

The Future of Missile Defense:

On the Ground, in the Air, Sea and Space

Ryan Timothy Jacobs

Candidate for International &

Domestic Conflict Management and Resolution,

UNCW

Throughout the course of the twentieth century, the way in which wars are fought has dramatically evolved from two opposing powers to a multifaceted struggle that involves any player that can obtain weapons of mass destruction (WMD). Modern day warfare is also fought asymmetrically, and with the use of intelligence; missile defense systems on land, in the air, sea and space have proven to be the *sans-pareil* in the future of global war strategies. This article assesses various forms of missile defense systems on the ground, in the air, sea and space to provide theories pertaining to how future wars may be fought. By tackling questions concerning future technologies, innovations in modern day warfare, as well as the types of weapons that may be created and the missile defense systems that attempt to parallel the threat; the following will also provide recommendations for future U.S. missile defense and strategy.

MODERN DAY MISSILE DEFENSE & FUTURE CAPABILITIES

"I call upon the scientific community in our country, those who gave us nuclear weapons, to turn their great talents now to the cause of mankind and world peace, to give us the means of rendering these nuclear weapons impotent and obsolete."

~ Ronald Reagan

What innovations in modern day missile defense may be created, what types of weapons will be created to defend against the risk of an attack? Most importantly, where will the technology in warfare go from where it stands today? Ballistic missile defense systems can be constructed on the ground, in the sea, in the air, and in space. Ground-based systems are most

commonly chosen in modern day missile defense because they are set up close to the area that they seek to protect from an attack. One system that was not established within close vicinity to the region that it desires to protect is the National Missile defense system, which was deployed to protect the U.S. from threats of rogue nations. In addition, ground-based missile defense systems are currently the approach for theater (tactical) systems. Several of these systems have included the Patriot (PAC-3), THAAD, Arrow; and most recently, the Iron Dome system. The Iron Dome ground-based system is part of a futuristic missile defense systems which includes utilizing the Arrow (Arrow 2, and Arrow 3) system, as well as David's Sling, and Iron Beam.

David's Sling, named after the biblical story of David and Goliath, is a highly advanced two-stage missile underdevelopment by both Rafael, Israel's defense contractor); and Raytheon, the U.S. defense contractor, Raytheon. David Sling is also most recently referred to as Stunner. The interceptor includes a radar and an electro-optical sensor in the nose of the interceptor. Stunner provides defense against a variety of short-range ballistic missiles, large-caliber rockets, cruise missiles and unmanned aircraft systems. redefines the performance/cost value equation for terminal missile defense with all-weather, hit-to-kill performance at a tactical missile cost. David Sling's lethal, hit-to-kill effects ensure a wide margin of tactical overmatch against a broad spectrum of air and missile defense threats. Raytheon is also producing the Missile Firing Unit for the Stunner interceptor. The mobile, affordable MFU can carry up to 12 Stunner missiles. Raytheon is on contract to deliver four MFUs to Israel as part of a \$35 million contract with Rafael Advanced Defense Systems.¹ Although missile defense systems, such as the Israeli Iron Dome have been highly criticized, since the proven success of its defense against attacks have illustrated the ability and need for advanced ground-based defense systems.

¹ "Raytheon." Stunner Terminal Missile Defense Interceptor. January 1, 2014. Accessed November 12, 2014.

² For example, in 2012 the terrorist group known as Hamas launched 4,479 rockets at Israel from the Gaza Strip. Iron Dome destroyed ninety percent of the of rockets targeted at



Israel. Thus, the success of Iron Dome apparently gave the lie to the repeated claims that missile defense tests are rigged; that missile defense systems cannot work; that they do not save lives, and that the

threat of rocket attacks must be dealt with through appeasement and concessions.³ More recently, Gaza militants have fired hundreds of rockets into Israel, some more than 100 kilometres deep, covering an area of about 5 million people. But they have caused no casualties and very little damage. Newspapers have already crowned the U.S.-funded system as the star of the campaign. The front page of Yediot Ahronot carried the headline “Golden Dome,” with a huge spread of the system in action. The paper’s top military columnist, Alex Fishman, wrote that the Iron Dome has “changed the face of the battle.”⁴

² Heller, Aron. "Israel's 'Iron Dome' Anti-rocket System Changing Face of Battle | Toronto Star." Thestar.com. July 10, 2014. Accessed November 17, 2014. http://www.thestar.com/news/world/2014/07/10/israels_iron_dome_antirocket_system_changing_face_of_battle.html.

³ Huessy, Peter. "Iron Dome: "Rigged Success"?" Gatestone Institute. October 17, 2014. Accessed November 12, 2014.

⁴ Heller, Aron. "Israel's 'Iron Dome' Anti-rocket System Changing Face of Battle | Toronto Star." Thestar.com. July 10, 2014. Accessed November 17, 2014. http://www.thestar.com/news/world/2014/07/10/israels_iron_dome_antirocket_system_changing_face_of_battle.html.

Iron Dome's joint contractors, Raytheon and Rafael are in the process of bringing Ronald Reagan's dream of missile defense to life in Israel. Consider a terrorist attack from one of the U.S. borders today, without a ground-based system such as Iron Dome. If ISIS, Hezbollah, Al-Qaeda or any other terrorist group had the strength to use asymmetric warfare, and launch nearly 5,000 rockets over schools, churches, businesses and neighborhoods; the result would be devastating. Considering that is exactly what happened in Israel, it is without question that new and innovative missile defense systems will be under development for decades to come.

Destruction of theater ballistic missiles (TBMs) is based today almost solely on antimissile missiles of various kinds. Additional work (for future application) is being performed on high-energy laser beams (the airborne laser, ABL) and in the past some effort was put into the development of hypervelocity gun system as a local, last-ditch defense.⁵

SPACE-BASED WEAPONS & LASERS

There are four distinct classes of space-based weapons, including directed-energy weapons; kinetic-energy weapons against missile targets; kinetic-energy weapons against surface targets; and space-based conventional weapons against surface targets. Directed-energy weapons include a wide array of space-based weapons including laser cutting torches and electronic jammers. The latter of the two only needs to transmit enough power to compete with the targeted receivers intended signals, but destroying ballistic boosters would require

⁵ Naveh, Ben. *Theater Ballistic Missile Defense*. Reston, Va.: American Institute of Aeronautics and Astronautics, 2001.

developing and deploying lasers with millions of watts of power directed by optics on the order of ten meters in diameter.⁶ Lasers also have the ability to destroy multiple ballistic boosters because they travel at the speed of light. Using relay mirrors can also dramatically increase the military effectiveness of a laser, either airborne or ground-based, increasing the distance of the laser's reach. The success of ARMS will pave the way for deploying relay mirrors on a high-flying platform to extend a laser's lethality to cover the battlefield. And providing war fighters with the ability to deliver controlled amounts of laser energy in a precise location almost instantaneously will profoundly alter warfare.⁷

PROPHECIES OF WARS: DEFENSIVE SYSTEMS OF THE FUTURE

"This could pave the way for arms control measures to eliminate the weapons themselves. We seek neither military superiority nor political advantage. Our only purpose -- one all people share -- is to search for ways to reduce the danger of nuclear war."

~ Ronald Reagan



⁸ Western allies focus will continue to rely of missile defense as underdeveloped states continue to build offensively. Since the underdeveloped nations lack the capability to utilize existing technology, they will

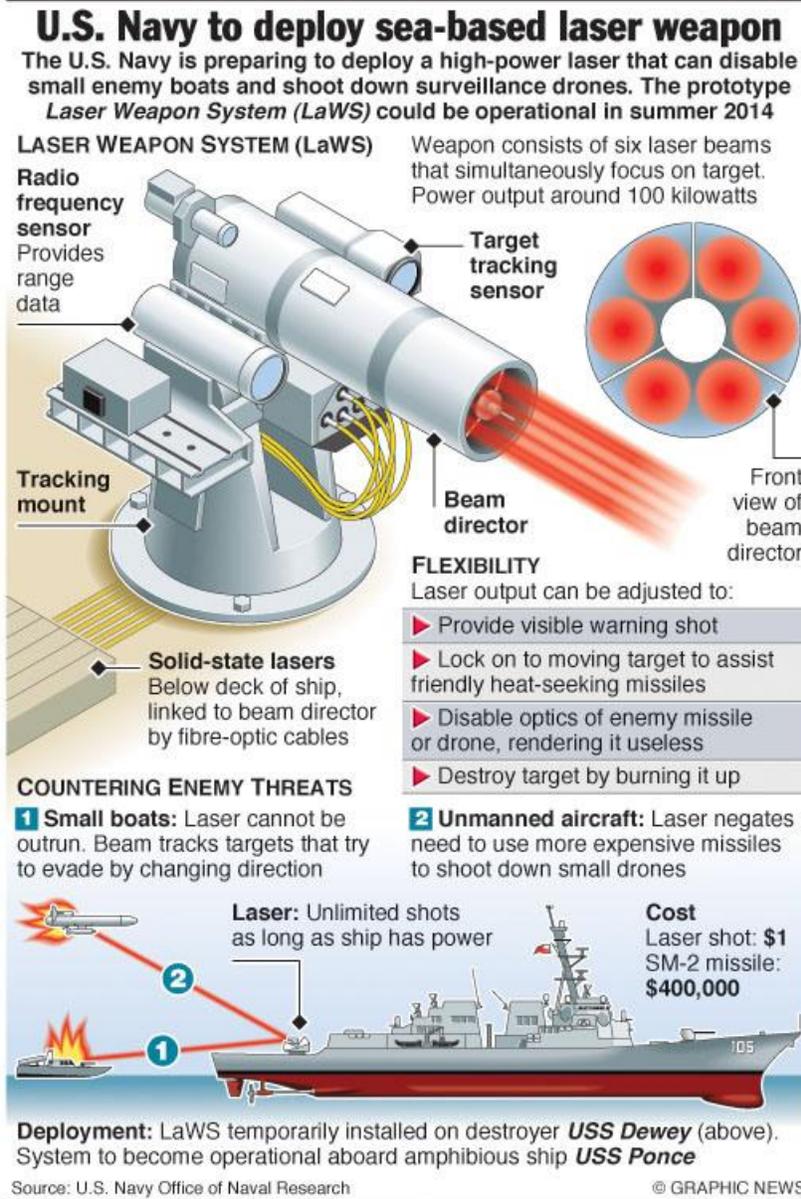
⁶ Preston, Bob. *Space Weapons Earth Wars*. Santa Monica, CA: Rand, 2002.

⁷ Beason, Doug. *The E-Bomb*. Cambridge: Da Capo Press, 2005.

⁸ "A Tale of Deception and Two Containers." Think Defence. June 29, 2012. Accessed November 17, 2014. <http://www.thinkdefence.co.uk/2012/06/a-tale-of-deception-and-two-containers/>.

continue to be inferior in their offensive and defensive military operations, but this does not make the danger that they impose any less significant. Ballistic and cruise missiles can be hidden inside a standard shipping container, which can then be transported by ordinary cargo-vessels to within striking distance of U.S. shores. Hundreds of these standard shipping containers can be carried aboard any given freighter, of which there can be up to tens of thousands of such vessels off the U.S. coastline at any given time. Thus, while an enemy may not have the overwhelming military and economic power of the United States, that enemy can nonetheless do tremendous damage to the U.S. by utilizing an 'asymmetric strategy,' which Kenneth McKenzie defines as, "leveraging inferior tactical or operational strength against the vulnerabilities of a superior opponent to achieve disproportionate effect, with the aim of undermining the opponent's will in order to achieve the asymmetric actor's strategic objectives."⁹ These alternative methods of attack make it nearly impossible to intercept launched ballistic and cruise missiles because of the proximity of the launch site to the U.S. Undetected in commercial traffic ships, WMDs within less than a few hundred kilometers of the U.S. coastline will continue to be center to U.S. debate concerning missile defense. Still, the cost and challenge of developing sufficient defensive systems against asymmetric attacks from rogue states; which possess cheap, alternative means of deploying WMDs, rather problematic.

⁹ Kleinberg, Howard, "A Global Missile Defense 'Network:' Terrestrial High-Energy Lasers and Aerospace Mirrors – Part I of II," United States Army's Fires: A Joint Professional Bulletin of U.S. Field and Air Defense Artillerymen, pg. 28-36, March/April 2011, <http://sill-www.army.mil/firesbulletin/2011/interactive/marchApril2011/marchApril2011.pdf>



Furthermore, the threat of asymmetric attacks from the ocean has been increasingly influencing the U.S. to develop missile defense systems concentrated on lighter-than-air (LTA) UAVs. Today, U.S. missile defense systems have the ability to deter, coerce, and compel weaker opponents once engaged in war, but if an enemy decided to utilize the asymmetric ¹⁰offensive strategy without the U.S. having prior intelligence of an attack, the defensive systems

that are currently within U.S. borders could not withstand such a surprise attack. Since current U.S. missile defense systems are not capable of defending against the sensor platforms (i.e. ISIS), the recommended weapon of choice for both the BMD and CMD missions is the AMRAAM-NCAD, a full three dozen of which can be carried by a single HA3 air-launch

¹⁰ Mitra-Thakur, Sofia. "US Navy Plans to Install High-power Laser Weapons on Its Boats - an Annotated Graphic." *Engineering Technology Magazine*. April 19, 2013. Accessed November 19, 2014. <http://engtechmag.wordpress.com/2013/04/19/us-navy-plans-to-install-high-power-laser-weapons-on-its-boats-an-annotated-graphic/>.

platform. This combination of nearly-alike LTA platforms and a single, common, easily-carried and highly effective interceptor weapon, together form arguably the optimal defense with which to shield the U.S. Homeland against the growing threats from ballistic and cruise missiles in the near future.¹¹

REDEFINING "DETERRENCE" & MISSILE DEFENSE

U.S. deterrence strategy since the Cold War will need to focus on an emphasis on defense over offensive tactics in order to establish what Emanuel Adler describes as "Deterrence by punishment" or dissuading an adversary from using force by making it more costly for him to engage in unwanted behavior.¹² Prior deterrence strategy (i.e. mutual assured destruction) weighed heavily on building up arms, and as states such as China and Russia will most likely continue to do so, based upon the affordability; concentrating on the sophistication on new defense systems will continue to be in the best interests of the U.S.

American leaders and involved academics need to come to grips with the fact that Washington can establish deterrence policies, but it cannot control the results of those policies with the predictability assumed in the Cold War past. The post-Cold War environment leads us back to Carl von Clausewitz's classic insight about war and politics throughout the ages; uncertainties predominate and no "fix" can remove the "fog" that denies high confidence in the

¹¹ Kleinberg, Howard, "A Global Missile Defense 'Network:' Terrestrial High-Energy Lasers and Aerospace Mirrors – Part I of II," United States Army's Fires: A Joint Professional Bulletin of U.S. Field and Air Defense Artillerymen, pg. 28-36, March/April 2011, <http://sill-www.army.mil/firesbulletin/2011/interactive/marchApril2011/marchApril2011.pdf>

¹² Emanuel Adler, "Complex Deterrence in the Asymmetric-Warfare Era." In Paul, Morgan, and Wirtz, *Complex Deterrence*, 88-89.

predictability of an opponent's behavior.¹³ In order to "know thy enemy", the U.S. could strengthen intelligence of states that purchase, build, and sell WMDs by utilizing regional and country specialist, as opposed to the assumptions, based on impressions of U.S. leaders. Creating a more empirical approach can clear the *fog*, but it could [also] challenge the egos and power of senior policy makers by making them more reliant on low-level country specialists, intelligence analysts, and independent academics.¹⁴

Thus, Keith B. Payne (2001) lays out an empirical approach which addresses the overwhelming need to gain intelligence, in order to evolve the deterrence strategy of the Cold War. Payne's six step approach to produce a new direction to U.S. deterrence strategy accentuates a conceivable management policy. As the U.S. has shifted from the building up of arms to missile defense since the 1980s, it is imperative that the U.S. develops its ability to gather knowledge by deploying specialists, analysts and academics. Nuclear deterrence in this setting requires evaluating various factors that may evolve. These factors include the national goals of foes, what dangerous regimes value, and their willingness to take risks. To treat the threat of nuclear war as stemming from the U.S. increasing its security and thereby tipping an imaginary balance, rather than recognizing that dangerous regimes inimical to the U.S. and its allies are the true threat of conflict and war, is to incorrectly portray deterrence as something far more simplistic than it really is. Failure to maintain a dynamic and effective nuclear force because of a misunderstanding of deterrence or an ideological pursuit of ridding the world of

¹³ Payne, Keith B. *The Fallacies of Cold War Deterrence and a New Direction*. Lexington: University Press of Kentucky, 2001.

¹⁴ Payne, Keith B. *The Fallacies of Cold War Deterrence and a New Direction*. Lexington: University Press of Kentucky, 2001

nuclear weapons could empower America's foes and increase the likelihood of a holocaust.¹⁵

Together these two crucial elements ("deterrence by punishment" and an empirical approach, as emphasized by Payne) can establish a powerful defense strategy which includes an important integral factor that the U.S. has lacked, *confidence*.

¹⁵ Heinrichs, Rebecca. "Deterrence and Nuclear Targeting in the 21st Century." The Heritage Foundation. November 30, 2012. Accessed November 3, 2014. <http://www.heritage.org/research/reports/2012/11/deterrence-and-nuclear-targeting-in-the-21st-century>.