

# REPORT DOCUMENTATION PAGE

*Form Approved*  
*OMB No. 0704-0188*

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

<b>1. REPORT DATE (DD-MM-YYYY)</b> 2/13/2006		<b>2. REPORT TYPE</b> FINAL		<b>3. DATES COVERED (From - To)</b>	
<b>4. TITLE AND SUBTITLE</b> Shortfalls in Joint Theater Ballistic Missile Defense				<b>5a. CONTRACT NUMBER</b>	
				<b>5b. GRANT NUMBER</b>	
				<b>5c. PROGRAM ELEMENT NUMBER</b>	
<b>6. AUTHOR(S)</b>  LCDR Matthew A. Phillips  Paper Advisor (if Any): CAPT William E. Dewes				<b>5d. PROJECT NUMBER</b>	
				<b>5e. TASK NUMBER</b>	
				<b>5f. WORK UNIT NUMBER</b>	
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b>  Joint Military Operations Department Naval War College 686 Cushing Road Newport, RI 02841-1207				<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b>	
<b>9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b>				<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b>	
				<b>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</b>	
<b>12. DISTRIBUTION / AVAILABILITY STATEMENT</b> Distribution Statement A: Approved for public release; Distribution is unlimited.					
<b>13. SUPPLEMENTARY NOTES</b> A paper submitted to the faculty of the NWC in partial satisfaction of the requirements of the JMO Department. The contents of this paper reflect my own personal views and are not necessarily endorsed by the NWC or the Department of the Navy.					
<b>14. ABSTRACT</b>  <p style="text-align: center;"><b>Iraq used Theater Ballistic Missiles in both Operation DESERT STORM and Operation IRAQI FREEDOM (OIF) in an effort to inflict damage to military and civilian targets. Coalition forces made a quantum leap from ODS in the capability to locate and destroy mobile launchers. There was little improvement, however, in command and control. The inability of our forces to exchange crucial Theater Ballistic Missile (TBM) data in our legacy data link systems is a significant shortfall. The difficulty in recreating complex and comprehensive scenarios to train joint forces needs to be addressed. Finally, a method of de-confliction, coordination and TBMD asset management still does not exist. This paper examines the lessons of the OIF TBM battle as a way to view current TBMD systems and discuss better ways to organize, train and equip joint forces for the future.</b></p>					
<b>15. SUBJECT TERMS</b> Theater Missile Defense; Ballistic Missile Defense; OIF; TBMD					
<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b>	<b>18. NUMBER OF PAGES</b>	<b>19a. NAME OF RESPONSIBLE PERSON</b>
<b>a. REPORT</b> UNCLASSIFIED	<b>b. ABSTRACT</b> UNCLASSIFIED	<b>c. THIS PAGE</b> UNCLASSIFIED			Chairman, JMO Dept
				XX	<b>19b. TELEPHONE NUMBER (include area code)</b> 401-841-3556

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Shortfalls in Joint Theater Ballistic Missile Defense

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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13 February 2006

## **Abstract**

Iraq used Theater Ballistic Missiles in both Operation DESERT STORM and Operation IRAQI FREEDOM (OIF) in an effort to inflict damage to military and civilian targets. Coalition forces made a quantum leap from ODS in the capability to locate and destroy mobile launchers. There was little improvement, however, in command and control. The inability of our forces to exchange crucial Theater Ballistic Missile (TBM) data in our legacy data link systems is a significant shortfall. The difficulty in recreating complex and comprehensive scenarios to train joint forces needs to be addressed. Finally, a method of de-confliction, coordination and TBMD asset management still does not exist. This paper examines the lessons of the OIF TBM battle as a way to view current TBMD systems and discuss better ways to organize, train and equip joint forces for the future.

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*“Within a matter of minutes, we had information flow for attack operations going from the Navy, to the Army, to the Air Force, to the Marines and putting steel on target and killing things, which was outstanding!”*

*—LTC Hartley, Passive Defense OIC,  
32d AAMDC*

## **INTRODUCTION**

The scud missile is an enduring vision of Operation DESERT STORM. For the first time, twenty-four hour news networks beamed dramatic images of Israeli civilians, and coalition military forces shuffling into bomb shelters in the middle of the night, donning gas masks and hoping for the best. The next scene inevitably showed Patriot missiles streaking toward the far away threat. It was no surprise then that twelve years later Iraq’s slightly more capable Ababil-100 and Al Samoud ballistic missiles again careened toward coalition forces and Kuwaiti population centers during Operation IRAQI FREEDOM. The Theater Ballistic Missile (TBM) attacks again met the determined steel of coalition Patriot missiles or landed harmlessly in unpopulated areas of the desert or Arabian Gulf.

This paper will show that the issues faced in both Operation DESERT STORM (ODS) and Operation IRAQI FREEDOM (OIF) are still applicable today. In both operations, as well as in any TBM battle of the future, a ballistic missile launch from enemy forces unleashes a series of events which can be categorized into three main actions: TBM Early Warning, TBM Engagement and Counter-Targeting. Counter-Targeting of Iraqi Ballistic Missile systems made great strides between the two wars. Similarly, a quantum leap must be made in other TBM areas before the next major conflict exposes the lessons we have already learned, and not corrected.

The proliferation of short and medium range ballistic missiles is steadily increasing. More than 25 countries possess or are developing nuclear, chemical or biological weapons and 22 countries currently possess theater ballistic missiles.<sup>1</sup> More to the point, the countries with growing TBM arsenals are also countries with questionable diplomatic ties, and even more worrisome political and military intentions.

North Korea continues to refine its Taepo Dong missile as well as its recently unveiled Taepo Dong X. “Scud missiles already deployed in North Korea constitute the main threat to the security and stability of the south. Estimates suggest that Pyongyang already has at least 500 of them in its inventory and that some or all of them can carry chemical warheads.”<sup>2</sup>

In recent days, press reports have detailed Iran as it continues toward the possession of indigenously produced nuclear weapons. Meanwhile, in August 2005, Iran’s Defense Minister reiterated that Tehran’s national military strategy included a significant focus on missile-based deterrence. “Recent estimates suggest Iran has between 250-300 Scud B and Scud C missiles with ranges from 300-500 kilometers, and an undetermined number of Shahab-3 missiles with a 1,300 kilometer range.”<sup>3</sup> Iranian officials have made claims that they have improved the Shahab-3, extending its range to 2,000 kilometers.

Despite the prominence of ballistic missiles in two wars and rampant proliferation to potential global hot spots, no organization exists to coordinate the various TBMD

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<sup>1</sup> Department of Defense Reports “Ballistic Missile Defense.” Lkd. at “Defense Link.” [www.defenselink.mil/execsec/adr95/bmd\\_5.html](http://www.defenselink.mil/execsec/adr95/bmd_5.html) [12 February 2006]

<sup>2</sup> Bruce E. Bechtol Jr., “The Future of US Airpower on the Korean Peninsula,” *Air & Space Power Journal* Vol. 19 (Fall 2005): 75.

<sup>3</sup> Steven R Ward, “The Continuing Evolution of Iran’s Military Doctrine,” *The Middle East Journal* Vol. 59 (Autumn 2005): 559.

forces that continue to grow within each service's stove piped world. Instead Joint Theater Ballistic Missile Defense (TBMD) remains an ad hoc collection of forces lacking a focus on technology, training and organization that could drastically improve their capability in future wars. What is the best way to organize, train and equip these forces to ensure they are ready to meet the increasingly complex and comprehensive TBM challenges of Joint and Coalition Warfare? To answer this, we will exam lessons learned from the TBM battle in the opening days of Operation IRAQI FREEDOM, which will serve as an illustrative example of the current state of Joint Theater Ballistic Missile Defense, and then address how it can be improved in the future.

### **TBM EARLY WARNING**

Early Warning (EW) of theater level ballistic missiles can be accomplished by a wide variety of national and theater sensors as it was during OIF. Under some specific conditions, these launches can be detected by satellite. The satellite system sends the launch detection to operators at the national and theater level. As the missile increases altitude, it can be detected by an AEGIS cruiser or destroyer configured for the TBM mission. During OIF, USS HIGGINS (DDG-76) served as a TBM Early Warning platform from its position in the North Arabian Gulf. The ship was able to detect every Iraqi launch and broadcast the TBM track over tactical data links. The exact type of track and how it is displayed in receiving systems is largely dependent on the individual ships, aircraft and ground units involved. The detected TBM tracks were successfully transmitted and received by other U.S. Navy warships, and Command and Control nodes at the Prince Sultan Air Base Combined Air Operations Center (CAOC) in Saudi Arabia

and United States Central Command (CENTCOM) headquarters in Qatar. However, their tactical data link track was not directly received by some of the most critical units— Army Patriot batteries providing protection in the targeted areas.

“When Iraq launched the first TBMs against Kuwait City and the 101st Air Assault division’s assembly area on G-1, the division received no TBM EW via the LINK-16 and MSE [Mobile Subscriber Equipment] network. Though we had a great tactical digital information link (TADIL)-J/Link 16 connection throughout the battle and regularly tracked well over 100 aircraft simultaneously, we were not able to receive any TBM EW digitally. In fact, the only TBM EW we received throughout the battle was by monitoring the Air Force EW tactical satellite (TACSAT) network . . . even though a TADIL-J feed can be received on the move and does not require MSE support, the relative short flight time of the missiles the enemy used and the time it took for joint tactical ground station (JTAGS) to identify and release the information through the Joint Tactical Information Distribution System (JTIDS) network resulted in no TBM EW information to be distributed via TADIL-J.”<sup>4</sup>

In addition to providing early warning to the Patriot batteries themselves, the AEGIS combat systems are also able to determine the launch point and predicted impact area of a detected missile. The impact area was then transmitted on multiple voice and computer chat<sup>5</sup> circuits to alert defended areas of the incoming threat.

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<sup>4</sup> U.S. Army Air Defense Artillery School. “Quality Assurance Office OIF Initial Lessons Learned.” Ft Bliss, TX: (9 September 2003)

<sup>5</sup> The term ‘Chat’ will be used throughout this paper to refer to the SIPRNET chat protocol system widely used by American forces. Chat rooms are hosted on servers with each Regional COCOM and are designated for specific requirements. TBM data was passed primarily in the “TBMD Coord” chat room, which allowed TBMD forces to send amplifying information and coordinating instructions without clobbering satellite voice circuits. At no time did chat replace satellite voice as primary means of communication.

Iraq's initial TBM launches provided some important demonstrations of effective Joint Warfare. "The day's first five TBM launches, with their detection by the USS HIGGINS, set the pattern for all further TBM early warning events. Prior to the war, most people had assumed that early warning would come from satellites and Space Command. In reality, most of the warnings came from the USS HIGGINS and the [USNS] OBSERVATION ISLAND."<sup>6</sup>

The 32<sup>nd</sup> Army Air and Missile Defense Command (AAMDC) was given the responsibility of translating HIGGINS' Early Warning broadcast into civil and military warnings for the appropriate areas. The Army "leveraged a previously tested concept and fielded a TBM early warning system called the Pager Alert Warning System (PAWS). Commercial digital pagers were used, along with a 486 Pentium PC and commercial phone lines to provide TBM early warning throughout the joint operational area (JOA)."<sup>7</sup> Alerts were passed via radio circuits, public address systems, early warning sirens and the PAWS pagers to the impact area and allowed personnel, both military and civilian, to seek shelter in basements or bunkers and don the appropriate chemical protective gear if required. This systems was activated and tested weekly prior to the start of OIF and was used successfully during the TBM battle, reducing minutes off of the previous voice-only warning systems.<sup>8</sup>

"The performance of the AEGIS system points to significant changes in early warning and communications systems, as well as the value of the United States Navy and inter-service cooperation. The Giant Voice and Kuwait Civil Defense early warning

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<sup>6</sup> 32<sup>nd</sup> AAMDC, OPERATION IRAQI FREEDOM Theater Air and Missile Defense History, prepared by the 32<sup>nd</sup> Army Air and Missile Defense Command (Ft Bliss, TX, September 2003): 50.

<sup>7</sup> Ibid., 13.

<sup>8</sup> Ibid., 13.

systems, as well as the many pagers purchased for this purpose, alerted all soldiers and civilians to put on chemical protective gear and take shelter. The AMDWS system passed the alarm to all Patriot batteries.”<sup>9</sup>

## **TBM ENGAGEMENT**

The task for TBM engagements fell squarely on the shoulders of the coalition Patriot Batteries, which possessed the only engagement capability fielded at the start of OIF. The Army deployed more than 40 Patriot batteries for OIF, including strategic protection of seven Middle Eastern countries and tactical protection of the Coalition land forces as they moved into Iraq.<sup>10</sup> The short ranges of the theater ballistic missile, coupled with the speed of the missiles themselves, provided for a very limited engagement window. The total time of flight for Iraqi Al Hussein TBMs was approximately six to seven minutes; the more common and shorter range Al Samoud and Ababil-100s had a time of flight of just 3-4 minutes. Once detected by a Patriot battery radar, operators had a very limited timeframe to confirm that they have an actual ballistic missile track and consummate the engagement.

In Operation IRAQI FREEDOM, each Iraqi TBM launch was from an expected point of origin, and against the high value targets which were, not-coincidentally, well protected with Patriot batteries. These circumstances are not unlike a live-fire training exercise, where because of range safety considerations, firing units have a good idea as to the location a target missile will be launched from, and where the impact point will be. To add to this live-fire exercise feel, each volley was one or at most two missiles, which

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<sup>9</sup> Ibid., 50.

<sup>10</sup> Ibid., 30.

the joint air and missile defense network handled with extreme professionalism. Had Saddam Hussein fired simultaneous volleys from the maximum available launchers, stationed at varied and unpredictable locations, or perhaps at targets not so high on the coalition force Defended Asset List (DAL), he may have had more strategic success.

Even under these live-fire exercise conditions, however, 22 Patriot missiles were employed to destroy nine Iraqi TBMs. In one engagement against a TBM that targeted Camp Doha and Kuwait City, five Patriot missiles were employed, from both Kuwaiti and American Patriot batteries against a single TBM. In another instance, four missiles were used. In a complicated tactical environment, we will need far better coordination to exercise better control of missile defense assets.

## **COUNTER-TARGETING**

As important as active and passive defense can be, the most effective way to win the TBM battle is to eliminate the launch platforms. Most, if not all theater level TBMs are launched from transportable erector launchers (TELs). These launchers are essentially semi-trucks and can be disguised to blend with the environment. A significant number of surveillance and reconnaissance assets were used prior to OIF to locate Iraqi TELs with limited success; only two launchers were located and destroyed prior to the start of hostilities. Coalition forces were more successful in using TBM launches to localize targets and attempt to destroy the launchers before they could return to their pre-designated hiding spots. These “flaming datums” to use an anti-submarine warfare analogy, provided the critical information needed to localize and target the mobile launchers.

“Chat worked extremely well in Attack Operations. . . . HIGGINS would send voice early warning, and over chat they would provide launch points for the Iraqi Ababils and Al Samouds. We [the 32<sup>nd</sup> AAMDC Passive Defense Cell] would turn that around and in a matter of seconds provide that information to our Attack Operations cell within the CFACC. The CFACC in turn would coordinate that as a TST [Time Sensitive Target].” This coordination would then be relayed to the Time Sensitive Targeting cell, which would contact pilots already in the air and briefed on potential targets. Based on pilot debriefings, this process was responsible for the kill of at least 3 TELs.<sup>11</sup>

“When you look at this in a Joint aspect, it is really outstanding. The Navy AEGIS detected the missile, provided that information to the Army, which in turn warned Army forces; the Army in turn related that information to the Combined Air Operations Center (CAOC) at Prince Sultan Airbase, which in turn coordinated that air strike to get steel on target, which, for the most part, ended up being Marine Air out of MAW III because most of the launches . . . were in the Marine sector.”<sup>12</sup>

## **RECOMMENDATIONS**

The OIF illustrations above demonstrate how a successful military campaign can still yield important information about our weaknesses. Coalition forces made a quantum leap from ODS in the capability to locate and destroy mobile TELs. There was little improvement, however, in command and control. The inability of our forces to exchange crucial TBM data in our legacy data link systems is a significant shortfall. The difficulty in recreating complex and comprehensive scenarios to train joint forces needs to be

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<sup>11</sup> Ibid., 69.

<sup>12</sup> Ibid.

addressed. Finally, a method of deconfliction, coordination and TBMD asset management still does not exist.

## **JOINT TRAINING ENHANCEMENTS**

These lessons in joint operations are hard to maintain without doctrine that supports the tactical and operational levels of TBMD and the constant rehearsal of that doctrine. To a certain extent, it's impossible to know the exact configurations and requirements a joint force will face until a warning order is published. But exercises like ULCHI FOCUS LENS and RIMPAC allow large scale joint and combined operations where forces can operate with current doctrine and use tactical data links that approach the number and complexity faced in OIF. These exercises are not frequent enough to train all of the forces that may be involved in any given deployment rotation. Joint TBM forces must conduct regular exercises on a large scale whenever and wherever forces are available to train.

A second step in increasing joint training is the aggressive use of intra-service exchanges of officers while still in pre-deployment training. It is almost impossible for a Navy Lieutenant to fathom the complexities of maneuvering Patriot batteries on the battlefield. The logistics requirements, time to set up and tear down batteries, and constantly changing field conditions are foreign to someone who has spent their life in an AEGIS Combat Information Center. Similarly, an Army Captain would probably be overwhelmed by the sheer amount of data and communications available to an AEGIS watchstander. Mid-grade officers from each Carrier or Expeditionary Strike Group (CSG or ESG), Air Expeditionary Force (AEF) or Brigade Combat Team, (BCT) should engage

in exchanges as these units enter their intermediate and advanced force training. Intra-service exchanges would allow for greatly increased understanding about how other services operate.

These officers should be exchanged for the duration of a major Air Defense/TBM or multi-threat exercise or training event, ideally three to six weeks. In most cases, CSG/ESG, AEF and BCT advanced training schedules occur at different times, so exchanges can be staggered to not interfere with home unit training. The exchange of officers (ideally O-2 – O-4) during training events alleviates the stress on commands to conduct exchanges when actually on deployment and in forward operating areas and allows more immersion into the culture and operations of other services. In the TBMD world, this exchange would be particularly effective to USAF AOC personnel, USAF AWACS aircraft personnel, USN E-2C personnel, USN AEGIS Air Defense personnel, and USA Patriot and ADA personnel. It is not important if deployments of these forces occur at the same time, but the understanding of how other services involved with TBM operate, what their capabilities and limitations are, and how they execute their mission would be infinitely beneficial.

## **REPLACEMENT OF LEGACY DATA LINKS**

Command and Control of TBMD assets was lacking in OIF, with no single dedicated Missile Defense net, tactical data links at maximum capacity and significant disconnects between airborne controllers and ground forces. As noted above, much of the vital data from USS HIGGINS was transmitted to the joint force by means of voice and chat. This information was then turned around manually at Army and Air Force

Command and Control nodes for use as early warning information or Time Sensitive Targeting data. Steps need to be taken to automate this system, perhaps even enabling Early Warning platforms like the Navy's AEGIS warships to send data directly to the PAWS and Host Nation civil defense programs, increasing their time to react to the threat.

AEGIS ships proved to be very effective at providing voice and chat early warning but Patriot batteries were unable to receive the tactical data link tracks that HIGGINS provided, reducing Patriot's situational awareness. Today's tactical data links are overcome by the physics of the TBM environment. In large scale joint and combined operations, the sheer number of friendly tracks can overwhelm display systems, even before large amount of red forces, unknown contacts and missiles are added to the system. A capability for Patriot systems to receive actual track data from AEGIS ships, for example, would enable them to correlate an incoming track and improve their reaction time.

While there may be software patches to amend current systems to more adroitly process mass amounts of data, a dedicated data link designed for TBMD is needed. The system will have to interface with current and future decision making and display systems throughout the Armed Forces. It could be made to be more efficient by allowing update rates to vary depending on the track. For example, ships and ground forces do not require updating as often as air tracks because of their relatively slow speeds of advance. Air tracks can be divided into fixed wing and rotary wing update times. TBM tracks would receive constant priority updates (meaning an updated position transmitted and received by all other TBMD units at an engagement quality rate.) The varied update rates

would allow TBMD units, particularly TBM Command and Control nodes, to have all of the pertinent information on one display, in a timely manner.

This is not a new idea, nor is it unique to the United States military. In spring of 2005, NATO approved the start of procurement of the “Active Layered Theater Ballistic Missile Defense (ALTBMD) program, which is essentially a battle management, command, control and communications (BMC3) architecture to provide the ballistic missile umbrella. The 652-million-euro (\$835-million) undertaking includes building a test bed at the NATO Consultation, Command and Control Agency (NC3A) in The Hague, Netherlands. The battle management device is being designed to operate at several levels, from the strategic coordination echelon to the operational sphere.”<sup>13</sup> The U.S. should capitalize on this effort by placing its significant TBMD experience and some of its Research and Development funds in support of this endeavor.

## **A NEW JOINT TBMD ORGANIZATION**

Whether TBM forces should fall directly under the Joint Force Air Component Commander (JFACC), or be assigned to a joint or combined component commander equal to the JFACC really depends on the specifics of the campaign being fought. For example, the Iraqi TBM forces provided what amounted to little more than a series of Patriot live fire exercises. Their single missile salvos, launched from predictable locations at predictable targets, allowed all of the coalition TBM assets (including Kuwaiti Patriot batteries who recorded their first wartime kills) to focus on the inbound target and then reset, even debrief if necessary, and make adjustments as required before

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<sup>13</sup> Robert Wall “Missile Shield,” *Aviation Week & Space Technology* Vol. 162 (April 11, 2005): 35.

facing the next TBM salvo. A more determined enemy, with a more sophisticated strategy, would require a more agile defensive organization.

In the future, as in OIF, a TBMD operations center needs to be the centerpiece of any Joint TBM Defense. With accurate, timely information the TBMD commander can exercise control over his forces. Stricter control of TBMD forces would enable de-confliction of engagements against incoming missiles to prevent mutual interference, fratricide and waste of limited TBMD assets. This is imperative as additional joint and coalition forces achieve TBMD capability. By August of this year, the Missile Defense Agency and the Navy expect to deploy the first tactically certified AEGIS Ballistic Missile Defense ship, USS SHILOH (CG 67).<sup>14</sup> The Navy's new engagement capability in a combined littoral environment like OIF, would only exacerbate the lack of Command and Control capability. Additionally, many NATO countries employ Patriot systems or other TBMD systems.

## CONCLUSION

It is vital for us to learn the lessons of history to avoid future failures. A new dedicated data link designed specifically for TBMD will enable exchange of vital data at speeds not currently available. Early warning platforms that can directly access military and civil defense warning systems will improve survivability in impact areas and streamline communications. Aggressive, continuous joint TBMD training at tactical and operational levels will expose gaps and shortfalls we cannot currently predict and allow us to maintain the high levels of readiness we expect in other warfare areas. Finally, a

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<sup>14</sup> Ann Roosevelt, "MDA, Navy, Expect Aegis BMD Tactical Certification This Summer," *Defense Daily* Vol. 228 (Dec. 20, 2005): 1.

TBMD operations center, capable of operating with Joint and Coalition forces will synchronize the force, put steel on target and prevent mutual interference.

Regional Component Commanders or Joint Task Force (JTF) Commanders will need to consider Theater Ballistic Missile Defense planning in the opening phases of combat in any theater of operations. Within this planning, they will need to incorporate early warning for both military and civilian populations, defensive engagements by Patriots and other anti-TBM missiles, and time sensitive attacks against small, mobile launch platforms that can hide almost anywhere and reload in only a few hours. They will need to account for a wide variety of defended assets, from civilian targets in host nations, to military targets on or near the battlefield, using Navy TBMD ships, Army Patriot batteries and coalition Air Defense systems all linked together by voice and data and instantaneously deconflicted from air control zones, UAVs and long range cruise missiles. As the enemy's technology increases, friendly force reaction time will continue to decrease.

There can be no doubt that the Theater Ballistic Missile battle that took place during Operation IRAQI FREEDOM was a success for coalition forces. Patriot batteries from Kuwait and the United States recorded 9 engagements and 9 kills. TMD assets were truly combined, with Jordan, Qatar, Bahrain, Turkey, Saudi Arabia, Kuwait, Israel, Holland and the United Kingdom participating. The TBMD battle itself was fought as a joint force, using all available assets to detect and engage incoming missiles and then locate and destroy their launchers. Future conflicts will almost certainly have bigger threat sectors, with more numerous defended areas. They will also have more joint and coalition TBMD assets than ever before. Changes to incorporate TBMD training, a new

TBMD data link and command and control system and exchange of officers during training events will all help to prepare joint forces for future TBM battles.

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