”*

- 2010 Lisbon Summit

*“We are pleased today to declare that the Alliance has achieved an Interim NATO BMD Capability. It will provide with immediate effect an operationally significant first step, consistent with our Lisbon decision, offering the maximum coverage within available means, to defend our populations, territory and forces across southern NATO Europe against a ballistic missile attack.”*

- 2012 Chicago Summit

*“The threat to NATO populations, territory, and forces posed by the proliferation of ballistic missiles continues to increase and missile defence forms part of a broader response to counter it...Missile defence will become an integral part of the Alliance’s overall defence posture and contribute to the indivisible security of the Alliance.”*

*“Today we are also pleased to note that additional voluntary national contributions have been offered, and that several Allies are developing, including through multinational cooperation, or are acquiring further BMD capabilities that could become available to the Alliance. Our aim remains to provide the Alliance with a NATO operational BMD that can provide full coverage and protection for all NATO European populations, territory, and forces.”*

- 2014 Wales Summit

*“As a means to prevent conflict and war, credible deterrence and defense is essential and will continue to be based on an appropriate mix of nuclear, conventional, and missile defense capabilities.”*

*“Russian statements threatening to target Allies because of NATO BMD are unacceptable and counterproductive.”*

- 2018 Brussels Summit

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 could play a crucial role in countering missile strikes that underpin potential adversaries' A2/AD operations. The United States will encourage NATO Allies to improve their missile defense capabilities by investing in interceptors and sensors, expanding data sharing and integration, and taking other appropriate steps to counter existing and projected ballistic and cruise missile threats.

There has been recent progress in this regard; Spain, Italy, Germany, and the Netherlands have deployed missile defense systems to Turkey in response to the ongoing Middle East conflict. Spain is also strengthening its air and missile defense capabilities by acquiring additional Patriot systems from Germany. In addition to hosting an Aegis Ashore site, in November 2017 Romania signed an agreement to acquire the Patriot system, Phase One of which is valued at \$756 million. In addition, in March 2018 Poland signed an agreement valued at \$4.75 billion to acquire Patriot systems. Several NATO Allies also have modern surface combatant ships that are being equipped with BMD sensors and, in the future, may be equipped with interceptor capability upgrades. The Netherlands, for example, is upgrading the SMART-L radars on four of its frigates. Denmark, in addition to hosting an Upgraded Early Warning Radar (UEWR) in Greenland, has committed to develop a sea-based sensor that could contribute to NATO missile defense capabilities.

In its 2015 *Strategic Defence and Security Review*, the United Kingdom (UK) committed to invest in a ground-based radar for ballistic missile defense and has participated in ballistic missile defense tests using its Type 45 destroyer. In addition, the UK's Fylingdales UEWR, an element of the U.S. homeland missile defense system and a key component of U.S. capabilities to counter potential Iranian long-range missile threats, is manned and operated almost exclusively by UK personnel. France, in cooperation with Italy, has developed the SAMP/T air and missile defense system, which was fielded in 2013, and could potentially be offered to support NATO missile defense. France also is planning to develop a long-range radar to contribute to NATO territorial missile defense. Additionally, France and Italy have developed the sea-based Principal Anti-Air Missile System (PAAMS), a European equivalent to Aegis.

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. NATO's BMD Operations Center (BMDOC) at Ramstein Air Force Base is now NATO's Command and Control center for missile defense and links national BMD assets together. As allies acquire and field additional missile defense systems in the future, the BMDOC will facilitate a "deepening of interoperability" allowing the Alliance's forces to act together more coherently and effectively to counter missile strikes.

In October 2017, a sub-set of NATO nations, the Maritime Missile Defense Forum, conducted Formidable Shield 17, the purpose of which was to improve allied interoperability in a live-fire IAMD environment using NATO command and control reporting structures. The UK hosted this exercise. Other participants included Canada, France, Germany, Italy, the Netherlands, Spain, and the United States. It involved live-fire launches of the SM-2, SM-3, and ESSM. Formidable Shield 17 broke new ground enhancing NATO's ability to integrate IAMD capabilities and operations.



Allied ships participating FS17. In October 2017, NATO Allies conducted Formidable Shield (FS)-17 at the United Kingdom Ministry of Defence Hebrides Range in Scotland. This exercise included a successful intercept test of an SM-3 Block IB Threat Upgrade (TU) missile against an MRBM target, fired from an Aegis BMD destroyer. (U.S. Navy Sixth Fleet photo)



Figure 31. Select Foreign Missile Defense Assets in Europe (2018).

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## The Middle East – Gulf Cooperation Council

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*Middle East: “We will help partners procure interoperable missile defense and other capabilities to better defend against active missile threats.”*

- 2017 National Security Strategy of the United States of America

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. Indeed, the United Arab Emirates (UAE) has procured the THAAD system to complement its earlier purchase of Patriot systems. Saudi Arabia and the United States are negotiating a potential THAAD Foreign Military Sales agreement. Saudi Arabia is also in the process of upgrading its existing Patriot batteries to the PAC-3 configuration, and is pursuing additional air and missile defense capability. Kuwait is acquiring Patriot PAC-3 batteries and Qatar is expected to field the Patriot system in 2018 or early 2019. UAE, Saudi Arabia, and Kuwait all have successful combat experience with the Patriot system.

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. GCC investments and participation in these exchanges are a positive trend and will be expanded, particularly with respect to missile defense interoperability and information sharing among GCC partners.

*“The conflict in Yemen has opened opportunities for Iran, which continues to provide support to the Houthis with the aim of building a proxy to pressure the Saudi-led coalition and expand its sphere of influence. This support enabled the Houthis to launch missiles at Saudi Arabian and Emirati cities and target ships in the Bab al Mandab and Red Sea on multiple occasions in the last year, threatening Americans and our partners and raising the risk of broader regional conflict.”*

- Commander, U.S. Central Command, General Joseph Votel  
Statement before the House Armed Services Committee,  
February 27, 2017





Figure 32. Select Foreign Missile Defense Assets in the Middle East (2018).

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## The Middle East – Israel

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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 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. U.S. longstanding support of Israeli ballistic missile defense programs now includes co-development and co-production of the David's Sling and Arrow-3 missile defense systems. DoD also continues to support co-production efforts for the Iron Dome program to provide critical defense against short-range rocket, artillery, and mortar attack. Taking advantage of various opportunities to conduct bilateral exercises, such as JUNIPER COBRA, the United States and Israel continue to improve their capability to cooperate operationally to address offensive missile threats in the region.

*“With its population centers exposed to rocket attacks and with diplomacy achieving only shaky, short-lived cease fires, Israel had no other response option except escalation. The need for an alternative, non-escalatory strategy became obvious to Israeli planners in the mid-1990s.”*

- Former Director of the Israeli Missile Defense Organization, Uzi Rubin, 2018



Figure 33. Select Foreign Active Missile Defense Assets (2018).

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## South Asia

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*“We will deepen our strategic partnership with India and support its leadership role in Indian Ocean security and throughout the broader region.”*

- 2017 National Security Strategy of the United States of America

The threats posed by offensive missile capabilities are no longer limited to a few regions around the world. There are now a number of states in South Asia that 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.

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## North America

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*“U.S. advantages are shrinking as rival states modernize and build up their conventional and nuclear forces. Many actors can now field a broad arsenal of advanced missiles, including variants that can reach the American homeland.”*

- 2017 National Security Strategy of the United States of 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 detect, track, warn, and defend against air-breathing threats, including advanced cruise missiles. 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.

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## Allied and Partner Interoperability

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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 IAMD systems. Moving towards networks of interoperable IAMD systems can take advantage of cost-sharing and help distribute the burden of defense to better address adversary A2/AD strategies.



The Arleigh Burke-class guided-missile destroyer USS Barry (DDG 52) transits past Mt. Fuji as it arrives at Fleet Activities Yokosuka in Japan. (U.S. Navy photo)

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.

Additionally, information-sharing is critical to this undertaking. The United States is currently sharing early warning missile threat information derived from the U.S. missile warning satellite system with dozens of allies and partners. Data and security standards for indigenous allied and partner missile defense systems must permit operational integration and improve collective defense against missile threats.

Another important component of building a more effective networked missile defense posture involves combined U.S., allied, and partner missile defense training and exercises, and greater allied and partner participation in U.S. missile defense tests. These activities will foster greater confidence in missile defense systems and create opportunities for



Senior Leaders gathered at the NATO headquarters in Brussels, Belgium, on September 12-13, 2018 to collaborate on the NIMBLE TITAN 18 integrated air and missile defense campaign of experimentation. (NATO photo)

further cooperation. Events such as U.S. Strategic Command’s NIMBLE TITAN series – with participants from 24 countries and four international organizations – are an important means to advance multinational collaboration, including in the experimentation of operational integration concepts to enhance deterrence and defense against missile attacks.

*“Our allies and partners multiply our capabilities. We are much greater than the sum of our parts.”*

- Vice Chairman of the Joint Chief of Staff, General Paul Selva,  
National Defense University, June 7, 2018



## VII. CONCLUSION

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For the past 16 years, the United States has devoted significant effort to developing and deploying a layered missile defense system. The U.S. BMDS must be continuously strengthened and expanded given the growing challenges posed by potential adversaries who are contesting the established international order and deploying greater numbers of increasingly sophisticated offensive missiles. 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.

Increased U.S., allied, and partner missile defense investments and integration will counter potential adversaries' offensive missile capabilities now and into the future. Doing so will sustain and strengthen our capabilities to protect the homeland, deter adversaries, assure allies and partners, hedge against future threats in all domains, and project power in support of national objectives. It also provides U.S. leaders with a position of strength in their diplomatic engagements to reduce tensions and limit security challenges.

This 2019 MDR establishes a policy framework for U.S. missile defense that is responsive to new and anticipated threats, and exploits new approaches to the defensive mission. 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. The emphasis on protection of the U.S. homeland is an imperative given existing rogue state ICBM capabilities, and the challenge they could otherwise pose to U.S. capabilities to defend the homeland, deter attacks, and assure allies.

While the United States today is postured to counter a number of rogue state offensive ballistic missiles directed against the homeland, to stay ahead of the possible evolution of these threats requires a concerted effort to develop and field increasingly advanced and effective homeland defense capabilities. Doing so will provide needed protection for the American people, help deter coercive nuclear threats, and provide continued U.S. diplomatic strength. It will also provide a measure of protection against the prospect of accidental or unauthorized missile launch by potential adversaries.

Increasingly effective regional missile defense will contribute to the defense and assurance of allies and partners. It will enable the United States to project power into contested environments in support of allies and partners by integrating the full range of U.S., allied and partner military capabilities to defeat adversary A2/AD goals. Leveraging allied and partner capabilities through the sharing of information, burden sharing, and coordinated command and control will increase overall missile defense effectiveness.

This 2019 MDR adopts a balanced and integrated approach to countering missile threats

through a combination of deterrence, active and passive missile defenses, and attack operations. The goal is to provide the optimal mix of capabilities to protect against the spectrum of increasingly lethal and complex missile threats. Toward this end, the United States will:

- Examine, develop, and exploit advanced and innovative missile defense concepts and technologies, including advanced technologies for boost-phase defense, to stay ahead of growing offensive missile threats, including cruise and hypersonic missiles;
- Place greater emphasis on countering a regional adversary's missiles prior to launch in the event deterrence fails and conflict ensues, in order to enhance overall regional missile defense effectiveness, and advance a more comprehensive and balanced approach to the missile defense mission;
- Develop and field missile defenses on a timeline to stay ahead of current and emerging threats;
- Strengthen the integration of U.S. homeland and regional missile defense capabilities, active defenses and attack operations, as well as the interoperability of U.S., allied, and partner missile defense systems;
- Strengthen regional defenses that protect U.S. Allies, partners, and deployed forces, against offensive missile threats from any source;
- Strengthen cooperative relationships with allies and partners to better address a more challenging and dynamic offensive missile threat environment; and
- Ensure missile defense programs are rigorously tested, and that the management of these programs enables DoD to shorten the time required to field improved and new capabilities.

The United States, allies, and partners have made great progress in our missile defense programs over the past 16 years since U.S. withdrawal from the ABM Treaty in 2002. This progress has enabled the United States, allies, and partners to field defensive systems with significant capabilities, including the U.S. capability to defend the homeland against today's offensive missile threat from rogue states. It has strengthened and expanded the space-basing of sensors for active missile defense.

These advancements 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.

It is a strategic imperative that the United States, allies, and partners continue to make further strides in the development, testing, fielding, and integration of our missile defense capabilities to address today's expanding offensive missile threats, and to hedge against future risks. Effectively doing so will require innovation, improved collaboration, and a fusion of offense and defense capabilities across the Joint and allied force. 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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