



NATO Parliamentary Assembly

DEFENCE AND SECURITY  
COMMITTEE

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BALLISTIC MISSILE DEFENCE AND NATO

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GENERAL REPORT

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## TABLE OF CONTENTS

I.	INTRODUCTION .....	1
II.	ENDS: WHY A MISSILE DEFENCE SYSTEM? .....	1
III.	WAYS AND MEANS: TOWARD AN ALLIANCE-DRIVEN BALLISTIC MISSILE DEFENCE... 2	
	A. HISTORY OF ALLIED COMMITMENT .....	2
	B. NATO BMD AND THE EPAA.....	3
	C. THE EPAA ROLLOUT .....	4
	D. NATO BMD ARCHITECTURE TODAY .....	4
IV.	WHAT IS THE THREAT? THE ACTORS AND CAPABILITIES NATO BMD SEEKS TO DETER .....	8
V.	RUSSIA AND NATO BMD .....	10
VI.	CONCLUSIONS FOR PARLIAMENTARIANS .....	13
VII.	APPENDICES AND SUPPLEMENTAL MATERIALS .....	14
	APPENDIX A – NATO’S MISSILE DEFENSE CAPABILITIES.....	14
	APPENDIX B – DEPLOYMENT OF THE EUROPEAN PHASED ADAPTIVE APPROACH .....	15
	APPENDIX C – IRANIAN MISSILE CAPABILITIES – OVERVIEW .....	16
	APPENDIX D – NORTH KOREA’S MISSILES .....	17
	APPENDIX E – RUSSIA’S A2AD BUBBLE .....	18
	APPENDIX F – RUSSIA’S ICBM DEVELOPMENTS (2012-2014).....	19

## I. INTRODUCTION

1. Alongside conventional and nuclear capabilities, ballistic missile defence (BMD) is now considered a core NATO capability. The current framework for NATO BMD integrates national missile defence assets and capabilities into a broader NATO command and control (C2) architecture. The purpose of this capability is to protect NATO European territory and population centres, as well as deployed NATO forces, from threats arising from the global proliferation of ballistic missile technologies. A modern, dynamic, and geographically flexible missile defence system will deny adversaries the benefits they may seek to pursue via a missile-based offensive strategy.

2. The July 2016 Warsaw Summit Declaration indicated the system is now at initial operating capacity, underscoring the continued progress of the NATO ballistic missile defence architecture. Transfer of command and control of the Aegis Ashore installation in Deveselu, Romania to Allied Air Command in Ramstein, Germany further ensured the decision-making process for use of the system is within the political guidelines established by Allied governments. These steps demonstrate the steady progress toward an Alliance-commanded BMD system capable of defending NATO's European territory from ballistic missile attack.

3. As the United States aims for the second Aegis Ashore component of the European missile defence system to be completed in 2018, the Defence Committee seeks to revisit the ends, ways, and means of NATO's current BMD system and architecture.

4. As such, this report will review NATO's current BMD policy and capabilities, and discuss the steps being taken to adapt and evolve this architecture to better serve Allies in a rapidly evolving European security environment. This report identifies contributions made by Allies to the NATO BMD system and the continued progress toward its completion. Finally, the report looks at global and regional trends in ballistic missile capabilities driving continued Allied investment in a robust BMD capability for its European territories.

## II. ENDS: WHY A MISSILE DEFENCE SYSTEM?

5. Ballistic missile proliferation poses a distinct challenge to NATO territory, assets, populations, as well as member states' deployed forces. There are currently approximately 50 different ballistic missile variants spread across 30 countries (Karako, 2017). The increasingly rapid development and acquisition of accurate, reliable, capable, and destructive missile systems is a distinct element of the ever more complex international security arena.

6. The proliferation of ballistic missiles in conjunction with advanced technologies increases their lethality; missiles today are more mobile, accurate, and survivable. Recent tests by Iran and North Korea of their new missile capabilities underscore these states' desire to develop accurate and long-range missile systems, capable of delivering increasingly destructive warheads. Concern about non-state actors' increasing potential to acquire and use more advanced missile capabilities is further complicating the threat posed by missile proliferation: For example, Daesh's capture of advanced weapons during its seizure of territory in Syria and Iraq in 2014 and its potential to acquire even more is a direct concern for Turkey, as well as many deployed Allied forces in the region.<sup>1</sup> These growing state and non-state capabilities could threaten Allied populations at home,

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<sup>1</sup> Non-state armed groups have increased in their ability to acquire and use advanced weaponry in recent years. Hezbollah is a good example of this, as the Lebanese Shi'a militia-cum-political party has been able to expand the size and sophistication of its weapons capabilities in the years since its 2006 war with Israel, particularly since the outbreak of the Syrian civil war (in which it is fighting on the side of its long-time supporter, the regime in Damascus). Today, it possesses heavy artillery from aerial drones to a rocket arsenal surpassing the 100,000 mark, including powerful short-range ballistic missiles ranging from the Fateh-110 to Scud variants to the Zelzal-2. For more on the evolution of Hezbollah's use of its missile capacity as a strategic deterrent in its regional struggle with Israel, see (Sobelman, 2017). Other groups in the region (and beyond) are also seeking to expand their

as well as their personnel and assets in operation.

7. Missile defence, therefore, offers three principal potential benefits for the Alliance.<sup>2</sup> The first, and core objective, is deterrence by denial. In developing a missile defence system, the Alliance aims to change the strategic calculations of potential adversaries. The perception that a missile attack launched against any part of NATO territory would fail in the face of a capable defensive shield would, therefore, be a successful means of deterrence by denial.

8. Absolute defence against a missile attack from a capable arsenal, however, at least with today's technology, is impossible. As such, the construction of a layered missile defence system can limit the damage from an attack. Damage limitation is, therefore, a clear second benefit.

9. A third benefit for NATO BMD in Europe is the protection of deployed forces. Allied forces deployed in operation would be shielded from at least part of the potential damage from a missile assault and could maintain crucial manoeuvre capabilities, thereby potentially shifting the balance of forces in the battle theatre to their advantage.

### **III. WAYS AND MEANS: TOWARD AN ALLIANCE-DRIVEN BALLISTIC MISSILE DEFENCE**

#### **A. HISTORY OF ALLIED COMMITMENT**

10. The foundational principles for Alliance-driven territorial missile defence stem from various political, technical, and cost considerations, building upon almost eight decades of US and NATO missile defence efforts.

11. US and European Allies began concerted efforts to enhance and coordinate missile defence in the 1960s in parallel to a growing perceived threat of a Soviet missile strike. The USSR's 1977 deployment of mobile SS-20 multiple warhead missiles, intermediate-range nuclear missiles, most of which targeted Western Europe, was considered a direct threat to all NATO European territories: NATO Allies responded (Shea, 2009). At a special meeting of Foreign and Defence Ministers on 12 December 1979, Allies decided to deploy new missiles and missile defence systems across Europe as a deterrent against the Soviet SS-20s. Coupled with the deployment was a series of initiatives designed to build the confidence necessary for a mutually-beneficial arms control negotiation agenda, known as the "Double-Track" Decision on Theatre Nuclear Forces (NATO, 1979).

12. Rapid technological advancements in missile systems in the 1980s directed focus toward capable ballistic missile defence, as NATO Allies sought to address the growing challenge of missile proliferation. The United States vigorously pursued new efforts to counter intermediate-range missiles effectively. Among the more notable programmes introduced during the Reagan Administration was the Aegis combat system (O'Rourke, 2017). Originally designed as a standalone, ship-based air defence system, Aegis eventually became part of a larger and automated BMD architecture. At the same time, the US government also worked to implement strategic weapons reduction agreements (INF Treaty, 1983)<sup>3</sup>, which eventually contributed to a

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arsenals. The ability of non-state armed groups to acquire SRBMs and beyond is a trend further impacting the international security environment of the 21<sup>st</sup> century.

<sup>2</sup> See NATO, "Ballistic missile defence," last updated 25 July 2016 and Thränert, Oliver, "NATO, Missile Defence and Extended Deterrence," *Survival: Global Politics and Strategy*, vol. 51, issue 6, 2009 for the strategic, geopolitical, and organisational justifications for BMD.

<sup>3</sup> In his 1983 "Address to the Nation on Defense and National Security," President Reagan detailed new efforts – the Strategic Defense Initiative (SDI) – to provide missile defence against the Soviet Union. SDI focused on neutralising the Soviet nuclear threat via a space-based missile defence component. The programme was slated to be very expensive, while some critics feared it would violate the 1972 Antiballistic Missile Treaty, which allowed both the United States and USSR only two anti-ballistic missile deployment areas. International frameworks were put to the test during the years negotiating the Intermediate-Range Nuclear Forces Treaty (INF Treaty).

more stable military relationship between East and West (Dean, 1985).

13. After the Cold War, the locus of ballistic missile proliferation and its associated threats shifted. North Korea's shipments of SCUD-Bs in the late 1980s to Iran (Pollack, 2005), and Iraq's use of Scud missiles during the Persian Gulf War, threatened NATO Allies' forces operating in the region (Apple, 1991).<sup>4</sup> In response, NATO ballistic missile defence efforts reoriented to defend against a broader set of threats to the Euro-Atlantic sphere in general, and to deployed forces more specifically.

14. To better protect deployed forces against medium-range missile threats, NATO Allies established the Active Layered Theatre Ballistic Missile Defence (ALTBMD) programme in 2005. While earlier BMD efforts sought to counter long-range missiles, ALTBMD bolstered defences against medium-range ballistic missiles up to 3,000 km, and also enhanced the integration of low and high-altitude missile defence (NATO, 9 February 2016)<sup>5</sup>. Later, NATO would endeavour to streamline ALTBMD for tactical missile defence with the United States' European Phased Adaptive Approach (EPAA) for territorial defence.

15. At the 2010 Lisbon Summit<sup>6</sup>, NATO Heads of State and Government recognised territorial BMD as a core objective of the Alliance, and decided to expand ALTBMD to enable the protection of NATO's European territory (population centres and military installations). Decision-makers thus set out to streamline the parallel missile defence initiatives being implemented by the United States and the Alliance.

## **B. NATO BMD AND THE EPAA**

16. A core component of NATO's current ballistic missile defence in Europe is the United States' EPAA. President Barack Obama adopted the EPAA in 2009 as a means for the United States to contribute to NATO's territorial defence against the increasing threat of a ballistic missile attack.<sup>7</sup> The adoption of the EPAA as part of a broader Alliance approach to NATO BMD allows Allies to invest in the existing US-planned missile defence architecture; with a relatively small contribution, the 28 other Allies gain considerably in terms of defence.

17. The EPAA replaces the Bush Administration's 2007 proposal for 10-silo ground-based midcourse missile defence (GMD) systems in Poland, which at the time heightened tensions between the United States and Russia. The site in Poland would have served as a complement to missile defence systems already in place in Alaska and California providing enhanced coverage for US and European missile defence. Russia viewed this deployment as a threat to their strategic nuclear deterrent capabilities (Sankaran, 2015; Shanker, 2007). The Obama Administration's EPAA proposal, while attempting to reassure the Kremlin, offered increased coverage for BMD by enabling mobile, flexible, enhanced coverage via maritime and land-based radar systems and interceptors.

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<sup>4</sup> For example, during the Persian Gulf War, on 26 February 1991, a SCUD missile destroyed the barracks of an Army Reserve Unit in Al Khobar (Dhahran), Saudi Arabia. The attack resulted in 27 fatalities and 97 injuries. A Patriot missile defence interceptor hit the missile, however the debris from contact set the barracks on fire.

<sup>5</sup> Beginning in 1961, NATO worked to integrate various defence systems under NATO Integrated Air Defence System (NATINADS) by providing a framework for NATO-led command and control. This was upgraded with the decisions made at the 2010 Lisbon Summit. NATINADS provided the baseline for NATO's current Integrated Air and Missile Defence System (NATINAMDS).

<sup>6</sup> This was further enhanced by the outcomes of the 2009 NATO Summit in Strasbourg where the Alliance set out to further integrate missile defence capabilities, including streamlining the command and control (C2) and battle management, command, control, communication, and intelligence (BMC3I) for various BMD systems under NATO.

<sup>7</sup> In 2009, the Obama Administration also negotiated the new Strategic Arms Reduction Treaty (New START). New START limited each party to 800 deployed and non-deployed (but not more than 700 total deployed) Intercontinental ballistic missiles (ICBMs) and submarine-launched ballistic missiles (SLBMs). This international legal framework, along with the parallel compliance mechanisms, was viewed as a significant step forward in the U.S.-Russia "reset".

18. The EPAA is framed around the deployment of the Aegis combat system in Europe. The system is currently deployed on US Navy destroyers and cruisers (O'Rourke, 2010), as well as hosted by Romania (and soon Poland) in a land-based "ashore" facility.

19. As the Defence and Security Committee learned on its visit to Raytheon Corporation in 2014, the American Standard Missile 3 (SM-3) is the system's essential component. SM-3 missiles are designed to hit incoming medium and intermediate-range missiles directly in mid-course. The direct impact of the SM-3 has given the system the 'hit to kill' moniker, as the object is to destroy any incoming missiles while they are still outside the earth's atmosphere via direct collision with the warhead.

### C. THE EPAA ROLLOUT

20. The EPAA has been rolled out in three distinct phases.<sup>8</sup> *Phase 1* of the EPAA saw the deployment of SM-3 IA<sup>9</sup> on Aegis-adapted ships to the Mediterranean. A land-based radar system (a mobile AN/TPY-2) was also stationed in southern Turkey. Finally, the United States deployed the *USS Monterey* to the Mediterranean in March 2011 (United States Navy, 2011), marking the successful operational debut of the first phase.

21. *Phase 2* entailed two elements; the deployment of four Aegis-equipped ships to the Rota naval base in Spain, and the installation of the first land-based Aegis Ashore interceptor in Deveselu, Romania. The Aegis Ashore site hosts SM-3 IB interceptors and the Aegis SPY-1 radar system. The successful deployment and operational certification of the Aegis Ashore system in Deveselu, Romania on 12 May 2016 marked the operational debut of *Phase 2*.

22. The Aegis Ashore system, as per *Phase 3*, is planned for deployment to Redzikowo, Poland in 2018. The site will include the more robust SM-3 IIA interceptors, which will markedly expand the coverage of NATO's European territories.

23. In March 2013, the Obama Administration cancelled a planned *Phase 4* for the EPAA. *Phase 4* would have deployed SM-3 IIB interceptors to the facility in Poland, which are faster and more capable than the IIA variant. Funding issues and the evolving ballistic missile threat posed by North Korea were the official reasons for cancelling *Phase 4*. Moscow's complaints about the introduction of SM-3 IIB interceptors into Europe, however, was also likely a key factor. Moscow's chief complaint was that the substantially more capable missiles would be able to intercept Russia's ICBMs, thereby changing the balance of strategic forces between the United States and Russia (Dickow, 2016). The decision by the United States to concede to Russia's concerns and cancel *Phase 4* is consistent with stated US BMD policy since the 1980s, which has been that US BMD missile deployments do not target Russia or China's strategic nuclear deterrent forces (Hildreth, 2017).

### D. NATO BMD ARCHITECTURE TODAY

24. At present, NATO's BMD architecture allows Allies to employ layered land and maritime-based capabilities to defend against current and future threats emanating from outside its European territories. As NATO's BMD system moves toward completion, Allied land-based architecture will be integrated with other EPAA BMD assets, including the deployed Aegis systems. The layered land and sea-based systems spread throughout member states' territory and territorial waters will provide the Alliance with the capability to defend against a potential ballistic missile

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<sup>8</sup> Appendix B outlines each phase of the EPAA, including numbers of missiles and platforms, the SM-3 variants deployed, and sensors and combat systems.

<sup>9</sup> Key to understanding the difference between the different SM-3 interceptor missile blocks is the system variant, from IA to IIB, etc. These variants indicate the missile's burnout velocity, which is the maximum speed possible, as well as discrimination and range. The faster the burnout velocity, the farther the missile can travel, which is an essential measure of capability.

attack.<sup>10</sup>

### *Command and Control*

25. The North Atlantic Council maintains political control over the NATO BMD system by pre-approving the necessary system parameters, such as defence design, the rules of engagement, or the delegation of authorities within the NATO command structure. Missile technology advancements by their very nature reduce the available time to target and intercept a missile before it re-enters earth's atmosphere, leaving only minutes from missile fire to interceptor launch. As such, decision-making in a crisis would be likely in the hands of NATO's command and control centre in Ramstein, Germany.

26. National missile defence capabilities, however, are not entirely available to NATO on a full-time basis. Rather, they remain national contributions to NATO BMD controlled by individual Allies in peacetime, but can be transferred to NATO control in the event of a crisis, based on pre-arranged criteria. For example, the maritime Aegis combat systems deployed on US Naval vessels are under US command and control in peacetime, but can be transferred to NATO command and control in a crisis. Currently, only the Aegis Ashore system in Romania and the early-warning radar system in Turkey are under permanent NATO command and control.

### *Programme Cost and Allied Contributions*

27. Accurate figures of total system cost to date are difficult to procure given the various ways in which Allies may choose to contribute to the programme. Individual member states determine their specific contributions to the NATO BMD architecture, choosing whether to contribute to radar systems, satellites, command and control capabilities, or to host BMD sites. Currently, NATO BMD in Europe relies heavily on US deployed capabilities. However, several NATO Allies plan to undertake modernisation projects, purchase or install new systems, or integrate additional BMD components into their current capabilities.

28. The following highlights some current Allied contributions:

- Romania hosts the certified Aegis Ashore site in Deveselu.
- Spain hosts four US Aegis-class destroyers at the Rota naval base; with a reoccurring annual foreign basing cost, incurred by the United States, of USD 100 million.
- Turkey hosts an early-warning radar system at Kürecik Army base (the AN/TPY-2 was installed in 2012).
- Germany hosts the command centre in Ramstein and pledges to contribute up to three Patriot missile system blocks. In December 2016, Germany also announced plans to upgrade its *Sachsen-class* air defence frigates with longer-range radar for missile defence. These upgraded ships will be integrated into NATO's command and control structure (Naval Today, 2016).
- The Netherlands contributes with the upgrade of several frigates to be Aegis system compatible and with Patriot missile system blocks.
- Denmark will soon acquire a frigate-based radar system.
- The United Kingdom will invest in a ground-based BMD radar system to enhance the coverage and effectiveness of NATO BMD.
- Poland will host the second Aegis Ashore system; to be completed in 2018.

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<sup>10</sup> At the 2016 Warsaw Summit, NATO declared its Ballistic Missile Defence had reached Initial Operational Capability. At full operational capacity, the system will deliver comprehensive and common NATO planning, monitoring, information sharing, interception and consequence management capabilities (NATO, 2012). Today, NATO's Integrated Air and Missile Defence System (NATINAMDS), provides the framework for peacetime and crisis management against all air-based threats. The Defence Policy and Planning Committee (Reinforced) (DPPC(R)) on Missile Defence oversees NATO BMD implementation, which involves several senior NATO bodies and provides political-military advice on issues related to NATO BMD.

29. In addition to the above, NATO Allies also contribute to common funding for the NATO BMD programme, which is being used to build and maintain the capability's command, control, and communications system. This budget encompasses all common ballistic missile system developments, upgrades, capabilities and ongoing command and control.

30. The development and evolution of NATO's BMD capacity represent the ongoing adaptation of the Alliance's military defence and deterrence posture. Still, despite NATO's adoption of the EPAA, the United States continues to fund almost all of the major equipment required for the installation of the system; including the major Aegis at sea and ashore systems, along with the radar systems necessary for detection and tracking (Missile Defense Agency, 10 March 2017).

#### *BMD and Interoperability*

31. Integration of European and US missile defence assets, specifically components of the Aegis combat system, supports Allied interoperability and critical defence investment. Common platform acquisition supports interoperability: for example, the Aegis combat system is gradually being purchased and adopted by a larger number of NATO member states and other US Allies. The Spanish Navy was the first European navy to be outfitted with the Aegis combat system; it currently operates five Alvaro de Bazan (F100) class air defence frigates and conducts exercises with the US Navy to test air defence systems and bolster BMD interoperability (Navy.mil, 2016). Continued Allied investment in the Aegis system is enabling a more global BMD architecture among NATO Allies and partners today.

32. NATO BMD cooperation also extends to basing and training. Today, common capabilities and deployed systems in Europe enable Allies to take part in joint training, thereby enhancing missile defence system readiness. For example, under the leadership of Supreme Headquarters Allied Powers Europe (SHAPE), Allies can participate in tactical firing scenarios at the NATO Missile Firing Installation (NAMFI). This joint facility is used primarily by Germany, Greece, and the Netherlands to conduct training with Patriot systems (AP, *Reuters*, 2015). Poland also hosts a rotational Patriot battery used for joint training with the United States (Nichols, 2010).

#### *US Missile Defence Policy and Programmes beyond 2017*

33. US missile defence policy is currently under a congressionally-mandated review. The US 2017 National Defense Authorization Act (NDAA) requires the US Department of Defense to conduct a thorough review of US missile defence policy and strategy: this review will be finished by January 2018. As such, exact information on the future balance between homeland and US extended theatre ballistic missile defence, which includes investment in the third and final phase of the EPAA, remains elusive.

34. The Trump Administration has made relatively few statements on ballistic missile defence.<sup>11</sup> The steady rise in the rate of North Korea's ballistic missile testing and system advances<sup>12</sup> over the past year, however, has put pressure on US lawmakers and defence community to ensure and demonstrate that the United States is prepared to defend its territory against this threat effectively. The Trump Administration is likely feeling the same pressure given the recent escalation of rhetoric and sabre rattling between the United States and North Korea in recent weeks; particularly in light of North Korean leader Kim Jong Un's threat to fire four missiles on Guam, a U.S. territory in the Pacific. The situation vis-à-vis the North Korean missile and nuclear programs continues to evolve and remains a central focus for the Alliance.

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<sup>11</sup> The official White House webpage states only, "We will also develop a state-of-the-art missile defense system to protect against missile-based attacks from states like Iran and North Korea." See: <https://www.whitehouse.gov/making-our-military-strong-again>

<sup>12</sup> On 4 July 2017, Pyongyang reported the first successful test of a claimed ICBM (named the Hwasong-14) it claims can strike anywhere in the world. *BBC News*, "North Korea's missile programme," 4 July 2017, <http://www.bbc.com/news/world-asia-17399847>.



35. In May, the US Missile Defense Agency (MDA) and the United States Air Force (USAF) succeeded in its first live-fire test of the United States Ground-based Missile Defense (GMD) system in a real-time crisis simulation by destroying an intercontinental ballistic missile target over the Pacific Ocean.<sup>13</sup> The US military is also working with Allies and NATO Partners – Japan and Korea – to strengthen further BMD interoperability and test its various systems’ reliability and capability. The will to continue investment in and testing of US missile defence systems is highlighted in the Trump Administration’s initial fiscal year (FY) 2018 budget request.

36. With respect to NATO BMD, it was originally thought that President Trump’s continued willingness to find a way to improve US-Russia relations may impact continued US investment in Phase 3 of the EPAA, which, as it is noted in *Section V*, continues to be a principal point of contention between Russia and the NATO ballistic missile defence system. However, the Trump Administration’s initial FY 2018 budget requests affirm a continued commitment to NATO BMD via proposed funding for the completion of Phase 3 of the EPAA.<sup>14</sup> The President’s budget request complements consistent and strong legislative efforts to expand the breadth and depth of US missile defence efforts – both homeland and theatre. While remaining committed to NATO BMD, it is also likely the Trump Administration will allocate additional resources to strengthen US GMD capabilities and territorial missile defence against threats emanating in the Pacific arena.<sup>15</sup>

37. Similar priorities are reflected in the MDA’s FY2018 Budget Estimate Overview – the Agency’s spending overview. The MDA requested \$7.9 billion for missile defence programmes in FY 2018, \$379 million more than its FY 2017 request.<sup>16</sup> The request features a substantial increase in funding for national missile defence and the Ground-based Midcourse Defense (GMD) system. The MDA estimate also demonstrates commitment to NATO BMD and outlines clear continued support for EPAA Phase 3.<sup>17</sup> This includes \$624 million for Aegis BMD and the procurement of 34 (upgraded) Aegis SM-3 Block IB missiles which will be deployed at the second Aegis Ashore site in Poland.

38. The US House of Representatives passed the NDAA for FY18<sup>18</sup>, which would authorise a budget of \$696.5bn. This bill requests the funds outlined in the MDA’s FY18 Budget Estimate. If approved, the NDAA (FY18) will provide funds for additional testing, interceptors, and Phase 3 of the EPAA and the second Aegis Ashore site. The US Senate has yet to pass its version of the bill, at which point both houses will find a synergistic compromise.

39. The US defence community maintains a policy that no external actor will dictate national defence and security efforts or policy. This position is echoed by NATO. The Administration will also likely consider how missile defence fits into the need to renegotiate arms control and proliferation treaties in the future.

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<sup>13</sup> In this test, a test target ICBM was fired from the Marshall Islands, tracked by AN/TPY-2 radar, and successfully destroyed by GMD interceptors launched from Vandenberg Air Force Base in California. The test result was confirmed by live data from sensors across the Pacific. This was the longest-range test conducted to demonstrate the effectiveness of the GMD homeland defence system. *Missile Defense Agency*, 30 May 2017, <https://www.mda.mil/news/17news0003.html>.

<sup>14</sup> This includes following through on the upgraded version of the Aegis BMD weapons system. The Aegis Ashore site in Poland, and upgraded Aegis BMD ships, will have SM-3 Block IA, IB, and IIA launch capability. *Missile Defense Agency*, May 2017, pp. 5.

<sup>15</sup> Jen Judson, “Ahead of Ballistic Missile Defense Review, MDA’s FY18 Plans Show Flexibility,” *Defense News*, 23 May 2017, <http://www.defensenews.com/articles/ahead-of-ballistic-missile-defense-review-mdas-fy18-plans-show-flexibility>.

<sup>16</sup> *Missile Defense Agency*, 15 May 2017, <https://www.mda.mil/global/documents/pdf/budgetfy18.pdf>

<sup>17</sup> *Missile Defense Agency*, “Fiscal Year (FY) 2018 Budget Estimates Overview.” (17-MDA-9186) 15 May 2017, p. 5.

<sup>18</sup> H.R.2810, National Defense Authorization Act for Fiscal Year 2018, 115<sup>th</sup> Congress (2017-2018), <https://www.congress.gov/bill/115th-congress/house-bill/2810?q=%7B%22search%22%3A%5B%22FY18+NDAA%22%5D%7D&r=1>

#### IV. WHAT IS THE THREAT? THE ACTORS AND CAPABILITIES NATO BMD SEEKS TO DETER

40. NATO's current BMD architecture works to deter and defeat ballistic missile threats originating outside the Euro-Atlantic area. As NATO officials stress, NATO BMD is not tied to any one threat, nor should it be. In fact, a key element to present-day NATO BMD efforts is ensuring a defence design dynamic and flexible enough to respond to an evolving threat landscape.

##### *Iran*

41. Defending against the proliferation of ballistic missiles from Iran is a core driver of NATO's BMD architecture in Europe (Thränert, 2013). Iran possesses one of the largest ballistic missile arsenals in the Middle East, and continues to develop and expand its capabilities (see Appendix C). As President Obama noted when announcing the EPAA: "We have updated our intelligence assessment of Iran's missile programmes, which emphasises the threat posed by Iran's short- and medium-range missiles, which are capable of reaching Europe (...) this new ballistic missile defence program will best address the threat posed by Iran's ongoing ballistic missile defence program." (CFR, 2009).

42. Driven by regime insecurity due to Teheran's inability to defend against Iraq's missile attacks on Iranian cities during the 1980-88 Iran-Iraq War, Iran's ballistic missile programme evolved primarily to be a regional deterrent; today it is a key pillar of regime power (Pollack, 2005; Rezaei, 2017).<sup>19</sup>

43. Most of the country's arsenal is composed of Shahab-1 & -2 missiles. With maximum ranges of 500km, Shahab-1 & -2 missiles are largely tactical; they have been launched only for regional strikes. As is clear from above, the EPAA component of NATO BMD is not designed to handle these threats: member states' individual air and missile defence systems would address shorter-range missile threats to deployed Allied assets. However, recent tests indicate Iran is pursuing technology and capabilities that would enable it to strike at longer distances more accurately.

44. Today, Iran's ballistic missile arsenal includes an expanding number of medium-range ballistic missiles (MRMBs). The evolving Shahab-3 variants have a larger strike range, approximately 1,500 to 2,500 km, thereby increasing the threat for Allied bases and assets (Sankaran, 2015).<sup>20</sup> The continued development and refinement of medium- and long-range missile systems by Teheran poses a growing threat to large parts of southeast Europe and Turkey today and more Allied European territory in the future. These variants are a mix of liquid and solid fuel rockets, some with a manoeuvring re-entry vehicle enabling a more accurate strike capability. Examples include: the *Shahab-3 Emad* (2,100 km), the *Sajjil* (2,000-2,500 km), the *Ghadr* (2,000-3,000 km), the *Fajr-3* (2,500 km), and the *Ashoura* (2,000-2,500 km) (Cordesman, 2015). There is clear concern these will be used as potential delivery systems for nuclear warheads.

45. NATO Allies and global partners are invested in preventing Iran's development of a nuclear weapons capability – years of economic and political sanctions, as well as negotiations following the first reports in 2003 of undeclared nuclear activities carried out by Iran in violation of its Non-Proliferation Treaty (NPT) obligations, attest to this. The potential for Iran to develop a nuclear warhead was addressed in the 2015 Joint Comprehensive Plan of Action (JCPOA), which was subsequently endorsed by the UN Security Council Resolution (UNSCR) 2231. These international agreements restrict Iran's nuclear-capable ballistic missile activities, but do not limit the Iranian

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<sup>19</sup> Iran's ballistic missile programme is run by its Islamic Revolutionary Guard Corps, a group with suspected ties to, and subjected to sanctions for its engagement in, terrorist activities. This is concerning to European actors as it introduces security of supply variables to threat calculations.

<sup>20</sup> For example, the Shahab-3 Sajjil or Ashoura missiles are a threat to the forces deployed at the Incirlik Air Base in Turkey.

ballistic missile programme itself (Lewis, 2016).<sup>21</sup>

46. According to the US Department of Defense, Iran has strengthened its ballistic missile capabilities since the signing of the JCPOA (IISS-Americas, 2016).<sup>22</sup> Several tests conducted between 2015 and 2017 demonstrate the expansion and refinement of Iran's missile capabilities (Kenyon, 2017). These tests have resulted in strong condemnation from the United States, and in July 2017, the US Government imposed new sanctions against Iran targeting, *inter alia*, its ballistic missile programme (Landler, 2017). Other Allied governments and the UN Secretary General also expressed concern following Iran's missile tests, and continue to oppose Iran's ballistic missile programme. While recent Iranian missile tests may not contravene UNSCR 2231, which underpins the JCPOA, they are certainly inconsistent with its spirit. Further, it is important to continue holding Iran accountable to the terms in the JCPOA and UNSCR 2231 which serves to reduce the threat-level of Iran's ballistic missiles by eliminating their potential to deliver nuclear weapons.

47. Iran's continued pursuit of increasingly capable medium- and long-range ballistic missile systems justifies the development of broad and flexible NATO ballistic missile defence throughout the totality of its European territory.

#### *Pacific/North Korea*

48. North Korea's recent ballistic missile tests<sup>23</sup> and continued disregard for international anti-proliferation law is unsettling security in the Pacific (Mullany and Gordon, 2017; Chanlett-Avery, Rinehart, and Nikitin, 2016; Tamkin, 2017). While Pyongyang conducted 17 missile tests and one nuclear test between 1994 and 2008, it has conducted over 70 missiles tests and 4 nuclear tests over the past 8 years, including dozens in the last year alone – in the same time frame, North Korea also conducted two separate nuclear tests (Cha, 2017). On July 4, North Korea tested a land-based intermediate range ballistic missile. The missile reached an altitude of over 2,500km over a distance of 933km; North Korean media claimed the test to be a successful demonstration of its ICBM capacity (CSIS, 2017). Such figures attest to the pace of the development of increasingly advanced and lethal missile delivery systems.

49. North Korea's ballistic missile advancements threaten NATO Partners Japan, South Korea, as well as NATO Ally the United States (see Appendix D). The United States has deployed forces on the Korean Peninsula as a deterrent to North Korea. North Korea is also actively working to develop capabilities that could enable nuclear strikes on United States and Canadian territory and beyond (Cha, 2017).<sup>24</sup> Therefore, the United States is working with its regional allies to shape stronger strategic defence against ballistic missile threats in the Pacific theatre.

50. Currently, the two countries most concerned with North Korea's evolving capabilities, South Korea and Japan, do not have nuclear weapons or strategic missiles of their own; as these capabilities are provided by the United States via bi-lateral defence treaties. Japan and South Korea do, however, operate Aegis systems on destroyers in the region (South Korea without the physical interceptors), which enables data sharing and cooperation with the United States for BMD purposes.

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<sup>21</sup> Paragraph 3, Annex B of UN Security Council Resolution 2231 restricts Iran from "undertak[ing] any activity related to ballistic missiles designed to be capable of delivering nuclear weapons."

<sup>22</sup> In the first ten months after the JCPOA was signed, Iran conducted eight missile tests.

<sup>23</sup> For a list of North Korea's ballistic missile test launches in 2016, see *The Military Balance*, IISS, 2017, pg. 243.

<sup>24</sup> When North Korea tested a Pukguksong-2 missile on Sunday, 12 February 2017, the only ballistic missile defences in the region capable of intercepting the missile were two guided missile destroyers, the *USS Stethem* and *USS McCampbell*, each equipped with the Aegis combat systems.

51. To enhance regional capacity for missile defence, the US Army announced plans in July 2016 to deploy the Terminal High Altitude Area Defense system (THAAD) missile battery<sup>25</sup> to South Korea. This system is the most advanced missile defence system in the world and is purposed to be a highly mobile asset able to intercept short- and medium-range missiles during their initial or terminal phase of flight. A THAAD deployment enables an extended defence of population centres, military forces, and resources on the Korean Peninsula as well as relevant strategic sites and population centres in and around Japan (Reynolds, 2016).

52. From March to May 2017 various elements from radar to launchers of the THAAD system were set up 300km south of Seoul. On 2 May, the system was declared operational with the ability to intercept North Korea's missiles, though the system only comprised two of the usual 6 missile launchers that are deployed with US THAAD batteries (Cho, 2017). When he first took office, South Korea's new President, Moon Jae-in, halted the installation of the four remaining launchers to allow for his administration to conduct a review of the system (CSIS, 2017). President Moon claimed that his predecessor had rushed the initial decision and further, that the South Korean Defence Ministry had failed to inform his administration of the upcoming installation of these additional launchers. Some observers also speculated that stopping the deployment of the remaining launchers may also have been in response to China's ongoing resistance to the system's deployment (Mcleary, 2017). However, following North Korea's July 4 and 28 ICBM tests, South Korea decided to proceed and "temporarily" deploy the additional launchers.

53. China objects to the US THAAD deployment in South Korea, seeing the move as an indirect means of further US encirclement and ability to monitor Chinese airspace. China views the THAAD addition as part of a larger US effort to build a regional missile defence system with its allies Japan and South Korea. In a clear sign of its disapproval of the presence of the US THAAD system on the Korean peninsula, China put significant economic and diplomatic pressure on South Korea to remove the ballistic missile defence system, such as shuttering South Korean department stores operating in China, and blocking Chinese travel agency sales of travel packages to the country, in addition to many other unofficial sanctions (McGuire, 2017).

54. Russia also objects to the system's deployment on the Korean peninsula, as Moscow is concerned the overlap of the system's range on eastern Russian territory will only further undermine Russia's strategic nuclear deterrent. The Kremlin may perceive the deployment of US military BMD systems in Europe and the Pacific as strategic encirclement (Sutyagin, 2013). Russia's objection to the US THAAD deployment, however, is only part of a broader objection to the United States and NATO efforts to construct missile defence systems.

## V. RUSSIA AND NATO BMD

### *Russia*

55. NATO-Russia relations are at their lowest point since the end of the Cold War. The six-year window from Russia's invasion of and annexation of Georgian territory in 2008 to its intervention in Ukraine in 2014 is a period of increasingly divergent perspectives on reconciling NATO-Russia post-Cold War security interests in Europe. Disagreements over the design and intent of NATO BMD in Europe are a key variable in the shift away from previous efforts at strategic cooperation between NATO and Russia today.

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<sup>25</sup> A THAAD battery includes a truck-mounted, mobile, launcher with eight interceptors, AN/TPY-2 (Army Navy/Transportable Radar Surveillance), and a communication and data-management system that links the deployable components to external command and control.

### *Failed Attempts at Cooperation*

56. The NATO 2010 Lisbon Summit produced what was considered a critical breakthrough over conflicting understandings between NATO and Russia over missile defence architecture in Europe: the NATO-Russia Council pledged to develop a comprehensive joint analysis for broader missile defence cooperation.<sup>26</sup> True progress on NATO-Russia missile defence cooperation, it was hoped, would serve as a sound basis for achieving the Lisbon Summit ambitions to create a real, strategic NATO-Russia partnership providing for “common peace, security and stability in the Euro-Atlantic area”.<sup>27</sup>

57. NATO officially suspended the project in April 2014 when all practical civilian and military cooperation between NATO and Russia ground to a halt in the wake of Moscow’s annexation of Crimea. The project was moribund well before then; serious attempts to negotiate NATO-Russia BMD cooperation in Europe only really lasted between the November 2010 Lisbon Summit and the three months following the 2012 Chicago Summit (Zadra, 2014), after which Russia unilaterally paused BMD cooperation in November 2013.

58. Neither NATO nor Russia were ever able to overcome fundamentally opposing views of how to construct a cooperative missile defence system. NATO and US officials always insisted on two “independent, but coordinated systems working back to back”, while Russian officials insisted on a joint system wherein Russia and NATO would be responsible for a sector in Europe (Zadra, 2014). The so-called sectoral approach according to Moscow would have left Russia in charge of a sector that included NATO’s Baltic Allies (Zadra, 2014). Former NATO Secretary General Anders Fogh Rasmussen summed up the Alliance’s objections to Russia’s approach at the time by stating; “We cannot outsource our collective defence obligations to non-NATO members” (Rasmussen, 2011).

59. In attempt to bridge the two competing views of missile defence in Europe, NATO proposed to accommodate Russia’s desires for a joint system by offering to form joint centres for missile defence command and control (Zadra, 2014). Russia rejected this proposal. In fact, neither side was ever able to bridge the gap by agreeing to any form of missile system that would ultimately outsource security guarantees. As such, the negotiations stalled in the wake of the Chicago Summit, never to regain any real traction (Zadra, 2014).

### *Russia’s Concerns*

60. During the 2010-2012 negotiation period on NATO-Russia missile cooperation, Moscow sought legal guarantees precluding either side from targeting the other’s long-range strategic deterrent capabilities (Pifer, 2012). As noted above, Russia is concerned advanced interceptor missiles in Europe would be able to undermine their long-range nuclear capability, which former Russian Ambassador to NATO Dmitry Rogozin noted is “the basis and guarantee of our sovereignty and independence” (Collina, 2011).

61. Studies show, however, this argument does not really hold water when considering the speed of the SM-3 Block interceptors being introduced into Europe as a part of the EPAA; those with burnout speeds below 5km/s would not be physically capable of intercepting Russia’s ICBMs (Wilkening, 2012). The most advanced SM3 interceptor block to be introduced into the Aegis Ashore site in Poland will be the IIA variant, which has a burnout speed of 4.5km/s (Sankaran, 2015). Further, NATO BMD interceptors are either located too far south or too close to Russia to do so (NATO briefing, March 2017). As such, Russia’s concerns, at least as far as the current NATO BMD architecture is concerned, lack technical merit.

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<sup>26</sup> See NATO Lisbon Summit Declaration, paragraph 37. [http://www.nato.int/cps/en/natohq/official\\_texts\\_68828.htm](http://www.nato.int/cps/en/natohq/official_texts_68828.htm)

<sup>27</sup> See NATO-Russia Council Joint Statement, 20 November 2010. [http://www.nato.int/cps/en/natohq/news\\_68871.htm](http://www.nato.int/cps/en/natohq/news_68871.htm)

62. Persistent messaging from NATO has attempted to assuage Russia's concerns. The Warsaw Summit Communiqué states clearly: "NATO missile defence is not directed against Russia and will not undermine Russia's strategic deterrence capabilities."<sup>28</sup> The Declaration continued by stating the aim of BMD in Europe is rather "to provide full coverage and protection for all NATO European populations, territory, and forces against the increasing threat posed by the proliferation of ballistic missiles" outside the Euro-Atlantic area.<sup>29</sup>

63. Broader global geostrategic factors likely dictate Russia's opposition to NATO BMD expansion in Europe. Russia views the increased deployment of US BMD capabilities globally, as well as US force modernisation, as a threat to Moscow's ability to construct and maintain an effective modern strategic deterrent (Zadra, 2014). For example, Block IIA interceptors would have enhanced strategic capability against Russia's ICBMs if deployed at sea closer to US territory, which describes the current posture of most US deployed missile defence capabilities.<sup>30</sup> Russia, therefore, views with suspicion Washington's broader motives, beyond its support for EPAA, for a global missile defence system (Zadra, 2014). The modernisation of the United States' nuclear and ICBM capabilities, in addition to US dominance in space and superior conventional strategic weapons, credibly undermine Russia's ability to sustain an effective strategic deterrent (Zadra, 2014; Pifer, 2016).

64. Russia's ICBM force, which will likely be deployed on missiles from mobile launchers, is projected to top out at 250 missiles by 2024, while the US Air Force will maintain approximately 400 ICBMs (Kristensen, 2014). In addition, the US FY2017 NDAA featured a change in language pertaining to the US missile defence framework. Previously the United States maintained the position that US BMD systems are purposed solely for the protection of US territory. Now, the NDAA includes language providing for the defence of the United States, US allies, and their respective territories and deployed forces (Hildreth, 2017). The imbalance in capabilities and change in language, coupled with the comprehensive nature of NATO's BMD architecture in Europe, contributes to Russia's opposition to NATO BMD specifically, and to US global BMD policies generally.

*Potential for new dialogue with Russia over NATO BMD?*

65. While NATO ensures flexible and adaptable responses to threats in the Euro-Atlantic area with its *enhanced forward presence* and *projecting stability* initiatives, the Alliance is not opposed to opening new avenues for dialogue with Russia. In the 2016 Warsaw Summit Communiqué, NATO established space for engaging in meaningful dialogue and called for the type of open communication necessary to prevent military incidents and enable transparency.<sup>31</sup> The Warsaw Communiqué outlines communication with Russia as a conflict prevention priority, and calls on Russia to use "all lines of communication" to address critical issues.<sup>32</sup> Any calls for a renewal of practical civil and military cooperation with Russia, however, depend upon a substantive change in Russia's behaviour. Until this occurs, NATO excludes the possibility of a "return to 'business as usual'".<sup>33</sup>

66. NATO public statements concerning ballistic missile defence reflect the shift away from efforts to create 'strategic and modernised partnership' with Russia as noted in the Joint Statement of the 2010 NATO-Russia Council in Lisbon. Language referring to Allied efforts to assuage Russia's concerns about NATO BMD through structured BMD cooperation with Moscow no longer appears. The Warsaw Summit evoked a firm and unwavering position that Russia's concerns have

<sup>28</sup> 2016 Warsaw Summit Communiqué, paragraph 59.

<sup>29</sup> *Ibid.* paragraphs 56.

<sup>30</sup> US deployment of BMD capabilities as part of the EPAA – Aegis capable destroyers based in Rota, Spain – are only 12% (or four of the 33) of the United States' ballistic missile defences based on Aegis capable ships (they also do not fall under NATO's command and control).

<sup>31</sup> Warsaw Summit Communiqué, paragraph 6

<sup>32</sup> *Ibid.* paragraph 12

<sup>33</sup> *Ibid.* paragraph 15

been addressed adequately, and any aggressive rhetoric towards members of the Alliance over BMD should cease.<sup>34</sup> Still, with the understanding of NATO's firm position on its BMD system, the Warsaw Communiqué does reiterate NATO's longstanding willingness for 'open discussion' with Russia once the latter is ready.

## VI. CONCLUSIONS FOR PARLIAMENTARIANS

67. Ballistic missile proliferation continues to be a global security challenge. As more state actors either acquire or develop sophisticated missile capabilities, the risk of proliferation of these capabilities to other states and non-state actors is increasing. NATO is responding to this threat with a dynamic and adaptable missile defence system capable of defending all European Allies from the growing threats ballistic missiles pose to their territory.

68. NATO BMD is currently focused on limiting ballistic missile threats by rogue states and non-state actors. The system seeks to protect NATO European populations, territory and forces from the risks posed by ballistic missile proliferation. The system is based on a common Allied threat assessment, built upon contributions from all Allies, and seeks to remain dynamic enough to respond to evolving threats. NATO BMD is not designed, developed or capable of undermining Russia's conventional or nuclear deterrent posture.

69. Development of the NATO BMD system continues apace. A growing number of Allies are contributing key elements to increase its efficacy and all Allies are contributing to its basic funding. The ability to deter and defend against ballistic missile threats is improving, but more remains to be done: For example, the third and final phase of the EPAA, which will install the second Aegis Ashore facility in northern Poland, is still on track and scheduled for completion by mid-2018. Other Allies continue to invest in future elements of the system, allowing for greater precision and resiliency.

70. NATO parliamentarians should be aware of the system's development and the degree to which their nations are contributing to this effort. The missile defence system's overall capabilities depend on the continued contribution of member states and on their willingness to make difficult decisions, not only about the placement of specific assets (from interceptors to radar systems) but also about rules of engagement in using the system. Decisions to deploy and even eventually use elements of the missile defence system will depend on legislatures' understanding of their nation's contributions to and role in the Alliance's BMD system. As system upgrades become necessary, a BMD-aware cadre of legislators can help guide effective decision-making. Upcoming system upgrades of national air defence systems that will eventually become part of Alliance architecture are a particularly important example of where parliamentarians can play a critical role in shaping decision-making.

71. NATO parliamentarians should also know that most of Moscow's protests towards the NATO BMD system are, in fact, ill-founded and merely politically expedient messaging directed toward a domestic audience. NATO's plans to defend its European territory from missile attack are in its clear interests – no external third party can be permitted to determine the Alliance's defence policies, just as NATO would not seek to dictate defence policies to an external party. Moving forward, a more secure European territory under an increasingly sophisticated ballistic missile defence shield will create the necessary secure space for the Euro-Atlantic institutions to continue to grow and prosper.

72. The Defence and Security Committee will continue to work to remain apprised of and educated on NATO BMD as it continues to evolve.

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<sup>34</sup> *Ibid.* paragraph 59

## VII. APPENDICES AND SUPPLEMENTAL MATERIALS

### APPENDIX A – NATO’S MISSILE DEFENSE CAPABILITIES



Source: NATO ([http://www.nato.int/cps/en/natohq/photos\\_112331.htm](http://www.nato.int/cps/en/natohq/photos_112331.htm))



**APPENDIX B – DEPLOYMENT OF THE EUROPEAN PHASED ADAPTIVE APPROACH**

<b>Timeline</b>	<b>Action</b>	<b>Details</b>
2009	President Barack Obama Proposes the EPAA.	Emphasising the importance of strengthening missile defence in Europe, the President cites Iran's ballistic missile programme as the threat of greatest relevance to the programme. <sup>35</sup>
Phase 1	SM-3 IA missiles deployed on US Navy Aegis combat capable destroyers and cruisers.	Phase I was initiated with the deployment of the <i>USS Monterey</i> in 2011. The missile defence provided by this component of the EPAA is tasked to track and defeat short-and-medium-range missiles (SRBMs).
Phase 2	SM-3 IB missiles deployed on US Navy Aegis combat capable destroyers and cruisers and at the Aegis Ashore site in Deveselu, Romania.	This phase was achieved in 2016 with the completion of the site at Deveselu. The site has one facility outfitted with one land-based Aegis SPY-1 radar and 24 SM-3 IB missiles. Phase 2 is purposed to provide capabilities against short-and-medium range ballistic missiles.
Phase 3	SM-3 IIA missiles were deployed on Aegis ships, and at the existing site at Deveselu and the new site at Redzikowo, Poland.	The United States and NATO broke ground on the site in Poland in June 2016, and Phase 3 is slated for completion in 2018. The second Aegis Ashore facility will also be outfitted with one land-based Aegis SPY-1 radar and 24 SM3-IB missiles.
Phase 4 (CANCELLED)	This <i>would have</i> seen SM-3 IIB blocks deployed at both the Romania and Poland Aegis Ashore sites.	As referenced in the text, the United States cited budgetary reasons for cancelling this phase, while Russia's opposition to the faster and more effective missiles instalments may have also played a role in the decision.

**Source:** *Arms Control Association*. "The European Phased Adaptive Approach at a Glance." May 2013. <https://www.armscontrol.org/factsheets/Phasedadaptiveapproach>

John F. Morton and George Galdorisi, "Any Sensor, Any Shooter: Toward an Aegis BMD Global Enterprise," *National Defense University Press*, issue 67, quarter 4, 2012, [http://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-67/JFQ-67\\_85-90\\_Morton-Galdorisi.pdf](http://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-67/JFQ-67_85-90_Morton-Galdorisi.pdf)

<sup>35</sup> See, "Obama's Remarks on Strengthening Missile Defense in Europe, September 2009." *Council on Foreign Relations*. 17 September 2009. <http://www.cfr.org/missile-defense/obamas-remarks-strengthening-missile-defense-europe-september-2009/p20226>

## APPENDIX C – IRANIAN MISSILE CAPABILITIES – OVERVIEW

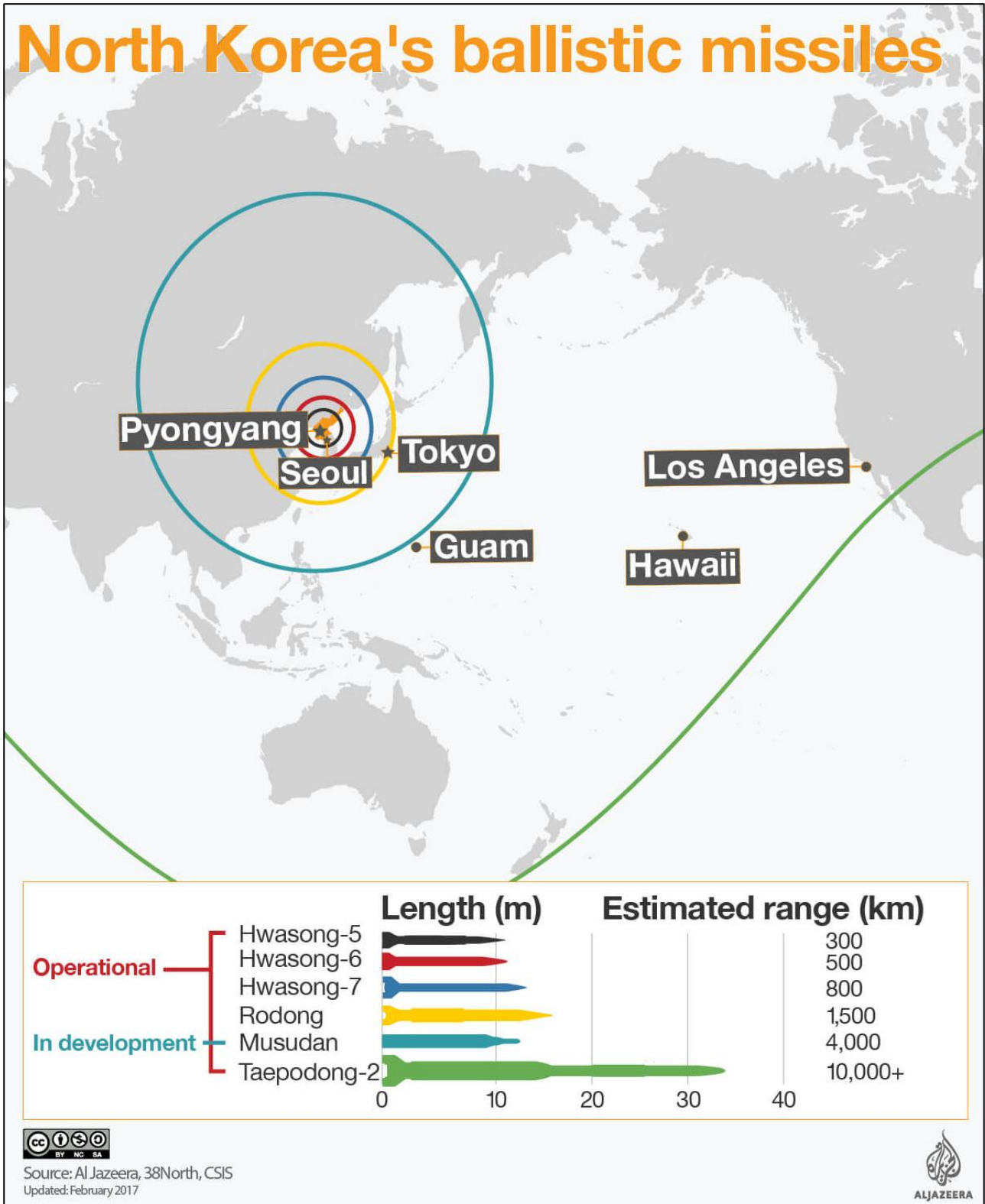
Table 2.1. Capabilities of Iranian Threat Missiles

	Stage	Fuel	$t_{bo}$ (sec)	$V_{bo}$ (km/sec)	Maximum Range (km)	Warhead (kg)
<b>Missiles Posing a Near-Term Threat</b>						
Shahab-3	1	Liquid	98	3.4	<u>1,300</u>	800
Shahab-3A Shahab-3M Ghadr-1	1	Liquid	98	3.7	<u>1,500-1,800</u>	500
Shahab-3B					<u>2,000-2,500</u>	500
Sajjil/Ashura	2	Solid	72	3.8	<u>2,000</u>	900
<b>Missiles Posing a Potential Future Threat</b>						
IRBM (Safir/ BM-25/Musudan)	2	Liquid	188	5.5	<u>5,200</u>	
Liquid-fuel ICBM	2/3	Liquid	329	7.6	<u>17,800</u>	

NOTE: These burnout times ( $t_{bo}$ ) will be used later as interceptor launch time delays.

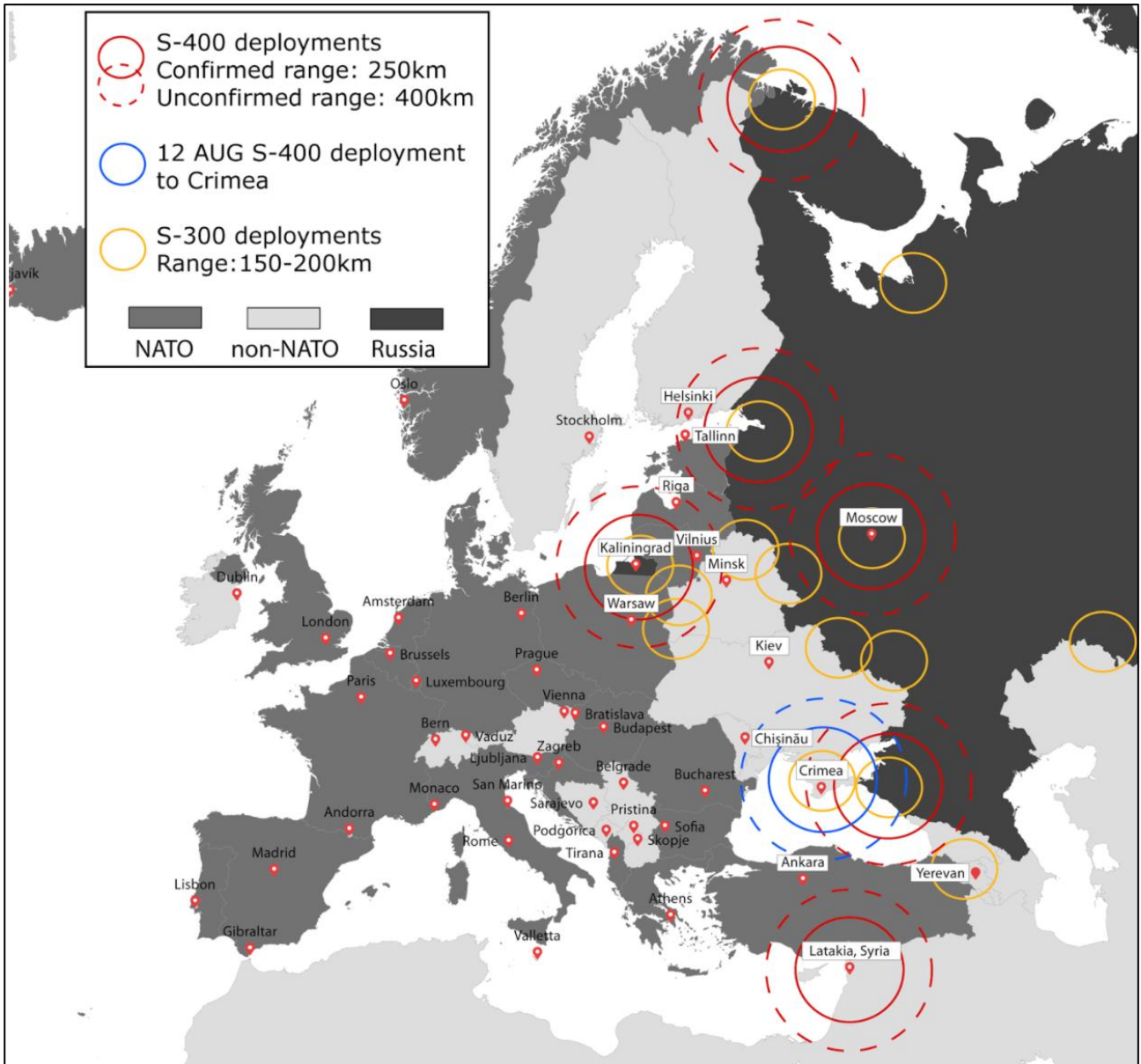
Source: Sankaran, Jaganath, "The United States' European Phased Adaptive Approach Missile Defense System: Defending Against Iranian Threats Without Diluting the Russian Deterrent." *RAND*. 2015.

APPENDIX D – NORTH KOREA'S MISSILES



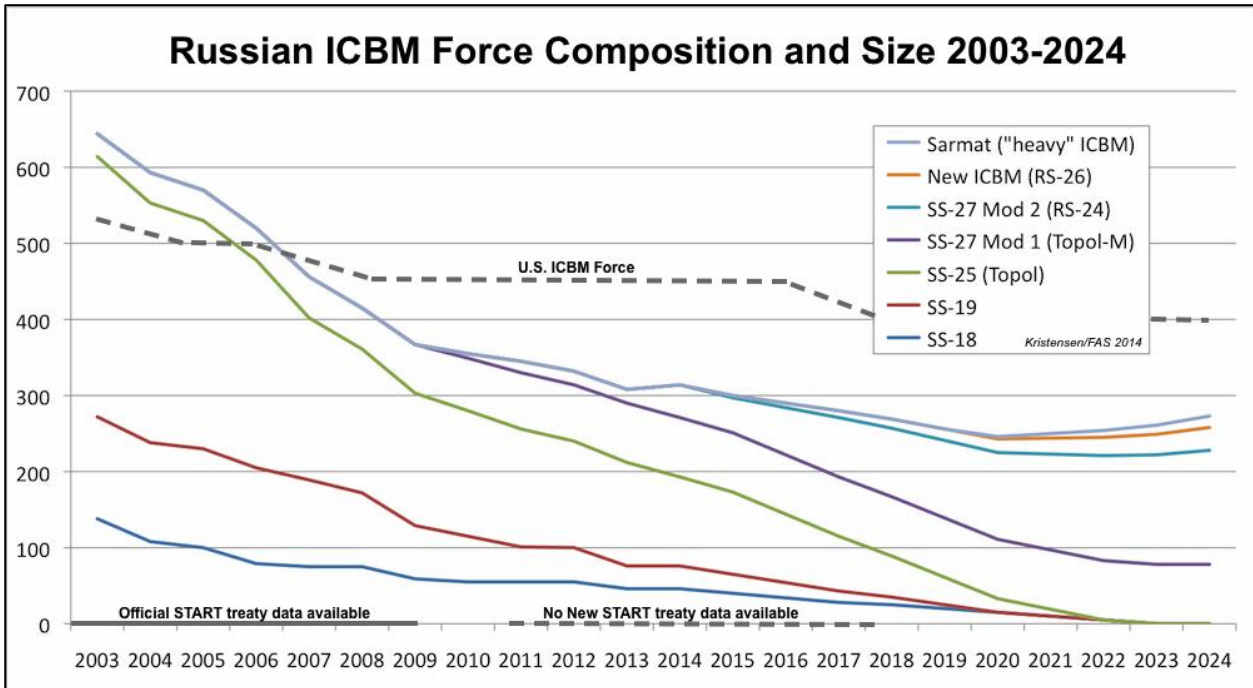
Source: Griffiths, James; Hancocks, Paula and Field, Alexandra, "Tillerson on North Korea: Military action is 'an option.'" *CNN Politics*. 17 March 2017.

**APPENDIX E – RUSSIA’S A2AD BUBBLE**



Source: Weinberger, Kathleen. "Russian Anti-Access and Area Denial (A2AD) Range: August 2016." *Institute for the Study of War*. 29 August 2016.

**APPENDIX F – RUSSIA’S ICBM DEVELOPMENTS (2012-2014)**



Source: Kristensen, Hans M., "Russian ICBM Force Modernization: Arms Control Please!" *Federation of American Scientists*. 7 May 2014.



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