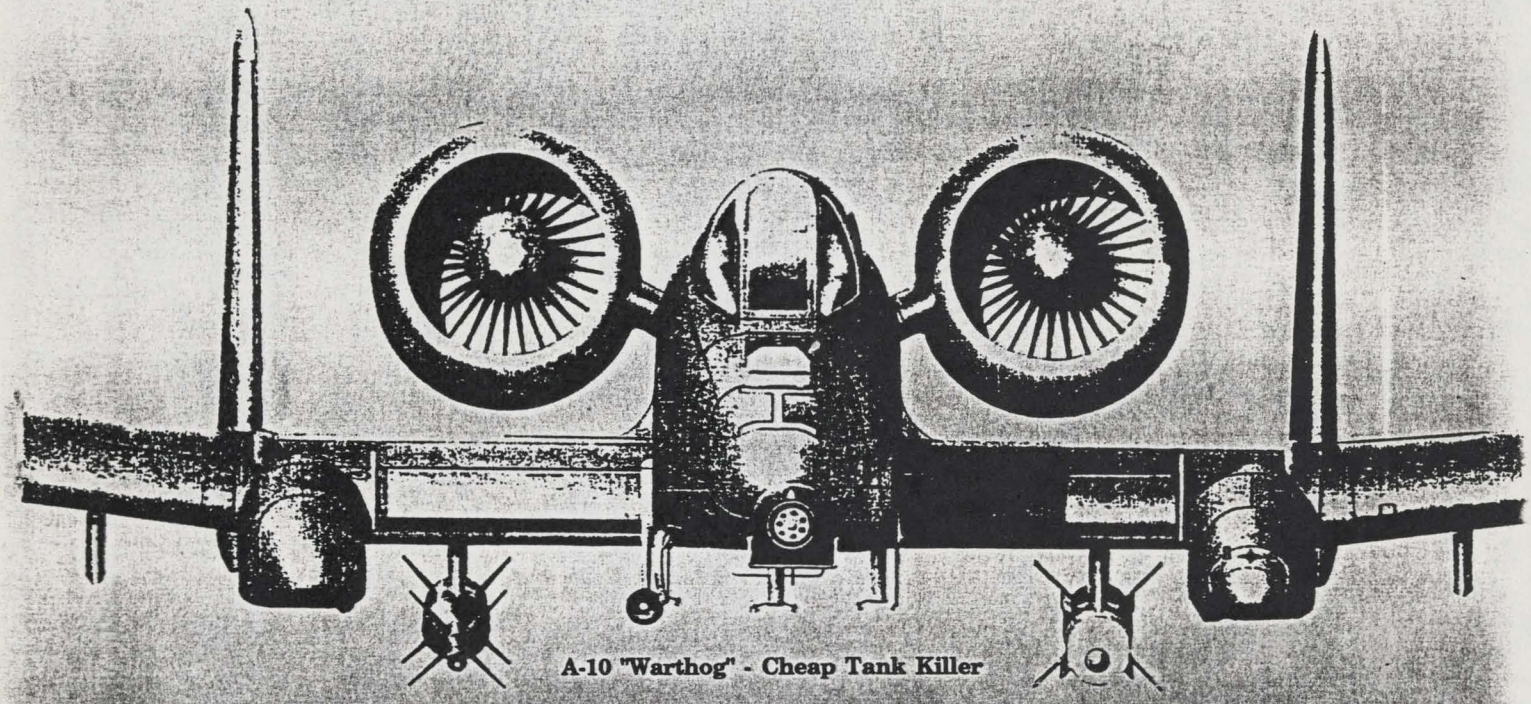
High Tech Weapons in Desert Storm:

Hype or Reality?



A-10 "Warthog" - Cheap Tank Killer

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Lessons Relearned

"A great deal of the capability of an army is its dedication to its cause and its will to fight. You can have the best equipment in the world, you can have the largest numbers in the world, but if you're not dedicated to your cause, if you don't have a will to fight, then you're not going to have a very good army..."

"And so I attribute a great deal of the failure of the Iraqi army to fight to their own leadership. They committed them to a cause that they did not believe in. They were all saying that they didn't want to be there, they didn't want to fight their fellow Arab, they were lied to, they were deceived, and when they went into Kuwait they didn't believe in the cause...they kept them there only at the point of a gun."

General Schwarzkopf
CENTCOM Briefing, 2/27/91

It has been almost one year since the Iraqi army invaded Kuwait and prompted Operations Desert Shield and Desert Storm. The war and its aftermath have led to Americans' pervasive belief that success was mainly attributable to U.S. high-tech weapons. And indeed, for the most part, U.S. weapons appear to have performed well in the Gulf -- against an Iraqi army that has been judged since the war to have been a paper tiger all along. How could the Iraqis have been so weak when they had so many tanks, planes and artillery? General Schwarzkopf said, "You can have the best equipment in the world...but if you don't have a will to fight, then you're not going to have a very good army." In the flush of victory, General Schwarzkopf attributed that lack of resolve in the Iraqi army to Saddam Hussein's unpopular political decision to invade Kuwait. Iraqi soldiers did not want to be there occupying a fellow Arab nation and facing world approbation. They were draftees kept there at the point of a gun by Hussein.

The seemingly pedantic point that the Iraqis did not believe in their cause is actually devastatingly important, as Americans will remember from experience in Vietnam. Those who say that the cause of the Iraqi mass surrenders was allied bombing are, at best, only half right. History demonstrates fairly clearly that bombing a determined, aggressive enemy does not reduce their determination to persevere and fight back. For example, neither the British nor the Germans in WWII capitulated or broke ranks under heavy bombing. Neither did the North Vietnamese give up under repeated pounding by American B-52s. Japanese soldiers throughout the Pacific withstood horrific bombardment prior to island invasions, and still inflicted heavy casualties on Americans as they hit the beaches. Bombing and fighting an enemy which believes that the fight is not worth fighting, however, tends to increase their level of despair and futility -- why fight and die for something that is wrong?

The point is simply that in the age of fast paced, computer "nintendo" wars, humans are still the warriors. Technology remains a tool of secondary importance -- although still an important tool. But the Iraqis, with a few exceptions, failed to fight aggressively with their Soviet-made weapons. They did not use their tools to the full extent they might have. That left a lot of room for American weapons and highly motivated warriors to take full advantage. The high-tech weapons with which American soldiers fought have emerged from the war looking far better than going in. The question remains however, as to how much of that enhanced appearance flows from American victory or Iraqi capitulation.

Today we face an even more pressing question: How much additional spending on high-tech weapons does the victory in Desert Storm justify? **At least 144 billion dollars** of new and expensive "next generation" high-tech weapons programs have been awarded since the Gulf War

began, and others are being planned.[1] Many of these staggeringly expensive systems are designed to replace weapons *that worked well in Desert Storm.* Before American taxpayers buy these new weapons and others, they should consider the following facts, many of which are previously unreported:

- The cheapest combat aircraft in the U.S. Air Force, the A-10, was responsible for over half of all Iraqi equipment losses, destroyed more tanks than any other aircraft (1,000), achieved the highest sortie rate, and the highest readiness rate of any U.S. Air Force combat aircraft in Desert Storm. At only $12 million each, this lone example of a cheaphawk "reform" weapon in Desert Storm succeeded with flying colors.

- To have enough spare parts to keep the 274 Apache attack helicopters in the Gulf ready for battle 90 percent of the time, the Army essentially grounded the remaining 300 Apaches worldwide. Even so, the Apaches in the Persian Gulf flew only an average of a half an hour per day -- approximately the same as they fly in peacetime -- and one fifth as much as the Army originally planned for them to fly in combat. Such low levels of activity inflate the readiness figures to make the Apache appear to be more reliable than it actually was.

- The $3 million M-1 tank's unreliability and thirst for fuel had a direct negative impact on their combat effectiveness. A 1st Armored Division report states, "Armored force operations in DESERT STORM confirmed our worst fears that the existing fuel-haul capacity of today's M1A1-equipped heavy division is wholly inadequate. ...The lack of a mobile bulk fuel transport capability cost the division at least 12-18 precious hours that may have subsequently allowed key Iraqi armored units to escape certain destruction."

- Marines' decades-old M60A1s, while inferior in many ways to the M1, cost only $1.2 million each, and handily destroyed Iraqi T-72s *and suffered no losses to other tanks or missiles.* Marine M60A1 units also stopped only once per day to refuel, and made daily maintenance checks with engines running. In contrast, Army M1 units planned one hour fueling and maintenance halts **once every three to five hours.**

- The high-tech Stealth Fighter, F-117A, was never touched by Iraqi air defenses, a fact used to support the validity of the high-cost Stealth concept. However, three other allied jets were also untouched throughout the war. These jets, the U.S. Air Force F-111 and the British Buccaneer and Jaguar, are all decades-old designs with no stealth features, and also delivered laser guided bombs. The F-111 flew several missions which were similar to those flown by the Stealth Fighter.

- It is reported that the F-117As' stealth radar defenses were pierced from up to 40 miles away by British radar on board three destroyers deployed to the Gulf.

- Allied fighters costing less than $50 million each had no trouble destroying Iraqi MIG-29's, the most capable fighters produced by the Soviet Union. The existence of aircraft like the MIG-29 is one of the principle justifications for the Air Force's Advanced Tactical Fighter, an aircraft likely to cost three times as much as current fighters at over $145 million per copy.

- Since the war, new information about the Patriot missile's performance has led to a much lower assessment of its effectiveness. Israelis and American scientists point out that **damage to buildings tripled and casualties increased by 50 percent *after Patriot was deployed to Israel.*** Early Army claims that 96 percent of Scud engagements were successful have recently been downgraded. DoD's recent Conduct of the Persian Gulf Conflict states that "the majority" of engagements were successful. In one unsuccessful engagement, twenty-eight people were killed and 100 wounded because a Patriot computer failed.

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[1] Comanche light attack helicopter, est. cost $34 billion. Advanced Tactical Fighter, est. cost $110 billion. Other expensive weapons planned include the A-X, Block III tank, and GPALS.

This paper is not intended to criticize high-tech weapons performance, but rather to add perspective to blanket statements that such weapons have been the essence of our success in Desert Storm. Indeed, the reader is encouraged to remember that something can be high-tech, without being highly complex, and that technology can be used to simplify weapons, and thereby make them cheaper and more effective.

This paper, moreover, is definitely not a criticism of our military personnel, who conducted themselves brilliantly in the Gulf.

With accuracy in mind, detailed source citations have been included in this paper. **All information not cited in the above pages will be cited in the body of this report.** We are happy to provide copies of any of these materials upon request. We encourage you to call the Project on Government Procurement, and to ask any questions you may have about our work.

A-10: Low-Tech Hero

"I always got dogged-out by other people. They would say the A-10 is not even a jet ... it's just an ugly bird. Now everyone's opinion has changed."
Airman Earnshaw, USAF[2]

"We know the Iraqis were afraid of us, because POW's said when they saw our distinctive profile they knew we were going to put a hurt on them."
Captain Erick Salomonson, A-10 Pilot, USAF[3]

As the cheapest U.S. Air Force combat aircraft used in Desert Storm, the A-10 Thunderbolt II stands out as a rare example what can be accomplished by simple, inexpensive, reliable weapons. Promoted by military reformers, and derided by many Air Force officials as slow and unmaneuverable, the $12 million[4] A-10 not only proved its value in Desert Storm, but it far outperformed more expensive aircraft. The list of superlatives is astounding, especially given the small number (144) of A-10's deployed:

- Responsible for the ***majority*** of all Iraqi military equipment destroyed[5]
- Destroyed more tanks than any other aircraft (1,000 vs. 500 for the $14 million Apache helicopter)[6]
- Highest sortie rate of any Air Force aircraft (The A-10 flew 6 times more hours per aircraft than the Apache.)[7]
- Most damage sustained by any surviving U.S. aircraft[8]
- Highest readiness rate of any U.S. Air Force aircraft (95.7%)[9]

Interviews with Iraqi POWs indicate that when it came to instilling fear, the $100 million F-117, the $50 million F-15, and the $14 million Apache all fell short of the $12 million A-10.[10]

The A-10 Thunderbolt II, more commonly known as the Warthog, is the only aircraft in the history of the U.S. Air Force designed from the ground up for close air support. As such, it was built with unparalleled emphasis on simplicity, survivability and economy. In addition to its rapid-fire internal antitank gun, the A-10 can carry up to eight tons of weapons, including laser guided bombs and Maverick antitank missiles. This heavy weapons carriage, as well as its fuel-efficient engines, allow the A-10 to fight for nearly two hours at battlefields 288 miles from its home base. The Apache, by contrast, must retire after less than an hour of combat.[11] The A-10

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[2] Molly Moore, "Warthogs Pursue an Elusive Prey", The Washington Post, 2/12/91, p. A1.

[3] Galen Geer, "Warthog Warriors Feat on Iraqi Armor", Soldier of Fortune, 8/91, p.61

[4] DoD Comptroller's Office, Procurement Programs (P-1) FY1983 (deflated to 1990 dollars using DoD major commodity deflator).

[5] Air Force White Paper, Air Force Performance in Desert Storm, April 1991

[6] A-10 tank kills - Associated Press, "High-tech Weaponry Receives Mixed Reviews", Baltimore Sun, 4/23/91. Apache tank kills - John Fialka, "'Actual' Performance of Apache Copters In Gulf Raises Questions on Arms Buying", The Wall Street Journal, 4/19/91, Apache price - GAO/NSIAD-90-294, Apache Helicopter, 9/90, p. 11.

[7] U.S. Army Aviation Systems Command, "Flying Hour Execution – SWA", 3/29/91. U.S. Air Force Briefing, "Logistics Indicators – Fighters", 2/22/91. Air Force White Paper, Air Force Performance in Desert Storm, 4/91.

[8] Molly Moore, Op. Cit.

[9] Air Force White Paper, Op. Cit.

[10] Associated Press, Op. Cit.

[11] Apache and A-10 statistics by Ray Bonds, Modern Weapons, Crescent Books, NY, 1985

is a slow and ugly fighter, but it proved its worth in Desert Storm.

For its primary role of killing tanks, the A-10 is equipped with the Avenger GAU-8 30mm cannon, and the long-range Maverick missile. While the Maverick offers the safety of long range, the Avenger carries enough ammunition for many attacks (33 bursts of 35 rounds each). Indeed, **the A-10 is credited with *more than half of all Iraqi equipment losses.***[12] In one mission, two A-10s reportedly destroyed 23 tanks, and damaged an additional ten.[13] By comparison, in the mission most often quoted by the Army as a demonstration of Apache lethality, it took an Apache battalion of 15 to 18 helicopters to destroy 50 Iraqi tanks.[14]

The A-10's gun also allows the pilot to get close enough for positive identification of his target. For the Maverick's guidance system to work, it must be fired from at least a kilometer away. By contrast, the gun allows the pilot to get as close as he wants, so that he can get a good look at his target. In addition, the A-10's armor allows it to survive such close passes. Sixteen allied troops were killed, and eleven wounded when Mavericks were fired at misidentified friendly targets. In contrast, the A-10's gun accounted for only two friendly fire deaths.[15]

The A-10's unique endurance, survivability and lethality made it one of the most useful aircraft in Desert Storm. In addition to killing more tanks than any other aircraft, the A-10 was used successfully against Scuds, air defenses and early warning radars.[16] In one night, A-10s destroyed six permanent Scud sites, three temporary sites and three mobile launchers.[17] During these operations, A-10s survived withering ground fire. In one case, an A-10 survived Iraqi fire that ripped a six foot hole in its wing. Senior Airman Jennifer Earnshaw, who worked on the plane, said, "Any other aircraft would not have made it back."[18] Despite taking heavy damage, A-10s maintained the highest readiness rate of any Air Force tactical aircraft in Desert Storm - 95.7%.[19]

It should be noted that the A-10 plays the modern equivalent of a role which military historians considered critical to our success over the Germans in World War II. In addition to *constantly* bombing key German rail installations and roads, the allies used *constant* attacks by fighters to destroy trucks and trains still in operation.[20] By purchasing small numbers of expensive aircraft, such as the $100 million F-117 and $50 million F-15, rather than cheaper aircraft like the A-10, the military has made it more difficult to perform this mission. This was particularly evident in Scud hunting throughout the course of the war. On two occasions, when Pentagon Briefer General Tom Kelly was asked why we couldn't keep key Iraqi military facilities out of action, he responded that there just weren't "enough airplanes in the world" to cover them.[21] Larger numbers of cheap, effective aircraft, like the A-10, could have made this mission easier.

The A-10 is an impressive example of what can be accomplished with cheap, simple, effective weaponry. Its accomplishments in Desert Storm are untarnished by the high cost and unreliability that mar the war record of many other U.S. weapons systems.

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[12] Secretary of the Air Force, Office of Public Affairs, Air Power in Operation Desert Storm, 5/91.

[13] Galen Geer, Op. Cit.

[14] U.S. Army Community Relations Office pamphlet, "Army Weapon Systems Overall Performance"

[15] Centcom Public Affairs pamphlet

[16] Air Force White Paper, Op. Cit.

[17] Molly Moore & Guy Gagliotta, "Allied Air Forces to Step Up Attacks On Iraq's Ground Troops, Artillery", The Washington Post, 2/8/91, p.A-27

[18] Molly Moore, "'Warthogs' Pursue an Elusive Prey", The Washington Post, 2/12/91, p.A-1

[19] Air Force White Paper, Op. Cit., and Air Force "Logistics Indicators – Fighters", Op. Cit.

[20] United States Strategic Bombing Survey, Vol. 64 'The Impact of the Allied Air Effect on German Logistics", reprinted in W. Victor Madej, German War Economy: The Motorization Myth, Game Publishing, Allentown, PA, 1984, p.161

[21] Federal News Service, "Defense Department Regular Briefing" for 1/28/91 and 2/13/91.

Apache

"They got the best helicopter the Army has, but they aren't doing diddley."
1st Division soldier in Saudi Arabia[22]

The Army continues to assure the taxpayers that the Apache contributed to the Desert Storm victory by destroying approximately 500 Iraqi tanks[23] and being available over 90 percent of the time. However, the story behind those numbers is very important in terms of understanding the failures of this piece of high-tech weaponry. The Apache demanded such a high level of logistical support that the Army engaged in several "management initiatives" to keep the helicopters flying and repaired in the Gulf. While extraordinary actions were entirely appropriate in order to fight and win the war, they impacted very negatively on Apaches worldwide.

- **Over 300 Apaches worldwide were essentially grounded in order to provide spare parts for the 274 Apaches in the Gulf.** Apaches outside of the Gulf flew an average of four minutes per day, only 10 percent of normal operations, in order to save spare parts.[24] In essence, this means the taxpayer bought over 600 expensive attack helicopters in order for the Army to be able to field 274 of them. Instead of fixing the $11 billion Apache program's logistical shortcomings, the Army is pressing ahead with a new, $34 billion light attack helicopter program.[25]

- **Despite receiving massive logistical support, Apaches in the Gulf only flew at or below peacetime rates, *even during the ground war reporting period*.**[26] The peacetime rate is about 1/2 hour of flying per day, averaged over a month. This means that throughout the war Apaches flew only one fifth of the hours the Army stated it would require for combat.[27] However, statistics detailing hours flown by Apaches in the shorter four day period of the ground war are not yet available.[28] It is possible that combat objectives for the Apache were achieved during the 100 hour ground war. But even if so, it remains extremely unclear how a longer conflict would have strained Apache supply and readiness.

- **Flying the Apache less keeps its readiness higher, which is significant since the Army has used the readiness statistic to justify the Apache performance.** Furthermore, Apache maintenance support -- and therefore readiness -- was augmented by over 300 civilian contractor personnel who fixed Apaches close to the fighting.[29]

What can be said of the Apache combat potential as realized in Desert Storm? The 274 Apaches in the Gulf were credited with around 500 tank kills, an average of about two per helicopter. By way of contrast, 144 A-10 attack planes were credited with about 1000 tank kills -- almost 7 each. One reason for the disparity is that rugged, reliable A-10s were flying during the air campaign while the high-tech Apaches were husbanding spare parts for the ground war.

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[22] Charles R. Babcock, "Temperamental Helicopter Joins Battle," Washington Post, 2/20/91, p. A7.

[23] John Fialka, "'Actual' Performance of Apache Copters in Gulf Raises Questions on Arms Buying", The Wall Street Journal, 4/19/91, p. B-5A.

[24] Mark Thompson, "GAO Says Parts Crisis Grounded Most of Apache Fleet", Philadelphia Inquirer, 4/26/91, p. 23.

[25] Price of the new attack helicopter: Nelms W. Douglas, "Mission: Seek Out and Destroy", Army, June, 1991, p. 36. The Apache's cost is derived from GAO/NSIAD-90-294, Op. Cit.

[26] Army document, "Flying Hour Execution -- SWA", prepared 29 March 1991

[27] GAO/NSIAD-90-294, Op. Cit.

[28] Telephone conversation 7/25/91 between Greg Williams, Research Associate, Project on Govt. Procurement and Maj. Rhynedance, Army Media Relations [(703) 697-7589] confirmed that daily use figures were not yet available.

[29] James W. Crawley, "Civilian Technicians Kept U.S. Arsenal Fine-Tuned", The San Diego Tribune, 3/6/91, p. 1.

M1 Abrams Tank

Desert Storm has done nothing to change our analysis that the M1 is a very lethal, well-protected tank, that requires relentless maintenance, uses more fuel, and costs more money than any other tank in the world. M1 unit prices have increased dramatically in recent years, rising to $4.4 million from $3 million each two years ago. The Army's own detailed accounts speak highly of the M1's successes, but they also speak of its failings.[30] And while the Marines are eager to purchase new $4.4 million M1s[31], they were also quite pleased with the performance of their $1.2 million M60A1s.[32] This is not to suggest that the M60A1 is a match for the M1 or M1A1, but that it was good enough to defeat the fourth largest army in the world. There are several other main battle tanks available that can match the performance of the M1, at a much lower cost.

The Army's reports state that the M1 can detect and destroy enemy tanks at ranges of nearly two miles. These same reports say that the M1 must be shut down for repairs *every three to five hours*, and could not travel more than twenty miles before requiring emergency maintenance. At least one M1 tank crew was stranded in the desert for three days without resupply after their tank broke down during a night battle.[33] And the Army reported that on at least one occasion, enemy units got away as M1 units lost 12-18 hours of valuable time due to fuel shortages.[34]

M1 Successes in Desert Storm

DoD has repeatedly stated its satisfaction with the M1A1's main gun and targeting system. The M1's destruction of Russian-built T-72s in Desert Storm validates this:

> **"The performance of tank crews employing long-range gunnery techniques using the M829A1 ammunition was effective at ranges beyond 3,000 meters. Thermal sights permitted target acquisition at 4,000 meters, far beyond day sight ranges. Sabot rounds fired at these ranges destroyed catastrophically T-72M1 tanks."**
>
> Major General Ronald H. Griffith
> Commander, 1st Armored Division[35]

This performance is impressive, but one does not have to buy a $3 million M1 to achieve it. The German Rheinmetal 120mm gun (carried by the M1A1, and built under license in the U.S.) is carried by the best German and Israeli tanks, and proved its worth in Desert Storm, as the above quote illustrates. The German Leopard II costs roughly $2.5 million each, and the Israeli Merkava Mk.3 costs roughly $2.4 million each.[36] The British L7 105mm gun (carried by the older M1 and IPM1 and built under license in the U.S.) is carried by our older tanks, and has proven effective against Russian-built T-72s when used by the Israeli Merkava tanks, and U.S. Marine M60A1s during Desert Storm. The M1's targeting system (built in Canada) is similar to those carried by many of these other less expensive, state-of-the-art tanks. So the M1 is unique only in the price it charges for lethal long range gunnery.

In addition, there is some indication that the M1's crew protection features worked well. In four

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[30] Maj. Charles A. Jones, Armored Systems Modernization Materiel Fielding Team, Saudi Arabia. Memorandum for Record, a Collection on Armored Systems Modernization, Current Systems, Performance in Operation Desert Storm, 4/8/91

[31] Department of Defense, Office of the Comptroller, Procurement Programs (P-1), February 4, 1991

[32] Department of the Army, Annual Budget Estimates FY 1977, 1/19/76, p.3-25

[33] Peter E. Curry, Cpt, AV Commanding, P Troop, 4/2 ACR Desert Storm Combat Narrative, 3/21/91

[34] Memorandum for Commander, USA Armor Center and Fort Knox from Ronald H. Griffith, Major General, USA, Commander 1st Armored Division, 19 March 1991

[35] Ibid.

[36] For tank prices see Greg Williams, The Army's M1 Tank: Has it Lived Up to Expectations?, 6/12/90, available through the Project. These prices have been inflated to 1990 dollars, using the DoD Major Commodity Deflator.

days of combat, only four M1s were lost (plus four more damaged), and only two crewmen were killed in action.[37] However, it is also true that the Marines reported that none of their M60A1s were lost to enemy tanks or missiles.[38] Again, it is obvious that the M1 carries thicker armor than the M60, but the M60, at one third the cost, proved more than adequate.

Troublesome Turbine

While Army after action reports speak favorably of the power offered by the M1's turbine engine, they also complain of its weaknesses. These high-level Army reports speak extensively of fuel and reliability problems with the M1 tank. Indeed, due to these problems, M1 units had to stop for an hour, every three to five hours, to refuel and maintain their tanks.[39] These deficiencies had a direct impact on the combat effectiveness of the M1:

> **"Armored force operations in Desert Storm confirmed our worst fears that the existing fuel-haul capacity [of] today's M1A1-equipped heavy division is wholly inadequate. During a critical phase of the fight our tank-heavy units began to run critically low on fuel. The lack of a mobile bulk fuel transport capability cost the division at least 12-18 precious hours that may have subsequently allowed key Iraqi armored units to escape certain destruction."**
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> Major General Ronald H. Griffith
> Commander, 1st Armored Division (Op. Cit.)

The Army is fond of characterizing fuel problems in M1 units as the fault of the refueling trucks, rather than the M1 itself. At the very least this seems implausible given that unlimited free fuel was available from Saudi Arabia, and refueling operations went on unhindered by enemy air or ground counter-attack. In addition, other, cheaper, modern tanks, such as the German Leopard II and the Israeli Merkava Mk.3, use half as much fuel as the M1A1.[40] Marine units typically refuel their M60A1s only once per day, and are capable of going two or three days without refueling.[41]

The M1's turbine engine, which often caused the M1 to fail its reliability goals in peacetime[42], was also a maintenance liability in Desert Storm:

> **"Crews cleaned the V packs (turbine air filters) at all maintenance halts that would last 1 hour or more and 1 hour halts were planned every 3-5 hours. Commanders in the 1 CD commented that 30 kilometers [19 miles] were standard distance traveled before engine performance began to be degraded due to dirty V packs."**
>
> Major Charles A. Jones, Armored Systems Modernization Materiel Fielding Team (Op. Cit.)

The M1 tank's thirsty turbine engine requires much more filtered air than a diesel engine, and is fed by three large filters (V packs). If these filters become clogged, the engine quickly loses power, and begins to suffer serious damage if not shut down promptly.[43] Changing the V packs is an emergency procedure, not normally performed by the crew, which requires shutting off the engine, and locking the turret in place.[44] Diesel engines do not normally require such extensive maintenance. Marine M60A1 units reportedly did not change their air filters during Desert

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[37] "Modernization Program Systems Prove Themselves in the Desert", Army Magazine, May 1991, p.14

[38] Telephone conversation with Marine public affairs, 7-26-91

[39] Ibid.

[40] Figures for fuel capacities and ranges are from Christopher F. Foss, Jane's Armour and Artillery, 1990-91, Jane's Information Group, Surrey, U.K.

[41] U.S.M.C. Captain Hinman, Op. Cit.

[42] Greg Williams, The Army's M-1 Tank: Has it Lived Up to Expectations?, Project on Government Procurement, 6/21/90.

[43] Operator's Manual, Tank, Combat, Full-Tracked, 120mm Gun, M1A1, p.3-120

[44] Ibid., p.2-434

Storm, and could accomplish their daily maintenance procedures with their tanks running.[45] And while the M60A1's engine is not as powerful as the M1's turbine, diesel engines of equal power (1,500 hp) have long been available in less expensive tanks. One is installed in the German Leopard II, which boasts performance as good as M1A1's.[46]

[45] U.S.M.C. Captain Hinman, Op. Cit.

[46] Telephone conversation with Lt. Col. Melcher, German Procurement Liaison Office, 703-715-8158, 7-25-91.

The F-117A Stealth Fighter

"I think the F-117, the stealth characteristics, proved themselves out, and therefore it gives us great confidence to go ahead with the Advanced Tactical Fighter, the ATF, and to continue to go ahead with the B-2, and to look at a replacement for the A-12 program."

Donald J. Atwood, Deputy Secretary of Defense, before the Senate Appropriations Committee, 4/4/91

Very little hard information has surfaced out of the Gulf to provide detail of the much reported strengths of the F-117A aircraft. However, it appears that the Stealth Fighter had only four days to prove its radar evading qualities against a strong, coordinated Iraqi air defense system -- and air losses for all types of aircraft were much lower than estimated throughout the war.[47] Nonetheless, the Department of Defense is touting the F-117A's Gulf war performance in efforts to secure over $200 billion in funding for three new and very different types of stealth aircraft -- the B-2 bomber, the F-22 ATF and a Navy attack plane. These planes will replace many of the older and cheaper aircraft which destroyed Iraq. So even if the accolades given the F-117A are justified, does that success validate the purchase of over $200 billion of new generation stealth airplanes?

The Air Force claims that the Baghdad area, where only F-117As flew, was more heavily defended than any site in Eastern Europe during the height of the Cold War.[48] However, the Iraqi air defense system was so effectively suppressed, according to an official Air Force White Paper, that after the fourth day of the war, "**all allied aircraft operated with impunity** in the mid to high altitude environment across the area of responsibility (all of Iraq).[emphasis added]"[49] If **all aircraft** operated from this area with impunity, as the Air Force claims, there was apparently little need for stealth after the fourth day of the war. Indeed, it is worth noting that the Air Force's F-111, an older, less expensive airplane with a similar mission and no stealth characteristics, also completely escaped harm in war while precision-bombing command and control, nuclear, biological, and radar system sites -- all of which were probably heavily defended.[50] F-111s also spent much of their time attacking Iraqi armor, achieving 1,500 kills.[51]

The Odds of Surviving Desert Storm in an Airplane

One way to look at the effectiveness of the F-117A versus non-stealthy aircraft is to examine the survival figures. While the F-117 arguably flew some of the most dangerous missions, it flew very few of them, perhaps avoiding harm merely by not tempting the odds. During the course of the war, which consisted of over 100,000 aircraft sorties, a total of 41 airplanes of all kinds were lost in combat.[52] Of that total, almost half (18) of the airplanes were lost in the first week, when Iraqi air defenses were at their strongest. Thus, the Iraqi air defenses at peak effectiveness claimed one aircraft for every 555 flights.[53] The F-117As in the Gulf flew an average of 217

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[47] Department of the Air Force White Paper, Air Force Performance in Desert Storm, April 17, 1991

[48] Ibid.

[49] Ibid., p. 5. Telephone conversation 7/25/91 between Kevin Page, Project on Govt. Procurement and Captain Sillia at the Air Force press desk (703-695-0640) confirmed that the area of responsibility (AOR) included all of Iraq, including Baghdad.

[50] "Desert Storm Aircraft Losses", U.S. Air Force Public Affairs fact sheet, 2/27/91.

[51] Air Force White Paper, Op. Cit.

[52] Ibid.

[53] 10,000 sorties were flown in the first week of combat. 18 Allied aircraft were lost in combat during that time. See comments of Colin Powell, Chairman JCS, and Richard Cheney, Secretary of Defense, 1/23/91 DoD Special Briefing, Federal News Service.

sorties per week.[54] Even considering the possibility that the F-117 flew a disproportionately high number of missions in the first week, it is highly unlikely to have flown anywhere near the 555 times that would, on average, put the plane in statistical danger of being shot down. The Stealth Fighter may have escaped the odds simply by not throwing the dice enough times to crap out.

The F-117A Stealth Fighter's unblemished record of survival was matched by three other types of allied aircraft deployed in Desert Storm – the un-stealthy U.S. F-111, and the British Jaguar and Buccaneer. All of these aircraft were used extensively in Desert Storm -- the F-111 flew three times as often as the F-117. In fact, the $40 million F-111 flew many missions similar to those flown by the $100 million F-117, and delivered laser-guided bombs against hardened, high-value targets.[55] It was laser-guided bombs dropped from un-stealthy F-111s that destroyed the manifolds Hussein was using to pump oil into the Gulf.[56] While it seems probable that the F-117's stealth characteristics confer some advantage, it is unclear, so far, what the F-117 did, that the F-111 cannot do, at a lower price.

Of course, due to a lack of information, this analysis avoids the complicated and important issues of evaluating each mission's level of danger. It has been suggested that the F-117A, the only aircraft to attack heavily defended downtown Baghdad, is the best plane to accomplish this type of mission. But there has been no suggestion that F-15s, F-111s and other planes could not do it -- only that they would require many additional aircraft to help suppress radar, provide air cover and refueling, etc. The obvious advantage of using our existing arsenal is that it is bought and paid for, and was proved successful in the Gulf war. The new generation stealth aircraft the Pentagon requires to do this mission, in contrast, is going to cost well over $200 billion to procure.

F-117A and "Stealth"

To the degree that the F-117A's stealth technology permitted the selective targeting of key, heavily-defended command, control and communications centers in the first four days of the war, the stealth concept makes sense. Indeed, the F-117A was designed to be built in small numbers (at a high unit cost but relatively low overall cost) to do exactly what it did in Iraq; open the way for other aircraft better suited to perform the many missions required. The F-117As cost over $100 million each, designed for the limited but very important task of striking first to blind an enemy.

But the Air Force would like to (and is) making this special, very expensive capability a "standard option" on all aircraft. Two programs, the Stealth Bomber (B-2) and new Stealth Fighter (F-22) are expected to cost nearly $200 billion by themselves. Based on the overwhelming success of non-stealth aircraft in the Desert Storm air war, it is hard to see the need for an entire fleet of specialized stealth aircraft. And even the F-117A's successes do not prove the value of other current stealth programs since it has little in common with the F-22 Advanced Tactical Fighter (cost estimated at $146 million each), and even less in common with the B-2 Bomber (current cost: roughly $650 million each[57]).

The success of the F-117A Stealth Fighter has also done little, so far, to settle arguments over what types of radar can detect stealth aircraft. It is reported, for example, that the F-117As' stealth defenses were pierced from up to 40 miles away by British radar on board three

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[54] The Air Force White Paper, (Op. Cit.) says 1,300 sorties were flown by the F-117A over 42 days (six weeks) of the war. 1,300 sorties/ 6 weeks = 217 sorties/week.

[55] F-111 price - Jay Miller, General Dynamics F-111, Aero Publishers, Fallbrook, CA, 1981, p.32 (inflated to 1990 dollars using DoD Major Commodity Deflator). F-117 price - Melissa Healy, "57 Stealth Jet Fighters Built, Pentagon Says", Los Angeles Times, 4/4/90, p.1. Aircraft missions - Air Force White Paper, Op. Cit.

[56] Air Force White Paper, Op. Cit.

[57] Defense Department Comptroller, Procurement Programs (P-1), For Fiscal Years 1992 and 1993, 2/4/91, p.F-2

destroyers deployed to the Gulf.[58] Those British destroyers employ a modern D-Band wave radar -- one type of radar the F-117A was designed to avoid.

On the other end of the radar spectrum, many opponents of the B-2 program have argued that stealth aircraft can easily be detected, although not pin-pointed, by older, long-wave radars. The Air Force acknowledges this weakness, but argues such long-wave radars do not precisely locate the aircraft -- therefore such detection is useless for the purpose of tracking and shooting-down stealth aircraft.[59] They argue that to guide a missile to an enemy bomber, the position must be known to within a few feet, rather than a few miles. Stealth critics suggest that missiles are not the only way to destroy stealth aircraft -- intercepter planes, guided to within a few miles of a stealth aircraft by long wave radar, could use guns or infrared missiles to shoot down slow, unmaneuverable stealth aircraft like the B-2. The technical arguments over stealth detection have not all been resolved. For instance, the B-2 bomber has completed only 1 percent of its stealth testing.[60]

Iraq apparently had some long-wave radars but they were very likely suppressed by allied measures to keep radar turned off. Ninety-five percent of Iraq's radar was destroyed or suppressed within the first week of combat.[61] So the F-117A almost certainly benefited from radar suppression, not just its stealth capabilities. But even if the Iraqis did detect the F-117A, their intercept aircraft almost never left the ground except to head for Iran, again failing to test the ability of the F-117A to avoid interceptors. The war in Iraq did not aggressively test the F-117A's ability to evade enemy interceptor aircraft since the Iraqi air force engaged in almost no active defense.

Some interceptor aircraft do not need to spot a target on radar to destroy it. The latest Soviet fighters, as well as a few of our own, carry long-range infrared detection equipment, which can search the night sky for enemy aircraft.[62] Many such systems are capable of detecting even small aircraft.[63] While Iraq deployed a few aircraft with this capability, they were apparently not able to use them due to the effectiveness of the allied air forces' non-stealth fleet. It is interesting to note that had the Iraqis attempted to intercept our stealth aircraft, the F-117A would have had a substantial advantage over the B-2 in avoiding the Iraqis since the B-2 is over four times as wide as the F-117A, making it easier to see. And while both the B-2 and the F-117A incorporate technologies designed to reduce their heat signatures, the B-2's engines produce nearly four times as much thrust as do the F-117A's, thus potentially making it a much easier target for infrared systems to spot. Thus, the small F-117A's relatively unchallenged success says little about the much larger B-2's ability to penetrate Soviet airspace. Using the mere survival of the F-117A to justify such programs as the B-2 at this point seems inappropriate.

No Validation of the B-2 Bomber's Mission

One of the most important missions of the Stealth Bomber, according to the Air Force, is to hunt down Soviet mobile missiles after an initial exchange of strategic nuclear weapons. Saddam Hussein posed a similar, though much smaller, strategic threat to Israel, Saudi Arabia and other coalition partners with its modified Scud missiles. Thus, Desert Storm provided a test of our ability to knock out such weapons. The conditions of this test were very favorable to the U.S.: American forces had unprecedented coverage of Iraq, not only by satellites, but by AWACS, JSTARS surveillance aircraft and various reconnaissance aircraft. Also, allied attack aircraft were stationed close to all possible Scud launch sites.

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[58] Michael White, "Stealth Defence Pierced," The Guardian, U.K., 3/25/91, p. 1.

[59] "Rice: Soviets Likely to Spot B-2, But Shooting It Down 'Difficult'", Aerospace Daily, 11/1/89, p. 180.

[60] Statement of Les Aspin, Chairman, House Armed Services Committee, 7/17/91.

[61] Colin Powell, Chairman, JCS, DoD Briefing, 1/23/91, Federal News Service.

[62] Michael J.H. Tailor, Soviet & East European Major Combat Aircraft, Tri-Service Press, London, 1990, pp. 93, 117

[63] Neil Munro & Barbara Opall, "European Officials: Electro-Optics Will Counter Stealth", Defense News, 6/24/91, p. 44

The Soviet Union, in comparison, spans 11 time zones, and cannot possibly be covered as thoroughly by intelligence assets. If Scuds in Iraq were a needle in a haystack, missiles in the Soviet union would be a single drop in the ocean. And the Iraqi Scud missiles were old and liquid-fueled, requiring an hour of preparation before launch, giving the coalition forces more time to find them. More modern Soviet missiles would provide much less detection and response time. Finally, as the result of air supremacy, coalition aircraft were able to operate largely unchallenged in Iraqi airspace while searching for Scuds. Not withstanding all those advantages, while allied air attacks did significantly reduce Scud launches during the course of Desert Storm, Scud attacks were never completely stopped.

Attacks on Scud missiles were reportedly made by F-15E, F-16 and A-10 -- all unstealthy aircraft[64]. We are aware of no such attacks made by F-117A Stealth Fighters. Stealth aircraft were apparently not required since the Iraqi air defense net had been destroyed or suppressed. However, the Air Force has acknowledged that a nuclear attack would create a similar situation by crippling Soviet air defenses before any anti-missile missions were flown by the B-2. Thus, we are left with the question: Why does the U.S. need a radar-evading B-2 if we are going to destroy enemy radars with nuclear missiles before any attack? In any case, the allied anti-mobile missile performance in the Gulf, even with the F-117A, has yet to demonstrate a plausible justification for the extraordinarily expensive B-2.

[64] F-16 and A-10 attacks on Scuds were reported in CENTCOM briefings on 2/13/91 and 2/27/91, published by Federal News Service. F-15 attacks on Scuds were reported in the Air Force White Paper, Op. Cit.

The Patriot Missile

"In truth, Patriot could not have an easier target than missiles based on the Soviet SS-1 Scud-B, an inaccurate, liquid-fueled beast that takes more than an hour to prepare for flight and is not very far removed in design concept from the German V-2 of World War II. There is no separating reentry vehicle, no penetration aids and no terminal guidance, so the trajectory plotted by the radar is extremely predictable."
Army Magazine, March 1991

Patriot's early perceived success against Scud attacks continues to be widely heralded as a victory for high-tech weaponry, a justification for the Strategic Defense Initiative (SDI) and a validation of the $11 billion Patriot program itself. However, as more information has trickled out of the Pentagon, it has become clear that the high-tech Patriot was not nearly as successful as originally reported by the Army. Nonetheless, the original euphoria over its perceived success has prompted the DoD to request nearly double the $2.8 billion per year budget of the Strategic Defense Initiative Organization[65] and to push for the deployment of a massively expensive limited "Star Wars" defense system within the next ten years.[66] In a nearly total switch, when the Patriot seemed to be working, it was used to validate SDI; as the Patriot began to show its failings, the call arose for a defensive weapon that would work.

In any case, the limited success of the $11 billion Patriot missile system against conventional Scud attacks does not even remotely demonstrate an ability to make a coordinated defense against hundreds of missile warheads with decoys -- or operate in the presence of electromagnetic interference caused by nuclear weapons. The ambition of creating such a strategic defense has already cost more than $20 billion in research and development, almost twice as much as the Patriot cost to research, develop and build. That being the case, it should be of interest to see how well the high-tech Patriot performed in light of the modest capabilities it was to provide relative to SDI.

The idea that "high-tech saves lives" does not seem to reflect the actual record of the Patriot system. Israelis and American scientists point out that **damage to buildings tripled and casualties increased by 50 percent** ***after Patriot was deployed to Israel.***[67] This makes a great deal of sense considering that a minimum of two $700,000 Patriot missiles[68] were fired at each incoming Scud, increasing the amount of debris and explosives flying low over defended cities. Video clips show Patriot missiles following Scud debris into the ground -- in essence helping Scuds to strike their targets.[69]

It may never be known precisely how many Scuds the Patriot intercepted because, except for three cases at the end of the war, Patriot batteries lacked data recorders which could accurately count kills. Instead, the Army used crater and missile fragment analysis to determine if an intercept had occurred, a much less accurate measure.

However, the Army's overly optimistic early estimate that Scud intercepts by Patriot exceeded 95 percent has been officially down-played by the DoD, which now claims to have intercepted "the majority" of Scuds. And interceptions do not necessarily include killing the Scud warhead. For example, one person was killed and scores wounded in Riyadh by a Scud the Army considered

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[65] RDT&E Programs (R-1): Department of Defense Budget for Fiscal Years 1992 and 1993, p. D-II, 2/4/91.

[66] See Special Defense Department Briefing: SDI and Global Protection Against Limited Strikes, remarks by Ambassador Cooper, Director Strategic Defense Initiative Organization, Published by Federal News Service, 2/12/91

[67] Patrick E. Tyler, "Did Patriot Missiles Work? Not So Well, Scientists Say", The New York Times, 4/17/91, p. A-11.

[68] Fred Kaplan, "Specialists Debate the Value of Patriot", The Boston Globe, 5/5/91, p. 1.

[69] Ibid.

to be successfully intercepted by a high-tech Patriot.[70] An additional twenty-nine people were injured by debris in a suburb of Riyadh after a reportedly "successful" interception.[71]

Perhaps most devastating, despite claims that the Patriot system consistently maintained a 95 percent readiness rate in the Gulf, two Patriot batteries defending an American barracks broke down and allowed a Scud to kill 28 people and wound 100 others.[72] One computer reportedly failed because it had been running for over 100 hours. The high-tech Patriot is normally shut down every 14 hours for maintenance.[73]

The Patriot's record against Scud ballistic missiles must reflect the fact that Scuds are old, easy targets when compared to modern missiles. They have large radar cross-sections which make them far easier to track. Additionally, Scuds are slow targets compared to the more modern Soviet intermediate range missiles Patriot was also designed to intercept -- and much slower than intercontinental ballistic missiles (ICBMs) likely to confront SDI.

Furthermore, Scuds fall in predictable (parabolic) paths and have no decoys or multiple warheads like many modern missiles, although by breaking apart in flight they simulated this capability. When Scuds broke apart in flight, Patriot could not handle the situation. In one case, a Scud broke into fourteen pieces, confusing the Patriot's computers and triggering 28 Patriot launches which cost over $19.6 million.[74]

Patriot also protects only a limited area, a concept known as point defense. For example, during the war, two Scud missiles landed in the Saudi town of Hafir Al-Batin. Patriots were unable to engage them, because they "weren't in a Patriot fan."[75] Patriot's coverage is small enough that nuclear warheads could fall outside Patriot's coverage and still cause significant damage to non-hardened targets, like cities -- or the Patriot itself. Thus, before Patriot is used as a major argument for the Star Wars anti-nuclear missile defense, it is important to understand the Scud's limited capabilities relative to other missiles -- and further realize that Patriots' record against conventional Scuds would be totally inadequate against nuclear tipped missiles. In addition, Patriot missiles are also limited in their ability to destroy chemical warheads mounted on ballistic missiles.[76]

The Patriot never had a chance to prove itself in its primary military role of anti-aircraft missile. As initially procured, Patriot was intended to be moved often to provide defense against enemy aircraft for rear areas of American army units as they advanced across Europe. As deployed in Israel and Saudi Arabia, Patriot defended stationary civilian and military targets from Scud ballistic missiles. Patriot missiles did defend the headquarters of VII Corps in its sweep through the desert, but apparently were never needed, due to the lack of any Iraqi aerial attacks.

In fact, many capabilities paid for in the Patriot program were not used in the Gulf. The following points compare and contrast the conditions under which Patriot was designed to perform, and the conditions it experienced in the Gulf.

- A capable, aggressive enemy would create confusion and real danger to the Patriot system. There was never a high threat of attack by Iraqi aircraft because the Iraqi air force was outnumbered, outclassed, and quickly rendered ineffective. The one-sided air victory enjoyed

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[70] Fred Kaplan, Op. Cit.

[71] Eric Schmitt, "U.S. Bombers Hit The Iraqi Bunkers And Supply Lines", New York Times, 2/4/91, p.A8.

[72] Donatella Lorch, "Twisted Hulk of Warehouse Tells a Grim Story of Death", The New York Times, 2/27/91, p. A 18. DoD's interim report of lessons learned suggests 97 people were wounded.

[73] Eric Schmitt, "U.S. Details Flaw in Patriot Missile", The New York Times, 6/6/91, p. 9.

[74] Fred Kaplan, Op. Cit. Note: An earlier New York Times editorial, 4/19/91, suggested that 5 Scuds were fired, rather than one.

[75] General Tom Kelly, Defense Department Regular Briefing, Federal News Service, 2/14/91

[76] Sarah Christy and Tony Capaccio, "Patriot Missile: Army Cinderella Story", Defense Week, 1/23/91, p.1

by the coalition would probably not have been possible in a European war with the Soviets, for which Patriot was originally procured.

- Enemy airplanes, unlike Scuds, are maneuverable. Maneuvering targets are often much more difficult to hit. Also, airplanes can fly in low and from many directions at once, attempting to hide from the Patriot's radar, while simultaneously employing electronic countermeasures to confuse the system. The Patriot simply never had to prove itself capable of handling this threat.

- Since the system had to handle only a small number of Scuds at any one time, the Patriot's capabilities to handle multiple threats was not heavily taxed. Crews were able to focus primarily on a single threat -- the Scud missile fired from a known direction and flying in predictable parabolic trajectories.

- Patriot crews had months to set up, calibrate and adjust their equipment for a rear defense of fixed points in Saudi Arabia. Israeli positions, although more hastily established, were also fixed. Patriot batteries that moved with coalition forces in the ground war, as designed, were apparently never required to fire. Constantly moving complex equipment like the Patriot tends to cause more frequent breakdowns. The ability to move was most likely a major cost driver in the Patriot development, contributing greatly to its expense.