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Tactical Ballistic Missile Defense for the United States Marine Corps

Lieutenant Colonel
Robert C. Dodt, Jr.
U. S. Marine Corps

Faculty Research Advisor
Mr. James E. Toth



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TACTICAL BALLISTIC MISSILE DEFENSE
FOR THE UNITED STATES MARINE CORPS

LtCol Robert C. Dodt Jr., USMC

The author begins by describing the proliferation of Tactical Ballistic Missiles (TBM's) in the Third World as well as future improvements expected in the range, accuracy, and lethality of these weapons. He concludes that TBM's are emerging as a threat to U.S. crisis-response forces at the strategic, operational, and tactical levels. He then goes on to discuss how the Marine Corps could obtain near-term expeditionary TBM defenses for its operating forces. He closes by recommending a Marine task-organization for dealing with the issues associated with TBM defense.

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GLOSSARY OF TERMS

AAW -- Anti-Aircraft Warfare

Al Abbas -- Iraqi modified Scud TBM (<900 KM)

Al Husayn -- Iraqi modified Scud TBM (<600 KM)

ATBM -- Anti-Tactical Ballistic Missile

GPALS -- Global Protection Against Limited Strikes

HQMC -- Headquarters, Marine Corps

ICBM -- Inter-Continental Ballistic Missile (5001+KM)

INF -- Intermediate Nuclear Force (Treaty)

MAGTF -- Marine Air Ground Task Force

MCCDC -- Marine Corps Combat Development Command

MCSYSCOM -- Marine Corps Systems Command

MTCR -- Missile Technology Control Regime

NPT -- Nuclear Non-Proliferation Treaty

Scud -- Scud missile, Soviet TBM (300 KM)

SSM -- surface to surface missile

TBM* -- Tactical Ballistic Missile...several definitions exist. Most commonly used as a general descriptive term for the SRBM and IRBM class of missiles.

SRBM -- Short Range Ballistic Missile, 70-1000 KM

IRBM -- Intermediate Range Ballistic Missile, 1001-5000 KM

TBMD -- Tactical Ballistic Missile Defense

TMD -- Theater Missile Defense

TMDI -- Tactical Missile Defense Initiative

* Footnote: The definition of a "tactical" and "theater" ballistic missile can be confusing. The terms are used rather loosely and at times even interchangeably -- since tactical missiles are usually employed within a theater of operations. Definitions get even murkier when "TBM's" are used strategically such as when the Iraqis fired Scuds at Israeli cities during the Gulf War. In any case, a TBM is generally considered to be one of the short or intermediate range ballistic missiles (SRBM and IRBM) described in the glossary above.

CHAPTER ONE

INTRODUCTION and BACKGROUND

Introduction. As Americans watched their evening news programs during the recent war in the Persian Gulf, the general public first became aware of an emerging threat to U.S. forces abroad. We all watched transfixed as the Riyadh, Dhahran, and Tel Aviv areas were subjected to Iraqi attack by tactical ballistic missiles (TBM)--the now infamous Scuds.

The Army rushed hastily modified Patriot batteries into the target areas to provide limited protection against the Scuds once they were launched. The coalition air forces spent countless hours and many hundreds of sorties in counterforce missions seeking out the mobile Scud launchers, attempting to destroy them before the missiles were launched. Many other resources were also brought to bear on the problem. Satellite sensors were used for launch detection and early warning. In-theater assets such as the Joint Surveillance Target Attack Radar System (JSTARS) tried to locate missile positions in southern Kuwait. Special Forces were even employed to pinpoint launch sites and to call in air attacks on the launchers or their command and control nodes. The results of all of this effort were mixed. Many of the missiles and the supporting infrastructure were destroyed, but many also escaped attempts to locate them as evidenced by the Scud attack which demolished the Army barracks in Dhahran. We are also just now learning that Saddam Hussein was able to hide many more of his missile batteries

and the supporting equipment than we had estimated during Desert Storm--and that today he retains a considerable surface-to-surface missile (SSM) capability that we were simply unable to locate and destroy during the war.

The purpose of my paper is basically to ask for the U.S. Marine Corps, "SO WHAT?" Are the events that were just described of importance to the Marine Corps? Are they illustrative of a larger problem that may just now be unfolding? As an air defense officer I feel that may be the case. I am disturbed by tactical ballistic missile trends that I have observed in the developing countries in recent years. It appears to me that Third World TBM's may be advancing to a stage where they won't just be limited to employment against area targets such as cities. They are quickly becoming a tactically significant threat for the commander of military forces in the field. There certainly are other anti-air warfare problems that will pose serious problems for the Marine Corps in the future--cruise missiles and stealth aircraft for example. The Marines, however, are well aware of these latter threats and are already working on a variety of defenses for them. I have chosen to concentrate on TBM's in my paper for two reasons. First, creating expeditionary and deployable TBM defenses that could support rapid-response Marine forces will be very challenging. Second, this is a mission area that is not well understood in the Marine Corps and it needs to be fully explored.

In my examination of this topic, I will frame my paper by exploring three fundamental questions for the Marines:

1. What is the nature of the threat?
2. Is it likely to be a problem for future Marine forces?
3. Is this a mission area that the Marine Corps should be involved in? If so, then:
 - a. What general capabilities are required?
 - b. What organization is required to guide the response?

As I explore these questions, I will draw several conclusions and make some general recommendations for the Marines. I have very deliberately decided to keep this paper at the unclassified level. This may at times make the resulting discussion seem rather rudimentary. There are, however, many classified resources available to anyone seeking more in-depth information on this subject. My intent is to create a "primer" that can be widely and easily distributed to stimulate discussion of the subject.

Background. Tactical ballistic missiles have been around for quite some time. The Soviets and the Warsaw Pact as well as the United States and NATO have included TBM's in their respective arsenals almost as long as there has been a Cold War. Until recently, however, these weapons have been largely confined to the major parties involved in the East-West conflict--with most of the weapons intended for potential employment in Central Europe or along the Sino-Soviet border. In certain respects, the Cold War was well understood by all the parties involved. Because of the threat of nuclear holocaust in the event that World War III broke out, deterrence and the avoidance of direct hostilities between the

players was one of the longstanding tacit understandings or goals of the Cold War. There were, therefore, certain restraints or inhibitions against initiating hostilities and certainly against using these types of weapons if at all possible. There were even notable achievements such as the Intermediate Nuclear Force (INF) Agreement which eliminated some classes of nuclear-capable TBM's and IRBM's as destabilizing. The U.S. Pershing missiles, for example, were destroyed as a result of this treaty. The parties were constrained by the likely outcome of open conflict and acted accordingly to try and prevent war.

That pattern began to change in the last decade or so--or at least certain parties within the U.S. government began to recognize that there were new developments underway. During the summer of 1988, then-Secretary of Defense Caspar Weinberger became concerned about the growing proliferation of missile systems and missile technology in the Third World. These countries were not constrained by INF or many of the elements of deterrence found in the Cold War. In fact, a number of these countries have adopted radical ideologies openly hostile to the U.S. and its allies. Weinberger directed the Defense Science Board (DSB) to do a quick-response assessment of the issue and to report back to him whether there was a potential threat emerging to U.S. forces. The DSB task-group's final report concluded that there was indeed a new threat appearing in the Third World. The report determined that there was a threat emerging both to U.S. military forces deployed abroad (such as those found at the Naval Base at Sigonella Italy,

or forward based military units on Okinawa) as well as U.S. power projection forces employed in contingency operations (such as those conducted by Marine Air-Ground Task Forces). A separate Joint Staff study conducted by the J8 concluded much the same in 1990.

While DOD was studying the problem, certain key legislators in Congress were also becoming aware of the issue even before Desert Storm. Individuals such as Senators John Warner and Sam Nunn, as well as Congressman Les Aspin became concerned and began to research the issue and to take action. As a result, Congressional concern soon began to be translated into legislative guidance and funding.

Initial guidance which truly expressed the heightened level of concern within the Congress was provided in a Tactical Missile Defense Initiative (TMDI) decreed by Congress late in 1990. The Conference Report on FY 91 Appropriations directed:

"...A U.S. Tactical Ballistic Missile [Defense] system with the necessary capabilities should be fielded as soon as technologically and fiscally feasible."

"[Include] as appropriate...the Navy and Air Force requirements for Tactical Ballistic Missile Defense systems and programs."

The Authorization Act (Sec 225) for FY 91 further stated that:

"It is the sense of Congress to ensure that the Navy and Marine Corps are involved in development programs for future ATBM systems suitable for deployment with their projection and expeditionary forces."

The Congressional initiative gave supervision of the TMDI to the Secretary of Defense. In November 1990, Deputy Secretary Donald Atwood in turn assigned the DOD lead-agent role to the Strategic Defense Initiative Organization (SDIO). This was

accompanied by considerable debate within the Congress and the U.S. Army (which has considerable experience developing and fielding air defense missile systems) about whether this was a sound move or whether it was simply a political effort to shore-up the faltering Strategic Defense Initiative program. Nevertheless, the decision stood and TMDI was consolidated with the tactical missile defense program element in SDI.

Spurred on by memories of Patriots and Scuds doing battle over Saudi Arabia and Israel, Congress provided additional guidance following Desert Storm. The "Missile Defense Act of 1991" (included in the National Defense Authorization Act for FY 92) retitled TMDI and now calls the program Theater Missile Defense (TMD). It further identified the following goal:

"The development of deployable and rapidly relocatable advanced theater missile defenses capable of defending forward-deployed and expeditionary elements of the Armed Forces of the United States, to be carried out with the objective of selecting and deploying more capable theater missile defense systems by the mid-1990's."

The TMD program element section reinforced this goal by directing DOD to:

"Aggressively pursue the development of a range of advanced TMD options, with the objective of downselecting and deploying such systems by the mid-1990's."

Anticipating greatly reduced budgets in the years ahead, and recognizing the great public and Congressional interest in theater missile defenses, SDIO "restructured" itself in 1991 and initiated a new down-sized version of SDI entitled Global Protection Against Limited Strikes (GPALS). In other words, "Star Wars" was going austere and embracing the darling of the post-Desert Storm period.

The new GPALS program contains three major components. The first piece, the Theater Defense Element, responds to the Congressional guidance to DOD to deploy TMD systems as soon as possible. SDIO describes the Theater Defense Element as involving "defense against shorter range ballistic missiles within a theater (a specific area of operation, such as the Persian Gulf theater)." The other elements are "National Defense" and "Global Defense" which are beyond the scope of this paper other than to say that if all three elements are developed and deployed, SDIO envisions them as interoperable, mutually supportive pieces of a larger defensive system. Very simply, all the elements would be able to interoperate and eventually contribute to a defensive shield for the world. For the moment, my interest lies with the tactical and theater missile problem.

Congress seems serious about its commitment to TMD since the 92 Defense Authorization provides \$828.7M directly to TMD and another \$360M to related interceptor programs.

All of this background still does not yet make a case that the Marine Corps needs to involve itself in this mission area. To make that determination first requires an assessment of the potential TBM threat to objectives which may be assigned to Marine operating forces as well as the expeditionary force itself. Following that, if a threat does exist, a determination must be made what defensive capabilities are required and what is the best method of obtaining them. I will initiate that process in the following section by outlining the status of missile proliferation in the Third World.

CHAPTER TWO

CURRENT STATUS OF MISSILE PROLIFERATION

Introduction

Throughout many regions of the world today, countries that are not major military powers are adding ballistic missiles to their military arsenals. The Soviet Union and the United States, as well as China, have all provided short range ballistic missiles to countries in the Middle East, for example. But very significantly, as the major powers have eliminated or at least become more discriminating about these foreign sales, the ability to produce such systems indigenously has rapidly begun to spread. This raises the possibility that substantial numbers could be deployed in most regions of the world in the near future. The proliferating countries are often in areas of the world with regional tensions and where the United States has important security interests. Many of these countries are also on the list of nuclear proliferators.¹ A significant threat appears to be emerging, both to U.S. forces deployed abroad, as well as to power projection forces that would be employed in future crises or contingencies. This has increasingly become a matter of concern within DOD. The following section will summarize recent proliferation trends and briefly discuss likely future developments.

Missile Attacks

Some regional powers have already demonstrated a willingness to use ballistic missiles. Following U.S. air strikes in 1986, Libya retaliated by firing two Scud-B's at a U.S. Navy detachment

on the Italian island of Lampedusa near Sicily. Apparently the missiles missed by less than a mile.²

In 1988, Iraq and Iran engaged in the most extensive use of missiles since Germany attacked England with V-1 and V-2 rockets during World War II. The Middle East belligerents may have used as many as a thousand ballistic missiles during the eight year Gulf War. Most of these missiles were used in the "war of the cities" during the spring of 1988, killing and wounding thousands of civilians and causing significant destruction. These attacks may have played a significant role in convincing the Iranians to end the war and agree to the August 1988 cease-fire.³

The Iraqi attacks on Israel and Saudi Arabia were nightly fare for U. S. evening news programs during Operation Desert Storm. The Iraqis modified the venerable Scud to extend its range for this purpose, creating their own variant called the Al Husayn. A great deal of energy and effort was expended by the coalition forces in attempting to locate and eliminate the mobile Scud launchers before the missiles could be fired. Even though strike operations mounted by air and special operations forces had some success in finding and destroying some launchers, many of them eluded our best efforts and were never eliminated. It remained for hastily modified U.S. Army Patriot batteries to provide active point defense in critical areas of Saudi Arabia and Israel.

Finally, it has been widely reported in the news media that the Afghani government has been using Scuds regularly against mujahideen concentrations after the Soviets evacuated the country.

Clearly, Third World states have not been reluctant to use these missiles when they perceive that it is to their advantage to do so.

Sources of Missile Proliferation

There are both demand and supply-side forces at work influencing missile proliferation in the Third World. The following section will briefly discuss both of these aspects of the problem.

The demand for these weapons in the Third World is generated by a number of motivations. Ballistic missiles strike quickly and are impossible for most countries to defend against. They are cheaper and easier in the long run to maintain and operate than a moderately sophisticated air force. So, many countries see them as a relatively cheap force multiplier and necessary to achieve status as a credible power. Add the regional tensions and conflicts of our increasingly multi-polar world, and the reasons many countries desire these weapons become readily apparent.

The supply-side factors that contribute to ballistic missile proliferation are a little more complex, but can be grouped into two broad categories. One is the fledgling space programs of countries such as India and Brazil. Except for components such as the warhead and the reentry vehicle, the development of a space launch vehicle to launch satellites into orbit provides much of the technical ability to build surface-to-surface ballistic missiles. Frequently, these fledgling space programs have benefitted from cooperative ventures with the major powers on scientific space research. Many of the technologies involved are so called "dual-

use" technologies that have both civilian and military applications.⁴ Because of this duality, it has proven to be very difficult to constrain the spread of this technology or even to make it easily definable.

The second major supply-side factor is direct--that is through dedicated military missile programs in the aspiring missile power countries. Typically, there are several major elements contributing to these missile programs:

Missile Transfers. The Soviet Union has transferred thousands of short range missiles, and in some instances even medium range missiles, to countries such as Egypt, Iraq, Libya, Syria, and North Korea.⁵ Some analysts believe that all the ballistic missiles actually used by Iran and Iraq in the Gulf war were manufactured in the USSR--although some were locally modified, and others may have been copies made by countries such as North Korea. China entered the market dramatically in 1988 by selling intermediate range CSS-2's to Saudi Arabia. Previously, China was known to have provided Iran with Silkworm cruise missiles and probably a Chinese version of the Scud-B.⁶ Over the years, the United States has also provided at least rudimentary ballistic missile systems to Israel, South Korea, and Taiwan.⁷

Missile Production. A number of the non-major powers are already producing ballistic missiles and more are developing the ability to do so. Israel, North Korea, South Korea, India, and Pakistan are producers. Argentina, Brazil, Egypt, Iran, Iraq, Libya, South Africa, and Taiwan are all trying to be.⁸

Technological Cooperation. The Third World has proven to be very adept at using missile related resources whenever and wherever it has been available. Countries, firms, and individual scientists and engineers have often provided developing countries with missile technology or even vital components. The pressure to do so has increased even more so of late due to the worldwide recession and the often urgent need for hard cash by the major powers. A variation of this theme is the "brain-drain" from countries that have come upon economic hard times. The case of the former-Soviet Union immediately comes to mind. There have been numerous reports in the press lately about high-paying job offers from countries such as Libya and Iraq made to defense industry scientists out of employment in the former Soviet Union.

The flow of missile expertise and cooperation to the Third World has not been limited to the Communist bloc. West European countries, private concerns, and individuals have reportedly helped Argentina, Brazil, Egypt, Iran, Iraq, Israel, Libya, Syria, and others with missile development. A number of these countries have in turn reportedly aided North Korea, Pakistan, South Africa, Taiwan, as well as each other. China has been clearly implicated as a source of technical assistance and hardware in a number of instances.⁹

This pattern of international cooperation has been driven partly by the efforts of the United States to restrict the transfer of missile technology to other countries. The Missile Technology Control Regime (MTCR), initiated in 1987 and now with twelve

signatories, attempts to preclude the export of certain missile systems, as well as critical components, materials, and information. This has made it more difficult but not impossible for the missile developing countries to get what they want. They have partially compensated by adapting dual-use technology, and by looking to each other, the Soviet Union, China, and to illegal sources for assistance. Tables 1 and 2 (pp. 17-18) provide a summary of current Third World missile arsenals.¹⁰

FUTURE TRENDS

The effectiveness of ballistic missile attacks recorded to date has been limited in one respect. The antagonists have utilized early-generation, relatively inaccurate missiles in concert with conventional high explosive warheads. Trends in threat development, however, point to several disturbing patterns.

Missile ranges are increasing, and guidance technology is advancing so that targeting accuracy will improve significantly.¹¹ Today's CEP's of one to three kilometers may become 300 meters or less in the near future.¹² The Soviet SS-21 which has been exported to the Middle East has a CEP of between 100 and 330 yards already. The adaptation of commercially available satellite navigation data such as the Global Positioning System (GPS) could further exacerbate the problem by improving targeting accuracy many times over. These range and accuracy improvements, in combination with improved conventional warheads, such as Fuel Air Explosives (FAE), submunitions, or anti-radiation homing reentry vehicles, represent a significant advance in warfighting capabilities and

utility.

The very near-term potential for adapting weapons of mass destruction to these missiles is even more disturbing.

Israel is widely thought to have to have nuclear warheads on its missiles already. Other countries, such as Argentina, Brazil, India, Iran, Iraq, Pakistan, South Africa, South Korea, North Korea, and Taiwan, have both nuclear and missile research and development programs.¹³ The significant nuclear advances of India and Israel have probably been the nuclear inspiration for Pakistan, Iran, and the Arab countries, despite the tremendous costs and competing domestic priorities.

Chemical and biological weapons also add to the litany of mass destruction potential. No country is yet known to have used chemical or biological weapons in a ballistic missile attack, but the ability to deliver these warheads on a TBM is believed to have been achieved or is at least within the grasp of a number of Third World countries. For example, as we all watched the nightly news during Desert Storm, the Israelis clearly acted on the premise that Iraq would use chemicals during its Scud attacks on Tel Aviv. This was very prudent, of course, since Saddam Hussein had publicly threatened to do just that.

Syria reportedly has chemical warheads for their SS-21's. Iraq has used chemical weapons (deployed by aircraft or artillery) extensively against Iran and the Kurds. Iran has also been charged with using chemical weapons.¹⁴ Other countries outside of Europe that are reported to have chemical weapons include: Burma, Egypt,

Ethiopia, Israel, North and South Korea, Libya, Taiwan, and Thailand.¹⁵ Very little is known about the state of biological weapons outside of classified sources. However, open sources have speculated that a significant number of countries have active biological development programs if they don't already have deployable capabilities. This type of "weapon" could be adapted to ballistic missile warheads in the future.

OUTLOOK

The rapidly emerging rapprochement between East and West has only a limited impact on the Third World. The rest of the world is not INF-constrained, and even deliberate efforts to slow missile proliferation such as the MTCR have had only moderate effect. Regional conflicts will continue if not actually increase. There is often little incentive other than economic not to acquire TBM's. Tables 1 and 2 (pp. 17-18) summarize the current status of missile proliferation.

Within this decade, more countries will almost certainly acquire the materials and technology to build missile systems. If present trends continue, by the year 2000 the missiles in the Middle East, Africa, Asia, and Africa will be far more numerous, more accurate, longer in range, and equipped with deadlier warheads.¹⁶ CIA Director William Webster predicted that by the end of the century, "at least 15 developing countries will be producing their own ballistic missiles."

In the next chapter, I will provide an assessment of the emerging TBM threat to U.S. power projection forces.

CHAPTER 2 ENDNOTES

1. Ballistic Missile Proliferation Potential of Non-Major Military Powers, CRS Report for Congress, Washington DC, August 6, 1987, p.1.
2. Regional Power Ballistic Missiles -- An Emerging Threat to US Forces?, Air War College Research Report, Maxwell AFB, Alabama, 1990, p. 4.
3. Missile Proliferation: Survey of Emerging Missile Forces, CRS Report for Congress, Washington DC, February 9, 1989, p. 2.
4. Ballistic Missile Proliferation Potential of Non-Major Military Powers, p. 2.
5. Ballistic Missile Proliferation Potential of Non-Major Military Powers, p. 2.
6. Missile Proliferation: Survey of Emerging Missile Forces, p. 2.
7. Ballistic Missile Proliferation Potential of Non-Major Military Powers, p. 2.
8. Missile Proliferation: Survey of Emerging Missile Forces, p. 2.
9. Missile Proliferation: Survey of Emerging Missile Forces, p. 2.
10. Source: Nolan, Janne E.; Trappings of Power: Ballistic Missiles in the Third World, Brookings, Washington DC, 1991, pp. 68-69.
11. The Impact of Missile Proliferation on U.S. Power Projection Capabilities, Rand Note, Rand Library, June 1990, p. 25.
12. Regional Power Ballistic Missiles -- An Emerging Threat to US Forces?, p. 59.
13. Missile Proliferation: Survey of Emerging Missile Forces, p. 3.
14. Ibid.
15. Missile Proliferation: A Discussion of U.S. Objectives and Policy Options, CRS Report for Congress, Washington DC, February 21, 1990, p. 3.
16. Ibid, p. 6.

Third World Missiles Middle East and Africa

(in lbs.)				
	Payload	Range	Propulsion	Source
EGYPT				
Frog-7	1,000	40	Solid	USSR
Scud-B	1,100	190	1-stage liquid	USSR
* Vector	1,000	500-600	Solid	Egypt/Argentina
Sakr 80	450	50	2-stage solid	Egypt/Iraq/N. Korea
* Scud-B	2,200	190	1-stage liquid	Egypt/N. Korea
IRAQ				
Scud-B	1,100	190	1-stage liquid	USSR
Scud-B	N/A	375	1-stage liquid	?
* Scud-B	N/A	560	1-stage liquid	?
* Condor II	1,000	500-600	Solid	Argentina/Egypt/Iraq
LIBYA				
Frog-7	1,000	40	Solid	USSR
Scud-B	1,100	190	1-stage liquid	USSR
SS-21	1,000	75	Solid	USSR
* N/A	N/A	300	N/A	FRG design
IRAN				
Scud-B	1,100	190	1-stage solid	USSR/N. Korea
Oghab	N/A	25	N/A	Iran/N. Korea
Iran-130	N/A	80	Solid	Iran/China
ISRAEL				
Jericho	N/A	400	2-stage solid	Israel
Jericho	N/A	900	2-stage solid	Israel
Lance	600	80	Liquid	USA
SAUDI ARABIA				
CSS-2	4,500	1,600-1,860	1-stage liquid	China
SYRIA				
Frog-7	1,000	40	Solid	USSR
Scud-B	1,100	190	1-stage liquid	USSR
SS-21	1,000	75	Solid	USSR
NORTH YEMEN				
SS-21	1,000	75	Solid	USSR
SOUTH YEMEN				
Frog-7	1,000	40	Solid	USSR
Scud-B	1,100	190	1-stage liquid	USSR
SS-21	1,000	75	Solid	USSR

Source: Arms Control and Disarmament Agency

*Research and development

FIGURE 1.

Third World Missiles Far East, Southwest Asia and South America

(In lbs.)
Payload Range Propulsion Source

SOUTH KOREA				
Honest John	N/A	25	Solid	US & S. Korea
SSM	N/A	110-160	2-stage solid	South Korea

PAKISTAN				
*Hatf I	N/A	50	1 or 2 stage	Pakistan with China & Europe
*Hatf II	N/A	187	1 or 2 stage	

INDIA				
Prithvi	2,200	150	Liquid	India
*Agni	1,500-2,000	1,550	2-stage liquid	India

NORTH KOREA				
FROG-7	1,000	40	Solid	USSR
Scud-B	1,100	190	1-stage liquid	North Korea

(In lbs.)
Payload Range Propulsion Source

TAIWAN				
Green Bee	N/A	60	Solid	Taiwan
Sky Horse	N/A	620	N/A	Taiwan

ARGENTINA				
*Condor I	880	60	1-stage solid	Argentina
*Condor II	1,000	500-600	2-stage solid	Argentina

BRAZIL				
*MB/EE-150	1,100	90	Solid	Brazil
*MB/EE-350	N/A	215	Solid	Brazil
*MB/EE-600	N/A	370	Solid	Brazil
*MB/EE-1,000	N/A	620	Solid	Brazil
*SS-300	2,200	185	Solid	Brazil
*SS-1,000	N/A	740	Solid	Brazil

Source: Arms Control and Disarmament Agency

*Research and development

FIGURE 2.

CHAPTER 3

THREAT ASSESSMENT

The previous chapter outlined the types of TBM trends presently being encountered in the Third World. Since the TMD goal is to field a TBM defense capability in the mid-1990's, I will quickly review below the threat trends expected in the near future:

1. The missiles themselves are likely to achieve greater ranges, improved accuracy, and increased lethality (with the use of improved-conventional as well as unconventional warheads).

2. The number of countries obtaining TBM's is likely to increase for several reasons:

- a. As regional conflicts multiply, becoming a "missile-power" adds prestige and power to the possessor. If one regional power has TBM's then others in the area often feel the need to obtain similar capabilities or be left at a disadvantage. A variation of this theme can be seen in the motivations for the Indian ballistic missile programs. In addition to wanting missiles for potential use against the Pakistanis or Chinese, the Indians see themselves using these weapons to prevent "blackmail" or undue muscle flexing by the major powers in South Asia--an area that they feel is legitimately an Indian sphere of influence.

- b. Proliferation control mechanisms such as the MTCR and the Nuclear Non-Proliferation Treaty (NPT) are ineffective. They just aren't very good at stemming the spread of TBM's and are not likely to get better.

- c. Finally, as demonstrated by Saddam Hussein in the

Gulf War, developing a truly first rate air force is not an easy thing to do and may be truly unaffordable for many countries. A much cheaper alternative in the long run may be to obtain TBM systems. They do not require a great deal of infrastructure to operate and maintain, and they have the added benefit of being able to attack quickly over relatively long distances. Except for the PAC-II modified Patriot there are no defenses today against TBM's once they are launched.

If capabilities and not intentions are the gist of what military planners must contend with, then these future trends (widespread ownership and improved performance) represent a significant problem that must be dealt with. These capabilities could easily be harnessed to create a significant threat at strategic, operational, and tactical levels. It is easy to see that if only a portion of these projections come true, Third World TBM's could be used against ports, airfields, communications centers, or government centers seized and defended by expeditionary forces--either for political reinforcement operations or as an initial lodgement for a larger force buildup (e.g., Desert Shield). Moreover, they could pose a threat to an expeditionary force itself at assembly and staging areas, as well as to its command posts, command and control nodes, logistic support areas, and other "soft targets" such as air defense systems. These capabilities under the right circumstances could even be used to deter the use of U.S. power projection forces at all.

A recent example of a "close call" may help to illustrate the

potential of TBM's. In recent testimony on Capitol Hill, Henry D. Sokolski, the Pentagon's deputy for non-proliferation policy, described an incident that occurred on February 16, 1991:

At the Saudi port of Jubail, an Iraqi Scud struck just 300 meters or so from the pier at which eight ships were berthed. Two of the ships carried all of the provisions of the Marine Corps air arm in the Persian Gulf area. These ships were not harmed. Nor were the USS Tarawa amphibious assault ship and several ammunition ships [that] were berthed at the pier... Also untouched were the 5000 tons of 155 mm ammunition that sat at the pier... Had more Scuds come in it [would have been] unlucky for us.¹

Sokolski stated further,

There are reasons to believe the very things that made the Scud miss -- the lack of accuracy in the missile, the inability (on the part of the Iraqis) to know what was at the port, the inability to really aim and target that stuff -- are not likely to prevail in the future.²

Most of the detailed modelling done or being done in this area is classified, but there are some unclassified sources which can be used to generally describe the potential of TBM's in the near future. A recent Rand Study entitled, The Impact of Missile Proliferation on U.S. Power Projection Capabilities, postulates the results of two possible Middle East scenarios in which TBM's are employed against a U.S. rapid deployment force.³ In the first, it describes how a Middle East adversary could use even present-day capabilities to inflict casualties on highly visible and important deployed U.S. assets. This subverted American political and public will to sustain the use of military force. In the second, it describes how just four TBM's could be used to entirely cover an area the size of a civilian airport with a persistent chemical agent--with lethal effect for any unprotected personnel. This kind of attack clearly could be very disruptive of tactical military

operations or logistic support.

The results of an LTV Company study/war game conducted just before the Gulf War are also interesting. In Sand Storm Rising II, an amphibious force responded to a postulated crisis in Iran during the year 2004. As the situation evolved, the Iranians used TBM's to threaten a lodgement by attacking beachheads, suppressing air defenses, and disrupting communications nodes. When TBM-defenses were inserted into the scenario, it was determined that they could be effective at defending initial landing units, but only if ground based fire units were employed in a cooperative defense with ship-board fire units.

These kind of results certainly are attention gaining and put a new light on what might have been considered an insignificant problem for expeditionary forces in the past.

I will close this chapter with quotations from two early attempts to develop some lessons-learned from the Desert Storm conflict. They summarize the nature of the problem nicely, I believe. In an article from the Army Research, Development & Acquisition Bulletin⁴ entitled, "Military Lessons Learned from the Gulf War," the author concluded that:

"Tactical ballistic missiles will continue to pose a significant threat to U.S. interests and military forces. Iraq's use of the Scud missile system to terrorize the Israeli and Saudi populations demonstrated the political impact that even a rudimentary missile system, employed in relatively few numbers, can have. The proliferation of nuclear weapons and ballistic missiles will pose a growing threat to U.S. interests.

In an interim report, The Gulf War: Military Lessons Learned⁵, The Center for Strategic and International Studies described the

TBM problem as follows:

"The Iraqi use of Scud missiles brought home to the U.S. military the potential of tactical ballistic missiles. The Scud was one of Iraq's few technical successes of the war. Given that fact and that this war demonstrated the enormous difficulty in creating a traditional air force truly competitive with U.S. air and anti-air forces, tactical missiles may become increasingly appealing as a long-range strike weapon of choice...To the extent that the proliferation of tactical missiles increases...the need for further work in antitactical missile systems like the Patriot will become more pressing.

Given the trends now being recognized, the TBM must be considered more than just a terror weapon used indiscriminately against cities. TBM's will pose a threat not only to the future objectives that U.S. power projection forces may be called upon to seize and defend but also to our expeditionary forces as well.

CHAPTER 3 ENDNOTES

1. "North Korea Ready To Begin Flight Testing New Ballistic Missile," Aerospace Daily, March 16, 1992, p. 425.
2. Ibid.
3. David Rubenson and Anna Slomovic, The Impact of Missile Proliferation on U.S. Power Projection Capabilities, Rand Note, June 1990, pp 15-24.
4. Jason T. Hoffman, "Military Lessons Learned From The Gulf War," Army RD&A Bulletin, Nov-Dec 91, p. 3.
5. The Gulf War Military Lessons Learned, CSIS Interim Report, Washington, DC, July 1991, p.17.

CHAPTER 4

CAPABILITIES ASSESSMENT

Is It A Problem For The Marine Corps?

If military planners must contend with capabilities and not just intentions, then there appears to be something emerging in the Third World that should concern the Marine Corps. The trends, target sets, and employment options described in the two previous chapters could certainly pose a credible threat to either permanently forward-based forces, or to crisis-response expeditionary units and their objectives.

Advances in technology can undoubtedly be used by our potential future opponents just as we used "high-tech" to great advantage in Desert Storm. Tactical ballistic missiles are not even at the cutting edge of today's technology revolution and are relatively easy to obtain. The key factor in a Third World country obtaining a TBM capability seems to be having the will and the money to: (1) buy missile systems themselves, or (2) to use a combination of in-house scientific talent (or scientists hired from abroad), and (3) to develop components in-house or purchase them abroad. It does not appear to be hard to do if the a government wants the capability.

Desert Storm certainly demonstrated once again that the Marine Corps has a role as the nation's expeditionary force-in-readiness. A Marine Expeditionary Brigade (MEB) married up with combat equipment aboard Maritime Prepositioning Force shipping to provide a credible and sustainable U.S. combat force on the ground in Saudi

Arabia by 27 August. The MEB then quickly grew to a Marine Expeditionary Force (MEF). Marine Air Ground Task Forces (MAGTF's) afloat also played a key role in CENTCOM's strategy by providing a potent amphibious force in the Persian Gulf. The lesson re-learned again for the nation was that the Marine Corps' strength is its ability to get a powerful, flexible force to a crisis area in a hurry. The Marine Corps can expect to be employed in future scenarios similar to Desert Storm and to those postulated in Chapter Three. Typical missions will be to seize and control physical features essential to the conduct of a larger naval or continental campaign. Additionally, it is very likely that MAGTF's will perform quick-reaction political reinforcement operations. Such operations--embassy defense, evacuations, friendly government reinforcement, coup de main--will often require forces which can respond quickly and with the ability to operate against a wide range of threats including TBM's.

Clearly a threat is developing that the Marine Corps must contend with if it is to fulfill strategic and operational defensive tasks (e.g., port, airfield, and national capital security) and to prevent its tactical forces from becoming vulnerable in future regional conflicts. The next questions are how should the Marine Corps obtain a defensive capability and what should that capability consist of? The solution includes various elements such as passive defenses and doctrinal and training changes. I have chosen to limit the scope of this paper to the most difficult element to achieve--active ground based defenses.

The search for TBM defenses must include consideration of how the Marine Corps does this most efficiently and effectively with its limited resources.

What Does The Marine Corps Need?

If MAGTF's are likely to require a counter to such weapons systems in the future, then the next question must be how does the Marine Corps best obtain a defensive capability against them?

The long term answer is a conceptual replacement for the Hawk missile system called MSAM by the Marine Corps and CORPS SAM by the U.S. Army. The two Services have a Memorandum of Understanding to cooperate in the concept exploration and concept definition phase for this developmental system. One of the requirements will be for it to provide a strategically deployable and tactically mobile air defense capability against not only conventional aircraft but also TBM's--see Figure 3 on page 32. A problem with MSAM/CORPS SAM though is that it has just been initiated as a major new developmental program. It will be fielded well beyond the year 2000 (if funding is available!) The intent of Congress with TMD is to prevent a window of vulnerability for U.S. forces and to have an initial TBMD capability fielded by the mid-1990's. The question then becomes what can the Marine Corps realistically do in the near and mid term? The possible range of practical solutions is that the Marines can either obtain TBM defense from another Service, or modify some existing air defense systems, or possibly some combination of all these options. I would now like to discuss these options in a little more detail.

As part of TMD, the Army is developing a layered strategy for defending against TBM's. CORPS SAM will eventually become the bottom tier of Army TBMD, providing a rapidly deployable point-defense system to operate with its maneuver forces. The next tier, which will be fielded first, will consist of a series of upgrades to the now famous Patriot missile system. Patriot will continue to provide point and limited area defense for high value targets. And finally, the Army is developing a top tier called Theater High Altitude Area Defense (THAAD) which will be transported to a mature theater to provide an umbrella over large areas of terrain and space.

The long term development plan for CORPS SAM has already been discussed as an ideal solution but in the out-years. THAAD will be a theater asset transported into an area only after a theater has become "mature" i.e., not during the early stages of a campaign when Marine Corps forces would initially be employed.

But why couldn't the Marine Corps buy Patriot or have Army Patriot units accompany Marine forces? First, even if funding were somehow made available to buy this expensive system, the Marine Corps could never afford the manpower "bill." For comparison, the closest air defense system in size and capability to Patriot in the Marine Corps is the Hawk system. Hawk is a smaller, shorter range system which complements Patriot in Army Corps, and Echelons-above-Corps, air defense systems. As the DOD force drawdown begins, the Marines have already had to eliminate (by actual deactivation or scrapping activation plans) about half of the Hawk batteries that

it had programmed for only a few years ago. The Marine Corps could simply not afford to "grow" the people to operate Patriot. It has already had to give-up much of its manpower in the smaller Hawk air defense systems.

Well then, why couldn't the Army attach Patriot batteries to MAGTF's on an as-required basis? The Army acquires Patriot equipment and mans it as part of its planned force structure as a Corps and Echelons-above-Corps asset. Taking these units away from the Army forces they are designed to be employed with is a problem that might be overcome if a future conflict is limited in scope and it or other conflicts did not require the employment of sizeable Army formations. Finally, however, a more basic problem is that Patriot is just too big and not mobile enough to be easily employed with the nation's expeditionary force-in-readiness. During Desert Shield and Desert Storm, with months of time to build up our forces, it took over four hundred C-141 equivalents to transport enough Patriot in-country to provide limited point defense of critical, high value areas. A MAGTF, at least initially, just couldn't employ such a cumbersome system in many of the scenarios for Marine forces. Patriot, therefore, does not seem to be a complete solution, especially early-on in contingency operations.

Another possible source for TBM defense could be ATBM weapons on Navy ships. The Navy currently does not have a TBMD capability but is using TMD R&D funds to explore upgrades to some of their existing air defense systems. Some promising candidates seem to be upgrades to Aegis battle management and command and control systems

along with modifications to the Standard missile. ERINT, an ATBM missile under development for SDIO, is also adaptable to shipboard launchers and has demonstrated significant potential. The problem with a future Navy defensive umbrella is that it does not appear that it could be relied upon to provide complete coverage ashore by itself. Without getting into classified data, it can be generally stated that the area that can be defended by near-term upgrades to Navy systems will be fairly limited.

The understandable reluctance to bring high value multi-mission naval combatants very close to hostile shores, where they are vulnerable to mines and sea-skimming cruise missiles, further exacerbates the problem and could in fact make this tactic totally unfeasible in some circumstances. Even so, shipboard systems would be an important contribution to an integrated area defense; just as carrier aviation and missiles on ships are important to the overall AAW effort in an Amphibious Objective Area.

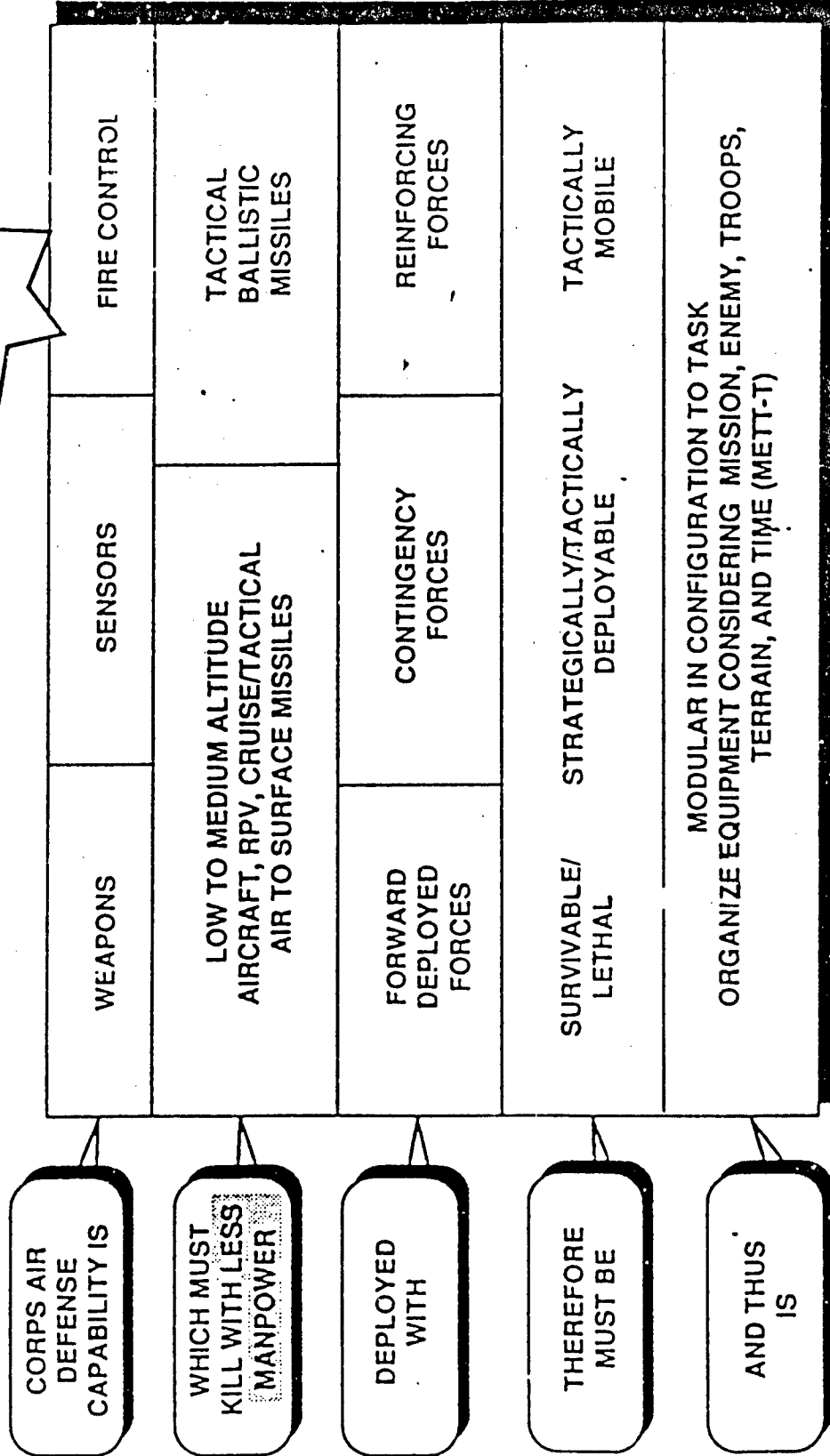
After considerable thought about what might be done in light of the less than completely satisfactory possibilities described above, it occurred to me that the problem that the Marine Corps now faces is really not unlike the conventional air defense threat that it has successfully dealt with since World War II. The solution in the past has been to develop air defense weapons that are deployable and mobile enough to accompany Marine forces ashore and to integrate them with AAW weapons afloat in an area defense network. The importance of integrated ground and ship-based TBMD fire units was just one of the lessons-learned from the previously

mentioned Sand Storm Rising II wargame/study. We have also been pioneers in AAW interoperability so that we could provide and receive mutual support from other elements of a joint force. Thus, in amphibious operations, we rely primarily upon air support and air defense from afloat until we establish a lodgement and then expand our integrated capabilities with ground-based sensors and fire units. For continental operations, our command and control systems and air defense weapons have always been interoperable with the Army and Air Force as well.

My conclusion then is that we can take a lesson from how we have dealt with a similar kind of problem in the past, and use existing AAW principles to respond to the developments we now see in the Third World. In the near-term, the Marines need an expeditionary TBMD capability with as much stand-alone capability as can be achieved with existing manpower and equipment, and which can in turn "plug-into" other more capable systems when and where available. Marine ground based anti-air warfare systems have demonstrated some TBMD capabilities that should be explored further. A combination of upgrades to existing Marine Corps equipment combined with the ability to interoperate with other ATBM systems, when they are available, may be the most feasible approach until a long term solution (MSAM/CORPS SAM) is achieved. I will examine some equipment solutions that the Marine Corps should explore next.

MISSION NEED STATEMENT

USMC
IN
SYNC



UNCLASSIFIED

FIGURE 3.

CHAPTER 5

POSSIBILITIES FOR THE NEAR TERM

For the near-term, until technology can provide better solutions, I believe that the Marine Corps will have to modify existing anti-air warfare systems in order to obtain defenses for TBM's. As we seek this capability, there are two overriding characteristics that must be kept in mind. First, this capability must be affordable both in terms of the associated manpower as well as the funds necessary to procure, operate, and maintain it. Second, it must be deployable and mobile in keeping with our expeditionary, force-in-readiness mission.

Affordability and deployability limit the possible solutions for the Marine Corps. These requirements strongly influenced my initial conclusion that we must modify existing systems for any near-term solution. If we can adapt current AAW systems and make them multi-purpose weapons, this will lessen cost. Further, by not adding a new single-purpose weapon system to the inventory, it will be possible to minimize ATBM requirements for space on air or sealift, thus fostering deployability.

There are three basic building-blocks that would comprise an achievable TBMD capability for the Marine Corps. The Marine Corps Systems Command (MCSYSCOM) is currently doing research and development on at least portions of all three. These include:

1. A battle management/command and control system.
2. A TBM sensor.
3. An anti-TBM missile.

Up to the present, Marine Corps investment in these three areas has been very modest. Seed money for initial R&D and feasibility testing has been provided by SDIO or through engineering upgrade programs for existing AAW hardware. These exploratory efforts are not yet indicative of any firm commitment on the part of the Marine Corps leadership to endorse this mission area or to field TBMD systems for Marine forces. Indeed, the number of Marine Hawk missile batteries (which might comprise part of an underlying architecture for TBM defense) has been reduced in recent force structure cuts.

I will now briefly describe and comment on each of the three components of a potential Marine Corps TBMD system.

Battle Management/Command and Control System

The current Hawk system's acquisition radars are designed to detect conventional aircraft and not TBM's, which fly profiles at extremely high (sometimes even exoatmospheric) altitudes. However, the Hawk missile's capability to intercept and provide a mission kill* against short range TBM's (when augmented by an appropriate sensor) has been demonstrated as early as 1961.

This capability was most recently demonstrated in two tests at White Sands Missile Range. In 1988, a modified Marine Hawk battery, cued by an Army Patriot radar, successfully intercepted a short range TBM. Again in 1990, an Army battery cued by Patriot intercepted a surrogate SS-21. The Hawk system, therefore, has demonstrated a capability to intercept certain classes of TBM's if

* Mission kill: Preventing the TBM from hitting the intended target. "Warhead kill" will be discussed in a subsequent section.

cuing information is provided by an appropriate sensor.

MCSYSCOM is currently doing R&D on a concept to expand a planned upgrade to the Hawk system called the Air Defense Command Post (AD-CP). This C2 node, which will fit into a small shelter on the back of a standard HMMWV, was initially intended to give the Hawk battery commander an improved capability to exchange AAW information with nearby Stinger teams. By expanding its capability with some C3 equipment and a TBMD work station, the AD-CP could network with external sensors and other TBMD systems. These might include a Marine sensor or Aegis and Patriot radars. It would also be compatible with other sources of cuing information such as satellite ground stations receiving early warning from overhead platforms such as those used in Desert Storm. Present and planned data links (such as JTIDS or the Navy's Cooperative Engagements network) can provide the required connectivity between TBMD nodes. All of this provides a basic architecture to command and control a TBM engagement by modifying existing systems. MCSYSCOM anticipates taking the AD-CP to developmental and operational tests in 1994.

A more self-contained capability would be achieved if the Marine Corps had its own sensor to augment cuing and early warning information received by outside sources. That is the subject of the next section.

A Marine Corps TBM Sensor

The existing Hawk system radars cannot "see" a TBM during most of its flight because of the extremely high altitude profiles that they fly. This problem can be partially remedied by linking other

sensors to the Hawk fire unit. These outside sensors will continue to be an important part of TBM defense, and any Marine C2 system must be interoperable with them the way the AD-CP was just described. However, additional operational improvements are possible if MAGTF's could be equipped with their own TBM sensors as well.

This became a possibility after tests at White Sands on 18 May 1991. While an Army Hawk and Patriot team actually engaged a classified target, a modified Marine Corps TPS-59 radar also participated in the mission. The TPS-59 is one of the AAW surveillance radars found in the Marine Air Control Squadrons. This particular radar had software modifications which allowed it to track a high flying TBM. During the test, the TPS-59 received TBM track data 40 seconds prior to apogee and was used to guide a Marine Hawk fire unit to a "lock" on the target. The Hawk system then indicated that the target was engageable and multiple simulated missile firings were performed.

The data from this test indicate that the TPS-59 may be able to detect and classify TBM targets at ranges out to 400 nautical miles and at altitudes up to 500 thousand feet. This would be quite sufficient to provide direct cuing to Hawk. Of course, other sensors would also be employed whenever possible--the AD-CP would be designed to operate as part of networked system with whatever resources could contribute to TBM defense--be they Patriot, Aegis, satellite, or others. A TBM-capable TPS-59, however, would give the Marine Corps a quick-response TBMD package for power projection

contingencies. That capability could then be expanded with time as other resources became available.

MCSYSCOM is continuing the development of the necessary software modifications and expects to be able to conduct developmental and operational testing during 1995.

An Anti-TBM Missile

As previously mentioned, Hawk has had an inherent capability to provide a mission kill against short range TBM's since it was first fielded. That capability was never seriously developed due to budget restraints and other higher priority air defense issues in the Army and Marine Corps. However, in response to requirements during Desert Storm, a Quick Reaction Program was initiated in January 1991 to develop a warhead kill* capability for Hawk. This program resulted in the development of fuze and warhead modifications to provide higher lethality for the Hawk missile against short range TBM's. These modifications were tested on May 18, 1991 at White Sands. During the test, an Army Hawk fire unit, cued by a Patriot radar, achieved a warhead kill on a classified target. This is a significant advance and MCSYSCOM is currently defining a program to implement the fuze and warhead modifications to some of the existing stocks of Hawk missiles. There is also an additional refinement for Hawk that may have potential value, but which MCSYSCOM has not yet been actively

* Warhead Kill: Destroying the TBM warhead by causing it to detonate, incinerate, or dud. The intent is not only to keep the TBM from hitting its intended target but also to prevent the warhead from causing damage elsewhere.

pursuing. The modifications to the Hawk missile previously described are promising and should be pursued. The missile itself, however, has certain characteristics that will limit how much more capability it can grow against TBM's. In this respect, its limiting features are its relatively short range and its blast fragmentation warhead.

To achieve significantly greater ATBM missile ranges (and commensurate increases in area which can be defended) as well as more lethality against TBM warheads, may require a different class of missile--one specifically designed to kill TBM's. A promising missile technology being developed by SDIO for TBM defense is called "hit-to-kill." This is a targeting scheme designed to be so accurate that the ATBM missile relies on the energy from a direct impact to destroy the target rather than a blast fragmentation warhead. Blast fragmentation warheads tend to leave large segments of debris intact to fall on the ground as witnessed during Desert Storm. Hit-to-kill technology may hold tremendous potential for destroying all of an incoming TBM at high altitudes (including the contents of chemical warheads). This would have obvious advantages especially if an enemy utilized a chemical or biological agent that would simply be dispersed over the heads of friendly troops by the effects of a standard blast fragmentation warhead.

A planned upgrade called the Hawk Mobility Enhancement will theoretically allow the Hawk system to be easily adapted to fire other missiles as well as its own Hawks. SDIO is currently developing a hit-to-kill ATBM missile called ERINT that has shown

promise for achieving significant defensive ranges and warhead kill lethality. This missile is presently being considered as a complementary weapon in Patriot batteries (mounted in canisters on Patriot launchers), but it could easily be mounted on the upgraded Hawk launchers as well. It might provide the Hawk system with a capability against more than short range TBM's, as well as an increase in the size of the area that it can defend. What needs to be done now is to conduct relatively simple initial engineering studies to see if the two (ERINT and Hawk system) can really interoperate and what design modifications would be required. If the results of the design studies appeared promising, additional developmental testing could then be done with hardware. A mix of Hawk and ERINT-type missiles in Hawk fire units could prove to be a very versatile combination. To date, this seems to be an opportunity that has been largely overlooked despite its potential payoffs and the modest investment required to determine its feasibility.

Summary

I have described in simple terms the three components of a possible TBMD system for the Marine Corps. Certainly, much detail has been left out. These building-blocks need further testing and refinement before they become viable. Doctrine and training would be necessary ingredients too. In some cases, additional funding would need to be obtained before hardware could be fielded.

What I have attempted to capture, however, is the core of what could be an achievable TBMD system for the Marine Corps. It is

multi-purpose since all existing AAW elements would retain or improve their conventional capabilities. It is as affordable an approach as penny-pinching and manpower conscious Marines could make it. And when conducted in concert with other ongoing initiatives to reduce the embark footprint of our AAW systems, it would be deployable.

Recommendations

The Marine Corps should continue to pursue its R&D efforts in the pursuit of an expeditionary TBMD capability. Any solution we pursue should be "designed to" our requirement for deployability and affordability. Interoperability has always been a hallmark of the way we have conducted anti-air warfare and should continue to be imbedded in the way we approach defending ourselves against this latest threat from the sky. Finally, this has been a "frugal" approach to dealing with an emerging problem. It has been based on modifying existing systems to provide us needed defenses. As we conduct our force structure planning in the future, we need to be farsighted enough to retain the core capabilities necessary to grow TBM defenses. Elimination of Hawk from Marine Corps force structure, for example, would effectively eliminate any opportunity for MAGTF's to field their own TBM-defense capability.

In the next section I will discuss one final requirement for addressing this issue--the need for a TBM Defense Team. This team is necessary to guide our internal planning, as well as our dealings with those outside the Marine Corps.

CHAPTER 6

MANAGING PROBLEM RESOLUTION

This chapter is a discussion of how the Marine Corps should organize to deal with this emerging issue. As mentioned in the first chapter, TBM defense is presently a high visibility subject. Congress is keenly interested and the American public is aware of it from Desert Storm news reports. In response to TMD, the Department of Defense, the Joint Staff, and the other Services are moving along smartly to determine roles, missions, and respective Service capabilities. Under SDIO direction, a roadmap (with funding lines!) for fielding a TBMD capability by the mid-1990's is quickly taking shape.

The Marine Corps needs to be a full participant in the process now underway which is determining Service capabilities and future missions. The other Services are well organized to clearly articulate their Service requirements, policies, and capabilities in this area. The Marine Corps, however, remains rather disorganized and not well prepared to deal coherently with TMD. All of the other Services have designated lead-agents that can draw on the necessary Service agencies and resources to deal credibly with this emerging issue, and then speak with one voice i.e., develop a clear Service "position." The Marine Corps needs to do the same, or it may lose the opportunity to develop and refine its inherent expeditionary TBMD capabilities. The following amplifying information may help to explain what I mean.

The Strategic Defense Command (SDC) at Huntsville is the

Army's three-star counterpart to SDIO. The Army Chief of Staff designated SDC as the lead-agent for TMD in the Army. SDC has tremendous resources to draw upon, and can easily pull together all the necessary material and talent to represent the Army forcefully and articulately.

The Navy has had a Navy-SDI office for several years in Crystal City. Its head has been a Navy captain as long as the Navy was uncertain that the Navy had a serious interest in this mission area. Now with advent of the Congressionally-mandated TMD and SDIO-dispensed R&D funds, the Navy has elevated their lead-agent to a one-star billet and expanded the size of the Navy-SDI office considerably. It is not as big an operation as SDC, but it is clearly a dedicated focal point with flag level responsibility

The Air Force space community, especially its Space Command, has always had an interest in TBMD but it was an area that had a relatively low priority until Desert Storm. As U.S. forces faced the likelihood of attack from Iraqi Scuds, some strategic satellite systems were adapted to detect TBM launches. The lessened probability of a nuclear ICBM exchange with the former Soviet Union and the spread of TBM's in the Third World has provided added incentive to the Air Force to participate in TMD. Interestingly, however, the Air Force has designated the four-star Tactical Air Command as their lead-agent for TBMD for two reasons. The Air Force sees this mainly as a matter of tactical support provided to operational forces on the ground and therefore a logical extension of TAC's existing mission. They also see this assignment as a way

to add emphasis to TAC's counterforce doctrine of trying to locate and destroy mobile TBM launchers on the ground before the missiles have been launched.

The other Services have obviously responded forcefully to this issue and the current political interest in it. Resources and flag level responsibility have all been brought to bear on the problem in such a way that a clear Service position can be developed and articulated. This will certainly be advantageous as roles and missions are defined and R&D dollars (and possibly future procurement funding) are disbursed by SDIO. The Marine Corps response to date has been sufficient to get started, but it may not be adequate when the train gets moving a little faster and the budgets get tighter. At present, the Marine Corps has not designated an overall lead-agent nor a general officer to lead its effort.

The Marine Corps needs to bring the right talent to bear on the problem, but at the same time insure that it speaks with one voice--and does so with authority in a timely fashion. Some of the right players are already involved, but we don't have someone with overall responsibility for assessing all aspects of the problem and guiding the Marine response to it (as the other Services have done).

The Marine Corps Combat Development Command (MCCDC) has primary responsibility for requirements definition and is currently staffing a draft Mission Need Statement for Marine Corps TBMD. The Marine Corps Systems Command (MCSYSCOM) is using SDIO seed-money to

do some small scale exploratory and TBMD development work with Marine Corps equipment. Several offices in Headquarters Marine Corps occasionally deal with policy issues related to TBMD-- typically the Department of Requirements and Programs, the Space Systems Branch within the Plans Division, as well as the Aviation Command and Control Branch of the Department of Aviation. All of these offices and agencies have a role to play, but the Marine Corps response to this issue to date has been piecemeal. We would be better served by a team approach to the problem.

My recommendation is that the Marine Corps resurrect the Marine Corps TBM Defense Team concept (see Figure 4 page 46) that was created for USMC participation in the Department of the Navy's 1991 quick-reaction TBMD Study. The integration and direction role (lead agent) should be performed by an office within HQMC for two reasons. First, HQMC is physically close to and easily responsive to events in the Washington, DC area where the Joint Staff and other Service Headquarters are located. Second, the Headquarters is best configured to provide policy guidance and oversight over all aspects of such an issue.

There are two likely candidates for the flag level lead-agent--either the two-star deputy to the DC/S for Plans, Policy, and Operations (the Director of Plans); or the one-star deputy to the DC/S for Aviation. The team itself would meet formally only as required by the lead-agent. Its function would be to make sure that the overall Marine Corps effort was coherent and well coordinated.

The lead-agent would be assisted by an O6 level steering committee. This group's role would be to guide all of the Marine Corps participants in the team and to prepare coordinated Marine Corps TBMD policies and positions for the lead-agent.

MCCDC and MCSYSCOM would be assigned primary responsibility for TBMD tasks appropriate to their respective charters (figure 4, page 46). Other departments of HQMC would be tasked to participate on the TBMD team as supporting agents as appropriate to their normal staff roles. Participation of elements of the Service Headquarters, for example, will be especially important when dealing with OSD and the other Services on policy issues.

The other Services have all adopted a lead-agent approach in response to the Congressional guidance to field a TMD system by the mid-1990's. The Marines need a Marine Corps TBMD Team or something like it to deal effectively with Congressional direction. All of this can be done without additional cost or the necessity to create new organizations or staff. The team concept is simply a way to use our existing resources coherently and intelligently to deal with a complex emerging issue.

USMC TBM-DEFENSE TEAM

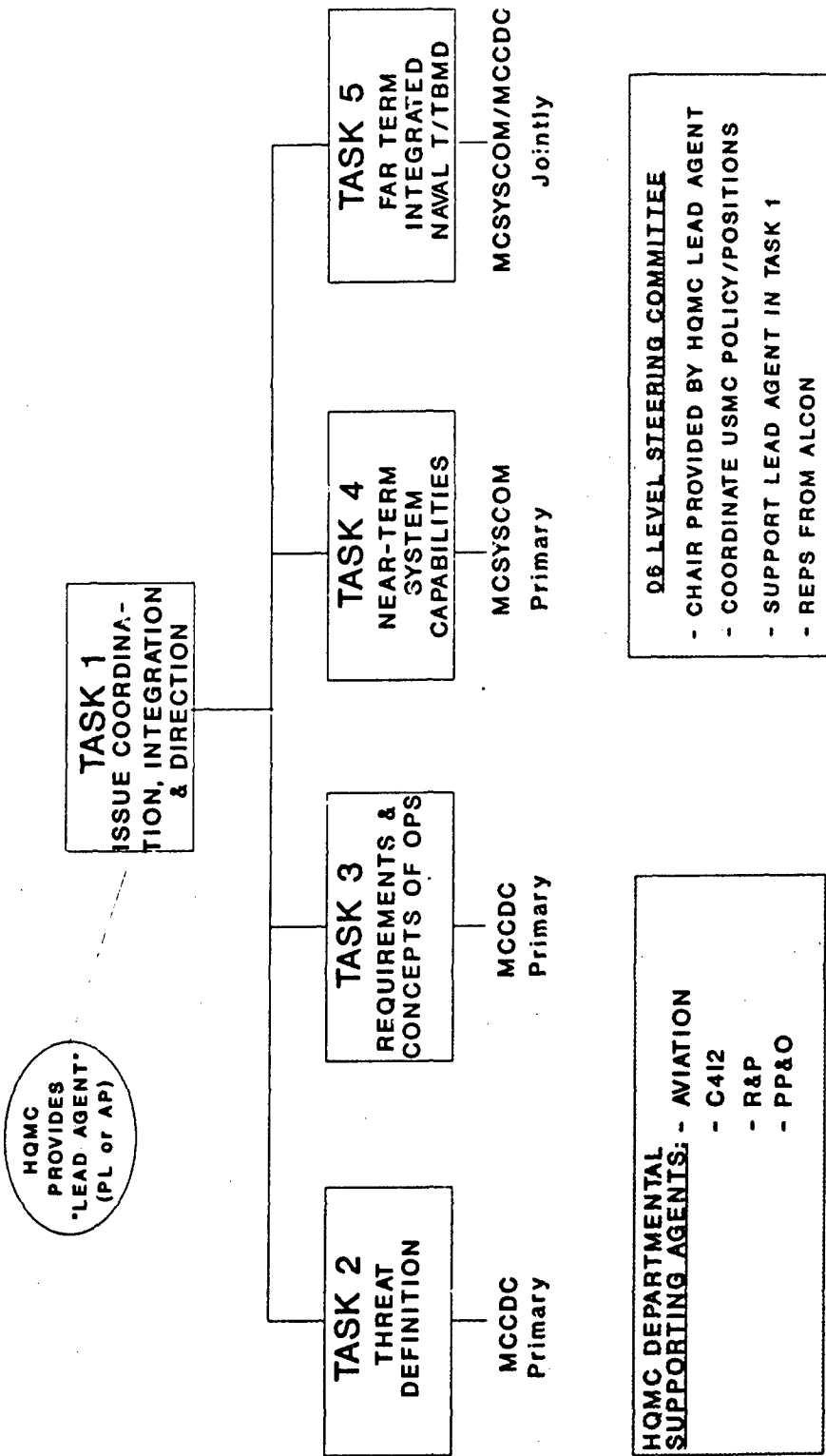


FIGURE 4

IN CLOSING

It is a fact that TBM's are proliferating in the lesser developed countries. Sixteen Third World nations currently possess ballistic missiles, and twelve of these countries are developing or producing at least portions of the systems domestically.¹ Additionally, the CIA's William Webster recently predicted that by the year 2000, "at least fifteen developing countries will be producing their own ballistic missiles."

It is also clear that many of the new missile powers (and aspiring missile powers) are often unencumbered by the familiar constraints recognized by the major powers during the Cold War. By Western standards, some of these countries even qualify as renegade or terrorist states that could easily exercise little restraint in the use of any weaponry in their possession. However the international political scene develops in the years ahead, a multi-polar world and advancing technology pose serious challenges for the U.S. military. Plans to develop TBMD and TMD systems are certainly prudent in light of the volatile and uncertain world that we as a nation face ahead. It is also likely that Marine forces will have to respond quickly to future crises in regions of the world where the local powers will be able to employ TBM's.

The Marine Corps needs to be full participants in the ongoing TMD development process. A foundation is now being built upon which future doctrine and equipment in this mission area will be based. In my paper, I have suggested that the Marine Corps has a contribution to make, and indeed must involve itself in TMD if it

is to remain viable as the nation's force-in-readiness. Additionally, I have made several recommendations about possible near-term equipment solutions and how we should organize as a Service to deal with the problems posed by TBM's. Hopefully, my assessment and recommendations will help to stimulate interest in this issue. This is mission area that the Marine Corps needs to begin addressing coherently and aggressively right now.

"IN CLOSING" ENDNOTES

1. Janne E. Nolan, Trappings of Power: Ballistic Missiles in the Third World, (Brookings Institute, Washington, DC, 1991), p. 8.

BIBLIOGRAPHY

- Aspin, Les. Patriots, Scuds, and the Future of Ballistic Missile Defense, Text of Speech presented by Congressman Aspin to the National Security Industrial Association, Arlington, Va., April 24, 1991.
- Assessing Ballistic Missile Proliferation and Its Control, Center for International Security and Arms Control, Stanford University, November, 1991.
- Bailey, Kathleen C. "Arms Control for the Middle East," International Defense Review, April, 1991, pp 311-314.
- Bailey, Kathleen C. "Can Missile Proliferation Be Reversed?," Orbis, Winter 1991, pp. 5-15.
- Ballistic And Cruise Missile Proliferation In The Third World, Hearing before the Subcommittee on Defense Industry and Technology of the Senate Committee on Armed Services, Washington, DC, May 2, 1989.
- "Ballistic Missile Proliferation," SIPRI Yearbook 1991: World Armaments and Disarmaments, pp. 317-343.
- Bilveer, Dr. S. "AGNI: India Fires into the Missile Age," Asian Defence Journal, supplement: Friday, Nov 3, 1989, pp. 28-31.
- Carus, W. Seth. Ballistic Missiles in Modern Conflict, Center for Strategic and International Studies, Praeger, New York, 1991.
- Carus, W. Seth. Ballistic Missiles in the Third World: Threat and Response, Center for Strategic and International Studies, Washington Papers, Praeger, New York, 1990.
- Carus, W. Seth. "Missiles in the Middle East: A New Threat to Stability," Policy Focus, June, 1988, pp. 113-125.
- Carus, W. Seth. "Missiles in the Third World: The Gulf 1991 War," Orbis, Spring 1991, pp. 253-257.
- Heller, Mark A. "Coping with Missile Proliferation in the Middle East," Orbis, Winter, 1991, pp. 15-28.
- Hildreth, Steven A. and Woolf, Amy F. Ballistic Missile Defense Deployment Options, Library of Congress, Congressional Research Service Report, Washington, DC, July 19, 1991.
- Jacobs, Gordon. "Third World Ballistic Missiles: A Cause For Concern," Jane's Defense Weekly, 15 Nov. 1986, pp. 1179-1180.

- Lennox, Duncan; The Global Proliferation of Ballistic Missiles, Jane's Defense Weekly, v.12, Dec. 1989, p. 1385.
- Mahnken, Thomas; and Hoyt, Timothy. "The Spread of Missile Technology to the Third World," Comparative Strategy, vol. 9, no. 3, 1990, pp. 245-263.
- Manfredi, Arthur F., et al. Ballistic Missile Proliferation Potential of Non-Major Military Powers, Library of Congress, Congressional Research Service Report, Washington, DC, August 6, 1987.
- McNaugher, Thomas L. Ballistic Missiles and Chemical Weapons: The Legacy of the Iran-Iraq War, Brookings Institute, Washington, DC, 1990.
- Milhollin, Gary. "India's Missiles -- With a Little Help From Our Friends," The Bulletin of The Atomic Scientists, November, 1989, pp. 31-35.
- "Military Lessons Learned From The Gulf War: An Analysis from the Center for Strategic and International Studies," Army Research, Development & Acquisition Bulletin, November 1991, pp. 1-3.
- Missile Proliferation: Survey of Emerging Missile Forces; Library of Congress Washington, DC; Congressional Research Service; CRS Report 88-642F by Foreign Affairs and National Defense Division; Revised Feb. 9, 1989.
- Missile Proliferation: The Need for Controls (Missile Technology Control Regime). Hearing before the Subcommittees on Arms Control, International Security and Science, and On International Economic Policy and Trade of the Committee on Foreign Affairs, House of Representatives, 101st Congress; July 12, and 30 October 1989, USGPO, Washington, DC, 1990.
- Navias, Martin. Ballistic Missile Proliferation in the Third World, Adelphi Papers, Brassey's, London, 1990.
- Nolan, Janne E. Trappings of Power: Ballistic Missiles in the Third World, Brookings Institute, Washington, DC, 1991.
- Ottenberg, Michael A. "Operational Implications: Middle East Ballistic Missile Proliferation," A&DS, Oct/Nov 1990, pp. 13-22.
- O'Pray, John E., Colonel. Regional Power Ballistic Missiles--An Emerging Threat to Deployed Forces?, Research Paper, Air University, Maxwell AFB, Alabama, 1990.

Rubin, Uzi. "How Much Does Missile Proliferation Matter?," Orbis, Winter 1991, pp. 29-39.

Rubenson, David; and Slomovic, Anna. "The Impact of Missile Proliferation on U.S. Power Projection Capabilities," Rand Note, June 1990.

SDI Program Focus: Global Protection Against Limited Strikes (GPALS), U.S. Department of Defense News Release, Office of the Assistant Secretary of Defense (Public Affairs), Washington, DC, January 30, 1991.

SDIO Briefing on the Refocused Strategic Defense Initiative (edited transcript), by Ambassador Henry Cooper and the Honorable Stephen J. Hadley, SDIO pamphlet, Washington, DC, Feb. 12, 1991.

The Gulf War Military Lessons Learned (Interim Report of the CSIS Study Group on Lessons Learned from the Gulf War), CSIS, Washington, DC, July 1991.

The President's New Focus for SDI: Global Protection Against Limited Strikes (GPALS), SDIO pamphlet, Washington, DC, June 6, 1991.

The Role of the Marine Corps in the National Defense, Fleet Marine Force Manual (FMFM) 1-2, United States Marine Corps, U.S. Government Printing Office, Washington, DC, July 1991.

Shuey, Robert. "Missile Proliferation: A Discussion of U.S. Objectives and Policy Options," CRS Report for Congress, February 21, 1990.

Starr, Barbara. "Ballistic Missile Proliferation: A Basis for Control," International Defense Review, March 1990, pp. 265-267.