Air Force Theater Missile Defense-Advantages and Challenges

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The Department of Defense requires a capability to both negate and deter the use of theater ballistic missiles in future conflicts. To meet this need, the United States Air Force is developing a revolutionary new weapon system call the Airborne Laser and employing one aspect of information warfare; the near real time transfer and use of theater ballistic missile launch point data. The Air Force theater missile defense program seeks to bring the battle to the enemy by engaging the launched threat as early as possible in its flight path. Additionally, it denies the enemy the use of their theater ballistic missile infrastructure through destruction and deterrence. This article outlines the threat that theater ballistic missiles pose to United States forces and those of our allies and explains the advantages and challenges of the Air Forces' emerging theater missile defense program.

The use and proliferation of theater ballistic missiles has been ever increasing since their development in the 1930's. Since the Second World War, theater ballistic missiles have been used extensively in six separate conflicts. Included in this history were the German V2 attacks against London in 1944, the Arab-Israeli war in 1973, the Iran-Iraq war between the cities from 1986-1988, the Afghan civil war from 1988-1991, the Gulf War in 1991 and the Yemen civil war in 1994. The most recent use of these weapons by China in 1996 was to coerce the Taiwanese people to forsake an independent political path in their upcoming elections. Despite the fact that the United States engaged in several international treaties and trade agreements to limit the spread of ballistic missile weapon systems, they continued to proliferate during the 1980's. By 1994, thirty-four countries had approximately 10,800 short (50 km to 500 km) and intermediate (500 km to 5500 km) range ballistic missiles. In addition, sources estimate eleven new short range and eleven new intermediate range programs are in progress.

Given that theater ballistic missiles are widely proliferating, it is important to understand why it is essential to defend against them. The most often cited rationale given for defense against theater missiles is that they are capable of employing nuclear, biological or chemical (NBC) weapons. Theater ballistic missiles have predominantly been used as psychological and terror weapons against civilian populations. Due to their inherent inaccuracy, however, many countries are increasing their lethality by developing warheads equipped with these warheads of mass destruction. In fact, eighteen countries are known to, or are assessed to have, warheads with NBC capabilities.

The second reason it is essential to defend against theater missiles is that they threaten our capability to effectively wage war. Theater ballistic missiles provide any enemy a capability to strike both deep and close targets simultaneously to achieve strategic, operational and tactical objectives. They can directly threaten our centers of gravity which include troop staging areas, airfields, ports and logistics infrastructures. This is possible through the parallel warfare operational concept the United States employed during Desert Storm. Future adversaries will also possess this capability. The coordination of information and command and control coupled

with the penetration characteristics of theater missiles allow any adversary to overcome an un-coordinated air defense system. During the next major conflict, the US could face an air superiority problem in which the enemy coordinates the use of aircraft, theater ballistic missiles and large numbers of cruise missiles. Inability to adequately defend against any of these threats will result in excessive casualties, loss of initiative, and ultimately, failure to achieve stated objectives.

The Air Force theater missile defense program is focused on boost phase intercept of launched ballistic missiles and the concurrent destruction of their launchers. Boost phase intercept is accomplished via the development of a revolutionary weapon system called the Airborne Laser. Indeed, the Airborne Laser answers the Department of Defense's need for negation and deterrence of theater ballistic missiles. The Airborne Laser is a Boeing 747 aircraft modified with a multi-mega Watt chemical oxygen-iodine laser. The weapon system includes a beam control system that corrects for atmospheric turbulence and distortion, and a fire control system that allows it to autonomously detect, track and engage theater ballistic missiles at ranges measured in the hundreds of kilometers. The advantages of the Airborne Laser are divided into those inherent in an airborne weapon system and those that stem from the effect of the weapon system.

As an airborne platform, the Airborne Laser is both rapidly deployable and operationally flexible. It is capable of deploying within hours from its home base in the United States to any conflict world wide. It arrives in theater fully mission capable to provide an immediate defensive capability for deploying United States or Allied Forces. Furthermore, as an airborne platform, it is extremely flexible and can assume any orbit location to engage the enemy wherever he chooses to employ his theater ballistic missiles.

The deterrent aspect of the Airborne Laser stems from its boost phase intercept capability. Boost phase intercept has several advantages, and as mentioned earlier, the first and foremost one is that it takes the theater missile defense battle to the enemy. Successfully engaging a theater ballistic missile in the boost phase of flight results in the missile not acquiring the velocity needed to reach the intended target. As an example, intercepting an Iraqi Al-Hussein missile at 75% of its boost phase profile results in a short fall of approximately 500 kilometers. This equates to the missile debris falling approximately 100 km from the launch site. Even intercepting the missile as late as 99% of its boost profile results in the missile debris landing approximately 100 km short of the intended target. The high probability that the warhead could land on the enemy's territory is sure to have a very strong deterrent effect on any adversary contemplating the use of warheads of mass destruction. Additionally, intercepting a theater ballistic missile in these altitude regimes negates any potential benefit the enemy could gain from a submunition, decoy or maneuvering warhead. It is also important to note that because of the Airborne Laser's range, it provides a credible deterrent even before hostilities commence as it can operate without violating the enemy's sovereign airspace.

The second advantage of boost phase intercept is its ability to defend entire regions of friendly territory. The Airborne Laser has a wide weapon element field of regard that, coupled with its weapon range, provides a defensive capability against vast areas of an enemy's territory. This provides a capability that is complementary to, but different than, the ground based theater

missile defense systems. A ground based Theater High Altitude Area Defense (THAAD) or Patriot system is able to defend against theater ballistic missiles that enter its field of regard which covers a specific area over the defended country. Because the Airborne Laser intercepts in the boost phase, it can defend against missiles launched within its weapon envelope to any area in the defended country. In effect, the Airborne Laser reduces the enemy's ability to take free shots at targets, such as population centers, that are not also defended by terminal systems.

A final advantage of boost phase intercept, unique to the Airborne Laser, is that it exploits a different lethal technology. The kill mechanism of the Airborne Laser is directed energy rather than kinetic energy. The Airborne Laser takes advantage of the fact that a theater ballistic missile is in its most vulnerable phase while it is boosting. In this phase, it has a very bright and distinguishable signature and is also under very high mechanical and aerodynamic stress. The Airborne Laser deposits sufficient energy on the side of the boosting missile to cause it to rupture from its own internal pressure. As a result, an enemy will find it much harder to implement countermeasures that will defeat a multi-tiered architecture based on different lethal mechanisms.

A common counter argument to the idea of a boost phase intercept weapon is that an enemy will simply move his theater ballistic missile inventory out of range of the boost phase intercept system. In some countries, this option may not be viable. Theater ballistic missiles, although mobile, are not free of support infrastructure for sustained operations. They require roadways of suitable grade to travel and to launch missiles. In order to sustain operations, they must be replenished with both fuel and weapons. Simply transporting their support infrastructure hundreds of kilometers away may prove a difficult task. However, given that the enemy is able to do this, the response is already militarily useful. First, by having to launch from regions deeper within his territory, an enemy will have to use longer range missiles to attack areas originally targeted by the shorter range systems. This could negate a portion or all of his short range weapon inventory. If he still has an offensive capability with his short range systems, rearward movement results in a counter sanctuary in the defended country since his missiles can no longer reach these areas. Additionally, depending on the size and topography of the enemy country, the relocation of his assets could force them into smaller areas that are conducive to more efficient counter force operations. Finally, warfare in today’s age is not static. As air superiority is achieved over the enemy's country, the Airborne Laser will take maximum advantage of its flexibility and penetrate the enemy's airspace to deny him use of any sanctuary he thought he might own.

In summary, the advantages of the Airborne Laser’s boost phase intercept capability are many and diverse. The speed, range and flexibility attributes of both the aircraft and weapon system provide defense and deterrence within a theater of operations. The boost phase intercept concept takes the battle to the enemy, establishes a defense in depth, and puts the enemy’s ballistic missile inventory at considerable risk.

The second aspect of the Air Force’s theater missile defense program is the development and dissemination, in near real time, of tactical data to prosecute time critical targets. The Iraqi Scud missile proved to be an excellent example of a time critical target. Pre-war estimates assessed that it would take approximately one half hour to move a transporter erector launcher after it launched its missile. The reality was that the Iraqi’s were able to do this in four to five minutes.

The Airborne Laser and other theater missile defense systems will have the capability to provide extremely accurate launch point information within seconds of a theater ballistic missile launch. This information will be distributed to all assets conducting offensive operations via broadcast data links such as the Joint Tactical Information Distribution System. Having this very accurate information within seconds of launch is the first step in the process of destroying, and over time, deterring the use of missile launchers. Timely launch point data is critical to commit strike forces to attack the missile launcher or to assign a sensor to monitor the launcher movement back to the larger supporting hide site so that it can be attacked later. The near real time transfer of information is the next step in our exploitation of the data sphere, however, it also challenges Air Force operational thinking.

The utility of very accurate and timely information is useless unless warfighters are free to use it. This implies that command and control authority must be decentralized to the nodes that best meet the Joint Force Air Component Commander's (JFACC) operational needs. As a result of the extremely short exposure time of missile launchers, the near real time targeting concept relies on the JFACC to delegate his engagement authority to lower levels.

Granting this type of decision making authority to lower level command and control nodes is challenging because it is something that Air Force doctrine has not adequately addressed. Joint Pub 3-56.1 *Command and Control for Joint Air Operations* does specifically authorize ground or airborne command and control platform mission commanders to redirect sorties as necessary. However, it does not explain or convey how this is to be done on a large scale or within the context of an integrated and coordinated air campaign. The increased availability of near real time information will dramatically increase the number of times mission commanders will be capable of redirecting sorties. The potential arises for lower level controlling agencies to digress from the overall campaign guidance that the Joint Force Commander (JFC) and JFACC have laid out by diverting too many flights to engage fleeting time critical targets.

The best way for the JFACC to overcome this challenge and retain centralized control of his air campaign is to clearly describe his objectives and intent. The idea of "Auftragstaktik" or commander's intent developed by the German General Staff in the late 1800's, should take on renewed emphasis in air operations. The idea of commander's intent is well known in US Army operations and is used to convey the end state objectives of the commander to subordinate units so that they can continue the mission in spite of unforeseen obstacles or the "fog of war" that surround military operations. The JFACC will have to clearly delineate his objectives for each phase of the air campaign in such a way that controlling agencies understand his intent and recognize when it is feasible and advantageous to divert resources to engage time critical targets. Ground or airborne mission commanders must have the commander's intent clearly in mind when considering the diversion of resources. They must be intimately familiar with the overall campaign concept developed within the Air Operations Center. Favorable answers to the following questions will guide the mission commander's decisions. How important are the original targets? Will redirecting assets conflict with the JFC/JFACC concept of operations? Which assets are available and in the vicinity with compatible ordnance for re-tasking? Is there a reasonable chance of success given the time difference from target acquisition to assets overhead the target? Clearly defined commander's intent will aid mission commanders in answering the

first two questions. Computer based decision aids are being developed to help answer the last two. Indeed, commanders intent is essential in order to maintain a coherent air campaign.

The joint service senior leadership recognize this potential conflict in their *Joint Vision 2010* document. "These capabilities [improved systems integration] could empower a degree of independent maneuver, planning and coordination at lower echelons which were normally exercised by more senior commanders in the past" The document goes on to say that "the optimal balance between centralized and decentralized command and control will have to be carefully developed as systems are brought into the inventories." The operational use of near real time accurate information is an excellent example of the capabilities *Joint Vision 2010* refers to. The technology required to collect and distribute the information is at hand. The operational concept of how to use it requires thought and doctrinal discussion. The underpinning of that doctrine, however, should include the commanders intent.

The Air Force theater missile defense program is focused on taking the battle to the enemy. Both aspects of the program, boost phase intercept and near real time information, provide not only a defensive, but a deterrent capability. Interestingly, the operational employment of the Airborne Laser is based on sound doctrine. Its challenge is to integrate all of the technologies required to make the system perform as an operational weapon. However, that is a challenge that our military defense industry has characteristically overcome. In contrast, the near real time use of accurate information is already technically achievable and has been demonstrated in the Joint Tactical Information Distribution System. Its challenge is how to effectively use that information while conducting an organized and coherent campaign. Again, the challenge is not insurmountable as the basis of commanders intent is available to further refine the operational concept.
