

Theater Missile Defense (TMD) Family of Systems

- Lower – Tier

The main purpose of lower-tier missile defenses is to defend relatively small areas from missile and ballistic missile attack. Their design allows them to intercept at altitudes lower than 20 kilometers, and have approximate ranges of 600 to 1,500 kilometers. Some of these systems can also target and destroy aircraft and cruise missiles. The lower-tier systems now being developed are the PAC – 3, Navy Area Wide, and a Medium-range Extended Air Defense System (MEADS). These all follow on the heels of the US - Israeli launched Arrow 2 project and the Gulf War's PAC - 2¹.

Currently, the only lower-tier defensive system in the US arsenal is the Patriot Anti-Tactical Missile Capability - 2 missile. This system was designed to protect critical assets and maneuver forces. The PAC – 2 can intercept TBMs (Theater Ballistic Missiles), CMs, UAVs (Unmanned Aerial Vehicles), helicopters, and some fixed-wing aircraft². In Israel the Arrow 2 met with little political resistance, as the memories of the 39 Iraqi SCUDs that impacted there in 1991 were still fresh. This system can be very good against missiles with ranges from 185 to 800-miles, but would be ineffective against any longer ranged missiles. The Arrow 2 is much faster than the PAC – 2 whose deployment in South Korea, Kuwait, Saudi Arabia, Israel, Taiwan and elsewhere is the most widespread of any lower-tier system³.

¹ US Missile Defense Programs and Security Implications.

² FY 99 Air and Missile Defense Master Plan, p. 5-12

³ John E. Carey, "Ballistic Missile Defense: Progress is Being Made," International Defense Consultants, Inc. <http://internationaldefense.com/articles/progress.html>

Due to new configurations in satellite technology and an improved thrust system, the PAC – 3 is touted as being more effective than its predecessor was. The PAC – 3 employs hit-to-kill technology in defending against WMD warheads and TBMs. Compared to the PAC – 2, the PAC – 3 more than doubles the defended ground area and can engage and kill TBMs with four times the range of the Desert Storm threat. A new upgrade called PAC – 3 Configuration 3 will enhance the lethality of the missiles as well⁴.

The Navy's Area Defense program rests on the capabilities of a new Block IV A missile, to begin production sometime in FY 2001. Aegis-equipped ships will be able to provide coverage to areas of vital national interest either on the coast or at sea. This program can be used in South Korea and other areas to supplement land-based missiles. In the example of South Korea, the Aegis ships could provide one layer of coverage against North Korean TBMs and CMs while a land-based system provides an additional defense. These sorts of overlapping systems will most likely be deployed with the advanced Patriot for a more complete coverage and protection⁵.

The cooperative program between the United States, Germany, and Italy, called MEADS or Medium-Extended Air Defense System, is designed to meet the threat of low-altitude CMs and SRBMs (Short Range Ballistic Missiles). These missiles usually have a range of up to 1,000-kilometers, and the systems also handle UAVs and rockets. The MEADS system can defend against SRBMs that are conventionally tipped or ones that carry WMD warheads. This system is strategically deployable in that it can be delivered via C-130 aircraft to the battlefield, effectively lowering the required airlift needed for

⁴ FY 99 Air and Missile Defense Master Plan, p. 5-12 and 5-13

⁵ William Cohen, "Annual Report to the President and the Congress (ADR 2000)," p.7. This can be found on-line at: <http://www.dtic.mil/execsec/adr2000/chap6.html>

mission start-up. The MEADS system, employing a 360-degree coverage, is the only TMD system that can protect maneuvering forces against most threats during every operational phase⁶.

- Upper - tier

Upper-tier missile defenses, unlike their lower-tier brothers, provide for the protection of large areas. They are designed to intercept enemy missiles high, or even above, the atmosphere. These defenses seen as the most problematic in relation to issues of nuclear proliferation and arms races. They are the first layer of defense against ballistic missiles and threaten to lessen dramatically the nuclear strike capabilities of some nations. These systems are far from being the missile shield called SDI, or Star Wars, during President Regan's tenure. The limited nature of these systems leaves the door open to countries like China who have a limited number of missiles, but who could also ostensibly produce more in an attempt to strategically overpower the system. These types of defenses, namely THAAD and Navy Theater-Wide, can only engage a threat after burnout has occurred since exact trajectories cannot be determined until then⁷. The Theater High Altitude Area Defense (THAAD) can intercept missiles at or above 40 kilometers. Its design as a system whose long-range, high-altitude ground defense is perfect for intercepting TBMs and protecting high-value assets. This land-based system is transportable by aircraft and uses hit-to-kill technology. THAAD's ability to intercept either inside or outside of the atmosphere gives a great advantage in that there is more time to complete a shoot-look-shoot process and the possibility of nuclear, chemical, or

⁶ FY 99 Air and Missile Defense Master Plan, p. 5-11 and 5-12

⁷ US Missile Defense Programs and Security Implications.

biological fallout can be reduced. Working in conjunction with either the Patriot or MEADS systems, the missile defense capabilities are expected to increase⁸.

The Navy Theater-Wide program is significantly less tested than THAAD, but shows promise as it builds off other systems' technologies. The Theater-Wide system will be sea-based, mounted on Aegis cruisers, and experimenting with a new type of missile system, the LEAP (Long-range Exo-Atmospheric Projectile) system. If successful, the system will be able to intercept long-range ballistic missiles from any strategic sea-based position. This system is particularly sensitive because it could provide a first level of defense against launched Russian and Chinese ICBMs, as implicated by the Navy's Chief of Operations, Admiral Jay Johnson⁹.

Admiral Johnson has said that such a sea-based NMD system would be beneficial to solving the ICBM threat in that it is mobile, and the infrastructure for such a program already exists. A few upgrades, however, to the Aegis cruisers and destroyers as well as an ABM Treaty change would have to precede deployment¹⁰. This provides NMD with a strategic benefit as it could take out a significant number of threats before the NMD system would have to deal with them¹¹.

- Boost – Phase

Boost – phase defenses may be the most viable missile defensive strategy against known launch sites where devices can reach the missile before it burns out. The only problem is that only a very small window of opportunity exists for completing boost-

⁸ FY 99 Air and Missile Defense Master Plan, p. 5-15 and 5-16

⁹ William Cohen (ADR 2000), p. 7.

¹⁰ "First by Sea," Wall Street Journal. April 10, 2000, p. 1. Can be found on-line at: http://ndunet.ndu.edu/IM/NCD/EBIRD/EB_html/e20000410/e20000410first.htm

¹¹ William Cohen (ADR 2000), p. 7.

phase intercept. Some Ground-Based Interceptors (GBI), if strategically placed no more than 1,000-kilometers from the launch site, could knock down outbound ICBMs.

However, Richard Garwin supposes by mathematical equation that a sea-based interceptor could be based as far as 2,100-kilometers away, assuming a 250 second burn time, from the launch site and still be able to intercept an ICBM. As of today however, the sea-based systems are non-compliant with the 1972 ABM Treaty¹². Two other boost-phase systems, however, are in development, the Airborne Laser (ABL) and Satellite-Based Laser (SBL).

Not expected to complete any demonstrations until 2003, the ABL system is an intriguing answer to the GBI shortcomings. The ABM Treaty does not ban the ABL system, this is a bonus for researchers and politicians since R&D (Research and Development) could start right away. The ABL could boast a high kill ratio if the Boeing 747s are placed in the right area at the right time, although dense fog or clouds hamper the high-powered laser¹³. Perhaps the most beneficial aspect of ABL is that it will destroy ballistic missiles before they have cleared their mother territory, spilling any nuclear, biological, or chemical warhead back onto the adversary's soil¹⁴.

The SBL represents a rather tough problem for most countries - the weaponization of space. Richard Garwin notes that while technically feasible, it would open satellites up to ground-based or space-based attack. Garwin supports the idea of boost-phase intercept, but is afraid of the possible outcomes of space weaponry:

“Now is the time for nations to discuss and possibly to negotiate a ban on

¹² Richard Garwin, "Technical Aspects of Ballistic Missile Defense," APS Forum on Physics and Society. (July 1999), 28(3).

¹³ Loren B. Thompson, "Give Airborne Laser Fair Shot at Missile Defense," Defense News. October 11, 1999, p. 25.

¹⁴ William Cohem (ADR 1999), p. 69.

weapons in space and on antisatellite tests . . . major attention should be given to cheaper and more effective systems such as boost-phase intercept.”¹⁵

Many governments, like Japan’s Diet, specifically forbid placing weapons in space and hosts of other countries are weary of the idea. It is difficult to say whether such an expensive system, with more in common with former President Regan’s Star Wars program than with modern day economics, will ever be fielded.

The draw of these technological wonders is so great that few world leaders do not at least look into the option of missile defense for their citizens. Indeed even the most adamant critic of TMD and NMD, The People’s Republic of China, acknowledges the usefulness of such defensive systems¹⁶.

¹⁵ Richard Garwin, "Toward International Security: The Role of Space Weapons, Antisatellite Weapon Tests, and National Missile Defense" (1999): 7.

¹⁶ Charles Ferguson, "Bait and Switch: Is Anti - North Korean Missile Defense Designed for China?" (1999); also: David Shambaugh, "China's Military Views the World" (Winter 1999/2000).