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UNITED STATES - JAPAN COOPERATION IN BALLISTIC MISSILE DEFENSE DEVELOPMENT: CAPABILITIES IN FACING THE THREAT OF BALLISTIC MISSILES AND WEAPONS OF MASS DESTRUCTION

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Introduction

The advent of ballistic missiles as transporting agents of weapons of mass destruction (WMD) has caused Washington to initiate the development of a system that would be capable of repulsing any WMD attack carried out by ballistic missiles. Based on Japan's geographical location and surroundings that act as a buffer in ensuring the U.S.'s hegemony is not threatened by Russian and Chinese influence, Washington saw the need for Japan to be involved in the development of the Ballistic Missile Defense (BMD) Program. However, the question that needs to be answered concerns the Nodong ballistic missile threat belonging to the North Korean regime, which is capable of posing a threat to Japan with its WMD warheads. It is very worrisome as Nodong is able to reach its target in Japanese territory in about 10 minutes after being launched. In view of this precarious situation, it is crucial to analyze the BMD's real capabilities in facing the threat of Nodong (where interception needs to take place in a minute after the launching of Nodong has been detected) together with other ballistic missiles with longer attack ranges such as the intercontinental ballistic missile (ICBM).

Japan and the BMD

Research about the possibility of Japan using the BMD system began in the 1980s. Dialogues concerning ballistic missile defense between the U.S. and Japan were initiated after the Security Defense Initiative (SDI) announcement in 1983 before the agreement for Japanese involvement in the SDI research was executed in 1987.[1] Subsequently, a study regarding the initial cooperation between American and Japanese industrial companies on the development of the BMD program, known as the Western Pacific Missile Defense Architecture Study (WESTPAC) was started in 1989.[2] This study, which cost US$8 million and took four years to complete, found there was a need for a defense system to protect the Western Pacific region and Japan from North Korean ballistic missile attacks from 2000 until 2005. The study concluded that Pyongyang's ballistic missile, the Nodong-1 was the biggest threat to Japan. It recommended that

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1 Gregg Rubinstein, *U.S.-Japan Missile Defense Cooperation: Current Status, Future Prospect*, Paper presented at the Center for Pacific Asia Studies, Stockholm University, 2007, p 2.

2 M. D. Swaine and R. M. Kawakami, *Japan and Ballistic Missile Defense*, Santa Monica, Center for Asia Pasific Policy, 2001, p 29.

Tokyo used terminal high altitude area defense (THAAD) as a first-tier approach in the BMD defense element and to assess the use of the sea-based BMD System.[3]

In August 1994, a special advisory panel known as the Higuchi Panel was convened and charged with drafting a security policy vision for the 21st century. This draft included the recommendation that Japan cooperated with the U.S. to develop the BMD system to face a limited missile attack from North Korea and China. It also proposed that Japan developed military reconnaissance satellites.[4] The Japanese government subsequently initiated a bilateral study with the U.S. on ballistic missile defense in January 1995.

The study further elucidated comprehensive findings to identify and review various ballistic missile defense structures. The Ministry of Defense (MoD)[5] also produced a report entitled *"On Research Concerning Ballistic Missile Defense"* in August 1995. This report stressed the need for ballistic missile defense and highlighted Japan's weak position in facing the threat of ballistic missile attacks due to the lack of the PAC-2 system; it was still in the process of being purchased[6] together with the existing Japanese Command and Control system (a system that needed to be further improved).

The results of the report paved the way for the MoD to conduct related system and technological research such as detection systems via satellite, more advanced weaponry systems and a highly integrated Command, Control, Communications and Intelligence (C3I) system.[7] Tokyo also gave the approval to develop Japan's first reconnaissance satellite in November 1998 after North Korea conducted the Taepodong-1 ballistic missile launch testing in August 1998.

Following this launch testing by Pyongyang, both houses in the Diet in September 1998 unanimously approved a resolution to condemn the test and asserted that Tokyo would undertake the necessary actions to ensure the safety of its citizens.[8] Washington cooperated with Tokyo to combat this North Korean ballistic missile threat by conducting technical research on the BMD. On December 25 1998, the Japanese government announced the "Joint Japan-U.S. Technical Research on the Ballistic Missile Defense (BMD)" for the Navy Theatre Wide Defense (NTWD) system.[9] The MOU for researching this BMD system was signed with Washington on August 16 1999.

The agreement known as the Joint Cooperative Research (JCR) involved research on interceptor ballistic missiles such as the SM-2 Block IIA interceptor missile version, which was later incorporated into the SM-3 Cooperative Development (SCD) program; research was also carried out on developing the four components in the interceptor

[3] M. D. Swaine and R. M., R. M Swanger and T. Kawakami, *Japan and Ballistic Missile Defense*, 2001, p 30.

[4] M. D. Swaine and R. M., and R. M Swanger, T. Kawakami, *Japan and Ballistic Missile Defense*, 2001, p 30.

[5] Before Japan's Ministry of Defence (MoD) was upraded into a full ministry in January 2007, it was known as the Japan Defense Agency (JDA).

[6] In 1991, Japan bought the PAC-2 system from the U.S following the decision to increase to a 24-unit system that had been enhanced (PAC-2 Plus). The Japan Air Self Defense Force (JASDF) began receiving the system in 1998; M. D. Swaine and R. M. Kawakami, *Japan and Ballistic Missile Defense*, 2001, p 36.

[7] M. D. Swaine and R. M. Kawakami, *Japan and Ballistic Missile Defense*, 2001, p 30.

[8] M. D. Swaine and R. M. Kawakami, *Japan and Ballistic Missile Defense*, 2001, p 34.

[9] Defense Ministry of Japan, *Statement by the Chief Cabinet Secretary on the Joint Japan-U.S. Technical Research on the Ballistic Missile Defense (BMD)*, 1998, p 497, http://www.mod.go.jp/e/publ/w_paper/pdf/2007/44Reference_1_63.pdf. Accessed on 21 June 2011.

missile.[10] The Japanese government through its Chief Cabinet Secretary officially announced the development of the BMD system in Japan on December 19 2003. The report entitled "*Introduction of Ballistic Missile Defense System and Other Measures*" contained approaches and content aimed at avoiding any potential problems, especially reaction and response from China.

Paragraph five of the statement stressed that Tokyo would only use the BMD to defend Japan. This system would operate completely according to Tokyo's stand and would not be influenced by a third party in determining the launch of interceptors when faced with threats. The statement also asserted that Tokyo would not use the BMD in defending a third country.

Meanwhile, regarding the issue of collective defense, Tokyo affirmed that Japan only used sensors owned by its Japan Self Defense Force (JSDF) without depending on help from U.S. tracking satellites to determine the necessary action needed to deal with the threat of attack from any party. The fifth paragraph in "*Introduction of Ballistic Missile Defense System and Other Measures*" stressed:

> As for the issue of the right of collective self-defense, the BMD system that the Government of Japan is introducing aims at defending Japan. It will be operated based on Japan's independent judgment, and will not be used for the purpose of defending third countries. Therefore, it does not raise any problems with regard to the issue of the right of collective self-defense. The BMD system requires interception of missiles by Japan's own independent judgment based on the information on the target acquired by Japan's own sensors.[11]

After this official announcement, both countries were largely involved in technical research, dialogues on policy and the integration of special BMD programs. To actualize BMD policies, Tokyo approved the "National Defense Program Guideline FY 2005" on December 10, 2004. In essence, this guideline approved the development of the BMD system and changed several fundamental principles on the export of weapons. Three years after Tokyo's official announcement on the development of the BMD system, there was major progress. In 2005, the "Joint Analysis Study" on future areas of US-Japan BMD cooperation was conducted.

The U.S. Secretary of State, Condoleezza Rice, and the U.S. Secretary of Defense, Robert Gates with their Japanese counterparts, Minister for Foreign Affairs, Taro Aso and Minister of Defense, Fumio Kyuma in honour of the Security Consultative Committee (SCC), Alliance Transformation: Advancing United States-Japan Security and Defense Cooperation had a meeting on May 1st 2007; all four leaders issued a joint statement regarding the U.S.-Japan BMD cooperation program. They reconfirmed their commitment on the following issues, such as Washington placing a U.S X-Band radar system at Japan's Shariki Air Base and placing a U.S. PAC-3 battalion unit at the Kadena Air Base.[12]

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[10] G. A. Rubinstein, G., A, *U.S.-Japan Missile Defense Cooperation: Current Status, Future Prospect,* Paper presented at the Center for Pacific Asia Studies, Stockholm University, 2007, p 3.

[11] Y. Fukuda, *Statement by the Chief Cabinet Secretary*, 2003. http://www.kantei.go.jp/foreign/tyokan/2003/1219danwa_e.html. Accessed 6 June 2011.

[12] Ministry of Foreign Affairs of Japan, *Joint Statement of the Security Consultative Committee Alliance Transformation: Advancing United States-Japan Security and Defense Coperation*, MoFA, Japan, 2007, http://www.mofa.go.jp/region/n-america/us/security/scc/joint0705.html. Accessed on 3/6/2011.

Besides that, Japan also reaffirmed its commitment in obtaining the PAC-3 to replace the PAC-2 that was purchased in 1998 as well as upgrading four destroyers with the Aegis BMD system. The JSDF would also upgrade its air defense tracking and monitoring together with the existing Command and Control series. The U.S. meanwhile, was committed to placing of AEGIS BMD destroyers equipped with SM-3 at the sea areas around Japan, deploying the PAC-3 system at Okinawa and fixing an early warning radar in Northern Japan.[13] As part of the initiatives for Japan's ballistic missile defense, the MoD had placed the PAC-3 system at the Iruma military air base in the Saitama region in March 2007 and the Narashino military air base in the Chiba region in November 2010. The capability of the Japan-owned PAC-3 was tested for the first time in September 2008 through interceptor testing which showcased the ability of the interceptor missile to intercept the target, followed by its eventual success in 2009.[14]

On December 24 2005, the Japanese government announced the cooperation with the U.S. to develop a new version of the SM-3 Block IIA under the "Japan-U.S. Cooperative Development of Advanced SM-3 Missile for Ballistic Missile Defense"[15] framework. In 2006, an agreement to upgrade the JCR was signed and it was replaced with the SCD where the SM-3 missile that was developed would be used by both countries.[16] The latest interceptor version developed is a SM-3 Block IIA interceptor missile believed to have the capability of countering the possibility of ICBM ballistic missile attacks[17]. It was suprerior compared with the other SM-3 owned by the U.S. at the time, which were only capable of countering intermediate range ballistic missiles (IRBM). Nonetheless, the ability of this new version is still in doubt as there have not been any recent tests conducted. Moreover, its expected time of completion is only in 2018.

This joint development of the latest SM-3 Block IIA version by both countries was believed to be able to improve the defense against IRBM ballistic missiles such as the Taepodong-1. According to the agreement between Washington and Tokyo, Japan agreed to conduct research and prepare a prototype for four components of the NTW tracking and monitoring system and the SM-3 Block II: a lightweight nose cone, the second-stage propulsion, the sensor with infrared scan and an advanced kinetic warhead.[18]

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[13] Ministry of Foreign Affairs of Japan, *Joint Statement of the Security Consultative Committee Alliance Transformation: Advancing United States-Japan Security and Defense Coperation*, MoFA, Japan, 2007.

[14] Ministry of Defense, *Japan's BMD,* 2007, p 6, http://www.mod.go.jp/e/d_act/bmd/bmd.pdf, Accessed on 3 July 2012.

[15] Defense Ministry of Japan, *Statement by the Chief Cabinet Secretary on the Joint Japan-U.S. Technical Research on the Ballistic Missile Defense (BMD*), 1998, p 501, http://www.mod.go.jp/e/publ/w_paper/pdf/2007/44Reference_1_63.pdf, Accessed on 21 June 2011.

[16] G. A. Rubinstein, *U.S.-Japan Missile Defense Cooperation: Current Status, Future Prospect.* Paper, p 3.

[17] Toki, M., Missile Defense in Japan. *Bulletin of the Atomic* Scientists, 2009, http://thebulletin.org/web-edition/features/missile-defense-japan. Accessed on 11 July 2012.

[18] M. D. Swaine, M. D., R. M Swanger and T. Kawakami, *Japan and Ballistic Missile Defense*, 2001, p 35.

According to the MoD, Tokyo planned to spend between US$200 and US$300 million for the period of five to six years to develop the research for this technology.[19] In addition, Japan's MoD also stated that this program was estimated to cost between US$7.4 billion and US$8.9 billion by the year 2012.[20] Nevertheless, this expenditure was expected to increase since plans to develop more advanced technology would continue. After a few years of cooperating with Washington in the development of the BMD in Japan, Tokyo began to test the BMD system through a series of tests organized with the cooperation of the U.S.

The Japan Flight Test Mission (JFTM) was conducted for the first time on December 18, 2007 together with the Missile Defense Agency (MDA). MSD destroyers equipped with Aegis BMD technology succeeded in detecting and tracking targets launched from the Hawaiian Islands, which were then destroyed by SM-3 Block IA ballistic missiles at the outer atmosphere in the Pacific Ocean air space. The success of this test illustrated Washington-Tokyo's efforts of almost a decade in the BMD cooperation, where it was able to place the defense system on a solid footing in facing any WMD threat.

Even though the test was just the beginning of more developments to come, China in particular started to pay more attention to the BMD cooperation between Washington and Tokyo. In fact, Beijing from the start made a statement that this cooperation would increase the weapon race in the Asian continent. Both U.S. and Japanese officials reiterated that the success of the test was a significant step forward for the U.S.-Japan BMD cooperation.

Lieutenant General Henry Obering III, the MDA Director, stressed that the test helped to strengthen the cooperative alliance for the U.S.-Japan defense and highlighted the importance of Japan's role as the forerunner in promoting the ballistic missile defense system among U.S allies.[21]

The JFTM was also conducted for the fourth time together with the U.S. under the MDA to further increase the ability of the BMD system in countering any threat. JFTM-4 was held on October 29 2010 by using the same interceptor missile as JFTM-1, the SM-3 Block IA. However, the JFTM-2 test on 19 November 2008 failed to destroy its target[22] due to a malfunctioning divert and attitude control on the SM-3 Block IA interceptor missile.[23]

Aegis BMD System and SM Interceptor Missiles

The Aegis BMD system is the defense element developed under the U.S.-owned NTWD project where it functions to intercept and destroy enemy ballistic missiles using the SM interceptor missile. The initial construction of this defense system started in the 1970s with the purpose of destroying enemy aircrafts that attacked U.S. warships. This system, which began to be used in 1983, was placed on destroyers belonging to

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19 M. D. Swaine, M. D., R. M Swanger and T. Kawakami, *Japan and Ballistic Missile Defense*, 2001, p 35.

20 M. Toki, Missile Defense in Japan, *Bulletin of the Atomic Scientists,* 2009.

21 M. Toki, *Missile Defense in Japan*, Bulletin of the Atomic Scientists, 2009.

22 N Jane, *SM-3 Fails to Intercept Target in Japanese BMD Test*, 2008, http://www.defence.pk/forums/pakistan-strategic-forces/16557-sm-3-fails-intercept-target-japanese-bmd-test.html. Accessed on 29 July 2011.

23 Missile Defense Agency, *Ballistic Missile Defense Intercept Flight Test Record*, 2011, http://www.mda.mil/global/documents/pdf/testrecord.pdf. Accessed on 29 June 2011.

the U.S. navy, which eventually became known as Aegis warships. The Aegis system was developed by the Lockheed-Martin company; it contains several versions of an integrated collection of sensors, computers, software, displays, weapon launchers and weapons like 3.6.1, 4.0.1, 5.0, and 5.1.[24]

TABLE 1

VERSION OF AEGIS BMD SYSTEM

EPAA PHASE	PHASE 1	PHASE 2		PHASE 3	PHASE 4
VERSION OF AEGIS BMD SYSTEM	3.6.1	4.0.1	5.0/5.0.1	5.1/5.1.1	5.1/5/1.1
CERTIFIED FOR INITIAL USE	2006	2012	2014	2018	2020
OTE ASESSMENT	2008	2014	2016	2020	2022
MID-COURSE INTERCEPTOR (S) USED					
SM-3 BLOCK IA	X	X	X	X	X
SM-3 BLOCK IB		X	X	X	X
SM-3 BLOCK IIA				X	X
SM-3 BLOCK IIB					X
TERMINAL-PHASE INTERCEPTOR USED					
SM-2 BLOCK IV	X			X	
SBT Increment 1			x		
SBT Increment 2				X	X
TYPES OF BALLISTIC MISSILES THAT CAN BE ENGAGED					
SRBM	YES	YES	YES	YES	YES
MRBM	YES	YES	YES	YES	YES
IRBM	LIMITED	YES	YES	ENHANCED	ENHANCED
ICBM	NOx	NOx	NOx	LIMITED	LIMITED

SOURCE: O'Rourke, R. (2011). *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*: DIANE Publishing.

Notes : OTE is operational test nd evaluation.
x : Can not intercept ICBM but the system has a *long-range search and track* (LRS&T) capability-an ability to detect and track ballistic missile at long ranges.

Destroyers equipped with the Aegis BMD system and the SM interceptor missile have the ability to deploy BMD operations. Currently, the U.S. and Japan are using version 3.6.1 on their destroyers, which will be replaced in stages with the 4.0.1

[24] R. O'Rourke, R., *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, DIANE Publishing, 2011, p 8.

version by 2012.[25] As of April 2011, a total of 23 U.S. warships equipped with the Aegis BMD system have been deployed to be based in the Asia Pacific region where five of them are based in Yokosuka, Japan.[26]

The interceptor missiles used by the Aegis BMD system are SM-3 and SM-2 Block IV. SM-3 functions to destroy the target above the atmosphere in the midcourse phase of an enemy ballistic missile's flight. It is equipped with a "hit-to-kill" warhead, called a kinetic warhead, which is designed to destroy a ballistic missile's warhead by colliding with it. The SM-2 Block IV is designed to destroy ballistic missiles inside the atmosphere, during the terminal phase of an enemy ballistic missile's flight. It is equipped with a blast fragmentation warhead.

The MDA proposed to use a more advanced interceptor missile by replacing the SM-3 Block IA with the SM-3 Block IB together with introducing the SM-3 Block IIA followed by the SM-3 Block IIB. Compared with the Block IA version, the components of the Block IB version have been improved with a two-color target seeker[27], an advanced signal processor, and an improved divert and attitude control system for adjusting its course. Both the Block IA and Block IB versions have a diameter of 21 inches at the booster stage at the bottom with a diameter of 13.5 inches for other sections like the engine and the warhead. However, since the burnout velocity of SM-3 Block IA and IB was only 3.0 to 3.5 kilometers per second (km/s), this version was not capable of intercepting ICBM assaults.[28]

On the other hand, the Block IIA version has a diameter of 21 inches throughout the whole missile, which gives the advantage of a broader kinetic warhead and more room for rocket fuel, hence having a burnout velocity that is 45% to 60% greater than that of the Block IA and IB versions. This burnout velocity can reach 4.5 to 5.5 km/s.[29] The MDA asserted that the cost needed to obtain one unit of the SM-3 Block IA interceptor missile would be US$9 million to US$10 million; the costs required to acquire the SM-3

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25 Under the Aegis BMD modification program and the deployment process of Aegis warships, the 3.6.1 version currently in use by the warships equipped with the Aegis system will be replaced with the 4.0.1 version, which is more capable in the identification of additional components such as the latest BMD signal processor, additional computers and downloading of tactical ballistic missiles; R. O'Rourke, *Sea-Based Ballistic Missile Defense: Background and Issues for Congress*, DIANE Publishing, 2011, p 4.

26 R. O'Rourke, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress,* 2011, p 8.

27 Since the end of the 2004 financial year, the MDA has succeeded in completing several Focal Plane Array (FPA) two-color infrared programs. SM-3 Block IA previously used a one-color target seeker, LWIR HgCdTe, which produced a high quantum wave effect. The use of the monolithic two-color target seeker is capable of increasing the ability of the SM-3 Block IB interceptor missile's target seeker. The MDA has developed 1024x1024 MW High Quantum Efficiency (QWIP) FPAs and 320x256 MW/LW two-color FPA. At the end of the 2005 financial year, Very long wavelength infra red (VLWIR), HgCdTe and Arsenic doped silicon (Si:AS) with multicolors, including cryocoolers were sent to Hardware in the loop (HWIL) and performance testing programs. See M.Z. Tidrow, "New Infrared Sensors for Ballistic Missile Defense," *Missile Defense Agency/Advanced Systems, Pentagon Washington DC, Quantum Sensing and Nanophotonic Devices II, In Proceeding of SPIE, 5732,* 2005.

28 W. Riqiang, "Global Missile Defense Cooperation and China", *Asian Perspective,* Vol. 35, No. 4, 2011, pp 595-615.

29 W. Riqiang, "Global Missile Defense Cooperation and China", *Asian Perspective*, 2011, pp 595-615.

Block IB and the SM-3 Block IIA would be US$12 million to US$15 million and US$20 million to US$24 million respectively.[30]

The table below conveys the interceptor testing conducted by the U.S. and Japan throughout the Aegis and SM development program.

TABLE 2

AEGIS BMD FLIGHT TEST SINCE JANUARY 2002

EXO-ATMOSPHERIC (USING SM-3 MISSILE)

DATE	COUNTRY	NAME OF TEST	TARGET	SUCCESSFUL
25/1/2002	US	FM-2	Unitary TTV short-range target	YES
13/6/2002	US	FM-3	Unitary TTV short-range target	YES
21/11/2002	US	FM-4	Unitary TTV short-range target	YES
18/6/2003	US	FM-5	Unitary TTV short-range target	NO
11/12/2003	US	FM-6	Unitary TTV short-range target	YES
24/2/2005	US	FTM 04-1 (FM-7)	Unitary TTV short-range target	YES
17/11/2005	US	FTM 04-2 (FM-8)	Separating medium-range target	YES
22/6/2006	US	FTM 10	Separating medium-range target	YES
7/12/2006	US	FTM 11	Unitary TTV short-range target	NO
26/4/2007	US	FTM 11 EVENT 4	Unitary ARAV-A short-range target	YES
22/6/2007	US	FTM 12	Separating medium-range target	YES
31/8/2007	US	FTM-11a	Classified	YES
6/11/2007	US	FTM13	Unitary ARAV-A short-range target	YES
17/12/2007	JAPAN	JFTM-1	Separating medium-range target	YES
1/11/2008	US	Pacific Blitz	Short-range missile target	YES
			Short-range missile target	NO
19/11/2008	JAPAN	JFTM-2	Separating medium-range target	NO
30/7/2009	US	FTM-17	Unitary ARAV-A short-range target	YES
27/10/2009	JAPAN	JFTM-3	Separating medium-range target	YES
28/10/2010	JAPAN	JFTM-4	Separating medium-range target	YES
15/4/2011	US	FTM-15	IRBM target	YES

ENDO-ATMOSPHERIC (USING SM-2 MISSILE)

DATE	COUNTRY	NAME OF TEST	TARGET	SUCCESSFUL
24/5/2006	US	Pasific Pheonix	Unitary short-range target	YES
5/6/2008	US	FTM-14	Unitary short-range target	YES
26/3/2009	US	Stellar Daggers	Short-range ballistic missile target	YES

SOURCE: Table adapted from "Aegis Ballistic Missile Defense Testing", accessed on 25/7/2011 at http://www.mda.mil/global/documents/pdf/testrecord.pdf. See also, O'Rourke, R. (2011). Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress:DIANE Publishing.

Notes: TTV is *target test vehicle*; ARAV is *aegis readiness asessment vehicle*.

30 R. O'Rourke, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, 2011, p 4.

Patriot Advanced Capability (PAC)

PAC is a lower-tier defense system that operates to intercept ballistic missiles with an attack range of less than 1,500 km like the Short Range Ballistic Missile (SRBM). Besides that, the PAC interceptor missile is a Surface to Air Missile (SAM) defense system that functions in shooting down enemy aircrafts or ballistic missiles. The PAC development program was initiated by the U.S. military in the 1960s; subsequently, in the 1970s this program became the most important program and the main priority in enhancing the U.S. and the North Atlantic Treaty Organization (NATO) defense systems.[31] It started operations in 1984 to replace the Nike (Nike-Hercules and Nike-Ajax) air defense system series. Japan's MoD decided to obtain the PAC in April 1985 during the administration of Prime Minister Yasuhiro Nakasone in order to improve its air defense capabilities.

The U.S. military began using PAC-2 during the Gulf War in 1991 to shoot down ballistic missiles launched from Iraq although the PAC-2 was actually operated to shoot down enemy aircrafts. There were reports that Pentagon officials exaggerated the level of accuracy of PAC-2 during the Gulf War and embellished on its effectiveness during the U.S Congressional Hearing on the Gulf War.[32]

Even though the rate of success of PAC-2 interception was low[33], its effect on the importance of this system for the nation's defense started to show results. Through research and continuous development, the PAC program has illustrated tremendous improvement in its intercepting abilities. For instance, during the Iraq War in 2003, PAC-3 was used to intercept ballistic missiles that were launched by the Iraqi army and succeeded in destroying two Al-samoud ballistic missiles from the SRBM range.[34]

The latest version of the PAC-3 has been further enhanced to intercept tactical ballistic missiles at the terminal phase. As of March 2005, out of 12 interception test missions using the newest version, 10 of them achieved success in the tests conducted.[35]

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[31] M. W. Chinworth, *Inside Japan's Defense: Technology, Economics and Strategy*, 1992, pp 68- 69.

[32] G. R. Mitchell, *Japan-U.S. Missile Defense Collaboration: Rhetorically Delicious, Deceptively Dangerous*, Paper presented at The Fletcher Forum of World Affairs, Vol. 25, No. 1 Winter, 2001.

[33] H. Kaneda, K. Kobayashi, H. Tajima, H., & H. Tosaki, *Japan's Missile Defense: Diplomatic and Secutiry Policies in a Changing Strategic Environment*, The Japan Institute of International Affairs, 2007, p 15.

[34] H. Kaneda, K. Kobayashi, H. Tajima, H., & H. Tosaki, *Japan's Missile Defense: Diplomatic and Secutiry Policies in a Changing Strategic Environment*, 2007, p 15.

[35] N. Norifumi, "Japan and Ballistic Missile Defense: Debates and Difficulties," *Security Challenges,* Vol. 8, No.3, p 10.

TABLE 3

RESULT OF LAUNCH TEST (PATRIOT PAC-3)

DATE	NAME OF TEST	TARGET	RESULT
21/3/2002	OT/DT-1	HERA Ballistic Missiles	Success
25/4/2002	OT/DT-4	Reconfigured PAAT (Patriot)	Failed to destroy warheads
29/5/2002	OT-2	HERA Ballistic Missiles (equipped with reentry body)	Success
4/3/2004		PAAT (reconfigured Patriot)	Success
2/9/2004	DT/OT-11	PAAT (reconfigured Patriot)	Success
		MQM-107 (simulated cruise missiles)	Success
18/11/2004	DT/OT-12	PAAT (reconfigured Patriot)	Success
		STORM	Success
8/9/2005	Test after revising software	PAAT (reconfigured Patriot)	Success

Notes: PAAT: Patriot as a Target, DT: Development Test, OT: Operation Test

Source: Kaneda, H., Kobayashi, K., Tajima, H., & Tosaki, H. (2007).

Japan Missile's Defense, Diplomatic and Secutiry Policies in a Changing Strategic Environment:

The Japanese of International Affairs, pg 56.

Table 4

Use of Patriot Missiles during the Iraqi War (Against ballistic missiles)

Date	Launching Troops	Target	Result
20/3/2003	No. 101 Airborne Division	Ababail-100	Shot down, using PAC-2x1 and GEM X 2
	US Army	Ababail-100	Shot down,using PAC-3 X2
	US Army	Ababail-100	Shot dow, using GEM X 1
21/3/2003	Kuwaiti Army	TBM	Shot down, using GEM X 3
25/3/2003	Kuwaiti Army	Al-Samoud	Shot down, using GEM+ X 1
26/3/2003	Kuwaiti Army	TBM	Shot down, using GEM X 1
27/3/2003	US Army	Unknown	Shot down, using GEM X 2
29/3/2003	Kuwaiti Army	TBM	Shot down, using GEM X 1
1/4/2003	US Army	TBM	Shot down, using PAC-3 X 1

Notes: TBM: Theater Ballsitic Missile,
GEM: Guidance Enhancement Missile,
PAC: Patriot Advanced Capability

Source: Kaneda, H., Kobayashi, K., Tajima, H., & Tosaki, H. (2007). Japan Missile's Defense, Diplomatic and Secutiry Policies in a Changing Strategic Environment: The Japanese of International Affairs, pg 56.

BMD Ability in Countering WMD Attacks

The question regarding the ability of the BMD system to protect the nation from any WMD threat needs to be thoroughly analyzed. This is because the BMD system has never faced a real WMD threat. Although several interceptor tests have been conducted by the U.S. and other countries, the true contingency threat is very different compared with when the tests are being conducted; in a test environment, all data about the threat are already known, including the location of the missile launch that is to be targeted.

The MDA has conducted Aegis BMD system interceptor tests to evaluate the SM-2 and SM-3 interceptor missiles in countering WMD threats. Since January 2002, the MDA has conducted 25 interception tests with 21 interception successes using the SM-3 Block IA and SM-2 Block IV interceptor missiles. The success of this interception included three out of four JFTMs conducted by the Maritime Self-Defense Force (MSDF) of Japan. Three of the tests by the MDA used the SM-2 Block IV interceptor missile that destroyed the target at the endo-atmospheric altitude while the rest destroyed the target at the exo-atmospheric[36] altitude using the SM-3 interceptor missile.[37]

The Department of Defense's (DoD) report to Congress in 1999 concerning the BMD system in its ability to defend Japan, South Korea and Taiwan did not provide a comprehensive evaluation of the challenges involved in the development of the BMD system in Japan. The findings of the DoD merely provided theoretical assumptions regarding the minimum number of lower-tier and upper-tier BMD systems required to form a defense system to face a small number (less than five) of North Korean ballistic missiles like the Nodong and Taepodong-1.[38]

This study did not take into account a defense system to counter more sophisticated ballistic missile inventory from China and Russia. Evaluation was needed to search for methods in countering ballistic missile attacks in big numbers and the technology necessary to deflect countermeasures from enemy ballistic missiles like decoys.

At the very least, with large ballistic missile numbers, a wider geographical area and more advanced ballistic missiles from China and Russia, Japan needed to develop powerful naval and air defenses in order to face all the above threats. 16 units of JSDF-owned PAC-3 launchers were placed at several Japanese bases and not inclusive of those owned by the U.S. in Okinawa; however, it did not guarantee Japan's safety from the Chinese IRBM threat as well as from North Korea if the ability to intercept PAC-3 missiles from less than 1,500 km were taken into account.[39] Besides that, the PAC-3's ability to intercept the high velocity Nodong ballistic missile was also not known.[40]

The high velocity of far range ballistic missiles like the IRBM and ICBM requires fast reaction to launch missiles capable of intercepting and destroying the threat before it reaches its target. Assuming that a ballistic missile launched from North Korea needs seven minutes or less to reach its target in Japan, the decision to launch an interceptor to destroy the ballistic missile aiming towards Japan would need to be made in 120 seconds.[41]

Looking from the defense concept viewpoint, all countries would need a ballistic missile to be destroyed before its warhead re-enters the earth's atmosphere or at the very least before its flight trajectory reaches the final or terminal stage. If an attempt fails to destroy a target at its boost phase and midcourse phase, the re-entering of the warhead into the earth's atmosphere will increase in speed. The warhead entering the earth's atmosphere with extremely high velocity is another factor that needs to be taken into consideration because the speed of the interceptor missile has to be of equal magnitude to destroy the warhead.

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[36] Exo-atmospheric refers to the space above the earth's atmosphere while endo-atmospheric refers to the space in the earth's atmosphere.

[37] R. O'Rourke, "Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress", 2011, p 62; Missile Defense Agency, "Ballistic Missile Defense Intercept Flight Test Record", 2011, http://www.mda.mil/global/documents/pdf/testrecord.pdf. Accessed on 29 June 2011.

[38] M. D. Swaine, R. M. Swanger, T. Kawakami, *Japan and Ballistic Missile Defense*, 2001, p 75.

[39] M. D. Swaine, R. M. Swanger, T. Kawakami, *Japan and Ballistic Missile Defense*, 2001, p 75.

[40] N. Norifumi, "Japan and Ballistic Missile Defense: Debates and Difficulties," Security Challenges, p 10.

[41] R. Halloran, "Consensus Culture Hinders Missile Defense", 2003, http://www.japantimes.co.jp/text/eo20030707a3.html. Accessed on 8 June 2011.

The *Nuclear Posture Review Report 2010* published by the U.S. emphasizes that:

> Nuclear forces will continue to play an essential role in deterring potential adversaries and reassuring allies and partners around the world. But fundamental changes in the international security environment in recent years – including the growth of unrivaled U.S. conventional military capabilities, major improvements in missile defenses, and the easing of Cold War rivalries – enable us to fulfill those objectives at significantly lower nuclear force levels and with reduced reliance on nuclear weapons.[42]

However, interceptor testing under real conditions, that is launching of ballistic missile without warning to test the ability of the tracking system, has never been conducted to determine the real ability of the BMD system.[43] Besides that, although several SM-3 interceptor missile tests have been held since 2002, tests to counter countermeasures like decoys have never been done.[44] The understanding among the U.S. academics is that the BMD system does not have the ability to differentiate between a real warhead and a decoy, which is the main problem with the BMD system.[45] Thus, testing to face countermeasures needs to be deployed before the the SM-3 can be said to be effective in interceptor operations. A mission to intercept two simultaneous targets that was held by the U.S. in 2007 also failed to destroy the targets. Meanwhile, for Japan, a similar simultaneous two-target interception has never been done. If the enemy launches an attack with two ballistic missiles at the same time, Japan would likely fail in intercepting both targets.

The previous failure of a number of interceptor tests under the NMD program also proves the failure of this interceptor program. Before Clinton made the decision to develop the National Missile Defense (NMD) into the Ground Based Missile Defense (GMD)[46] in 2000, his administration faced certain obstacles such as the failure of several NMD interceptor test series. Clinton stressed in September 2000:

> I simply cannot conclude, with the information I have today, that we have enough confidence in the technology and the operational effectiveness of the entire NMD system to move forward to deployment. Therefore, I have decided not to authorize deployment of a national missile defense at this time.[47]

This statement of Clinton's signaled that the plan to develop the NMD program would be discontinued based on technological restrictions as well as the ineffectiveness

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42 Department of US Defense, "Nuclear Posture Review Report," Washington DC, Department of US Defense, 2010, http://www.defense.gov/npr/docs/2010%20Nuclear%20Posture%20Review%20Report.pdf. Accessed on 5 January 2012.

43 Yousaf Butt, "The Myth of Missile Defense as a Deterrent", 2010, http://www.thebulletin.org/web-edition/features/the-myth-of-missile-defense-deterrent. Accessed on 14 October 2011.

44 D. Wright, & L. Gronlund, L., "Technical Flaws in the Obama Missile Defense Plan", 2009. http://www.thebulletin.org/web-edition/op-eds/technical-flaws-the-obama-missile-defense-plan. Accessed on 5 January 2012.

45 W. Riqiang, "Global Missile Defense Cooperation and China", *Asian Perspective*, 2011, pp 595-615.

46 After Clinton stepped down as the President of the U.S., Bush, who replaced him, changed the term NMD to GMD.

47 H. Kaneda, K. Kobayashi, H. Tajima, & H. Tosaki, *Japan Missile's Defense: Diplomatic and Secutiry Policies in a Changing Strategic Environment*, 2007, p 24.

of the NMD defense system, added with the change in administration under President George W. Bush in 2001. The GMD two-stage program suggested to be placed in Poland has never undergone interceptor testing. In the meantime, the GMD three-stage program has never had realistic interceptor testing that takes into account countermeasure factors and other potential complications to be faced in real attacks.[48]

Both interceptors are deployed to intercept enemy ballistic missiles out of the earth's atmosphere in a vacuum state where countermeasures like decoys operate more effectively, making it harder for the interceptor to function better.[49] The latest GMD interceptor testing in December 2010 that was conducted at the Pacific Ocean also failed.[50]

Furthermore, Washington-Tokyo needed to solve the issue of coordinating C2BMC (Command, Control, Battle Management, and Communications) to ensure that all agencies involved were competent in reacting if the radar or early warning satellite detected the launch of enemy ballistic missiles. If such a situation were to happen, fast and effective coordination between the BMD systems of both countries must be done to shoot down the missile heading towards its target.

Cooperation between Japan and the U.S. for the BMD program has only focused on technology related to the interceptor missile whereas discussion regarding the C2BMC has been difficult to commence. For the time being, there is no mutual understanding regarding the development of the C2BMC. This is caused by the lack of coordination in the Joint Operation and Procedure Plan with the U.S.[51] Japan does not have its own capability yet to conduct interceptor testing. In fact, the four JFTMs were held with the aid of the C2BMC system owned by the U.S.

There are a few measures to counter the threat of ballistic missiles, which are able to deter the possibility of such attacks. However, these measures have not been applied by Tokyo. Such measures include dissuasion diplomacy, deterrence posture, denial power through offensive defense, defense capability through powerful and active conceptual defense, and damage confinement known as passive defense.[52] The

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48 D. Wright, & L. Gronlund, L., Technical Flaws in the Obama Missile Defense Plan, 2009, http://www.thebulletin.org/web-edition/op-eds/technical-flaws-the-obama-missile-defense-plan Accessed on 5 Janury 2012.

49 D. Wright, & L. Gronlund, L., Technical Flaws in the Obama Missile Defense Plan, 2009, http://www.thebulletin.org/web-edition/op-eds/technical-flaws-the-obama-missile-defense-plan Accessed on 5 Janury 2012.

50 Missile Defense Test Conducted, 2010, http://www.mda.mil/news/10news0019.html. Accessed on 13 February 2012; Missile Defense Test Fails, 2012, http://www.missilethreat.com/archives/id.7382/detail.asp. Accessed on 13/2/2012.

51 H. Kaneda, K. Kobayashi, H. Tajima, H., & H. Tosaki, Japan's Missile Defense: Diplomatic and Secutiry Policies in a Changing Strategic Environment, 2007, pp 93-103.

52 Although several measures such as deterrence posture and denial power are highly likely to encounter difficulty in being administered following restriction from Japan's peace constitution, together with the nuclear protection umbrella given by Washington and the ongoing debate on whether Tokyo should develop its nuclear weapon capability for defense purposes, measures like defense capability and damage confinement are capable of being taken. Meanwhile, for the aspect of defense capability, prominence will not be given here as it involves a huge discussion representing the overall defense system of Japan. With that, deterrence posture and denial power will not be discussed here. See H. Kaneda, K. Kobayashi, H. Tajima, H., & H. Tosaki, Japan's Missile Defense: Diplomatic and Secutiry Policies in a Changing Strategic Environment, 2007, p 45.

five measures are known as the "5Ds." Dissuasion diplomacy refers to the first step that should be administered and enhanced by Japan in order to prevent any potential ballistic missile attack.

A solution through diplomatic channels is one of the most effective steps in preventing the possibility of ballistic missile attacks. For instance, the six-party talks negotiations involving the U.S, Russia, China, North Korea, South Korea and Japan succeeded in attracting the North Korean regime to have discussion about efforts to develop WMD and ballistic missiles. These efforts at the negotiation table at the very least were able to slow down the regime's ambition and definitely gave time to Japan to react and take the appropriate action to deter Pyongyang from continuing with their program.

In addition, there were agreements held in line with the efforts to control the spread of ballistic missiles such as the Missile Technology Control Regime (MTCR) and the Hague Code of Conduct against Ballistic Missile Proliferation (HCOC). Although Japan had signed these two control regimes, there was no regime or control framework as such at the East Asian level even with some neighboring countries having ballistic missile capabilities. Tokyo should have initiated the promotion of the Confidence Building Measure (CBM), which was capable of being a framework to create a regional control regime that would act to control the spread of ballistic missile technology in East Asia. If such a regime were successfully created at the regional level, the threat of the spread and development of ballistic missiles would be under control, where it would indirectly halt the possibility of WMD attacks using ballistic missiles.

Concerning the aspect of damage confinement, Japan should look into the steps related to civil defense as soon as possible. In Japan, some public organizations operate to support the police and firefighters, but the civil defense concept is almost non-existent. Hence, there is a need to create a civil defence system that is able to face the possibility of ballistic missile attacks. The federal and local governments, public entities and other organizations can play a role in developing passive defense measures.

Individuals should also increase their awareness of their country's safety and participate in civil defense planning programs as much as possible. Such actualization is crucial in the aspect of disaster and damage management. For now, there is a dire need to develop communicative steps and reactions using organizations and available funding such as the Japanese law about protective measures for the public. Regarding the steps to improve communicative competence, it would be more effective if Tokyo integrates the existing system found at the Prime Minister's Office, various directive and control systems at the MoD and the SDF, the disaster prevention system at local government level, the police, the firefighters, lifeguards as well as the competency of reporting at public broadcasting stations.

Many countries have established civil defense measures to lessen the impact of damage due to ballistic missile and WMD attacks. Some of these measures might prove useful to Japan:

- Implement a warning system that encompasses the whole country;
- Educate and provide the necessary training to the people concerning reactive steps towards damage caused by ballistic missile and WMD attacks;
- Establish civil defense units and voluntary corps;
- Encourage the storing of basic necessity items and medical supplies;

- Encourage the federal and local governments to build public transport facilities.[53]

For example, the lesson learnt from the 9/11 terrorist attack was that President Bush established the *"Freedom Corp,"* a civil defense organization.[54] It is also important to determine the sharing of roles among the public sector deparments like the SDF and the police with other parties like non-governmental organizations (NGOs) and individual participation in voluntary activities from other parties.

Currently, Japan has almost zero efforts in attempting to create an organized civil defense system.[55] For reactions towards the potential damage of ballistic missile attacks, Japan needs to immediately increase the competency level of several civil defense systems such as the coordination of duties between the SDF and the fire and rescue department. During the launching of North Korea's ballistic missiles in July 2006, there was a problem of late communication from the federal government to the local authorities. Concerning SDF activities, it is of utmost importance to establish a concrete action plan to create disaster and damage management through discussions headed by the Ground Self Defense Force (GSDF), MSDF, Air Self-Defense Force (ASDF), the U.S. military, the fire and rescue department, as well as related ministries together with local governments. Moreover, it is necessary to activate prevention and management of disaster training among the Japanese people.

Conclusion

Progress from the development of the BMD system has not helped to maintain stability and peace, which are still pioneered by the role of nuclear weapons as deterrent agents to any WMD threats. This is because the capability of this system has not been proven effective to protect a country from any threat even though numerous interceptor testings have been conducted, together with the increase in the number of countries that have shown interest in the cooperation and development of the BMD. Thus, since this system has never faced any real conflict situations, it would be unwise to depend solely on the BMD system in countering ballistic missile attacks carrying WMD warheads.

However, even though the BMD system has not proven its ability to counter any WMD attack, it does not mean that in a few years or the next decade, this technology would not be able to face more advanced ballistic missiles and countermeasures. This possibility exists, although the BMD would not be able to achieve the fundamental concept of defense, which is to ensure the safety of a country in the event of WMD attacks. In reality, the BMD is only capable of rendering minimal defense.

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53 H. Kaneda, K. Kobayashi, H. Tajima, H., & H. Tosaki, *Japan's Missile Defense: Diplomatic and Secutiry Policies in a Changing Strategic Environment*, 2007, p 51.

54 H. Kaneda, K. Kobayashi, H. Tajima, H., & H. Tosaki, Japan's *Missile Defense: Diplomatic and Secutiry Policies in a Changing Strategic Environment*, 2007, p 51.

55 Japan also has a fire and rescue team that is made up of members of the permanent fire department and volunteer fire department. However, up to today there are no measures to coordinate both departments with the SDF as well as with other safety agencies even though the relationship is stronger between the fire department and its neighboring areas compared with the department's relationship with other safety agencies. See Mary A Haddad, "From Undemocratic to Democratic Civil Society: Japan's Volunteer Fire Department," *The Journal of Asian Studies*, Vol. 69, No. 1, 2010, pp 33-56. Doi: 10.1017/S0021911809991549

The BMD needs to provide effective and real protection in case of WMD attacks. Therefore, in the process of strengthening a country's defense system to face any nuclear, biological or chemical weapon threat, as well as ballistic missiles, it is necessary that the BMD technology be fine-tuned to increase its capability of handling the true threat of ballistic missiles equipped with WMD and provide effective countermeasures.