



STRYKER BRIGADES

Versus

THE REALITY OF WAR

**Fundamental Concerns About The Stryker's Capabilities
In Combat When Evaluated Against Lessons Learned
From The Conflicts In Afghanistan, Iraq And Elsewhere.**



**Wheeled Armored Vehicle similar to the Stryker burned out in Somalia.
Such vehicles, as was shown in Soviet occupied Afghanistan, have proved
exceptionally vulnerable to RPGs and machine gun fire.**

**"The preponderance of damage to our tanks and Bradleys
was done by RPGs."**

**Major Jeff Voight USA, Battle Damage Assessment Team
Leader V Corps BDA Iraq 2003**



A SIMPLE ISSUE:
**In a time of war, should the lives of American soldiers
be put at stake by – knowingly - fielding substandard
vehicles procured to meet a symbolic peacetime
agenda?**

In peacetime, the procurement of military equipment resembles a commercial spectator sport where the rewards are profit and the penalty is loss.

Of course, most thinking Americans know it should not be that way – because the lives of American soldiers, sailors, marines and airmen could *theoretically* be at stake - but their concerns are largely swept aside by the imperatives of a free market economy where the good, without question, outweighs the bad.

Senators and Congressman, quite rightly, fight for their states, districts and party interests. Defense contractors fight for their bottom line. The military fight for their services.

All of this is understandable, if less than ideal, in peacetime.

But, we are at war, and, as this document is being written, American soldiers are being killed or injured virtually every day in Iraq – with equipment limitations making no small contribution.

Apart from our tanks and Bradleys, virtually none of our vehicles have any significant degree of RPG resistance, yet the RPG is the most predictable weapon, apart from the AK-47 that we are likely to encounter in any foreseeable conflict.

The issue raised in this report is whether the US Army should be allowed to field the Stryker, a family of vehicles whose extensive deficiencies are comprehensively laid out in the following pages, but which, for technical, bureaucratic and political reasons, has managed to elude the Department of Defense's Operational Test and Evaluation.

In this document, we ask that this exercise in symbolism, instead of substance, be stopped.

There are far, far, better and more cost effective alternatives.

More to the point, American lives, and the missions for which our soldiers fight, should not be put at risk unnecessarily.

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Author's Note:

This report contains serious criticisms of the Army's decision to procure and field the Stryker. They are being advanced in the spirit of former Army Chief of Staff General Sullivan's comment that, "Disagreement is not disrespect."

The author has the greatest respect and affection for the Army but believes that flawed decisions, particularly in a time of war, where lives are immediately at stake, must be opposed.

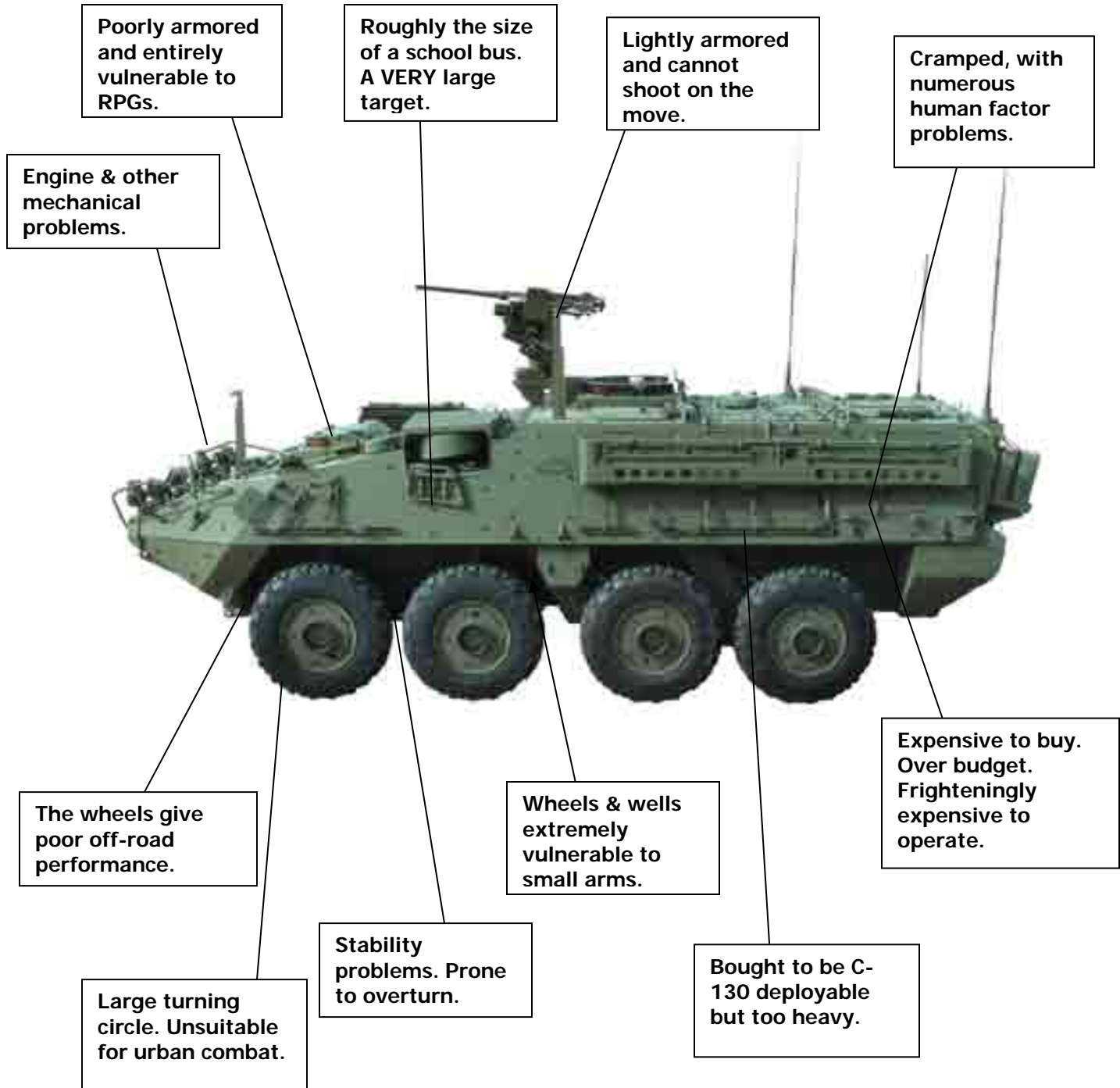
Such is one's right and duty in this great democracy. It was that same democracy that the US Army, to its enduring credit, originally fought for, and won.

This is a draft which will be refined and extended as additional information becomes available. In that context, it is to be wished that soldiers of character will step up to disclose the truth. There are issues of principle at stake here.

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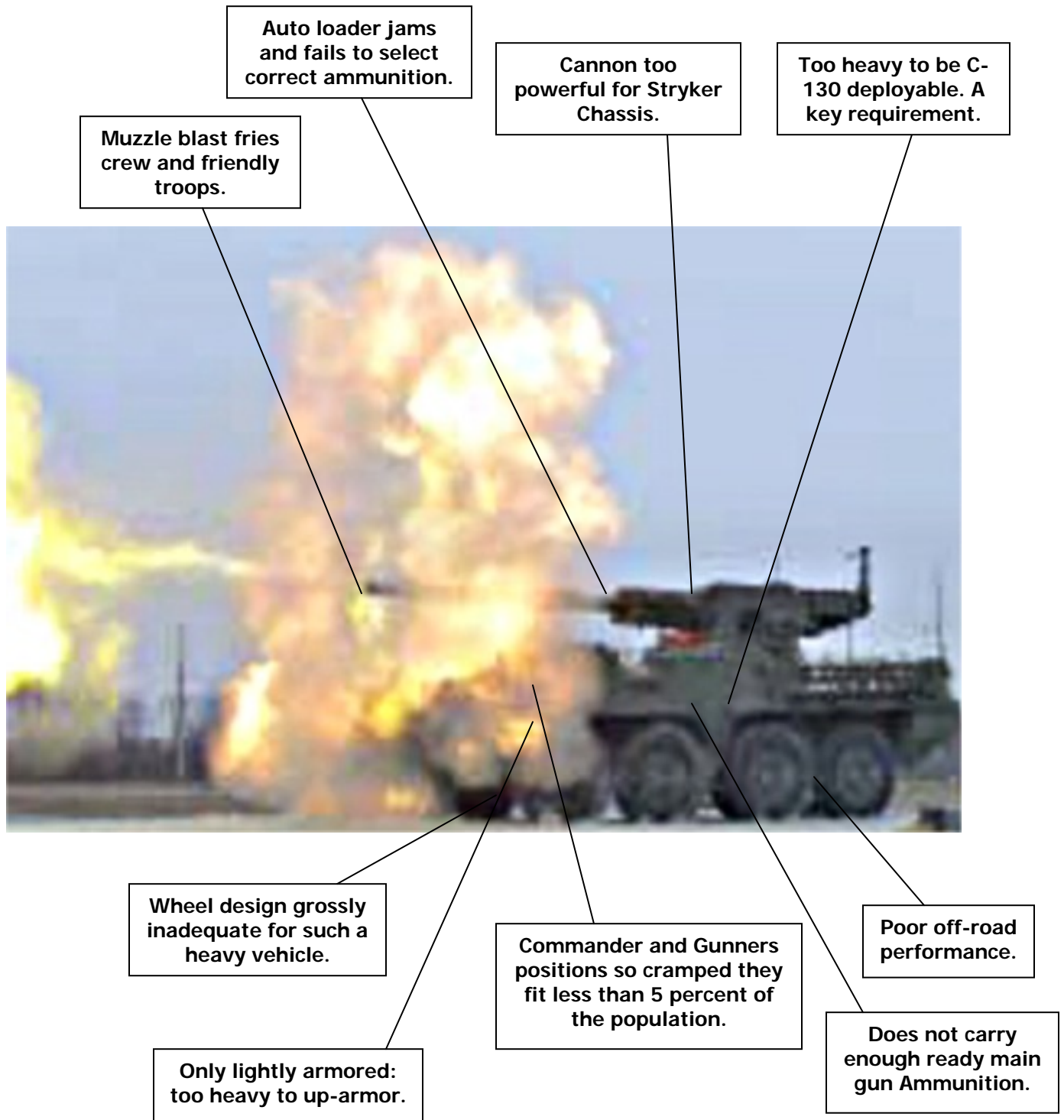


EXECUTIVE SUMMARY: THE STRYKER ICV & SOME OF ITS PROBLEMS





EXECUTIVE SUMMARY: STRYKER MOBILE GUN SYSTEM & ITS PROBLEMS





EXECUTIVE SUMMARY: KEY FACTS ABOUT THE STRYKER

There are the strongest arguments for the Stryker program to be curtailed and the Stryker Mobile Gun System to be cancelled.

The Stryker Concept reflected the vision of the previous Chief of Staff of the Army, General Shinseki, who argued that the existing force was either too heavy to be deployed quickly (tanks and infantry fighting vehicles) or too light to be effective (airborne or light infantry). He attempted to solve a deployment problem by buying more hardware instead of restructuring the force to make it more agile, and by talking to the Air Force and the Navy about lift.

The 8 wheeled Stryker Light Armored Vehicle was selected (under debatable circumstances) to be the basis of a series of 6 Stryker Brigades targeted at global deployability in 96 hours (an objective which was found to be infeasible in a recent GAO report #03-81). They were to be transported by C-17s into theater and C-130s intra theater. C-130 deployability was a key performance parameter (KPP). Stryker Brigades were to be the US Army's intervention force pending the development of a new force, the Objective Force, which was to be fielded in 2008 (an optimistic figure).

General Shinseki's vision came from a period during which the future of the Army seemed to lie, in the main, with peacekeeping – Operations Other Than War. He did not change it after 911 although the requirements changed dramatically because the United States was, is, and will continue, to be at war.

The Stryker program was supposed to be, in effect, 'off the shelf.' The Stryker, itself, was an evolution of the LAV III, a well proven lightly armored vehicle, albeit of limited operational capability (a very important qualification). However, the Army system decided to modify it significantly and ended up with a vehicle, or series of vehicles, which were vastly heavier than the LAV III and, indeed, too heavy to be C-130 deployable over tactically useful distances. Strykers were also marketed to Congress and elsewhere as being capable of 'Full Spectrum Warfare' which, palpably was not true. They could not stand up to heavy machine gun fire and were still entirely vulnerable to Rocket Propelled Grenades – RPGs – and the weight of their increased armor impacted negatively on speed, reliability and off road performance.

The basic Stryker family of vehicles, which were lightly armed, were supposed to be accompanied by a Mobile Armored Gun System. Although a type classified (fully Army tested and approved) tracked armored gun, the M8, already existed, the Army decided to try and put an M68A1 105mm gun on a Stryker chassis – and the results have been disastrous.



Costs of 6 Brigades could reach \$12-15 billion. The cost of the proposed 6 Stryker Brigades looks like it could reach \$12-15 billion or more for a force that brings little punch to the fight – at a time when we are at war.

This \$12 billion is made up of 6 brigades at \$1.5 billion plus support equipment and \$3 billion in MILCON (Military Construction). The remaining \$3 billion relates to cost escalation and contingencies.

The disturbingly high operational costs are not included.

True cost of the Stryker. The true cost of the Stryker lies less in the financial outlay than in the waste of time and effort and in the distraction from the warfighting and other capabilities the Army genuinely needs.

Note. 'The Stryker' is actually a family of 8 wheeled lightly armored vehicles built on a common chassis. All suffer from the same fundamental deficiencies and vulnerabilities outlined in this report. However, the Stryker Mobile Gun System, discussed in its own section, is particularly dysfunctional and is actually dangerous to its own crew.

THE STRYKER VARIANTS ARE.

- **Stryker ICV Infantry Carrier Vehicle**
- **Stryker MGS Mobile Gun System**
- **Stryker ATGM Anti Tank Guided Missile**
- **Stryker CV Commander's Vehicle**
- **Stryker MC Mortar Carrier**
- **Stryker RV Reconnaissance Vehicle**
- **Stryker ESV Engineer Squad Vehicle**
- **Stryker NBC RV NBC Reconnaissance Vehicle**
- **Stryker MEV Medical Evacuation Vehicle**
- **Stryker FSV Fire Support Vehicle**

ALL of these variants are too heavy to be C-130 deployed for any tactically useful distance.

NONE can roll-on, roll-off combat ready.

ALL are vulnerable to RPG fire.

ALL are particularly vulnerable in the wheel well area.

ALL are proving to be extraordinarily expensive both to buy and operate.



**EXECUTIVE SUMMARY:
THE "STRYKER" IS A FAMILY OF DEEPLY (&
POTENTIALLY FATAALLY) FLAWED VARIANTS.**



ICV Infantry Carrier Vehicle



MGS Mobile Gun System



ATGM Anti Tank Guided Missile



CV Commander's Vehicle



MC Mortar Carrier



RV Reconnaissance Vehicle



ESV Engineer Squad Vehicle



**NBC RV NBC Reconnaissance
Vehicle**



MEV Medical Evacuation Vehicle



FSV Fire Support Vehicle



EXECUTIVE SUMMARY: KEY QUESTIONS ABOUT THE STRYKER.

- **Why was the wheeled Stryker ordered in the first place when the technical data did not support the decision – and the Stryker was significantly more expensive than the leading alternative?**
- **Why was the Stryker never tested, in an operational environment, against the leading alternative, the MTVL?**
- **Why did a senior Army general, a friend of the Chief of Staff of the Army who had pushed the Stryker decision through, move to the Stryker defense contractor at a high salary plus stock options?**
- **Why was the initial peacekeeping oriented decision – to buy the Stryker, essentially a police vehicle - not re-assessed post 9/11 in time of War?**
- **Why is the fundamental fact that a vehicle, the Stryker, bought to be C-130 deployable for global expeditionary warfare – and now found to be too heavy – ignored?**
- **Why is the contractor not being held accountable to deliver Stryker variants at the deployment weights specified in the firm fixed price contract?**
- **Why is the Stryker, an under-gunned, vulnerable, under-armored wheeled vehicle with a turning circle too wide for many roads being touted as being 'optimized for Urban Warfare?' – especially when it is entirely vulnerable to RPGs and sniper rifles, our enemies' weapons of choice in an urban environment?**
- **Why are hundreds of millions being spent on the Stryker Mobile Gun System when there is already a perfectly good type classified alternative, of vastly greater capability, already in the Army's inventory?**



- **Why are 6 Stryker Brigades being requested before the effectiveness of one has been evaluated?**
- **Why are we spending \$12-15 billion on this fiasco?**
- **Why are the Stryker's actual extraordinarily high operating costs of \$50 a mile not causing the decision to be re-assessed – especially when anticipated low operating and support costs were used to justify the Stryker purchase to Congress?**
- **Why has the Army omitted to purchase the Stryker Technical Data Package thus ensuring that General Dynamics Land Systems, the contractor, have a monopoly on the supply of spare parts at prices and availability of their choice?**
- **Why has the Stryker been allowed to evade normal Operational Testing & Evaluation through the device of being bought under 'LRIP' – Low Rate Initial Production? Note. LRIP normally applies to no more than 10-15% of a planned buy. In the case of the Stryker, approximately half the planned buy of c.2100 vehicles has been ordered this way.**
- **Why has the Army been allowed to evaluate the Stryker by itself without the normal oversight that precedent has shown is required?**
- **Why have the numerous faults found with the Stryker, from problems with the armor to stability, been suppressed?**
- **Why have the Army professed to be entirely open about the Stryker, yet forced staff involved in the testing to sign non-disclosure agreements?**
- **Why are virtually no hard facts – independently verified data – available on the Stryker, even to concerned members of Congress?**



- Why is a supposedly 'off the shelf' vehicle – which is how it was sold to Congress – so flawed?
- Why, despite fundamental failures on just about every issue, is the Army pushing to put the Stryker Mobile Gun system into production?



August 2003 picture of a Stryker being fitted with a decidedly primitive Anti-RPG shield. Note that top and the wheel well area remain entirely vulnerable.

Lip service to an RPG solution and a disgrace.

The above picture illustrates the crudeness of the Stryker and the inadequacy of the thinking behind it. The basic Stryker is *entirely vulnerable* to RPGs – our enemies' weapon of choice – so the Army is trying to cobble together a solution, essentially to save face. The above birdcage is simply lip service to a solution, and is a disgrace. Not only does it leave the top and wheel well entirely vulnerable but the cage, itself, offers minimal protection against what is a ferociously effective weapon which is used today *in volleys*. The first RPG will shred the cage. The second will shred the 11 soldier complement inside.

Clearly, the Stryker should have had RPG protection designed in from the beginning. The only effective solution now is to add on anti-RPG resistant armor (and such armor does exist) but here the problem is that the basic Stryker, already far too heavy, cannot handle the extra weight of around 8,000lbs without seriously degrading both on road and off road performance, and such an upgrade costs around \$300,00 per vehicle. The Stryker is fundamentally flawed.



Part of a Stryker Infantry Armored Vehicle (IAV).

This is a BIG, BIG, vehicle (target) with NO resistance to RPGs – Rocket Propelled Grenades – which are used in just about every attack against us. Note that the vulnerable wheel well area comes up to nearly shoulder height.

The former Chief of Staff of the Army (CSA), General Shinseki, is in the center. (from the left, there is Col Davis Ogg, MG Ross Thompson, Congressman Bob Riley (now Governor of Alabama), General Shinseki, Nicholas Charbaja from General Dynamics, Senator Sessions from Alabama, a top executive from GM of Canada, and LTG Caldwell (who is pictured in the MGS later in the paper).

1. INTRODUCTION TO THE STRYKER

Origins.

The debacle of Task Force Hawk in Kosovo during the Spring of 1999, where it took a month to get a small force of AH-64 attack helicopters and supporting armored assets to Albania, challenged yet again the practical utility of the US Army.

The Army, in the Nineties, had developed a track record of either turning down missions, or being unable to deploy without vast costs in both time and resources. It was seen as having a garrison mindset and lacking in agility.

As an instrument of global policy for the US Government, the Army was beginning to be thought of as irrelevant.



General Eric Shinseki became the Chief of Staff that summer of 1999 committed to regaining relevance. His solution was to put the Army in the C130 deployable, wheeled combat vehicles that became the Stryker because he believed, and so stated publicly, that advances in Sport Utility Vehicle (SUV) technology made wheeled vehicles virtually as capable both on and off-road as tracks, while being much lighter to deploy.

The decision was made, and under Shinseki's administration, the Army was never given a chance to question it. The Army is a hierarchy. Dissent was a career breaker and was crushed.

But Shinseki was wrong, even at that stage, on at least three points.

Many other flaws would emerge later during the execution of his vision.

First, the problems of Task Force Hawk, of deployment, were not to be solved with just a new combat vehicle. They had much more to do with mindset, leadership and force structure; or what, in the corporate world, would be referred to as management and organization.

Second, wheeled vehicle technology was – and is - nowhere near as advanced as he thought; and progress in civilian SUV design should absolutely not have been confused with the demanding requirements of warfighting. There is scant comparison.

Third, far from standing still for twenty years, as Shinseki stated, tracked technology had evolved enormously to yield significant increases in combat capability.

The US Army's Stryker Brigade Combat Teams (SBCTs) were conceived in 1999 by General Shinseki, to create a force that would be lighter and more deployable than existing Army armor and mechanized units, but which would have vastly more punch than light infantry units such as the 82nd Airborne Division.

The basis of these SBCTs is the Stryker, a large, heavy eight wheeled armored vehicle derived from an original design some four decades old.

The name is new.

To be capable of Urban Combat & Full Spectrum Warfare.

SBCTs (originally called Interim Brigade Combat Teams or IBCTs) are, so the Army has advised repeatedly, intended to be capable of Full Spectrum Warfare (everything from peacekeeping to the invasion of Iraq).

There was, and remains, particular emphasis by the Army on their suitability for urban warfare though the basis for that claim is far from clear since the Stryker cannot pivot steer, is hard to turn in narrow streets, is less than suitable for surmounting barriers, is vulnerable to RPGs (Rocket Propelled Grenades), is only lightly armed, and, when closed up, suffers from blind spots (so can be destroyed with satchel charges). It is also vulnerable to mines and more likely to set them off than the same weight of vehicle equipped with tracks (because tracks exert a dramatically lower ground pressure).



In short, the baseline Stryker was a choice by the Army that does not stand up to close examination. The situation becomes a great deal worse when some of the variants, such as the even heavier Stryker Mobile Gun system, are factored in.

First Stryker Brigade to be globally deployable in 96 hours.



Unfortunately, the Stryker is too heavy to be C-130 deployed for any tactically useful distance.

The Army goal was to deploy the first SBCT to anywhere in the globe in 96 hours and to make each SBCT (Stryker Brigade Combat Team) C-130 deployable intra theatre (c.1,000 miles). To speed up the implementation, the original intention was to use an off-the-shelf version of the wheeled LAV III (the Marine Corps have used the LAV2 or LAV25 for over two decades though they are now due for replacement) and to produce variants of it to yield the logistical advantage of a common chassis.

In fact, the off-the-shelf version of the LAV III was significantly modified in an attempt to meet US Army Requirements (for example, increased armor made it significantly heavier) and thus the LAV III was changed into the Stryker and the scene was set for a series of other problems, some fundamental. In addition, the cost per vehicle escalated significantly.

The all important Mobile Armored Gun. It does not work.

Arguably, the most important variant is the Stryker Mobile Gun System (MGS). Much experimentation has shown that such a 105mm gun, or similar, is essential to provide direct fire support for the infantry carried in the Stryker Infantry Carriers which are armed with only a single remote un-stabilized .50 heavy machine gun each, or an M19 Grenade Launcher. The MGS is designed to deal with bunkers, fortified positions, buildings, human wave attacks and enemy armor. Although not a tank as such, because it is not heavily armored, and is wheeled and suffers from the deficiencies of the Stryker family of vehicles, the MGS, in theory, is designed to carry out many of the functions of a tank. An SBCT does not contain tanks so the MGS, or an alternative large caliber direct fire weapon, is critical to ensure mission success, combat effectiveness and force protection; and it is designed to be deployed at the same time. Of course tanks can be attached to an SBCT but then the rationale for the Stryker's very existence (a lighter, air mobile, more deployable force) begins to vanish.

The Army could have chosen the tracked M8 Armored Gun System (AGS) which was already fully developed and tested to the point of being type



classified (completely ready for service) and which had the advantage of being air droppable and was functionally significantly more capable (this is worth emphasizing) but instead elected to chose the Stryker Mobile Gun System in the stated interests of having a common chassis. This remains a puzzling and highly contentious decision because the more effective M8 AGS works *now*, and the decidedly less capable MGS still does not after more than 30 months of development in a program that was to complete all testing through engineering and manufacturing development (EMD) in 24 months. Further, extensive tests by the US Army's own experimental 9th Division (a unit renowned for taking a fresh look at traditional solutions) in the early 1980s had rejected the concept of a wheeled gun system. Even more confusing is the fact that the AGS had been tested against a wheeled LAV heavy caliber gun in the early 1990s and the AGS had won and had gone on to become the M8.

Stryker force is leaving the Current Force under-funded.

Provisional estimates, based upon the Army's own figures, suggest that the Stryker program is heading towards being \$2 billion over budget by 2005 before ancillary costs are factored in. Meanwhile the existing force – the Legacy Force (Abrams tanks, Bradley Fighting Vehicles, M113 series vehicles and so on) which are now and will continue to be doing the bulk of this nation's land fighting for the next two decades or more, is being under-funded in numerous critical areas.



This is the versatile M113. Because of the Stryker, the Current Force which is doing the actual fighting *now*, is under-funded.

The many problems of the Stryker:

The many problems of the basic Stryker vehicle have been documented elsewhere (they include the fact that the basic Stryker is too heavy to be C-130 deployed for any tactically useful distance and has off-road mobility problems). In all, the Army intends to establish six Stryker Brigade Combat Teams at a cost in excess of \$1.5 plus billion a brigade. These brigades will contain a total of c.2,100 (2,131 is the actual advertised number) Strykers in all of which c.200 are targeted to be Stryker Mobile Gun Systems. The average cost of a Stryker variant is listed at in excess of \$3 million per unit in the latest budget. The true cost of the MGS variant, including all the additional development work involved, is not known. The true cost of all the various ancillary expenses relating to the Stryker,



such as the \$700 million being invested in Hawaii and \$1.2 billion being invested in Alaska to support one of the new Stryker Brigades are also not known in total but the overall impact on the Army, when ALL Stryker related costs are factored in is very substantial.

The first SBCT is targeted to be operationally capable in the Summer of 2003 (significantly later than originally envisioned), yet, will be still be fielded *without* the essential MGS variant and without the 120mm mounted mortar variant (The Stryker chassis cannot withstand the recoil of the Army's standard 120mm mortar so is having to be fitted with a special Israeli mortar which incorporates a recoil system, is heavier and cannot be dismounted from its vehicle. The Army's currently fielded M113 operates the standard 120mm mortar, either mounted or dismounted without difficulty, and is C-130 deployable). This means the first Stryker Brigade Combat Team will be woefully short of firepower and the infantry will lack adequate support and protection. None of the Stryker variants are armored beyond 14.5mm protection and all, as matters stand, are vulnerable to RPG fire (the weapons most likely to be encountered on the battlefield as shown in Mogadishu and more recently in Afghanistan) let alone the large ballistic windows around the wheel wells and other areas that are penetrable by advanced small arms.

The Stryker is a Large Target (roughly the size of a school bus).

The Stryker is a very large vehicle indeed, roughly the size of a school bus (hard to believe though this may be).

Because of its size, it makes for a very large target and it is easy for the enemy to acquire and hit. This is scarcely a new insight, but most of us seem to have discovered that it is easier to see bigger things.

The quietness of the Stryker is touted. It is relatively quiet on hard surfaces but requires engine power to run its subsystems. Consequently, it lacks the stealth power of hybrid electric tracked vehicles and remains a much larger target.



Stryker is about the size of a school bus. This makes a BIG target in Full Spectrum War; or even under any circumstances.

Size does make a difference.

The Army proposes to use one of the Stryker variants for reconnaissance, a task that history, and commonsense, shows requires stealth. The idea is to observe the enemy without being seen.

One has to wonder at the wisdom of using a school bus sized vehicle to sneak up on the enemy.



Poorly Armored & entirely vulnerable to RPGs.

The Stryker is armored *in places* to withstand enemy weapons up to 14.5mm (heavy machine gun) but it is entirely vulnerable to RPG-7s (rocket propelled grenades) and it has particularly vulnerable areas such as the near shoulder high wheel wells (where small arms can penetrate).

The enemy's weapon of choice worldwide is the RPG. They are being used daily against American troops, often to fatal effect. Enemies also use small arms to shred tires to either slow or stop a target, thereby enhancing RPG effectiveness.

If Strykers had headed the dash to Baghdad, instead of Abrams tanks and Bradley Fighting Vehicles, based upon the hits received, and particularly the use of RPGs used in volleys, our casualties could have been in thousands.

Similarly, Strykers would be vulnerable to the hit and run tactics currently being used by our enemies in both Afghanistan and Iraq.

During the Soviet occupation of Afghanistan, the Soviets had a broadly similar vehicle. The Afghans destroyed many hundreds by exploiting the wheel well vulnerability. They also discovered that the burning tires would cook the Soviets inside.



Rocket Propelled Grenades (RPGs) are our enemies' weapon of choice

Problems with the armor.

The Stryker is a derivation of a 1960s armored car designed for police duties rather than combat. The body was made of thin steel plate which could protect against small arms but not much else. That was fine for police work because such duties, subject to a few notable exceptions, rarely involve anything close to combat.

When the Marines bought a version, they decided they would live with the light armor but mounted a stabilized 25mm automatic cannon so they could shoot and disengage if they ran into trouble. Also, they use their LAVs in a very controlled and limited way with supporting air.

The Army decided they would carry out a whole range of combat tasks with the Stryker, ignoring the fact that it was never designed for such purposes, but decided it had to be up-armored. This entailed adding ceramic plates to the steel body so that the base armor is now a steel/ceramic sandwich. That brought the base protection up to 14.5mm where the ceramic was applied, though it also



increased the weight hugely to over 38,000lbs, reduced the fuel consumption, strained the transmission and impacted negatively on overall performance.

Even worse, the flexing of the steel core has a habit of working the ceramic tiles loose or creating stress cracks. Further, the jackhammer effect of incoming full automatic fire has the same effect. In short, even where ceramic plates are applied, full 14.5mm protection is not guaranteed.

Lightly armed & cannot shoot on the move.

The Stryker IAV is only lightly armed with either a .50 cal machine gun or an M19 grenade launcher operated through a Remote Weapons System (RWS). This RWS is not stabilized. It cannot shoot on the move with any accuracy. Firepower does not compare with that of an Abrams tank, Bradley Infantry Fighting Vehicle or Marine LAV.



The Stryker RWS (Remote Weapons System) cannot be shot accurately on the move. Weapon is NOT stabilized.

This lack of a stabilized weapon defies commonsense and flies in the face of Lessons Learned over decades. A static target is vastly easier to hit than a moving target, so why force Strykers to stop in order to shoot? This is such an irresponsible omission that it borders on the criminal. It is also illogical in the face of the Army's much touted emphasis on the Stryker's speed. Does this mean that the preferred tactic when fired upon is merely to attempt to drive

away?

This, along with many other aspects of the doctrine behind the Stryker, has been poorly and inconsistently thought out.

Note. There is a proposed variant of the Stryker called the Mobile Gun System (MGS) equipped with a 105mm cannon, and machine guns, which is supposed to compensate for the lack of firepower of the Stryker IAV. However, the MGS suffers



How do you fit a 105mm cannon designed for a tank on a Stryker? You can't!



from so many fundamental deficiencies that these are described in a separate section. Most stem from the fact that the contractors have tried to install a 105mm gun designed for use in a tracked 60 ton tank in a wheeled vehicle of a third of that mass. The results, as can be seen, have been catastrophic. Also, it cannot shoot on the move with precision.

Cramped, with numerous human factor problems.



Stryker MGS. Cramped doesn't even begin to describe it. Only 5 percent of the population fits.

Because of the space taken up by the wheels, and its design, the Stryker is disturbingly cramped inside and suffers from numerous human factor problems.

Despite the fact that internal temperatures can rise to 120 degrees and more, and the crew may be confined for many hours at a stretch, there is no air conditioning.

Experts, who have been consulted, refer to this as poor integration by the manufacturers or what

a layman might call plain bad engineering. Perhaps the most extreme example of this is in the Stryker Mobile Gun system variant known as the MGS. Details are listed later in this report but to give a flavor it will be noted that when the 105mm gun is fired, it can fry the tank crew and puts friendly troops to left and right in serious harm's way.

Engine and other mechanical problems.

The prime reason why the Stryker costs so much to operate and maintain is that the original vehicle, the LAV III, was not designed to operate at the weight of the Stryker.

Add extra weight to any wheeled vehicle and you will quickly see a deterioration in performance and an increase in wear and tear. The Stryker, even in one of its lighter variations, the infantry carrier, is still about 10,000lbs heavier than the LAV III (or its Marine predecessor) the weight of the crew, ammunition and other supplies is factored in (add another 4,000lbs plus), and that has proved to be a major strain on the vehicle's reliability and fuel consumption.

The Army's recently admitted figure that the Stryker has been costing \$52 a mile to operate speaks for itself. They *hope* to get it down to \$25 a mile. That remains ludicrous. An M113, carrying the same load but with greater capabilities, can be operated for a little more than 10% of that figure.

A Stryker Brigade contains about 300 Strykers. These high running costs mean that it costs about \$15,000 in direct Stryker costs (there are others) to move a Stryker Brigade just *one* mile. More disturbing is that the Army has no way to use competitive forces to lower this operations and support cost because the



service does not own the Technical Data Package (TDP); therefore, all matters related to reliability and maintainability are sole source procured from General Dynamics.

Unreliability is not merely an extra cost. It also impacts greatly on morale and mission capability. It undermines survivability. It kills American soldiers.

Stability problems. Prone to overturn.



The center of gravity of the Stryker is too high. It is NOT stable and overturns.

The Stryker is tall and heavy and carrying at least 50% more weight than its suspension and transmission were originally designed to bear.

The result of this is that the vehicle has a tendency to turn over when operating off-road.

Here, we are not talking about extreme off-road conditions. Our information is that the six roll-overs that occurred at the National Training Center happened when the Strykers concerned were on un-paved tracks.

This problem is particularly acute where the Stryker Mobile Gun System is concerned.

Poor off-road performance.

The wheeled Stryker has poor off road performance compared to alternatives so tends to be road bound and thus vulnerable.

Although it has some off road capability, like all vehicles, its tires tend to suffer over hard ground (as the Marines found in Afghanistan and Iraq) and to get stuck in soft or boggy ground. Further, its speed drops and its fuel consumption rockets. The Army also recently reported that they have procured \$50 million in spare tires just for its truck fleet in Iraq.

The Stryker is fitted with both a central tire inflation system and a height management system which allow the pressure in the tires to be adjusted to cope with different terrain. This is of some slight help but at the expense of increasing weight and introducing vulnerabilities in the wheel well area. Even worse is the fact that the tires need to be single ply to flex in accordance with the varying air



Note the tires progressively digging themselves into being stuck fast in the mud!



pressure. The result is a serious problem which bursts tires in any difficult terrain. Finally, when tires do need replacing, the crew needs mechanical support to manage the replacement tires because they are so heavy.

The Stryker does have two run flat tires on each side but they only allow limping home a comparatively short distance. The Stryker does not carry a spare tire because they are so big there is really no place to put one. The tires are also vulnerable to being set on fire – as with a Molotov Cocktail or Thermite Grenade. Being road bound does not matter in a peacekeeping environment such as Bosnia, where the main work is patrolling, but it matters a very great deal when you are dealing with a shooting enemy.

Being able to go where you are not expected is fundamental to survivability.

Too heavy to be C-130 deployable.

Although purchased to be C-130 deployable, the Stryker IAV *just* squeezes in but is too heavy to be C-130 deployed for any tactically significant distance, and some of the essential variants, such as the Mobile Gun system, are too heavy to lift in that aircraft at all. That means, in effect, that one of the prime rationales for the purchase of the Stryker – C-130 deployability – is no longer valid. The C-130 is the most readily available intra-theatre aircraft (we have about 600) and the fact that it cannot be used to carry the Stryker is a disaster.



Stryker *just* squeezes into a C-130 but is too heavy to fly any useful distance. Some variants are too heavy for C-130 to take off!

Simply put, Stryker fails this Key Performance Parameter (KPP), a fact which alone justifies cancellation of this program, particularly when it is considered that other alternatives are readily available which easily meet this KPP.

The point about the C-130 is not just that we have plenty of them, but also that it is the one transport we have that the Air Force is willing to use on unprepared landing fields – so an important strategic capability (to insert an armored force where the enemy do not expect) has been lost.



The C-130 can land on un-prepared airfields – a vital strategic capability. But the Stryker is too heavy for it.

The Army have carried out a number of carefully staged demonstrations showing that a Stryker can be fitted in to a C-130 and can be flown for a short distance (well under 100 miles). However, what they do not say is that these demonstration flights feature stripped down Strykers over tactically irrelevant distances and do not include the Stryker variants that are fundamental to the operation of a Stryker Brigade.

In short, they are

deceptions.

The Army argue that the C-17 can be used. This is very true but not only do we have a very limited number of C-17s but it should also be pointed out that they can carry Abrams main battle tanks and Bradley Fighting Vehicles which bring vastly more punch to the battle.

So, why do we need to invest \$10-12 billion buying Strykers?

Unsuitable for Urban Combat.

The Army has touted the Stryker as being optimized for urban combat on the basis that it can deliver infantry quickly and that infantry are the real answer to the urban fight. As explained elsewhere, that flies in the face of combat experience over more than half a century, and most recently in Iraq, where heavy armor – tanks and Bradleys, which can take a hit but resolve the argument with dispatch – have been found vastly more suitable.

The Stryker has numerous disadvantages for urban combat. It is grossly under-armored for the kind of threats that are normally encountered in an urban environment (which include RPGs, mines, anti-tank grenades, Molotov cocktails, heavy machine guns, heavy caliber sniper rifles and so on) – let alone enemy armor.

The Stryker has huge ballistic windows – basically most areas below upper chest level- that can be penetrated by RPGs or machine guns.



Israelis use Merkeva tanks and up-armored M113s for urban combat & take few casualties.



The Stryker has a huge turning diameter of well over 50 feet' and an inability to traverse rubble, either of which significantly increases the probability of becoming blocked or trapped in an urban street.

The Stryker IAV is under-gunned to deal with an enemy concealed in buildings. Its hatches are vulnerable. It's wheel well area (which takes up about over half of each side) is notoriously vulnerable because not only is the armor thin in those areas, but the Stryker's complex height management and central tire inflation systems are exposed.

The tires can be shot to pieces and set on fire.

The Stryker does not have the traction to break through, or surmount, heavy barricades such as cars chained together. Its turning circle is wider than that of many streets. Its external visibility, when buttoned up is very poor. It has blind spots in the rear. There is no gun shield for the gunner when the hatch is open. The weapon has to re-loaded with the gunner exposing himself, and, as stated elsewhere, it cannot be fired accurately while the vehicle is moving. The weapon also suffers from a very limited field of view which enables the enemy to sneak up undetected (as has happened on exercises).

It is hard to image why the Army consider the Stryker remotely suitable for urban combat, let alone 'optimized.'

A very poor foundation for future development.

Military vehicles typically evolve over time as weapons systems and electronics are upgraded, and further uses are found for the basic chassis. Good examples of this are the M113 personnel carrier, which has ended up being used for just about everything from ambulance to mortar carrier, and, subsequently, the Humvee.

Unfortunately, the Stryker's design is not efficient in the usable space it provides under armor. There are structural problems re wiring it for the electronic battlefield, and the fact that it is already overweight, in relation to its engine, transmission, suspension and chassis, makes further utility, at an economic cost, problematic.



The vulnerable Stryker is not a good foundation for further development.

Expensive to buy. Over budget. Frighteningly expensive to operate.

The Stryker, is expensive to buy and frighteningly expensive to operate. Proceeding with this program detracts from essential warfighting capabilities.



Our enemies are dispersed globally in locations which, more often than not, lack not just roads, but a developed infrastructure. Our equipment *has to be able to cope with this now*. We are at war *now!*

2. LESSONS LEARNED FROM COMBAT

This is a Global War.

Afghanistan, Pakistan, Iraq, Syria, Iran, the Philippines, Malaysia, Indonesia and Morocco, to name but some of the better known havens, demonstrate the global nature and requirements of the War On Terrorism to an extent not seen since World War II.

The evidence would seem to show that we need to be able to fight anywhere in the world at short notice, particularly in locations where the terrain, and access to that terrain, is unusually difficult – for such terrain provides natural and perceived protection for Al Qaeda and others who wish this nation harm.

So far, this War On Terrorism has been relatively low in casualties, if not in resources, but there is absolutely no guarantee it will stay that way. It could escalate in a heartbeat. Consider the North Korean situation. Let us remember that the Vietnam War started with only a few casualties a month.

We need to focus on the implications of the word ‘War’ and the fact that we are at war *now*.

The significance of being at War *now!*

Fundamental to being at War now is that we be ready to fight *immediately* and not be locked into a Transformation Plan which is dependent on the promises



of tomorrow – especially when it is realized just how long new technologies, at least where the Army is concerned, seem to take to reach maturity. The Comanche helicopter project was started in 1983 and, as matters stand, is not due to go into service until 2009 (and, even then, will lack certain key features).

The search for new and better equipment should always be taking place, especially given the imperative of the driving speed of technology, but the fact remains that a vast amount can and should be done immediately with the *existing* US Army Force Structure to get it ready for war without needing new technological breakthroughs, or needing to purchase vast quantities of new equipment.

Changes in mindset, the personnel system and structure should, and must, lead Army Transformation.

This is a War where part of the enemy's agenda is to drain us.

Fundamentally, America's freedoms and values are guarded by our creation and maintenance of the World's most successful economy. That is no reflection on the courage of our military. It is merely stating that without economic resources, we could not field the high caliber of forces that we do. To illustrate that point in relation to Iraq, year by year, particularly if one factors in the British contribution, we have outspent them militarily by about 500 to 1. That is not just overmatch – to use the military term. It is a mind-shattering degree of dominance.

Our enemies are well aware of our economic strength so are focusing, in particular, on undermining the US economy *over time*. The selection of the World Trade Center was not an accident and the immediate economic consequences, let alone the longer term ones, were colossal.

No small part of their long term strategy (they take a vastly longer view than we tend to do) is a deliberate policy of causing us to over-react militarily and dissipate our strength globally through ever increasing commitments.

So far we have taken the bait but it is worth considering that it is rarely a good idea to do what your enemies want you to do.

We need to spend our massive, *but still limited*, resources with prudence and safeguard the core aspects of our economy that underpin our quality of life.



A deliberate attack on our economy and way of life.



Security, no matter how fundamental, no matter how much the patriotic drum is beaten, does not feed us, give us jobs, educate our children, keep us healthy from disease, fund our vacations, nor contribute to many aspects of what is termed 'The American Way of Life.' We would be wise to bear that in mind.

Any vehicles we field need to bring serious punch – and survivability - to the fight.



M1A1 Abrams tanks epitomize 'punch' – speed, survivability and firepower.

During the Nineties, after the collapse of the Berlin Wall and the Soviet Union, the US Army became pre-occupied with Operations Other Than War, which in turn induced a careerist mindset, and a Leadership timidity, much more concerned with Force Protection than with accomplishing the mission (and here I am quoting various US Army General Officers in addition to the observations of many).

The facts, even at the time, did not support this mindset, and 9/11 finally illustrated the obvious which is that we were at war, whether we knew it or not, and had been for years.

The reality is that there are no neat demarcation lines between Peace, Peacekeeping, Peacemaking, and War; and War itself comes in numerous shapes and sizes and degrees of violence.

The Korean War, for which we were dismally prepared, was called a 'Police Action' yet killed millions.

Somalia was a 'Humanitarian Mission' yet must have looked remarkably like war during Black Hawk Down to those involved.

The lesson in all those, where the fielding of military vehicles, such as the Stryker is concerned, is that we should make sure that whatever we field can handle the full realities of modern combat – even if such vehicles are temporarily employed in only a peacekeeping role.

It should be further stressed that the transition from peacekeeping to a war situation can happen as fast as a crowd can turn ugly – *which means seconds*.

There is a real need for an air-insertable, globally deployable, armored force.

The advantages of inserting a military force where it is least expected – such as behind enemy lines – are well known.



Traditionally, such a task (leaving out Special Forces for the moment – a significant omission) has been carried by Airborne units, whether paratroopers by fixed wing, or Air Assault units by rotary aircraft.

The trouble with both types of units is that once on the ground they are little more than foot mobile and vulnerable to enemy armor and artillery. True, Air Assault units can leapfrog further distances, but their logistical demands are so great that there are limitations to what they can accomplish. They need to link up with ground units – to effect ‘Ground-lock’ within a few days.



It looks like a tank. It has devastating punch. It is the air deployable and air droppable M8 Armored Gun System, or AGS.

It is vastly superior to the Stryker MGS support (some, at least, by direct air – a long neglected asset).

The requirement for such an option was demonstrated in Afghanistan when the Marines, albeit with limited armor, not only seized Camp Rhino, a much needed air base, but also secured the surrounding area. However, the need was really demonstrated in Iraq when Turkey refused to offer basing facilities to US ground forces. In this case a modest Northern Front was opened by the 173rd Airborne Brigade seizing an airfield in Kurdish territory (actually it was already in friendly hands) but then being decidedly constrained from taking further initiatives because of a lack of armored mobility.

Infantry, already over-burdened, have a real problem with distance.

The current Administration advocates pre-emption where there is a clear danger. To make such pre-emption conclusive frequently demands regime change, a task for which air inserted armor is well suited.

Situational awareness is not a substitute for armor:

One of the theories behind the Stryker is that situational awareness, resulting from UAVs, total air dominance, technological superiority and so on, can be traded for armor.

Armored units not only bring with them survivability and firepower, but they also add speed and mobility so give the combatant commander considerable additional tactical flexibility.

He can not just take a position by surprise, and hold it, but also open up a further front if he so wishes. He can travel hundreds of miles from his original point of insertion - providing he has logistical



Unfortunately, *full* situational awareness – knowing where *all* friendlies and *all* enemy are at all times - is not possible and, almost certainly, never will be.

Network centric command, control and sensors bring enhanced situational awareness generally, but cannot avert tactical surprise. Therefore, survivability and lethality in combat vehicles cannot be solely traded for better information. Certainly, we are becoming vastly better informed about the battlespace but, as can be seen in Iraq right now, the elimination of tactical initiative (surprise) by our enemies is a fantasy.



Bradley Fighting vehicles, with their 25mm cannon, can survive the first hit and go on to win.

Currently, the technology is not good enough and by the time it is, our enemies will inevitably be using electronic counter-measures (We have trained enough of them in American Universities) and, as always, human ingenuity.

Technology can be manipulated to deceive as well as to inform.

Bottom line: Regardless of our perceived technological superiority, we need to expect to be tactically surprised from time to time, and to take the first hit; or, at least, to be hit. What counts then is the ability to survive the hit and respond

with interest to the enemy's terminal disadvantage. Abrams main battle tanks and Bradley Fighting Vehicles proved they could do just that.

Knowing where the enemy is does not render him harmless:

Consider the game of chess.

The forces of both sides are in plain sight – full situational awareness – yet that does not guarantee the outcome of the contest for either of the players.

Intentions remain concealed.

Often you will not be able to distinguish enemies from noncombatants.

However, full situational awareness, even if it is possible, will not protect you from being hit. The fact that you know exactly where the enemy is does *not* render him harmless.

Units maneuvering in plain sight in the Civil War could see each other close up but managed to kill more of each other than in every American war before or since put together.



War without mystery (Full situational awareness). It is still deadly.



Situational awareness is a useful, indeed essential, aspiration, and it certainly helps enormously to be Information Dominant, but it is not a solution in itself; nor does it eliminate casualties.

Beware of the 'incompetent' (by US Army standards) enemy. He can still kill you.

As was, and is, being shown in Iraq, the fact that your enemy refuses to fight in a conventional way, in set piece force-on-force battles, does not render him harmless either. An incompetent enemy, *as judged by US military standards*, can still kill a lot of people. Many of our enemies are far from incompetent. Many are unconventional.

We would be well advised to study the Lessons Learned from the Vietnam War where we faced a truly formidable enemy. There we had technological superiority and many of our enemies were less than adequate by conventional Army standards.

Yet, look at the results.

Better yet, let's look at their mindset and their Tactics, Techniques and Procedures. Enemies or not, we have much to learn from them.

Armor is better than flesh in achieving survivability.

Given that some of our soldiers will be hit, no better protection has been found to date than armor (where that can be used). Armor is not foolproof, even where an Abrams tank is concerned, but it is vastly better than human flesh in achieving survivability.

The statistics over the decades show that soldiers mounted in armored vehicles have a vastly greater chance of surviving than infantry, even if their vehicles are damaged or destroyed. Armored vehicles provide, or should provide, mobility, heavy shoot-on-the-move firepower, speed, on and off road maneuvering capability, advanced sighting systems, chem-bio protection, communications and a base from which to operate.

Note: This is not an argument in favor of armor for every combat situation although there is clear evidence that the present boundaries between the Heavy Force (Armor), Light Infantry and Airborne are ill conceived.

Simply put, you should have mobile Armor when you can, a minimum of Mobility when you cannot have Armor, and un-protected foot mobile Infantry *only when you have absolutely no other alternatives.*

Current US Army Branch differences, which are tribal in their intensity, make no military sense and are downright destructive. They promote prejudice instead of professionalism.

These principles about the use of Armor should also apply to Special Forces who, fortunately, tend to be much more pragmatic about what tools to use, and when to use them, despite the best efforts of conventional forces to rein them in. There is much mystique about Special Forces, and not all are the same, but the



essence is that they are rather better trained soldiers who are actively encouraged to use their initiative.

If you are going to have armor, it has to be RPG resistant.



Armor is not infallible – but it is far, far, better than flesh!

If you are going to have armor, it has to be RPG resistant because it is virtually guaranteed that RPGs will be shot at you. They are cheap, ubiquitous and deadly. Even more vicious weapons are available or on the way but the fact that they are does not mean that armor is less relevant.

All of this becomes very clear when one is being

shot at.

The ability to maneuver on and off roads is essential.

Survivability does *not* depend on armor alone. Not even close. It depends on mindset, combat skills, firepower, and the fortunes of war. But armor truly helps.

Speed and the ability to operate both on and off roads – to maneuver for positional advantage - are essential. Conversely, if you stay road bound, you become predictable and will be ambushed. That happened on numerous occasions in Iraq. Fortunately, our enemies were, in the main, lousy shots or the consequences could have been more serious.

Such ambushes could and should have been substantially avoided by operating off road. Tracked vehicles are very good at operating off road. Wheeled vehicles,



The Australians tried wheeled armored in east Timor without success. They switched to tracked M113s which worked fine, both on and off road.



particularly above 10 tons in weight, are not. It's a matter of physics.

Tracks were invented for a very good reason.

Neither tracks nor armor are, *let me emphasize*, a substitute for fighting smart.

Survivability is also helped by being able to shoot the enemy before he shoots you.

The Bradley's turreted stabilized 25mm chain gun illustrated that fact again and again in Iraq, and the Marine Corps, using their LAVs and their 25mms, had the same experience.

The point about the rapid fire 25mm is that it is deadly accurate with advanced optics such that it drastically outranges most small arms and RPGs, and has considerable destructive capability in itself even against the 30mm mounted on much Russian made armored fighting vehicles, and against all but the latest tanks.



Bradley 25mm chain gun outranges small arms and RPGs and significantly enhances offensive capability and survivability

.50 cal machine gun or M19 grenade launcher, although both fine weapons, do not compare.

Clearly, Abrams M1A1/2 tanks, armed with 120mm cannon and both 7.62mm and .50 machine guns were better still. They survived considerable punishment with minimal casualties and still routinely ended their fights to their advantage.

The Abrams, though it has a few weaknesses, which should be attended to, is awesome. Its greatest weakness is its turbine engine which gulps fuel and has to be re-fueled every eight hours or so. Installing a diesel engine of similar performance, would solve that and would vastly ease the logistical burden and, thus, combat capability.

A diesel powered Abrams could make it from Kuwait to Baghdad, with only one re-fueling, in half a day or less. Yet Stryker, which Army General Officers have complained is only getting 2 or 3 miles per gallon, brings a strict operational limitation since it carries only 60 gallons of fuel.

This strain on operational logistics adds to the operation risk associated with employing a Stryker brigade.

Unfortunately, the US Army, unlike some other forces, has evolved the notion that a unit should advance at the speed of the *slowest* vehicle in the



division. A reasonable person might argue that a little fresh thinking might be in order.

Speed in combat is only remotely related to road speed.

The much praised dash to Baghdad over about 350 miles actually took about two weeks. You could walk to Baghdad in that time.

True, the first 300 miles were done in about five days but that is still only 2.5 miles per hour by the most powerful military in the world backed by total air dominance against no serious opposition (which is not to see that there were no serious firefights).

Speed in combat is a matrix of political will, combat leadership, brainpower, willpower, training, intelligence, terrain, maneuvering capability, logistical support, weather conditions, vehicle reliability, vehicle speed, and the enemy's will and capability to resist.

Theoretical top speed on a well surfaced road under peace time conditions is *not* a big factor in this equation. If it was, the Army would drive Ferraris (which would still be much, much, cheaper than Strykers).



Great courage by the troops, but we could have walked to Baghdad in the time.

We would be well advised not to count on a convenient road network.



This, believe it or not, is an Afghani road. You need tracks to handle the terrain we are fighting in.

the rest of Africa. In all of these countries good roads are hard to find, and off road, *all weather*, capability is a must. Wheels do not deliver that capability and therefore constrain forces to the road network – which is easily targeted by the

Being stationed in Western Europe for decades has given the US Army some bad habits. Well surfaced roads have proved to be rare items in both Afghanistan and Iraq and look like being equally rare in the countries we are most likely to have to fight in the future. Consider Syria, Iran, North Korea and, regrettably, the possibility of a conflict with China. Consider problematic countries like those around the Caspian Basin or Indonesia or the Congo – let alone



enemy - and wheels become almost completely ineffective in extreme climatic conditions.

Furthermore US forces with GPS and tracked mobility can navigate cross country to avoid such enemy traps.

The Australians learned the limitations of wheels the hard way in East Timor where they found their wheeled armored vehicles just could not cope. They brought in tracked M113s which worked fine. Australia has since invested in upgrading their M113s in addition to procuring wheeled vehicles – as have the Canadians to balance permissive peacekeeping situations.

The US *can never assume* a permissive peacekeeping environment.

Wheeled vehicles can be a major problem away from good roads.

Wheeled vehicles have proved to be much more of a problem than expected in both Afghanistan and Iraq even when, of necessity, confined to roads or what passes for roads.

The unbudgeted costs have been huge, in the many tens of millions. Tires have been shredded over comparatively short distances in both countries. Supply trucks have been unable to keep up. Many have been wrecked in accidents.

The clear lesson here is that tracked vehicles need to be re-assessed because it is not much use having a fast moving Tip of the Spear (tanks and Bradleys) if the logistical tail not only cannot keep up but serves as a soft target for guerillas.



Tracked M113 tows wheeled Humvee out of the mud. Wheels are not too good at off road maneuver.

Tanks and other tracked vehicles effective in urban terrain.

Tracked armor, if utilized properly, has proved itself again and again in urban environments. It has the capability of ending the fight physically (if necessary by changing the terrain), and of deterring further enemy action through intimidation and psychological dominance.

That is a lesson that has been proven in many cities over many decades from Manila in World War II to Hue in Vietnam to urban combat by the Israelis to Baghdad itself. That, in turn, begs the question of why the lightly armed and armored Stryker, entirely vulnerable to RPGs and which cannot turn in narrow streets, is seen as particularly suited for urban combat.

The answer would seem to be that the US Army, in the face of all the evidence, believes, and publicly advocates, that infantry are the solution to urban



combat. They can be if you ignore the fact that, unarmored, they die easily and in large numbers.

The Israelis, the people with most experience of sustained combat in complex urban terrain, use tanks, the tracked D9 bulldozer, upgraded M113s, supporting Apache gunships, a limited number of infantry and an innovative mindset (Intelligence, close coordination, snipers, mouse-holing etc.). They sustain remarkably few casualties in such combat.

The reality from the sharp end. The following is a *verbatim* extract from an April 2003 After Action Review of the experiences of Task Force 1-64 Armor during Operation Iraqi Freedom. It is sobering in its description of the RPG threat.

“The current doctrinal manuals on Urban Operations do not address how best to utilize armored forces in an urban environment. The enemy faced by this unit hid his tanks and vehicles under camouflaged covers, beneath bridge overpasses, inside of buildings on narrow streets, and under low trees. These enemy systems were not seen until they were only meters away. No degree of IPB could compensate, alert or prepare for the massive numbers of RPGs stored in houses, shacks, lockers, and cars. The only way to counter RPGs fired from covered and concealed positions was to absorb the hit, identify the source of the fire, and respond with massive overwhelming firepower.

“Tanks and Bradleys repeatedly sustained hits from RPGs and ground directed anti-aircraft fire that dismounted infantrymen, HMMWVs and other light skinned vehicles could not sustain. Bradleys successfully protected the infantrymen inside while at the same time delivering a massive volume of fire against dismounted enemy, trucks, tanks, and armored vehicles. The firepower and shock generated by tanks and Bradleys could never have been matched by dismounted infantry. Without the use of these systems initially, the enemy would have caused many more casualties.

“The current doctrine recommends clearing the built up area with dismounted troops prior to any armored vehicles entering. This Task Force proved this is not a requirement and not necessarily the best initial course of action. By moving armored forces along a pre-determined route and destroying any enemy forces whether dug in, in buildings, or on roof tops, with massive overwhelming fires from M1A1 tanks and M2A2 fighting vehicles, and entire line of communication can be opened up allowing access not only into the built up area but through it also.

“Recommendation: The BCT submit to the United States Army School and United States Armor School an update to the current urban operations doctrine.

“Additionally, send only vehicles that can sustain RPG hits into urban combat zones.”

The Stryker *cannot* sustain RPG hits (note the plural).



3. THE STRYKER CONCEPT vs. THOSE LESSONS LEARNED



But, we are at WAR.

Fortunately, the M1A1/2 tank is a highly survivable and lethal combat vehicle – so pictures like this are very rare. The Stryker *lacks* these attributes.

The Stryker Concept – a decision made in peace, inspired by a mix of embarrassment and the desire to make a symbolic change.

Research has shown that the Stryker concept was not thought out in great detail. In fact the decision to purchase the Stryker range of vehicles was made before much serious thinking had been done at all. In effect, the hardware decision was made first, and doctrine was cobbled together afterwards – a process which is exactly the wrong way to do things. The Leadership ends up justifying an acquisition decision instead of focusing on the capabilities required to defeat the enemy and then sourcing equipment needed, if any.

Putting it another way, Tactical should always dictate Technical.

The context of the Stryker decision was not war, or even the prospect of war. It was embarrassment over the Army's sluggishness in deploying to places like Bosnia and the prospect that peacekeeping would be the primary task of the Army for the indefinite future. And peacekeeping, as interpreted by the Army, was about Force Protection and patrolling the roads, villages, towns and cities of places like Bosnia and Kosovo. It was more about showing the flag than remaining hard to detect. It had virtually nothing at all to do with finding, out-maneuvering and then destroying an enemy.



In Bosnia, the French used armored cars for much of their patrolling and, General Shinseki's opinion, they seemed much better suited to the task than M1A1 Abrams tanks or Bradley Infantry Fighting Vehicles.

General Shinseki had a further imperative on his mind when he made the Stryker decision. He wanted to make a few decisions which would, of themselves, symbolize that there was a new regime which was determined to shake the decidedly moribund US Army out of its complacency. Two of these symbolic decisions were his choice of the Black Beret as the new US Army headgear, and the wheeled Stryker.

Both decisions were imposed from the top rather than being arrived at after some process of discussion to ensure support within the Army.

The Stryker Concept begins to get out of hand.

Buying a limited number of wheeled vehicles for patrolling in Bosnia, or other peacekeeping environments, was not an unreasonable decision and would have attracted little attention by itself. For instance, the British keep wheeled armored vehicles for patrol work in Northern Ireland and each unit deployed there, whether Infantry, Airborne, Armor, Artillery or whatever, uses them in turn. They do not take much special training to master.

However, General Shinseki and his people were not content with such a modest proposal but instead evolved the idea of air-deployable Stryker Brigades which could be flown to trouble spots anywhere in the world in 96 hours (4 days).

Note. An analysis by both the GAO (Report #03-081) and Rand (Vick, et al. *The SBCT, Re-thinking Strategic Responsiveness, 2002*) have determined the 96 hour objective to be unachievable.

The idea of a global fast reaction force is a good one but 'trouble spots' imply considerably more than a peacekeeping capability so the Army set to work to develop the Stryker into a range of vehicles which would be 'Full Spectrum of War' capable. What had started as an off-the-shelf purchase, and had been sold to Congress that way, morphed into something vastly different.



Wheeled vehicles get STUCK! Note the way the wheels have dug themselves into the mud, and the tow rope.

This plan was a reach by any standards because the wheeled vehicle the Army had chosen to be christened the Stryker, the LAV III, while an adequate armored car, was certainly not a good vehicle for



serious combat for all sorts of technical reasons. It was lightly armored. It was an awkward shape to up armor. It had limited off road capability, and so on. Certainly, the Marines used a variant for reconnaissance but *they deployed the vehicle within the envelope of its limitations* and installed a 25mm chain gun so it could shoot its way out of trouble. The Army had more grandiose plans. The Stryker would be made to do pretty much everything. Stryker Brigades would contain only Strykers as their main vehicles (along with Humvees and supply vehicles and so on).

The Army system is not set up to feed back bad news to the Army Leadership, and General Shinseki's Command Climate tolerates neither discussion nor opposition, so TRADOC (Training and Doctrine Command) and the various Branches of the Army set to work to make the Stryker happen. GAO documents that General Shinseki's office ran the publicity campaign.

It was at this stage that things started to go badly wrong, and then from bad to worse with 'worse' being the Stryker Mobile Gun System which is such an awful story it is described separately in this report in some detail.

What dominated everything was weight.

Stryker and the weight issue – a diet goes wrong.

Weight was, theoretically, the vital issue because the Stryker absolutely had to be C-130 deployable, and, able to enter and exit the aircraft capable of immediate combat operations.

That was a KPP – Key Performance Parameter. It was a standard set in stone. After all, if the Stryker could not be C-130 deployed, it could not get to where it needed to get in 96 hours and if scarce C-17s had to be used, then you did not need the Stryker because the C-17 can carry both the M1A1 Abrams tank or Bradleys (both of which bring vastly more punch to the fight).

Unfortunately, initially, the Army did not involve the Air Force in the weight issue, which was a pity because the issue of weight, of how much a C-130 can carry, is more complex than a simple figure. It depends upon altitude, weather, the nature individual aircraft and airfields used, cruising speed, whether there is re-fueling at the destination and so on. It is a moveable feast.

There is then the issue of the simple fact that the weight of a combat ready armored vehicle is substantially more than that of the vehicle itself. You have to



Stryker vehicles are ALL overweight.



factor in the vehicle crew (11 soldiers in the case of the Stryker), fuel, water, food, ammunition, anti-tank weapons, personal weapons and so on. That adds up to about 9,000lbs in addition to the vehicle weight.

The Army put the Stryker on a diet and removed all sorts of good things such a turreted gun, weapons stabilization, air-conditioning, swim capability and so on in the interests of saving weight, but at the same time increased the overall weight of the vehicle by adding extra armor.

The end result was a Stryker Infantry Carrier that still was not protected against RPGs but which weighed about 38,000lbs even before the combat load of 8-9,000lbs was added.

At 38,000lbs you could take off but fly only a short distance, perhaps 100 miles. At 38,000lbs plus up to 9,000lbs (a total of 47,000lbs) you could not take off at all.

The situation actually gets worse because the Infantry version is one of the lighter vehicles. Others are heavier and the Stryker Mobile Gun system is so heavy, it just cannot be lifted in a C-130.

The Army's solution to all this has been, in essence, to deny the problem. Their operational proposal has been to propose using 5 C-130s to carry 4 Strykers, with the fifth C-130 carrying much of the combat loads.

That still does not solve the issue of being able to fly a tactically significant distance.

It also does not deal with the Mobile Gun System issue. This is vital because the MGS is needed to provide the punch, the firepower, that the Stryker Infantry Carrier lacks. It is a survivability issue.

Note. A Stryker IAV at 38,000lbs does *not* have any RPG protection. It is estimated that such a kit would weigh 7-8,000lbs plus. Such an additional weight which would require 6 C-130s to carry 4 Strykers - with the RPG armor being carried separately and added in the combat zone.

For all practical purposes, the Stryker is *not* C-130 deployable.



The Stryker Concept & The Reality of War.



**Wheeled Armored Vehicle in Grenada.
Note burning tires.**

The Stryker Brigade concept is based upon the notion of using technology, and the speed and maneuverability of the wheeled Stryker vehicles, to out-maneuver the enemy.

A Stryker Brigade, equipped with its high tech RSTA (Reconnaissance, Surveillance and Target Acquisition) squadron will have, it is claimed, information dominance of the battlespace and thus will never have to go head to head with the enemy but will, in most cases, kill him from afar. As a consequence, the kind of protection that heavy armor gives will not be

needed. There is no intention of slugging it out with the enemy. However, if some clearing up is required, then the Strykers will not do the job in the main. Instead they will disgorge infantry to do the fighting.

A Stryker Brigade, in essence, is a motorized infantry Brigade with rather more mortars than normal, and its own *towed* artillery.

That all sounds fairly credible if you accept that you have Full Situational Awareness and that the enemy will obligingly fight you on your all terms at all times. However, such thinking is riddled with flaws.

- There is absolutely no evidence that we will *ever* come close to full situational awareness because of the weather, peculiarities of the terrain, and all kinds of technical limitations together with the fact that the enemy has a vote. Reflect that despite more UAVs and other types of aerial and ground reconnaissance, the Iraqis still managed to surprise US forces in a sandstorm; and managed to ambush them again and again even when the weather had cleared.
- Full Situational Awareness does not guarantee you will not be shot at.
- The Stryker's speed is largely road based. Off road, its speed drops dramatically and there is substantial terrain where it cannot progress at all. In short, its maneuvering capability is disturbingly limited. And on road, the speed, as it climbs, actually reduces the ability of the soldier to maintain awareness. The faster one goes, the more likely the ambush.
- As described elsewhere, the Stryker is highly vulnerable in an urban situation. It cannot surmount barricades, it cannot turn easily, it cannot shoot on the move, it has poor visibility when buttoned down, and it is entirely vulnerable to RPGs and, in some areas, to small arms.



- The Stryker Concept is heavily dependent on Infantry but Infantry are extremely vulnerable in modern high intensity combat.
- The Stryker Infantry Carrier does not have enough firepower to give the Infantry sufficient protection.
- The Stryker MGS with its 105mm cannon is still in development and is in serious trouble so not yet available. A Stryker mounted with bunker busting TOW missiles is being fielded to act as a temporary replacement but it does not come close to providing the firepower of a 105mm and cannot shoot rapidly in volume or at close range. Numerous studies and exercises have shown that a direct fire 105mm, or similar, is absolutely essential to deal with armor, fighting positions, urban obstacles etc..



Full Situational Awareness does not guarantee you will not be shot at.

Stryker and the Findings from War Games.

One might well ask why these weaknesses do not show up in the kind of simulation based war games that the Army run on a regular basis. Research has shown that these weaknesses do indeed show up but are then encountered by the insertion of assumptions to give the result the Army Leadership wants.

Such practices are, unfortunately widespread. They reflect the highly undesirable combination of an oppressive Command Climate, careerism, and a lack of intellectual honesty and moral courage that is both distressing and dangerous.

The truth is, in fact, known in many Army circles but it is widely known that to oppose Stryker is fatal to one's career.

The Stryker story is symptomatic of some serious problems within the Officer Corps of the Army, and particularly with the culture and mores of more senior officers.

The Stryker concept and Afghanistan.

Strykers could not have been C-130 deployed within Afghanistan because of the weight issue already described. The Marines were able fly their LAVs in because they are 10,000lbs lighter than the Stryker despite mounting a 25mm gun.



The Marines had great trouble with the tires on their LAVs when driving over the pervasive volcanic rock surfaces.

Strykers would have been extremely vulnerable in combat given their lack of RPG resistance, limited firepower, and a population that was expert at destroying the Soviet equivalent.

One could argue that a Stryker Brigade could have utility now in a peacekeeping role, but here we run into the tire issue, the problem of high running costs, and their vulnerability if events do escalate.



Marine LAV 25 in Afghanistan. Note the severely damaged tires.

Vulnerable Strykers have the potential of killing a lot of soldiers. Each infantry variant contains 11 troops.

It is disturbing how often the issue of Strykers themselves needing protection comes up.

The Stryker concept and Iraq.



The *essential* ability to take a hit and still be able to fight and win. Stryker cannot do this.

Stryker proponents within the Army have argued that Stryker Brigades would have been ideal to lead the dash to Baghdad.

That is a truly alarming suggestion.

To illustrate the point, it is salutary to look at some of the after action pictures that are scattered throughout this report.

There were no force on force pitched battles but there was still substantial incoming from pockets of

resistance. The fact that casualties were so low is not because vehicles were not hit. It was because the tanks and fighting vehicles were tough enough to take a hit and still keep going – which is, of course, the whole point. Also, they were able to lay down such a curtain of fire that sustained attacks by the enemy were rarely possible. They were also able to push aside or run over barricades, surmount obstacles and maneuver off road to an extent that would not have been possible in the Stryker.

The weapon of choice was, and remains, the RPG. The Stryker is entirely vulnerable to it.



The RPG issue and the running costs also raise questions about using Strykers in a peacekeeping role.

The Stryker concept and other missions. Not good.

The notion of using Stryker Brigades, by themselves, in high intensity combat is quite clearly, not feasible. However, you could argue that they could be useful if supplemented with tanks and Bradleys.

Unfortunately, here you run into the fact that the Strykers cannot take the same punishment as the other vehicles and are particularly vulnerable in any sort of urban environment. There are better choices available to a combatant commander.

One might then consider a scenario such as using Strykers in a country such as the Congo in a low intensity situation. That sounds fine, if one accepts the ever present RPG risk, until one realizes that the Stryker's lack of good off road capability is critical, as is its inability to be deployed any useful distance by C-130. The Congo is a vast country with limited roads where moving one's force by air is tactically essential.

We have surveyed many other possible missions. The innate disadvantages of the Stryker render other options preferable in every case. The Korean commander suggested he would use them to remove refugees from the conflicted areas.

Surely one should experiment with one Brigade before fixating on six?

It is the Army Leadership's insistence on having no less than six Brigades that has turned an error of judgment into an assault on the Army's capabilities, and what looks like becoming a major hindrance to the Army's modernization plans – not to mention a financial drain approaching that of a debacle.

So why is there this insistence on having six Brigades when not even one is working yet, and will probably not work later?

Surely, it makes sense to experiment and test in the field before you commit to what looks like being well over \$12 billion – a particularly significant figure in the context of the Army's limited capital budget?

Is there a military reason, or is there another agenda?

The evidence would seem to suggest that this number of Brigades was determined by the need to get political support for the Stryker – not for military reasons.

No one grudges a politician fighting for his state or district but when we are at war and the wrong vehicle is being purchased, one has to become seriously concerned because the defense of this nation is being put at risk.

Six Stryker Brigades equates, roughly, to two divisions. We only have ten divisions in the Active Component of the US Army.



Are there better alternatives to the Stryker? Absolutely.

One might well ask about this Army Leadership obsession with one flawed vehicle. In the light of experience to date, and particularly the weight issue which is so fundamental to everything else, why has there been no attempt to try out alternative vehicles – in parallel if necessary?

Part of it could be a rather too close association between senior officers involved in the acquisition process and the supplier, General Dynamics Land Systems.

Part of it could be that the former Chief of Staff of the Army's prestige was attached to the project and he did not want to be proved wrong.

Whatever the reasons, the fact is that there are a number of excellent alternatives to the Stryker – depending on how the mission is defined.

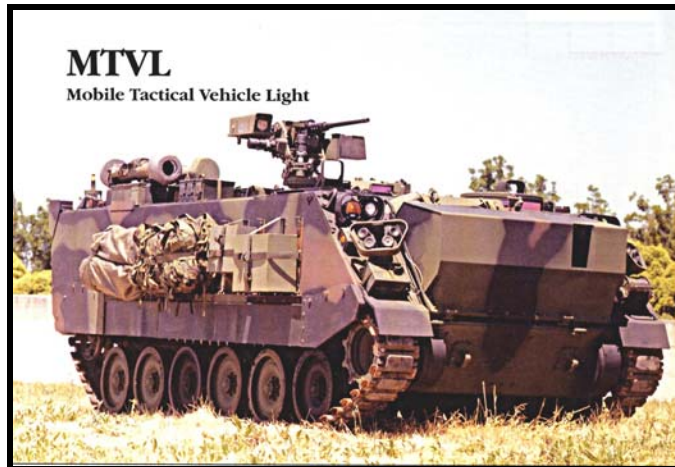
One alternative, now being seriously reviewed, is a fresh look at forward basing. Another option is to invest in Fast Ships (the new all weather 40 knot per hour ships).

The finding by many about the Stryker is that it is neither fish nor fowl. It is self evident that it is too heavy for fast, global deployability. It is equally self evident that it has neither the punch nor the armor to hack it in serious combat. It is too expensive, both in capital and running costs, to use as a routine peacekeeping patrol vehicle.

The alternatives will be described elsewhere.

One thing we do know – the Stryker is a problem, a very expensive problem.

We do not need six Brigades of such very expensive problems. \$12 billion is an awful lot of taxpayers' money.



Tracked MTVL outperforms Stryker under just about every heading.



Stryker Infantry Vehicles are both vulnerable and lightly armed. Enter the requirement for an escort such as a Mobile Armored Gun.



This is a Stryker Mobile Gun System. Note the wheels. It has terrible off road performance & overall just does not work.

remained that a mobile gun of substantial caliber was invaluable, and that meant something a whole lot bigger than the 25mm carried by the Bradley. It needed to be able to take on enemy armor, bunkers, urban emplacements and similar. Tests in the Eighties through the experimental 9th Infantry Division confirmed that truth again – and so do current exercises, both real and simulated.

A Bradley could not carry such a gun and still have room for infantry.

By common consent, it was generally agreed that a gun of the caliber of 105mm would be ideal for the job. This caliber used to be the standard for the Abrams tanks before the decision was made to go to the 120mm. A 105mm is a large round (it comes in various versions) of immense capability, particularly when made of depleted uranium or contains another such advanced Penetrator. It can destroy enemy armor at a considerable distance and handle bunkers and other threats.

The difference between a Mobile or Armored Gun and a Tank is not that precise. In broad terms, a Mobile gun is primarily a turreted gun with only light armor and either wheels or tracks. In contrast, a Tank has a heavily armored turreted heavy gun on tracks with the capability of rapid precision fire on the move so that it can, if need be, slug it out with enemy tanks. A Tank is designed to take hits and survive to destroy the enemy. It is designed to be the ideal balance between speed, maneuverability, firepower and survivability. It is an integrated system. Its two disadvantages, typically, are weight and cost. Most feel that the advantages dominate, as was well demonstrated in Iraq.

A Mobile Armored gun on tracks is, for all practical purposes, a Light Tank. The advantages of tracks, and the useful fact that they allow excellent off-

Back in World War II, the most intense combat environment experienced, at least in terms of scale, the advantages of a Mobile Armored Gun – a cannon of serious caliber than could knock out strong points up there with the infantry – were well recognized. In fact the Sherman tank spent 75% of its time performing such a role.

Over time, infantry started to travel in armored Infantry Fighting Vehicles, such as the Bradley, but the principle still



This is the M8 AGS Armored Gun System. Note the tracks. It is US Army Type Classified.



road mobility, have been listed elsewhere but there is an added bonus where a large caliber gun is involved. Tracks are more stable, dissipate recoil better and thus ensure greater accuracy. Accuracy is vital when engaging an enemy at long range and, clearly, it is highly desirable to destroy him before he can hit you.

Given that the Stryker range of vehicles is not heavily armored, a Mobile Armored Gun up there with them at all times is essential both for their defense and to give them some degree of punch.

'*Essential* is the operative word.' As has been described elsewhere, Stryker Infantry Armored Vehicles, by themselves, are extremely vulnerable. They absolutely have to be escorted by Mobile Armored Guns or similar.

Further, such Armored Guns have to have RPG protection if they are to stand up to the hazards encountered on a daily basis in areas of conflict such as Iraq – and which are predictable in virtually all other trouble spots throughout the world. Since the Stryker Mobile Gun System is already too heavy to be upgraded with RPG resistant armor, that leads to the inevitable conclusion that it is not suited to the task.

The only alternative is the tracked Type Classified M8 Armored Gun System (AGS) which many think is the Armored Gun which should have been chosen in the first place.



This is a Stryker Mobile Gun System (MGS) digging itself into immobility. Note the way each set of wheels digs a little lower. The Stryker MGS is very poor off road (as can be seen) and the gun does not work with that chassis.

4. THE STRYKER MOBILE GUN SYSTEM (MGS)

Stryker MGS does not work. Wrong gun on wrong chassis.

The Stryker Mobile Gun System was billed to be that critical combat multiplier, built on a common Stryker chassis, which would give the Stryker Brigade Combat Team essential bunker busting and rapid fire combat vehicle killing capability. Yet, the demonstrated performance of MGS development tells a very different story – one that raises even more questions about the viability of the entire Stryker concept.

The source of this development failure is easily understood.

In short, the Army and contractors have tried, with the Stryker MGS, to integrate an M68A1 series tank cannon on the Stryker chassis.

That cannon was designed to be fired from a 20 ton turret resting in a *60 ton tracked M60 tank*; not a low profile turret in a 20 ton wheeled combat vehicle. Consequently, the MGS has significant recoil challenges both because a 20 ton vehicle cannot absorb the same forces as a 60 ton vehicle, and because the wheeled chassis cannot transfer pressure to the ground as efficiently as a tracked chassis can.

This is simple, but fundamental, physics.



Stryker MGS problems with the 105mm cannon get worse.

To partially address the recoil challenge with the M68 cannon, the MGS employed a pepper-pot muzzle brake, which then caused significant other problems.

First, this muzzle brake was too close to the driver's compartment and creates extreme overpressure inside the vehicle, to such a great extent that the helmets worn by test dummies were cracked and lights/mounting brackets/instruments were destroyed during test firings. Furthermore, the Driver's Viewer Enhancer (DVE) was also destroyed, thereby blinding the vehicle for night driving or requiring the crew to expose and use night vision goggles.



MGS busy incinerating its own crew. Fortunately only a test.

MGS recently without the muzzle break and the recoil shattered the recoil mechanism and caused other extensive damage, plus it is reported that two live rounds of ammunition were dumped on the floor of the vehicle in the process.

Second, the MGS gun design created such significant sound blast, approaching 200 db, that no soldiers could be within 450 meters of the vehicle when it fires. Therefore, dismounted soldiers and other vehicles cannot be in proximity of the MGS, which undermines the entire operational concept of the gun system providing supporting fires for infantry.

Third, the muzzle brake created such extensive blast debris, that it could not be fired from a defilade position unless the crew was completely buttoned up and no friendly soldiers were in the area.

To solve these problems, the Army could remove the muzzle brake. But then, the MGS could not handle the increased 105mm recoil.

Note. The contractors tried to fire the Stryker

Why are the contractors trying to use the wrong cannon, on the wrong chassis – at the taxpayers' expense ?

The short answer to this question is that the Army has a large number of surplus M68A1 cannons which are being made available to the contractor virtually for free (The M68 105mm cannon was the standard weapon for the M60 tank and the early Abrams).

Accordingly, it is very tempting indeed to try and use that free cannon in the Stryker Mobile Gun system because it increases profit per vehicle by about \$250,000.


The only problem is that fundamental engineering issues stand in the way. Unfortunately, fundamental engineering problems re the Stryker MGS are not confined to the attempt to use the wrong cannon. They are pervasive.



Other fundamental problems with the Stryker Mobile Gun System.

On March 18 2003, the Army Safety board issued a report that was a damning indictment of the Stryker MGS under a host of headings including the 105mm cannon deficiencies

BLAST OVERPRESSURE



- **Halo effect created by perforated muzzle break design to lessen recoil**
- **Burn/overpressure hazards to adjacent personnel and crew members (with hatch open)**

This is but a brief extract: A slide from the Army Safety Board Report: March 2003. Read on below.

- **MGS is too heavy to be shipped by C-130** (a Key Performance Parameter). Now bear in mind that the Stryker MGS exists to protect the other Strykers. True, the other Strykers cannot be flown over a tactically useful distance in a C-130 but it means that if a mission was tried over a very short distance (under a 100 miles) the under-armed Strykers would not have the protection of the MGS because, where they are concerned, the C-130 cannot take off at all.
- **Numerous integration problems.** These refer to safety, equipment put in places which make it hard or impossible to use etc., and design and equipment deficiencies so fundamental that they are best illustrated.
- **Autoloader unreliable.** The problems here refer not just to its ability to re-load properly but also to the ability of the system to select the appropriate ammunition when you need it. You may need one type to



destroy an enemy tank, another type to blow up a bunker and a third to defeat enemy infantry. The ability to select the right ammunition on demand is essential. It may well be the difference between life and death. Yet the sensors in the MGS autoloader may not be able to recognize certain types of ammunition with brass casings.

- **No protective separation from ammunition storage.** This is a core survivability issue. If the ammo is hit you want it to blow *away* from the crew.
- **Failure to eject casings causing jamming.** The significance of that deficiency in combat can be imagined. You are engaged with the enemy but you cannot fire your weapon.
- **Driver's Vision Enhancer partially blocked by steering wheel.** Significant Field of View obstructions. Combat is confusing enough but if the driver cannot see, the fate of the vehicle is unlikely to be a happy one.
- **Gunner's space can be occupied by only 1-5% of the population.** This is such a gross design error one has to question the core competence of the contractor and the Army's oversight. How can you design something which is that cramped without it being noticed?
- **Commander's space accommodates only 1-5% of the population.** To make one error of this type is extraordinary but to make two is approaching the criminally irresponsible.
- **Commander's displays are hard to read.** This is not good. The Commander depends upon his vehicle electronics for just about everything. His FBCB2 tells him, or is supposed to tell him, where he is, where his friends are, and where the enemy is. If he cannot see the screen, he may well end up shooting his friends – or being shot.
- **Insufficient room to grasp and rotate AZ/EL wheels for manual turret/gun movement.** Power does go out. This is basic survival stuff.
- **Insufficient adjustability of Auxiliary Sight Eyepiece.** To see is to survive. To fail to see is life threatening.
- **Multiple space problems – too many ergonomic issues to list.** Tankers live in their tanks and the last thing they need is a cramped environment which is hostile to the human body.
- **Commander's machine gun has only a 90 degree fan.** This is a core survivability issue since the enemy may attack from any direction

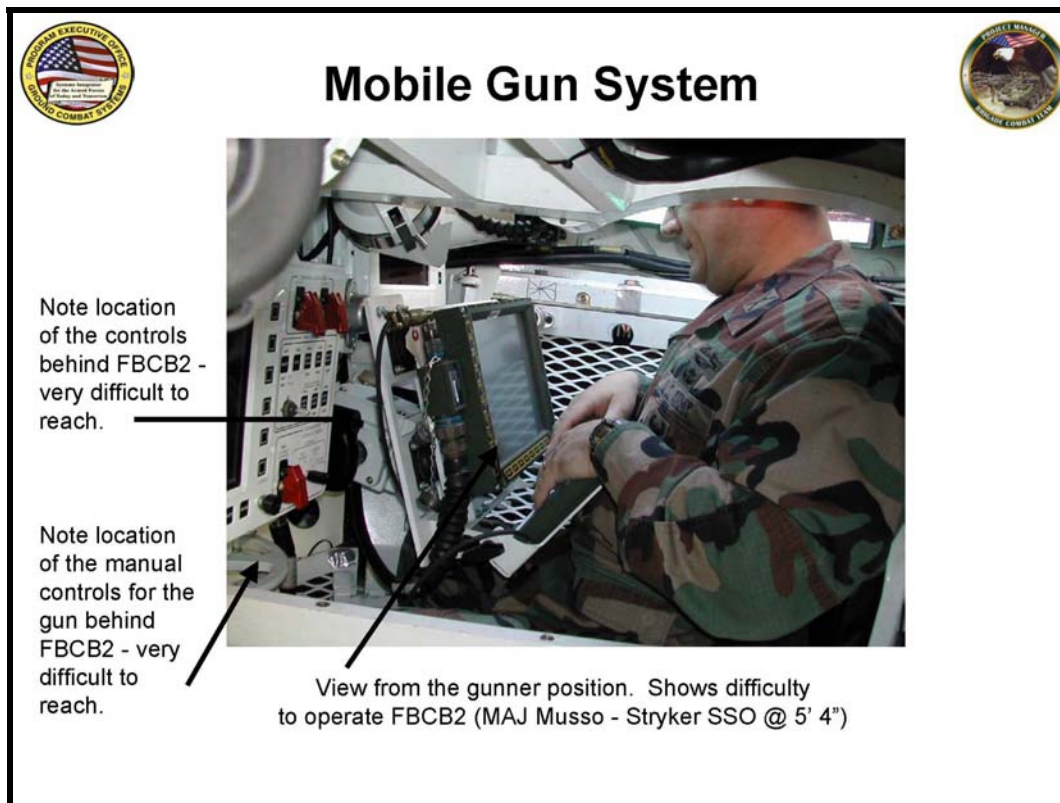


The ergonomics – human factors – in the Stryker MGS have proved to be appalling. You cannot see what you need to see – and there is no space for 95% of the population.



of his choosing. The MGS, in effect, is vulnerable from three-quarters of the perimeter, and the enemy will quickly learn this deficiency and adapt in ways that will heighten the risk to US soldiers.

- **Adjacent smoke grenade launcher can be blocked by gun and mount.** If the enemy cannot see you, he probably cannot shoot you. Smoke is a survivability issue. This kind of design carelessness is unforgivable.
- **Co-axial machine gun cannot be cleared without exiting vehicle.** The last thing you want to have to do is leave armored protection to clear your co- axial machine gun. The co-ax is used against troops – which means the enemy is close and trying to kill you.



Apart from the fact that the Stryker MGS does not work, the MGS crew cannot fit in properly. Only 1-5% of the population can squeeze in. The shape and size of a typical soldier is scarcely a secret so a reasonable person might query why the MGS is so badly designed, and why those involved in Army Acquisition are pushing this project given the existence of a vastly more capable Type Classified alternative, the M8 Armored Gun System..

- **Nametag defilade difficult to obtain in Commander's position.** Under heavy fire, procedure requires the Commander to hunker down so he is only exposed from his name tag up. However, his



position is so cramped, this is near impossible. Chin defilade is also required under particularly heavy fire but, under such cramped conditions, that is absolutely out. The result would clearly be additional fatalities.

- **Wheel design inadequate.** The Stryker MGS runs on wheels. This is not an encouraging statement.
- **Wheel design grossly inadequate for 2 axle operation** considering only 2 axles equipped with run-flat inner cores. The Stryker has 4 wheels on either side and therefore 4 axles. The theory is that if the tires are punctured, the Stryker can limp home on the 2 wheels on either side that are equipped with run-flat (solid core) tires. The reality is that the weight on 4 axles then gets transferred to only 2 – and neither the wheel design nor the axle is up to it because the MGS is grossly overweight.
Note. To save weight, the Army reduced the number of heavy run-flat wheels by half – and deleted the winch on MGS.
- **Inadequate interlocks and guarding for turret.**
- **Blast overpressure. Burn/overpressure hazards to adjacent personnel and crew members (with hatch open).** Halo effect created by perforated muzzle break design to lessen recoil. See above. Remember also that it is rather hard to close the hatches because of space limitations. Recall also that, as a practical matter, a vehicle commander needs to be able to look around so tends to fight with his hatch open where he can – at either nametag defilade or chin defilade. Either way, the MGS, his own weapons system, will fry him.

The ammunition issue. Too little, too late, and in the wrong place. Serious problems with the MGS Autoloader.

Experience has shown that a Mobile Armored Gun needs to carry a minimum of 17 ready rounds of ammunition. That does not sound a lot to begin with but it is, in fact, even less than it seems because that number is split amongst different types. What kills a tank is not necessarily good for destroying a bunker – and neither is adequate to deal with infantry.

The Stryker MGS provides only an 8 round carousel. The further 10 rounds available in the replenisher (giving a total of 18) can only be accessed by taking the gun out of action for minutes. This is absolutely not something you want to do in combat with hostiles shooting at you. It is a matter of basic survivability.

The MGS autoloader has a tendency to jam.

The whole MGS system has fundamental flaws. In fact, even the secondary armament is incorrectly integrated.



The Directorate of Training, Doctrine, and Combat Development, United States Army Armor Center at Fort Knox, are not happy either.

Mobile Gun System (MGS)

C4ISR FBCB2 EPLRS PLGRGPS SINCGARS	FEATURES Crew of 3 41,572 lbs transport weight M68A1E5 105mm gun Eye-safe Laser Range Finder (ELRF) Autoloader and replenisher 18 rounds 2 axis stabilization 1 ½ generation thermal (240 X 4 array) Full solution fire control	TESTING TO DATE Extended contractor testing Vibration profile/prooing Gun system Autoloader and replenisher LUT programmed for Sep 03
	 <p>Weapons 105mm Main Gun 7.62mm Coax M2 HB .50 cal MG</p>	Experiencing delay with MGS test dates and LRIP due to Human Factor Engineering, Safety and engineering problems with gun system, auto loader, replenisher, and overpressure issues

This is the Stryker Mobile Gun System or MGS (note the wheels). This slide is taken from a briefing at the annual US Army Armor Conference, May 2003. It confirms, if you can read Army speak, that the thing does not work and is still far too heavy. Note that the excessive transport weight is still far less than the combat weight (which includes crew, fuel, ammunition and so on).

Other significant Operational Issues: Cannot shoot on the move etc.

There are also significant operational issues beyond mere autoloader functionality and performance of the main gun.

To begin with, the Stryker MGS has neither demonstrated the capability to effectively fire over the side of the vehicle, nor to shoot on the move with stabilized precision and/or reliability. Why would the Army pay such significant sums to develop and field a gun system that had to be stationary to fire accurately, when such advanced stabilization technology exists? One can only conjecture that weight was the issue which brings one back to the issue of the wrong baseline vehicle being chosen. However, one should not minimize the combat



disadvantages of being unable to shoot accurately on the move. It is a most serious deficiency which, over time, is certain to have fatal consequences.

Secondly, the MGS does not have a winch, which was assessed by the Army to be a *critical capability* for the Stryker Infantry Carrier in the recent comparison evaluation. Certainly given the weight and mobility characteristics of the MGS, it would have at least as high a probability of getting stuck as a Stryker ICV; yet it has no self-recovery capability. So, how does the Stryker Brigade Combat Team recover the MGS if it gets stuck?

Despite major problems, Army pushing for Product Qualification Testing for the MGS.

One would reasonably think that these development challenges would require the Army to undertake a fundamental engineering assessment of the MGS.

Quite the contrary.

First, the Army pushed General Dynamics to manufacture 8 MGS prototypes that have a broad range of known technical failures.

There were originally to have been 10 prototypes but the Army cancelled 2 to free up money to cover nearly \$30 million in early cost overruns – yet those overruns continue.

Those prototypes are to be used in Product Qualification Testing - the gate that must be passed for a developmental platform like MGS to enter Low Rate Initial Production (LRIP). This PQT was to have begun last November, but has been repeatedly delayed due to technical failures.

Despite no demonstrated progress in fixing the recoil, overpressure, sound blast, autoloader reliability problems and hatch design issues (the Stryker range suffers from numerous Human Factors (usability) deficiencies), GD announced on February 25, 2003 that the Army had cleared the MGS to start Product Qualification Testing.

How? Look at the evidence. The MGS gun incinerates the crew, the autoloader jams, the crew cannot even fit, the vehicle is not stable, the amount of ready ammunition carried is derisory. What is going on here? Real soldiers are going to have to fight in this thing and they will die if we get it wrong.

We should reasonably wonder what agenda is at work here and whether the Army will require any rigor in that PQT process whatsoever.



This is an M8 Armored Gun System or AGS. It has been tested and works fine. It is already Army Type Classified. So why are we spending millions on the Stryker MGS?



The Army has only disclosed that it approved the MGS to enter PQT. Yet, the Army should disclose much, much more information about the schedule, cost, capability and test status of the MGS. For example,

- Given its vast analytical and technical resources, that the Army either did know, or certainly should have known that the M68 cannon-based LAV would not be a feasible solution for a C130-deployable gun system due to its cannon, recoil, and autoloader characteristics.
- That the MGS is significantly over C130 deployable weight and that its autoloader has failed to reliably meet cycling requirements in testing and that its cannon cannot achieve crew firing safety requirements at Aberdeen Proving Grounds related to the Stryker brigade operational concept.
- That the Army already invested approximately \$250M in the 1990s to develop, test, and type-classify a C130-deployable and air-droppable 105m Armored Gun System, the M8 AGS, that fires the entire inventory of 105mm ammunition, exceeds MGS operational capability in every performance area (except perhaps vehicle speed on hard surface roads), and could have already been fielded to the Army.
- That the Army never conducted a side-by-side test of the cost, schedule, capability and demonstrated performance of the Stryker MGS versus the M8 AGS. Perhaps it did not conduct that test because it knew the MGS's lack of capability would undermine any argument for the desired outcome -- a common wheeled platform which the late Leadership was committed to for symbolic reasons.



5. The Stryker: Survivability Examined.



Stryker really is about the size of a school bus – which is about as big a target as you could reasonably want. Being this large, really and truly, does nothing for survivability.

Stryker weaknesses.

- A very large target with a high profile
- Under-gunned
- Blind spots
- Reliability issues
- Poor off road capability
- Poor urban capability
- Problems with its standard armor
- Weak spots in its armored area
- Highly vulnerable in its wheel well area
- Tires that can be shot up or set on fire
- Entirely vulnerable to RPGs
- RPG upgrade kits too heavy for the vehicles, without affecting performance, and cannot be fitted to entire vehicle, or all variants. Wheel wells remain entirely vulnerable.



Thesis: Survivability is built into the way Stryker Brigades fight. Hmm! Because it should be so - does not make it so.

As has been discussed in some detail in Section 3, 'The Stryker Concept v. Lessons Learned,' the thesis underpinning the Stryker is that a Stryker Brigade's advanced reconnaissance capabilities will mean the enemy will be detected and destroyed from afar so that contact in the traditional sense will rarely happen.

The evidence is that such a thesis is not based upon the realities of war and both our current and anticipated capabilities. In short, despite our best efforts, we are going to be tactically surprised on occasions and our vehicles will be hit.

Consider the experiences of 3ID or the Marines in Iraq who were surprised again and again in their drive to Baghdad (despite the most elaborate reconnaissance the world has ever seen). Fortunately, it did not help the Iraqis much because they were outgunned and outfought. But we were still hit.

Arguably, a more sinister threat exists now that the main hostilities have ended. Daily, despite UAVs and rotary over watch, our vehicles are being ambushed and American soldiers are dying.

The bottom line is that for the foreseeable future, despite our best efforts at reconnaissance and our advanced technology, we can expect our vehicles to be hit. This brings us straight to the issue of survivability. Here the Stryker does not stack up well – especially when compared to the alternatives.

In the context of combat, or even peace-keeping (where ambushes are still common) it is an intrinsically vulnerable vehicle.

The RPG issue examined in more detail.





For all practical purposes, it is impossible to protect a vehicle completely because a totally survivable vehicle – survivable against the kind of anti-tank weapons that are in general use – would be too heavy to maneuver and probably too heavy to move.

In practice, the best compromise currently on the battlefield is probably Main Battle Tanks such as the M1A1/2 Abrams and they weigh close to 70 tons.

The opposite extreme is something like a Fast Attack Vehicle, which is not armed at all but relies upon stealth and speed to avoid detection. FAVs are very small and their structures are so minimal there is very little for anti-tank projectiles to explode against. Further, the crew wear body armor because the principle there is to “Armor the man not the vehicle.” It is a principle which works well for Special Forces, the main users of FAVs, although they normally have the luxury of picking the fight.

A vehicle such as the Stryker is a compromise, and accepted as such. However, the question is the level of compromise. Here, it is fairly clear that the level of compromise for the Stryker should be the RPG because in virtually any scenario one can devise, this is the weapon most likely to be encountered.

We also need to factor in the way in which this weapon is being used. Sometimes RPGs are used individually but increasingly our enemies are using them in teams so that a vehicle is likely to be hit by a salvo of 4-6 more or less simultaneously. This was a technique used in Chechnya to great effect. Snipers and machine gunners were also incorporated in such teams to take out the vehicle commander, optics and communications, and to suppress any supporting infantry. It was and remains an effective combination and this method of attack has been widely taught by the Chechens to our enemies.

Now we know what we are up against, do we have a solution?

Up-armoring the Stryker against RPGs. It is not really possible to do properly because of the awkward shape of the vehicle, the wheel wells, and the weight issue.

The Stryker was not ordered with the RPG in mind. Clearly Blackhawk Down, and numerous examples of RPG use around the world by our enemies, had not made the impact one might have expected. Evidently, the Army are still very conditioned by the Fulda Gap mindset (defending the Fulda Gap in German against Soviet hordes) so stipulated the kind of protection it would be nice to have if you came up against a Soviet Rifle Regiment. That meant 30mm in the frontal arc and 14.5mm elsewhere – if you ignore the wheel wells.

It is highly unlikely that our foes will ignore the wheel wells.

Not only had the Stryker decision been well and truly made before the Army thought of doing something about the RPG, but the vehicle was actually in production, so it became a matter of sticking something on to the existing armor.

That can be done, theoretically, but the Stryker started off by being too heavy already for the engine, drive train and suspension, and wheels do not spread the load over a wide area in the manner of tracks.



The bottom line is the best you can do to protect a Stryker from RPGs is to hang RPG resistant armor around the upper sides because if you try and armor the top, the weight is far, far too much for the vehicle to absorb. So your top surface remains entirely vulnerable even though a known standard tactic for RPG shooters is to engage from roof tops and upper floors.



The Stryker wheel well area is nearly shoulder height, on a vehicle that is roughly 23' long and impossible to up-armor. This vast target is a major area of vulnerability.

The Soviets lost numerous vehicles in Afghanistan over this weakness.

In addition, the wheels and wheel wells remain entirely vulnerable which gives the bad guys in basements and foxholes something to shoot at (as was much practiced by the Mujahideen against the Soviets in Afghanistan). Wheel wells cannot be provided the protection of armored skirts, commonly found on tracked vehicles, because the two sets of front wheels must turn. Therefore, the tires themselves, as well as key elements of the suspension and hydraulic system, remain completely exposed and unprotected.

The additional weight of partial anti RPG armor has a hideous effect upon speed, acceleration, and maneuverability on road. Off road, the performance, never good, becomes disastrous.


The simple fact is that you cannot go on loading weight on a vehicle which is not designed to take it. That common sense rule is even more applicable where wheels are involved because they don't spread the weight like tracks and, apart from getting stuck, are likely to burst.

The Stryker was supposed to weigh 38,000lbs *combat ready*. Combat ready includes over 4,000lbs of crew, weapons, ammunition, fuel, food, water and other supplies. Since the original weight could not be met, the Army chose to ignore that critical fact and accepted the vehicle at 38,000lbs empty. Add in the crew etc. to achieve combat readiness and the weight climbs to over 42,000lbs. Add in partial RPG protection of about 8,000lbs, and the total weight is now 50,000lbs.

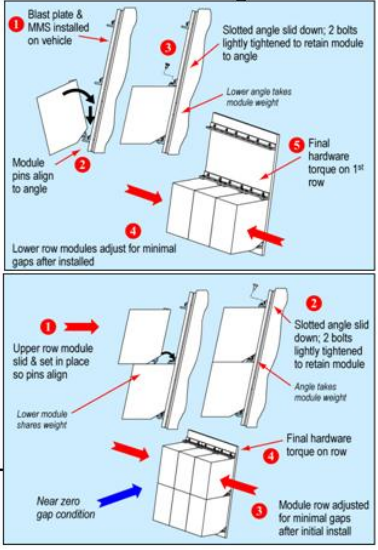


Initial RPG Add-on Armor Design

Wide Load



- **Requirements**
 - Stryker Shall Protect Against Hand Held HEAT Up to RPG-7
 - Armor will Provide Full Frontal, Side and Rear Protection
 - Armor Must be Crew Mountable Within 4 Hours
- **Status**
 - IBD Passive Armor did not Meet Requirements. Weight was Approaching 14,000 Pounds
 - GM Defense Issued Contract to UD(LP) on 5 Nov 02 for Integration of Reactive Armor to Stryker Family of Vehicles



This is an official Army slide. It shows the sides being up-armored but the top and wheel well area being left unprotected. However, that is only part of the problem. The other serious aspect is that the weight of even partial anti-RPG armor is too heavy for the basic Stryker vehicle.

Stryker, with only partial RPG protection, ends up weighing 50,000lbs or nearly as much as the M8 armored Gun System which mounts a 105mm cannon and has full RPG protection.

This is insane.

It means that the Stryker, at 50,000lbs, which has neither a turret nor serious gun, still weighs nearly as much as the M8 Armored Gun System, with full Level 3 armor, which not only mounts a stabilized 105mm cannon but also is fully protected against RPGs with virtually no ballistic holes.

The M8 AGS with Level 3 protection weighs only 52,000lbs and retains excellent on road and off road operation.

Why? Firstly, it was designed with a 600 HP engine to carry that weight and secondly the tracks spread the load. That is what tracks do. That is why they were invented. Third, it was designed with a much higher horsepower to ton ratio.



6. The Stryker: Deployability examined.



The Stryker can just be squeezed into a C-130 but then cannot be flown any tactically useful distance and some variants, such as the Stryker Mobile Gun System are too heavy to be flown in a C-130 at all.

The Stryker Brigades are supposed to be all about fast deployability – the ability to deploy a Stryker Brigade anywhere in the world in 96 hours to snuff out a problem, pre-empt a dictator or otherwise apply decisive military force at minimum notice in the National Interest.

Vastly greater ease of deployability was *the reason* given to Congress, the media and the American Public and others by the Chief of Staff of the Army for their introduction.

The question: If Stryker Brigades are *not any easier to deploy*, and bring significantly less to the fight than tanks and Bradleys, what is the point of wasting \$12 billion in acquiring vehicles with poor warfighting capabilities, poor off road and urban performance, and unusually high running costs?

This is a reasonable question, but so far there have been no answers emanating from the Army except to change the goal posts and argue that C-130



deployability was never really that important because it was always C-17s that would really be employed, or catamarans or – well, something or other that they had not got around to producing yet.

Here one has to ask about the point of giving testimony to Congress if it is meaningless. Has the relationship between the Army and Congress become so tainted with cynicism that distortions on this scale are accepted as normal? Is such a lack of candor in relation to the public acceptable, especially given that we are paying the bill.

In fact, there is no doubt at all that Strykers were always meant to be capable of C-130 deployability intra-theatre (the last 1,000 nautical miles or so) and there were, in fact, excellent reasons for this.

- The C-130 is the only transport aircraft that can land on unproved landing sites that we have. We have about 600 of them.
- The C-130 is the only transport aircraft that we have in sufficient quantity to be able to risk intra theatre.
- C-17s are a scarce resource that we just cannot afford to risk right now.
- C-5s and C-141s are aging, have maintenance problems, and need approved high specification runways.

Further, there is direct proof from the Army's own documentation that C-130 deployability was mandatory, or what the Army call a Key Performance Parameter (KPP).

The following are extracts from the Army's own performance specification for the Stryker range of vehicles (then called IAVs or Interim Armored Vehicles) dated April 28 2000. The language is extremely clear and specifically mandates:

- **C-130 Air Transportability**
- **Drive off capability *ready for immediate combat operations***
- **Combat capable deployment weight (which includes crew, ammunition etc) must not exceed 38,000lbs.**
- **C-130s loaded with combat ready Strykers to be capable of 1,000 nautical miles without requiring a USAF waiver for maximum aircraft weight on fixed runways.**

Recall that Stryker is merely the name that was subsequently given to IAVs or Interim Armored Vehicles. These are direct extracts from the IAV solicitation in 2000:

1.1 System Description. The family of Interim Armored Vehicles (IAV) will provide the primary combat and combat support platform for the Brigade Combat Team (BCT). The family of IAV will be employed as an integral part of the BCT within a divisional or corps



C4ISR structure. The Infantry Carrier will be the baseline vehicle in the IAV family.

1.2 Scope. The ICV is comprised of the ICV and respective subsystems, Training Devices and Desired Capabilities.

1.3 Key Performance Parameters (KPPs).

1.3.1 All Vehicles. The following performance parameters apply to the IAV family:

- a. Interoperability (Paragraph 3.1.2.1.1.1)
- b. C-130 Air Transportability (Paragraph 3.1.1.1.1.1)

3.1.1.1 Transportability.

3.1.1.1.1 Air Transportability. The ICV shall be capable of air transport in C-5, C-17 and C-130 aircraft IAW MIL-STD-1366 and MIL-HDB-1791.

3.1.1.1.1.1 C-130 Air Transportability().** **The ICV shall have the capability of entering, being transportable in, and exiting a C-130 aircraft under its own power and be capable of immediate combat operations (does not require a full basic load, but is desired).**

3.1.1.1.1.2 Weight. The ICV shall not exceed 13,000 pounds maximum axle weight or 100 psi tire pressure for wheeled vehicles, or 6000 lbs. per liner foot tread contact pressure for tracked vehicles, on the treadways of C-130 aircraft. **The ICV combat capable deployment weight must not exceed 38,000 pounds gross vehicle weight to allow C-130 transport of 1,000 nautical miles without requiring a USAF waiver for maximum aircraft weight on fixed runways.**



What does 'combat capable deployment weight' mean?

It means it must be fully manned and able to fight even if its full basic load of ammunition is not on board. A 'basic load' is the standard amount of ammunition a vehicle is supposed to carry.

Typically, the weight of a driver, vehicle commander, nine man squad and all the related supplies, from ammunition to fuel and water, would be over 8,000lbs. Cut back on the basic load a bit and you are still talking about 5,000lbs.

The Army got their calculations wrong from the beginning. Even their target weight of 38,000lbs combat ready, *which has not been met*, will not yield a C-130 range of 1,000 nautical miles.

Calculating the mission range of an aircraft is a more complex business than merely keeping the weight or the cargo to a fixed target. It depends upon a host of factors including altitude of both take-off and landing fields, profile and speed to be flown, weather, re-fueling availability at point of arrival, and so on.

The Army team working on the Stryker would have known about these issues if they had worked closely with the Air Force from the beginning. Unfortunately, they did not. Instead they initially relied upon a rather simplistic interpretation of the manufacturer's specification. Later, when the degree of their error became apparent, they fudged the issue of 'combat ready' and began to say that such had never been the intention.

The Army's own words in their own specification prove the contrary.

If the Army had been serious about shipping a combat ready Stryker in a C-130, with a target overall weight of 38,000lbs, the empty weight of the Stryker *alone* should have been about 32,000lbs.

In reality, the empty weight of most of the Stryker vehicles has come in around 38,000lbs or higher, with variants such as the Stryker Mobile Gun System, even when empty, being more like 42,000lbs.

What this means in practice is that a Stryker Brigade cannot be deployed for any tactically useful distance by C-130s. A realistic distance, depending upon the parameters previously discussed, is approximately 100 miles or about 10% of the original intent – providing the Stryker Mobile Gun System and the Mortar Carrier, which are too heavy to be C-130 deployable at all, are excluded.

It is noteworthy that all the Army's demonstration to date, where they endeavored to prove that the Stryker could be deployed by C-130, have involved distances of 100 miles or less, airfields at little more than sea level and stripped down Strykers.

Being able to land combat ready is an important capability.

The Army have attempted to argue that being able to land combat ready is unimportant. That is true in a peacekeeping situation where working on the vehicles for a time after landing may well have scant impact on the mission.

It is entirely untrue in a warfighting situation when the ability to assume an offensive posture immediately may be mission critical. A recent example



could have been the seizure of Baghdad airport. In fact, the airport was not being actively shelled when the first aircraft landed (or the Air Force would not have landed) but there were still sufficient hostilities in the area to want to be combat ready as soon as possible.



An Air Force C-5B can carry 8+ M113s combat ready but only 5 Strykers

The Army's proposed Stryker C-130 deployment compromise.

The Army have recently proposed that a solution to the C-130 deployment dilemma be for 5 C-130s to fly 4 Strykers with the fifth C-130 carrying much of the combat ready element (personnel, ammunition etc) for the 4 Strykers.

Such a solution is expensive in terms of airlift but still does not solve the core problem of the basic Stryker vehicles being too heavy to be carried any useful distance – even when empty – and the heavier variants being too heavy to fly at all.

If anti-RPG upgrade armor for 4 vehicles is factored in, then a total of 6 C-130s would be needed to carry 4 Strykers.

You cannot cherry-pick which Stryker variants to fly. The Mobile Armored Gun (or something similar) is *essential* for warfighting capability and force protection.

As has been established elsewhere, the basic Stryker Infantry Carrier are not only lightly armored but also, unlike Marine LAVs or Bradleys, are under-gunned. Accordingly, they need to be protected by the Mobile Gun System or similar and cannot safely be deployed by themselves.



A Stryker brigade is a package of inter-dependent capabilities and the Stryker Infantry Carriers lack both the firepower and survivability of, for instance Bradleys (which carry vastly more firepower and are better armored).

Supposing we accept the Stryker C-130 error, does that really matter?

The Stryker C-130 error matters a great deal because the promise of greater ease of deployability is the only credible reason for the existence of Stryker Brigades.

Surely Stryker Brigades are also about new methods of fighting – as in combining the purported speed of Strykers with vastly enhanced situational awareness?

No.

Let me put it this way, if your want to experience the joys of satellite based XM radio, you don't have to sell your existing automobile – and buy another at vast cost. You merely have to install the right electronics at a small fraction of the cost of a new automobile.

Don't confuse the vehicle with the electronics. The electronics can be installed on any remotely suitable vehicle – and have been. The digitized 4th Infantry Division, as it happens, uses legacy equipment such as M1A1/2 tanks, Bradleys and large numbers of M113s.

The vehicle is merely a conveyance of convenience for the electronics. You do not need a new vehicle to test out new electronics.

A further point: if the intention had been merely to evaluate new methods of fighting, new doctrine, as a preparation for the Objective Force, not only could this have been done with existing vehicles such as the M113A3, but you certainly would not need to commit close to 20% of the entire Active Component of the Army to unproven Strykers.

Sheer common sense, let alone financial prudence, would suggest you would experiment first with, at the most, one brigade. At over \$1.5 billion a brigade, one brigade, in itself, constitutes no small experiment.

But what about the speed issue? Surely you would need Strykers for that?

No.

Just because the Stryker has a higher top road speed than, for instance, the M113A3, does not mean it is faster overall. As was shown in the September 2002 Comparative Evaluation, other factors such as turning agility come into the equation. In the point to point trial there, despite the fact that it took place largely



Don't confuse the vehicle with the electronics.



on trails rather than cross-country, the M113A3 actually came in first because it could turn faster.

Where off road is concerned, the M113A3 is faster and can handle much terrain which the Stryker cannot traverse at all.



This shows an M113 (equipped with a turret) swimming using its tracks for propulsion. The Stryker cannot swim.

If evaluation of new doctrine was the intent, this could have been done perfectly adequately with the M113A3 or, at minimal extra cost compared to the Stryker, the considerably upgraded M113 known as the MTVL.

Do we really need to be able to deploy a lightly armored brigade anywhere in the globe 96 hours in the first place?

A reasonable person might think that if you were going to spend \$12 billion of taxpayers' money on a project, it should be supported by some serious analysis. Do we really, really, really, need to do this? Isn't there a better way? Isn't there a more cost efficient way?

As best as can be ascertained, after considerable research, the Stryker concept is supported by very little analysis except the expressed belief that it would be nice for the Army to be able to get somewhere fast because it has been embarrassingly slow to deploy in the past. One can think here of the interminable build up which preceded the Gulf War, the tortuous crossing of the Sava River and the painfully slow deployment of Task Force Hawk during the Kosovo campaign.

It is an open secret that the Army has turned down too many missions since Vietnam, and, as a consequence, has lost credibility as an instrument of policy with a series of Administrations. Where ground forces are concerned, the Marines are considered 'can do' whereas the Army (subject to the notable exception of Special Forces) has built up a reputation for being reluctant to do anything.

Such judgments may not be entirely fair because the services are structured differently and war is too serious a business not to be approached with caution, but they exist nonetheless.



The main arguments for Stryker Brigades would appear to be to overturn such judgments and prejudices and to re-establish the credibility and relevance of the Army. Unfortunately, that is a service-centric objective which, one could argue, may be of significantly less value to the National Interest

There is a case to be made for fast global deployment of effective combat power, but that should not be confused with the need for wheeled lightly armed Strykers. One has *nothing* to do with the other.

One can make a very good case for the fact that normally a deployment period of about a month should be adequate for most scenarios and that a period of delay before armed conflict may not be altogether a bad thing in itself in that it builds in time for alternatives to war to be considered.

That said, there are situations where the ability to insert an armed force on short notice would be extremely useful.

The classic relatively recent example was the Iraqi invasion of Kuwait and threatened invasion of Saudi Arabia. There the 82nd were sent in but, at the time, were generally considered too light to have acted as anything more than a speed bump given the array of Iraqi tanks and artillery massed against them.

One can argue about the ‘speed bump’ analogy even then given the 82nd’s fighting spirit and air support. However, if a similar situation happened today, Special Forces alone plus JDAMS could have blunted an Iraqi offensive – especially if working with the 82nd, now equipped with Javelins.

The situation would be better still if the 82nd were given some degree of tactical mobility (such as being equipped with Fast Attack Vehicles) and given the M8 Armored Gun system they were originally promised.

Conversely, one has to wonder about the effectiveness of a Stryker Brigade in such a situation. Such a brigade would absorb an extraordinary amount of air-lift just to get here but then be too light to go head to head with main battle tanks.

The conclusion would seem to be that we do need a limited fast deployment capability but that there are many better, more flexible and more cost effective ways of satisfying it that with Stryker Brigades.

Some concluding thoughts about the Army and deployability.

The truth is that, Vietnam apart, the Army has not concerned itself much with deployability for the last half century except in the context of individuals being posted from one garrison to another at such a dizzying rate that unit cohesions has been rendered near impossible. A garrison rather than an expeditionary mentality has prevailed largely because the location of the main enemy, the Soviet bloc, was static. This garrison mindset has been further exacerbated by the high costs of deployment, the innate difficulties of moving large numbers of soldiers, equipment and machines, the existence of out of date logistical tables, the clumsiness of divisions as maneuver elements, the existence




of a vast excess of irrelevant headquarters, and the convenience of computer simulations.

The Army does not, in the main, need new combat capability to learn how to deploy (though it needs some). It needs to re-structure to be more flexible and then to learn the art and science of global expeditionary warfare as really practiced – as opposed to being simulated in a computer.

It will certainly need new air-lift and sea-lift.

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- **Wide Beam/High Volume:** 2 Covered Decks 820'x100'x22' 158,000 SQ. FT.; 3.5 Million CU. FT.
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We do need more airlift, but there is more than one way to carry out global expeditionary warfare. This extraordinary water jet powered ship can carry up to 12,000 tons of military cargo (including M1A1/2 main battle tanks and Bradleys) in roll-on, roll-off configuration, and travel 1,000 miles in 24 hours, 7,000 miles in a week. It can off-load at sea, use a conventional port or even off-load directly onto a beach. It is the size of an ocean liner yet requires only 16 crew to operate. It costs about \$300 million so you could buy 5 for the cost of a single Stryker Brigade.



7. The Stryker: Costs.

For starters, let's compare Stryker costs and the original alternative MTVL proposal very simply (leaving out the limited capabilities & problems of the Stryker).

- The Stryker is an INTERIM vehicle of limited capability with a 20 year targeted life before the planned Objective Force is adequately fielded.
- The total Stryker program of 2,131 vehicles for six brigades will cost \$12 billion (if we are very lucky) yet take nearly a decade to field.
- The alternative, vastly more capable MTVL fleet of 2,131 vehicles for six brigades would have been completely fielded within FOUR years for *well under* \$4 billion. The first brigade would have been available for the Afghanistan conflict.
- Alternatively, if the Army really wanted to spend the \$12 billion it is planning for the Stryker, it could have had EIGHTEEN MTVL brigades for the same money, which could be very useful given that we are at war.

If there were unusual or unique combat capabilities associated with the Stryker, that would be one thing, but when the Stryker lacks the capabilities of the MTVL, yet costs so much more, the decision to buy the Stryker is more than suspect. It is flagrantly unwise.

Note. The MTVL (a stretched and much upgraded version of the well proven M113) is described and evaluated extensively in Section 8 of this report. The proposal assumed the proven and Type Classified M8 Armored Gun System would be used instead of the Stryker Mobile Gun System (which does not work).

Some ball-park numbers. How many billions to 'plus?' From small Stryker acorns large Stryker oaks grow. \$15 billion?

The Army originally said that it would cost "about \$1 billion" to set up a Stryker Brigade. Within a year, that figure became \$1.5 billion *plus*.

'Plus' is a useful word. It means whatever you want it to mean and, within the Beltway, it implies a tendency for the base figure to move *upwards*.

Since the Army want to set up no less than 6 Brigades that gives us \$9 billion plus – call it \$10 billion – as an establishment cost to which must be added roughly \$3 billion for Stryker related Military Construction.

That brings us up to \$12-13 billion according to how you define 'plus.'

It would be nice if it stopped there - but unfortunately it does not.

- Because Stryker Brigades are logistically light (this was a vain attempt to give the overall weight of a Stryker brigade down to aid air lift) Stryker Brigades are going to require extra logistical support – which will have to be paid for.



- Because the Stryker variants are too heavy to be deployed any tactically useful distance by C-130, the Army now want to buy catamarans.
- Because the Strykers are proving to be extraordinarily expensive to operate, the operational costs are going to be significant in themselves.

We are now up to something like \$15 billion – and climbing – for a range of vehicles which were bought to be C-130 deployable (but cannot be), which have less capability than tanks and Bradleys, and which can be destroyed by any hostile with an attitude and an RPG.

This is not a good situation for either our soldiers or the American taxpayer.

The Real Cost of Stryker – including the cancellation or restructuring of over 50 Army programs. Some detailed background.

The cost of the General Shinseki's transformation approach in general, and for the \$10-\$15 billion dedicated to the Stryker interim force has been a topic of Congressional interest, but has surprisingly escaped scrutiny within the Administration.

Recall that not a penny was allocated for this interim force before Shinseki became Chief of Staff of the Army. It was Shinseki who ordered the cancellation or restructuring of *over 50 Army programs* to create this funding wedge.

Several informed members and staff in Congress correctly held the view that the Army could have created this C130-deployable interim force for a very small amount, perhaps \$2 to \$3 billion by simply using or modifying the services existing C130-deployable equipment.

Those legislators were right. But then again, their approach would not have fit Shinseki's new image for the Army – it had to *look* different and wheels do look different from tracks. Whatever about substance, this had to be a highly visible symbolic change.

Section 113 of the Floyd D. Spence National Defense Authorization Act (NDAA) for Fiscal Year 2001 (FY01), as amended in the FY2002 defense authorization legislation, required the Army to conduct a comparison of the costs and operational effectiveness of the Stryker Infantry Carrier Vehicle (ICV) and the troop-carrying medium armored vehicles currently in the Army inventory. The reason for the comparison was based on Congress's expressed concerns about the affordability of the Army's plan to equip interim brigade combat teams with a new Stryker family of vehicles (FOV) rather than with the existing equipment.

The Comparison Evaluation (CE) consisted of a cost comparison and an operational effectiveness comparison between the Stryker and the M113A3.

The Army should have been forced to compare the Stryker with the comparable vehicle – the MTVL (which is a massively upgraded and stretched M113A3 of superior performance to the M113A3 under just about every heading).



The frustrating search for the real costs of Stryker.

On the face of it, determining the costs of the Stryker program should be a straightforward matter. In reality, every attempt to get hard numbers from the Army – by Congressman Saxton, for example - has been met with a succession of different figures and a considerable amount of obfuscation. The situation has been further confused by the fact that ‘Stryker’ is actually a range of vehicles, albeit all modifications of the same chassis.

Attempts to get *hard* numbers for specific variants such as the Stryker Infantry Carrier and the Stryker Mobile Gun System have also been unsuccessful to date. The Infantry Carrier is arguably the baseline vehicle and the Mobile Gun System the most complex variant.

In effect, the costs of the Stryker program are either being deliberately fudged or the Army has lost control of its finances. Or both.

Clear evidence of a deeply corrupted culture and a most unhealthy Command Climate.

A recurring theme throughout this Costs Section – and elsewhere – as we show, is the Army’s repeated distortion of the numbers, frequently in the most blatant way, to make them fit the result the Army Leadership requires.

In a commercial environment, such behavior could be regarded as clear evidence of criminal behavior. In the Army it seems to be regarded as appropriate behavior if it serves the expressed or implied or perceived interests of the Army Leadership.

This is the most serious evidence of a deeply corrupted culture, a most unhealthy Army Command Climate, and an indifference bordering on contempt towards civilian oversight.

We do know that the average cost of a Stryker variant has increased dramatically and that some costs appear to be open-ended causing other Army programs to be cancelled.

What we do know is that the wheeled armored vehicle that the Army selected to be modified into the Stryker, the LAV III, cost around \$900,000 in 2000 and has now morphed, over three years, into *an average total cost per Stryker* variant – in excess of \$3 million per vehicle - that is several times the cost of the original vehicle in what was supposed to be *an off the shelf program*. That makes no sense at all especially when it is realized that certain capabilities of the original LAV III (the swim capability, to give but one example) have actually been eliminated.

We seem to be paying a great deal more for substantially less.



It should also be realized that the costs of developing the Stryker Mobile Gun System (MGS) (which suffers from some fundamental flaws that are simply not fixable unless the Laws of Physics are changed) have become, in effect, open ended because the Army will neither disclose they have made a mistake, nor take the necessary remedial action.



Regrettably, the fatally mired Stryker MGS program appears now more to do with saving face than providing the troops with the weapons systems they need.

An example of Stryker MGS cost overruns

The following slide demonstrates just one example of MGS cost overruns. It will be noted it was so severe as to justify the cancellation of 2 prototype systems to free up funds to partially cover these losses. Typically, these overruns have never been disclosed and this is just the tip of the iceberg.



MGS STOP WORK RATIONALE

- GDLS estimates to complete the MGS development grew \$6.0M from April 2002 to July 2002
- April 2002 System Support Package (SSP) estimates were inadequate to support a 5 vehicle PQT with a 60,000 mile RAM test requirement
 - Ammunition Handling System (AHS) spare parts were lacking
- RDT&E funded test execution cost estimates rose \$20.0M for FY02 and FY03 combined
- Stop Work on MGS 009 and 010 added \$7.4M back into the Stryker RDT&E budget and added MGS unique spare parts into the MGS SSP in a timely manner

Source: Stryker Acquisition Decision Timeline and Program Update, 9-10 Jul 03, Col Ogg, Program Manager, Stryker BCT, slide 55 of 65.

Bad figures from the Army's Cost and Economic Analysis Center.

The Army had a Cost Comparison Report carried out by its own Army Cost and Economic Analysis Center (CEAC). It is dated October 31, 2002, and demonstrates very clearly how the Army has distorted data to justify its purchase of the Stryker as opposed to upgrading its existing M113s.

This study *incorrectly* used assumed estimates of Stryker's acquisition, development, and operating costs, at a time when the Army clearly knew these estimates were fundamentally wrong. Stryker acquisition costs were over budget, certain development efforts were failing and requiring additional funding, and Stryker operation and maintenance costs were skyrocketing – more than 5 times the assumed estimate.

Sadly, the Army put forward this inaccurate report, it would seem deliberately. More sadly, the Office of the Secretary of Defense, with its dozens



upon dozens of talented financial analysts, would seem not to have scrutinized the Army's submission.

Notwithstanding these disturbing analytical errors and oversight shortfalls, the CEAC report still found that each Stryker was approximately \$900,000 more expensive for the infantry variant alone – this difference alone being more than twice the purchase price of an MTVL. But the reality is that this Stryker initiative could easily cost 3 times the amount of a more capable, more mature alternative – at an incremental cost to the taxpayer of more than \$6B.

Central issue: Did we ever need Stryker at all or did we have an existing vehicle which could have performed the mission at least as well (if not better)?

The central issue of the comparison is whether the additional operational effectiveness that the Army believes the Stryker has over the M113A3 justifies the overwhelming additional cost and development time of the Stryker family of vehicles. With the add-on provisions readily available and proposed for the M113A3, and incorporated into the MTVL, the difference in operational effectiveness of the Stryker diminishes to a comparison of Stryker's additional cost vs. some very subjective operational advantages and disadvantages.

Furthermore, the Army's comparative evaluation omitted swim capability and perhaps the most critical area of performance – can the vehicles be deployed by C130 in a combat ready configuration over the stipulated tactically significant distance of 1,000 miles, and can it roll-on, roll-off combat ready?

The M113A3 has been certified *for years* as C-130 deployable whereas the Stryker variants are, in the main, still over their contracted weights, too heavy for their waivers and too heavy to deploy for any tactically significant distance

More funny numbers by the Army.

The CEAC cost analysis aimed to assess the 20 year life cycle cost of the Stryker vs. the M113A3 based on a quantity of 686 Infantry Combat Vehicles only, not the 2,131 vehicles across all Stryker variants. CEAC sought to limit this analysis to cost elements that total 75% of it's life cycle cost, that being the pay for maintenance units, and the cost of replacement parts and petroleum, oil, and lubricants (POL).

But, the cost elements that it does not include are identified in the analysis, and those are significantly different when comparing the fielding of a new Stryker vehicle into the fleet, versus employing M113 series vehicles, for which there are 15,000 already in the force with a mature maintenance and logistics system.

In addition, this analysis uses an adapted bid price of \$1.4M per Stryker ICV and estimated operating costs, when the actual cost is significantly higher based on reengineering development and production costs, as evidenced in the nearly 20% cost growth reflected in the November 2002 program Cost Performance Index of 0.83.



Operating costs will also increase based on the higher weight of the actual Stryker ICV, over 40,000 pounds, versus the bid ICV at 37,798 pounds *combat weight*.

M113A3 still shows up as less expensive.

Notwithstanding these errors, the Army cost analysis still shows that the M113A3 is substantially less expensive than the Stryker in procurement and in life cycle cost.

There are some assumptions in the Government cost analysis which are suspect and if corrected would show an even greater disparity in life cycle cost between the Stryker and the M113A3. Furthermore given the extensive U.S. installed base of M113 series vehicles, it is entirely possible to simply divert or modify vehicles for these interim brigades from fielded stock, further reducing program cost.

Stryker too expensive for the capability it brings.

The CEAC analysis, flawed though it was, still begins to make the point that Stryker is wildly too expensive in acquisition cost for the capability it brings. Even CEAC assessed only minor difference in operating cost, yet it will be shown that the tracked fleet is actually much less expensive to operate.

“The Stryker ICV is more expensive to buy, but less expensive to operate and maintain than the M113A3. The twenty-year life cycle cost of Stryker ICV for six SBCTs is more expensive than that of M113A3s (\$2.9 billion vs. \$2.3 billion). This equates to a difference of \$876 thousand per vehicle.” [page 2-7]

“The M113A3 is more expensive to operate and maintain over a twenty-year lifespan than the Stryker ICV (\$3.1 million vs. \$2.9 million). The Stryker ICV requires fewer military maintainers, uses fewer repair parts and consumables and consumes less fuel.” [page 2-7]

The Stryker Purchase Cost: \$1.4M per vehicle quoted in 2002 CEAC report yet Army Stryker Program Review of same period quotes \$3.5M average total per vehicle.

The CEAC analysis uses a Stryker bid price of just under \$1.4M per vehicle as the acquisition cost of the Stryker ICV. Yet, Army documents from the Stryker Program Review in November 2002, completed at virtually the same time as the CEAC comparative evaluation, show a very different story.

That Army Stryker Program Review, as of November 2002, shows a total Stryker program acquisition cost of \$7.5B, indicating an approximately \$3.5M per vehicle cost for an off-the-shelf vehicle, the vast majority of which are only manned by a .50cal machine gun.

These are the Army’s own figures – see following chart – and they are, to put it mildly, puzzling.



Stryker Funding

BES 3.2 Softlock	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	T/C	TOTAL	STATUS
RDTE												
Required	14.6	254.9	98.6	147.9	46.3	53.4	7.8	0.09	21.8	0.095	645.485	
Funded	14.6	254.9	98.6	147.9	46.3	53.4	7.8	0.09	21.8	0.095	645.485	G →
% Funded	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
UFR RDTE			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Procurement												
Required	22.0	920.9	653.2	788.0	990.6	993.1	924.2	798.8	78.3	621.8	6,768.9	
Funded	22.0	920.9	653.2	788.0	990.6	993.1	924.2	798.8	78.3	621.8	6,768.9	G →
%Funded	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
UFR Procurement			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
BaseLine Vehicle Qty	7	457	300	302	301	340	330	84	2121		2121	

FY01 Status (as of Sep 02)					FY02 Status (as of Sep 02)						
RDT&E	\$M	%	WTCV		RDT&E	\$M	%	WTCV			
Funded	254.9	100%	Funded	920.9	100%	Funded	98.6	100%	Funded	653.2	100%
Released	241.3*	100%	Released	920.9	100%	Released	98.0	100%	Released	653.2	100%
Obligated	241.3	100%	Obligated	874.5	95%	Obligated	84.9	87%	Obligated	547.0	84%
Disbursed	188.0	78%	Disbursed	397.6	43%	Disbursed	15.1	15%	Disbursed	49.9	8%

Legend:	G On Track	↑ Improved from last review
	A Not on Track but PM/SSO/RSO Solvable	↔ No change from last review
	R Not on Track. Need help	↓ Degraded from last review

Draft v4

Prod Status

Prog Update

Ex. Guidance

Updated as of 04 Nov 02
STRYKER 12

Source: Slide #12, Army Stryker Program Review, v4 BUS Stryker SSO, Dec 02

Stryker cost over-runs & schedule slips.

That same November 2002 Army Program Review goes further to documents the Stryker program cost over runs and schedule slips.

In particular, the contractor's cost performance index (CPI) of .830 indicates the Army is only getting \$.83 worth of budgeted effort for every \$1 spent on the program, over 20% over cost, indicating the potential for a breach of the Nunn McCurdy threshold for reporting to Congress of 15%. Applying this level of over run to the CEAC assumed acquisition cost of \$1.4M, results in a price of \$1.7M per vehicle.

Also, the program SPI indicates that Stryker is only getting .89 days budgeted output for every 1 day scheduled. This chart also indicates that the program is estimated to be somewhere between \$49 and \$65M over budget in the 4th quarter, 2002 alone.

Ballooning costs of the Stryker.

Furthermore, this program review disturbingly illustrates how much the CEAC estimate of \$1.4M per vehicle may be wrong. It shows that the contractor's initial estimate at completion (EAC) for Stryker was \$193M for that



current portion of the contract, and that this amount was supported by a budget of \$240M – this is the amount associated with the bid price of \$1.4M per vehicle.

However, the Program Manager's Office shows an EAC of nearly \$290M for the best case and \$304M for the adverse case – a 57% increase in the EAC estimate. CEAC absolutely should have had access to the actual data regarding the acquisition performance of the Stryker program. If they had used this same approximate 50% increase in the EAC, the acquisition cost balloons to \$2.1M per Stryker, more than 5 times that of the comparably modified M113A3.

The significance of the Canadian dollar. Stryker's primary production base is in Canada.

Finally, at the time of this review (Nov 2002), the exchange rate for the Canadian dollar was approximately \$.60 US dollar. As of July 1, 2003, that same Canadian dollar has appreciated to be worth approximately \$.75 US dollar. Correspondingly, General Dynamics' production and material costs for its primary production and vendor base in Canada, where as much as three quarters of the Stryker content is produced, may have increased 25% based upon the Canadian dollar alone.

Further, the Army program office's estimated costs to complete the project were over 20% higher than the original budget *before the appreciation of the Canadian dollar*.

Therefore since the Stryker contract between the US Army and General Dynamics is a Firm Fixed Price contract in US dollars, General Dynamics should be losing money on this contract. Yet, on July 16, 2003, GD announced its quarterly results, March-June 2003, which reflected Combat System revenue of over \$1B, with \$120 million in operating earnings – a highly profitable business.

GD is absolutely entitled to make a profit, but how can this be unless the US Army is providing funding for the Stryker program far beyond the levels contracted for in the Stryker Firm Fixed Price contract?



Contractor Cost Performance

Dollars in Thousands	1 st QT FY02	2 nd QT FY02	3 rd QT FY02	4 th QT FY02	Status
Negotiated Price	\$207,849	\$210,683	\$210,843	\$261,178	G
Estimated Price	\$299,937	\$238,389	\$246,093	\$312,000	G
Budget at Complete (BAC)	\$189,027	\$191,603	\$191,745	\$239,594	G
Management Reserve (Contractor)	\$7,105	\$1,844		\$21	G
Cumulative Cost Variance	-\$11,613	-\$14,478	-\$17,877	-\$27,723	A
-Cost Performance Index (CPI)	.828	0.848	.848	.830	A
Cumulative Schedule Variance	-\$11,416	-\$16,490	-\$14,215	-\$16,554	A
-Schedule Performance Index (SPI)	.830	.831	.875	.891	A
PMO Estimate at Completion (EAC)					
- Best Case	\$228,070	\$225,997	\$226,209	\$288,960	A
- Adverse Case	\$261,278	\$252,438	\$241,710	\$303,748	A
Contractor's Initial EAC Est. (FY01-06)				\$193,062	

(as of 30 Sep 02)

IPB Established: N/A
 OTB: N/A
 Most Recent Ktr EAC: \$290,239

G	On Track	↑	Improved from last review
A	Not on Track but PM/SSO/RSO Solvable	↔	No change from last review
R	Not on Track. Need help	↓	Degraded from last review

Draft v4

Updated as of 31 Oct 02 **STRYKER 24**

Source: Slide #24, Army Stryker Program Review, v4 BUS Stryker SSO, Dec 02

Responsibility for acquisition lies with confirmed civilian leadership.

Under the Goldwater-Nichols reforms to Title X US Code, the responsibility for acquisition programs wrests with confirmed civilian leadership of the Department of Defense. The Secretary of the Army and the Defense Acquisition Executive are accountable for reconciling the Stryker costs.

Major errors in costs attributable to M113A3.

The second half of the error in CEAC's cost analysis is the cost attributed to the M113A3.

Many of these figures are seriously inaccurate.

First of all, the Army cost estimate for M113A3 modification is too high. The cost of the M113A3 is stated as having been derived from the FY02 partnership between Anniston Army Depot and United Defense, a contract that produced no M113A3, but rather the M577A3, which has several expensive pieces of equipment, such as a \$15,000 auxiliary power unit, that do not go on an M113A3.



M113 costs overstated. Stryker costs understated. OSD, Congress and the taxpayer deceived.

A better approximation of the M113A3's cost is \$250k. In addition the Stryker-comparable modifications highlighted by CEAC are not as expensive as they assumed (a fact they should have known and one which raises even more questions about the integrity of the Army process).

Specifically, the 14.5mm armor upgrade for the M113A3 is approximately \$50k (CEAC stated \$73,000) and the remote weapon station (RWS) was bid on the MTVL at under \$100k (CEAC stated \$200,000).

These are massive distortions by CEAC.

So whereas the CEAC analysis concluded that the price of a Stryker ICV is approximately four times that of an M113A3 conversion (\$1.4 million vs. \$0.3 million), the actual difference may be more in excess of 6 times as expensive. More importantly, the full cost of a Stryker-comparable MTVL (under \$500k) could be one-fourth the cost the Army is paying for Stryker.

The Army also claimed that if M113A2s were taken from units to convert to M113A3s or MTVLs, that some units would have a reduced readiness for extended periods. That is a disingenuous claim because the Army has over 1500 M113 vehicles in excess of its needs and does not need to take M113s from units to accomplish the conversion.

The fundamental question the Congress, the OSD, and the taxpayer is left with is: What is the Army really paying to acquire Stryker? Sadly, this is a question that remains to be answered by the Army.

Stryker Operating Cost: Proclaimed savings are actually significant added costs

Beyond the CEAC's analysis significantly underestimating the investment cost of Stryker and overestimating the acquisition cost of M113A3, their analysis underestimates Stryker maintenance pay and allowances, replacement training, replenishment parts and consumables, and POL. As such, the Stryker total actual life cycle cost could be \$2 billion more for just the 686 Infantry carriers alone, and therefore could easily exceed \$6B across the Stryker fleet – and this does not even address the incremental costs for establishing a completely new logistics process for this new combat vehicle – a logistics process that has been well established for decades around the more than 15,000 C-130 deployable M113 series vehicles which have been fielded across the Army.

False assumptions and bad figures.

Under Maintenance Pay and Allowances, the Army assumed a very low maintenance structure for the Stryker brigade. A recent GAO report described the maintenance allocation for Stryker Brigades as "...one third of the required amount for sustained operations," and that "...the Stryker Brigades would require logistics support from external agencies" but that the Army had not planned for this support.



This logistical support discrepancy was identified as a serious issue in no less than three successive GAO studies – yet the costs for these external support efforts were not included in the analysis. In short, whether by omission, incompetence or intentional deceit, the logistical costs of Stryker Brigades have been massively understated by the Army.

More bad figures.

On the other hand, the cost for the M113A3 was adjusted *upward* based on the assumption that the track suspension of the M113A3 vehicle will require more maintenance than the wheel suspension of the Stryker. This is based on historical data comparing wheeled support vehicles on primary and secondary roads to tracked combat vehicles operating largely cross country. In comparing the Stryker and M113A3, both in a combat environment, using Stryker's 50% cross country, 30% secondary road, and only 20% primary road mission profile; it is not clear that the wheeled Stryker will require less suspension and tire maintenance; and recent evidence is that it will require more. Also, the suspension system on the M113A3 is much simpler than the Stryker's suspension system which has a troublesome height management system, run flat tires and central tire inflation system. It is also doubtful that the M113A3 will require any more maintenance support personnel than the more complex Stryker vehicle. Although the M113A3 requires tracked vehicle mechanics, the increased number of wheeled mechanics and the new logistics structure for the Stryker would largely offset any track personnel increases.

The Army has also recently disclosed that it is adding 17 HEMMT wreckers to the Stryker brigade because the Stryker winch is not capable of self-recovery and because the Mobile Gun System does not have a winch. The MGS's winch was removed in a failed attempt to get its weight down to achieve C-130 deployability.

The costs and added logistics complexity for this growth in the Stryker force structure has not been disclosed by the Army. Perhaps more importantly, the category does not include the cost for what Army officials have described as the "battalion" of contracted field service representatives (FSRs) that accompany and support each Stryker brigade. Therefore *at a minimum*, the actual Maintenance Pay and Allowances accounts are similar at the M113 level.

Under Replacement Training, there is no rationale for why the M113A3 Annual Replacement Training Cost per Vehicle is slightly more than the Stryker. Given the simplicity of the M113A3 vehicle and the added maintenance requirements for Stryker discussed above, it would seem that replacement training costs would be the same or lower for the M113A3 or MTVL. Also, given that more than 15,000 M113 series vehicles are already in the fleet, this replacement training should be far less than for the new Stryker because there is such a large inventory of already trained soldiers to rotate through such units.

Under Replenishment Repairables and Consumables, basically spare parts, the costs used for the Stryker and the M113A3 are suspect. The Stryker ICV



replenishment cost is based on the cost per mile of \$9.61 (FY03 constant dollars) computed by the Stryker IAV Source Selection and Evaluation Board (SSEB).

This number is invalid. It was based on proposal data, not demonstrated Stryker performance. Current Army data from the Stryker technical and operational testing should have been used to calculate the cost per mile for replenishment parts.

Stryker costing more than five times Army's original target figure to maintain – yet only target figure given to Secretary of Defense and Congress. Blatant misrepresentation.

As a further demonstration of the flawed source selection process employed by the Army to chose the LAV-III based Stryker as its Interim Armored Vehicle, CEAC used that same SSEB cost figures of \$9.61 per mile, at a time when Army officials who prepared that report and sent it to the Secretary of Defense and Congress should have known it was wrong. To correct that record, the Stryker's demonstrated performance indicates that it has been costing more than 5 times that estimated amount to operate and maintain.

On Tuesday, April 8, 2003 at the 12th Annual Logistics Data Symposium held by the National Defense Industries Association in Michigan, an official from the Headquarters, Department of the Army G8 stated in an open source briefing that the operating cost being experienced by Stryker is significantly higher than the cost originally estimated by the Army. Specifically, he stated that the Stryker has been costing the Army \$52/mile and that the Stryker program office is working to reduce that amount to \$25/mile.

Furthermore, that same Stryker SSEB used \$13.41 per mile for the M113A3 costs, when the actual repair part cost has been closer to \$3 per mile. The SSEB number was taken from the OSMIS (Operating Support Management Information System) database, which has M113A2 and M113A3 data mixed together. It also has data mixed together for all the variants of the M113 family of vehicles, which is invalid in a comparison with merely the Stryker infantry carrier.

The Army have been comparing apples with oranges so that their findings, yet again, are just not valid.

Army has not conducted a formal Operation and Support cost estimate of M113 FOV. In short, they don't know what they need to know to make informed decisions.

The Army has not conducted a formal Operation and Support (O&S) cost estimate of the M113 Family of Vehicles in its forty-year history.

The Army uses a Mean Miles Between Failure for the M113 of 2202, a number computed in 1986 from a single 2000 mile test.

That is a fifteen year old finding which was inadequate to begin with and is now entirely out of date



Since then, over 1,000 engineering changes and two major propulsion component upgrades have dramatically improved the reliability of the M113A3, let alone the even more advanced MTVL. In short, there are, fairly predictably, vast differences between the reliability of old, un-maintained M113s and newer upgraded models.

In a 12,000 mile test in Yuma Proving Grounds in 2001 and 2002, an M113 variant *never* incurred a mission-critical failure. Correspondingly, the M113 RECAP 2001 briefing noted then that the M113A3 operating cost experience was \$3.02/mile, less than 1/8th the new Stryker target operating cost of \$25.

That M113 briefing was prepared by the then LTC David Ogg (now Colonel Ogg) who is the current Stryker Brigade Combat Team Program Manager.

The Army knew the data provided to the CEAC was wrong.

Real data not disclosed.

Even more disturbing is that the actual cost for the five M113A3s employed across approximately 4,000 miles during the comparative evaluation itself was under \$1,600 – less than 50¢ per mile.

Both the CEAC and the Stryker Program Office clearly had access to both Stryker’s much higher operating costs, and to the M113A3’s drastically lower costs. Using CEAC and the SSEB’s cost analysis, the M113A3 platoon should have exceeded \$100k in repair part costs during the MAV CE, sixty times higher than the actual cost.

Why was this data on the real comparison never disclosed?

Using the actual cost figures of \$52/mile for Stryker and \$3/mile for M113A3, the comparison for the MAV CE should reflect an annual repair part cost of \$100k per Stryker, versus \$6k per M113A3 (much different than the \$18.4k for Stryker and \$25.7k for M113A3 presented by the Army). Furthermore even if we use the new Stryker goal of \$25/mile and \$3/mile for M113, the 20 year Stryker repair parts cost balloons to over \$500k, while M113A3 lowers to under \$100k, resulting in a present value of over a \$1M higher total lifecycle cost per vehicle for Stryker than M113A3.

Summary of Operating Costs

Stryker budgeted cost per mile of operation:	\$10
Stryker reported <i>actual</i> cost per mile of operation:	\$52
New Army Stryker target cost per mile:	\$25
M113A3 actual cost per mile (Army data)	\$ 3

Monopoly supplier of Stryker parts. Why?

The only ways to reduce these Stryker operating costs are to develop more reliable components, compete for the provision of spare parts to lower the price per part, or simply to re-categorize the costs into another area to hide the cost



growth. Yet, this analysis does not assess replacement costs for subsystems and parts, which must be bought directly from General Dynamics since the US Government does not have the Technical Data Package (TDP) for Stryker, a stark contrast in policy to its other combat vehicle programs where it specifically controls the TDP so that it can bring competition into the lifecycle support and upgrade of equipment.

There is competition for M113 parts.

For example, the Army conducts competitions to get the lowest cost for M113A3 parts and subsystems, which are built-to-print based on specifications of the government's TDP. However for Stryker, the government has no idea of the specifications, cost, or markup on Stryker parts, only what it is being charged by General Dynamics. As such, there is no compelling reason to believe that Stryker operating costs will be reduced. In fact, these maintenance costs would likely increase as the Stryker is required to train more in its 50% cross country mission profile.

High parts commonality throughout Army for MTVL and M113.

It should also not be missed that the MTVL or M113A3 supports a family of vehicles with high parts commonality that could be employed not only across the interim brigades, but that would be common with the 15,000 M113 systems across the remainder of the Army and with the vast numbers of M113s used by almost all America's allies.

This Army-wide commonality creates significant logistics savings compared to the unique logistics structure required for 2,130 Strykers. The MTVL can actually support the same full family of vehicles that Stryker does, many of which are fielded today in the M1064A3 Mortar, M1068A3 Command and Control system, and with the type classified M8 AGS turret. For example, the Stryker mortar requires a much more expensive recoiling mortar, which failed initial testing and which cannot be dismounted, while the M113 based M1064A3 uses the Army standard 120mm non-recoiling mortar, thereby providing soldiers much more operational flexibility.

Stryker fuel consumption twice that expected. Wrong figures used yet again by Army.

The POL (petroleum, oil, and lubricants) cost comparison for Stryker and the M113A3 is also incorrect.

CEAC assumed Stryker would achieve 5.4 miles per gallon (mpg), while the M113 would get less than 2 mpg (actual is 2-3). Again, CEAC used Stryker assumptions from SSEB and OSMIS factors for the M113A3; despite knowing that this OSMIS database includes mixed variants of M113A2 and M113A3 fleets and that recent track tests using an M577A3 reflect substantially better fuel efficiency than the OSMIS data.



In addition at the same NDIA conference mentioned above, it was disclosed by an Army General Officer that the Stryker is only getting 2 to 3 miles per gallon, not the 5.4 miles per gallon that was used in CEAC's analysis. This additional discrepancy creates further inaccuracies in the results of the comparative evaluation.

In short, the Stryker's fuel cost increases by 250% and the amount of petroleum support equipment in the Stryker organization needs to be augmented. Furthermore, the Stryker only carries 60 gallons of fuel, resulting in a vehicle with a cruising range of perhaps only 120 miles – far short of the Stryker 300 mile requirement or the M113 300 miles plus capability. This is a significant operational drawback, since it means that the Stryker has a much shorter operating range than other Army combat vehicles and will have to be re-fueled more often.

It should be noted that the Stryker's fuel consumption will increase even further if it is ever fitted with partial RPG armor, and further still if it is used off road.

Capability and Cost – Re-evaluating the Stryker decision.

The counter argument to the cost savings of the M113A3 is that it does not provide the same capabilities as the Stryker and does not meet the ICV requirements. In order to do a more equal evaluation, the Army should either add those modifications missing from M113A3, or simply compare the MTVL directly with the Stryker.

Cost conclusions.

Leaving out the fact that the Stryker lacks certain essential warfighting capabilities while having some fundamental warfighting vulnerabilities, the Army, the Congress, and taxpayers could save many billions by revisiting the decision to develop and procure 2,131 Strykers.

There is literally no justification for the huge and rising cost of Stryker, and the combat system program terminations demanded by General Shinseki to fund it.

This Army Stryker decision means that the rest of the Army will go wanting for operations dollars year after year, while the Stryker eats up more and more fuel, spare parts, and other resources.

The operational effectiveness vs. cost comparison strongly favors the M113A3 (with additional modifications) or the MTVL as is for their better performance under combat conditions and lower cost. In short, the Stryker works in the best of circumstances, while the M113A3 / MTVL works relatively better in the worst of situations.

Which is the preferred investment?

The evidence speaks for itself.



8. THE STRYKER: ALTERNATIVES.



This is an MTVL.

Note the tracks and the 6 wheels.
It is a major upgrade of the M113 and outperforms the Stryker.
Yes, it can be fitted with anti-RPG armor because the tracks spread the weight – and it has been designed to do so.



This is an M8 Armored Gun System.
Note the tracks. It outperforms the Stryker MGS under just about every heading – and it is Type Classified.

Yes, it also can be fitted with anti-RPG armor because, once again, the tracks spread the weight – and it has been designed to do so.

First question: Do we need alternatives or were the original premises underpinning the requirement for the Stryker wrong, or, at least, flawed?

General Shinseki, shortly after becoming Chief of Staff of the Army in 1999, argued that the Heavy Force (tanks and Bradleys) was too heavy and cumbersome to deploy quickly, the Light Force (Airborne and Light Infantry) was too light to be effective once it arrived, and so a highly deployable interim armored mid weight force was needed to for global intervention until the new advanced technology Objective Force, featuring the Future Combat System was fielded.

He divided the Army into:

- **The Legacy Force**, as the current force was to be called. This was an unfortunate term because it implied that the ‘Legacy Force’ was no longer relevant. Iraq II proved other wise.
- **The Interim Force**, to be equipped with the Stryker, which became known as Stryker Brigade Combat Teams. They were to be Full Spectrum of War capable. They are not.
- **The Objective Force**, which would be entirely different to the Legacy Force and which would be fielded some time in the future. 2008 was the most optimistic date for Initial Operational Capability. It will not be met.



General Shinseki was entirely right in saying that the Army had a deployment problem (amongst *many* others) but one can take serious issue with his solutions which were clearly heavily influenced by his recent experiences peace-keeping in Bosnia.

He was thinking peace-keeping, not war-fighting. He was thinking symbolism rather than substance. Some would argue that he was thinking of his place in history rather than the very real need to reform an inflexible, garrison oriented Army, right *now*.

He could in fact have fielded a C-130 deployable global expeditionary force at minimal expense, within a very short time, by using upgraded tracked M113 armored personnel carriers, the M8 Armored Gun, and other existing equipment, but instead chose to field the wheeled Stryker, a vehicle that was completely new to the Army, at least partially because he wanted to make a gesture that real change was on the way. In fact the US Army commanding general in Europe had already established a rapid reaction force built around the M113 and had deployed it for peace enforcement operations.

As best as can be ascertained, there was no convincing scientific reason or operational data for his focus on wheels. There was no evidence they would perform better across the span of requirements. And much evidence to the contrary.

This was a decision based upon opinion and what came to be known as ‘data-less analysis’ – an approach that became something of a feature of his administration over the next four years.

It was at this stage that matters started to go seriously wrong – with consequences that have been described elsewhere.

Worse, no effort was made by the CSA to change his vision after 911 even when subsequent events made it very clear that this country was now in for a long war against terrorism; and might well also be faced with serious conventional conflicts in countries such as Iran, Syria and North Korea.

In short, we needed, and need, globally deployable warfighting rather peace-keeping capabilities. Warfighting capabilities can keep the peace but the converse is not true.

Current events demonstrate dramatically that it can be very hard to tell when and where warfighting stops and peacekeeping starts.

It is the premise of this writer, and this report, that our focus should be on warfighting and that General Shinseki’s choice of the Stryker, with its high capital and operating costs, and limited capabilities, was wrong.



What distinguishes Warfighting equipment capabilities from Peacekeeping?

The following list is not comprehensive but endeavors to focus on the main points.

In essence, it makes the point that a warfighting situation is unforgiving.

In a peacekeeping situation, it may not matter how long it takes to get a vehicle combat ready after it has been flown in by a C-130.

In a warfighting situation, after you have secured an airport, for example, it is preferable if the vehicle can roll off ready to fight as soon as you land. It may also be that the situation demands a combat landing (a stomach churning rapid drop, and landing, which you cannot do with a Stryker).

In war, time is a major factor, seconds can make a difference and the enemy is very far from irrelevant.

Here are the benchmark requirements.



This is an MTVL fitted with a Bradley turret mounting a stabilized 25mm cannon and missile launcher.

No Stryker IAV has such firepower. Acceleration is *fast* and the MTVL is highly maneuverable both on and off road, and in urban terrain.

It can be easily fitted with anti-RPG armor and it will still function fine.

- **Firepower.** Stabilized guns capable of destroying both attacking infantry and combat vehicles.
- **Maneuverability.** The capability to maneuver at speed both on and off roads across virtually all terrain.
- **Urban maneuverability.** This refers to the ability to turn in a confined space, mount or destroy barricades and other wise deal with the particular hazards of urban combat.
- **Survivability.** Can protect the crew from up to an RPG hit and keep fighting.
- **Communications capability**
- **Reliability.**
- **Air deployability** by fixed wing – C-130 intra theatre. Be able to roll on and off a C-130 combat ready.
- **Logistically supportable.**
- **Soldier friendliness (human factors).**



The Stryker *fails* under 7 of these 9 categories – and you can argue about the other 2. The 7 it fails under are Firepower, Maneuverability, Urban Maneuverability, Survivability, Reliability, Air deployability, and Soldier friendliness.



The Stryker is *not* a warfighting machine.
As can be seen, it has a disconcerting tendency to get stuck off road. In fact the wheels have a tendency to dig themselves in.

One may further observe that the Stryker's communication capability comes from electronic devices that are not vehicle dependent. They can equally be installed in an M113.

As to 'Logistically supportable,' the Stryker has so many mechanical problems, that is a moot point.

If one accepts the need for air deployable Warfighting capabilities, there are two vastly superior alternatives to the Stryker Infantry Armored Vehicle, and the Stryker Mobile Gun System. They are:

- **The MTVL**
- **The MG 8 Armored Gun System.**

In previous reports, I have pointed out that that the M113A3 personnel carrier, which the Army owns in vast numbers, can do just about everything that the Stryker IAV can do – and exceeds its capabilities in some areas such as off road performance, suitability for urban combat and so on.

Tom Christie, Director of the Pentagon's Department of Operational Test and Evaluation agrees. Here are his words after a Comparative Evaluation carried out in September and October 2002.



“Based upon our review of the data from the MAV CE, we conclude that the Stryker and M113A3, were equally effective and suitable. The operational portions of the MAV CE showed no difference in unit effectiveness, weapon system lethality, or operational suitability.”

However, the M1113A3, even in its latest versions, is over 15 years old, so for the purposes of this exercise I am going to focus on a *radical upgrade* of the M113 which is designated the MTVL.

The MTVL is superior to the Stryker on just about every front, particularly where warfighting capabilities are involved – and is cheaper.

So, why was it not selected by the Army under General Shinseki? Well, that is a murky story but a significant reason is that General Shinseki wanted wheels – something radically different – to show he was really and truly changing the Army. Combat capabilities were not a big factor in the decision.

Symbolism ahead of substance, it might be argued, should have no place in time of war when soldiers lives are on the line. Unfortunately, that was not the case when it came to the Stryker decision.

The MTVL is a vastly superior combat vehicle to the Stryker.



This is a Stryker Infantry Armored Vehicle.
Note the wheels. The Stryker is 51%
LARGER in exterior footprint than the MTVL,
yet offers no more interior volume.



This is an MTVL, the big brother of the
M113. Note the tracks & 6 road wheels.
The turret is optional.



This is the tried and true M113A3 (only 5 wheels), the precursor of the MTVL.



Origins of the MTVL.

The M113 is the most popular Armored Personnel Carrier in the world for a large number of very good reasons starting with the fact that its core design is a remarkably efficient way of putting space under armor. Customers seem to have agreed with that assessment. To date they have bought about 80,000 with the US Army buying about 18,000.



This is the remarkable MTVL, a major upgrade and stretched version of the M113A3. Note the 6 wheels.

As with automobiles, exterior size does not directly relate to useable interior space. Good design, good engineering and ergonomic expertise are also vital.

The manufacturers capitalized on the core design of the M113 for the MTVL but added an extra drive wheel on either side – there are 5 on an M113 and 6 on an MTVL - and thus lengthened the vehicle by about 3 feet. This gave great roominess inside but the designers kept the external height as low as the M113 and thus ensured that the vehicle remained as hard to detect as its predecessor.

Low is good when you are being shot at and it is a desirable design feature that easier to achieve when you have tracks because they take up less space and height (though most people think otherwise). Tracks mean you can be low outside and yet have more than adequate head room internally.



The manufacturers then added a much more powerful 400 HP electronically controlled engine, a completely new drive train, increased the suspension travel and made numerous other modifications to end up with a vehicle that was not only fast on road (55mph – more with Band Tracks) but had quite astounding off road performance, an improvement of Zen proportions of 50% over the M113 which was no slouch itself.

Further options were Band Tracks and a hybrid electric engine.

The Band Track option for the MTVL.

Track life used to be a major issue but there have been vast improvements in track design in the light of experience and the latest T150 track is good for figures like 12,000 miles – which makes it more economical than wheels if the vehicle is heavy and off road performance is involved.

Wheels are very vulnerable to poor road conditions, let alone off road, as the current reports from both Afghanistan and Iraq indicate.

Band track, a continuous track which is made from a rubber composite over a steel core, is a relatively recent development, albeit widely tested.

- Delivers increased rider comfort and higher speed while saving a significant amount of weight.
- Already widely used on heavy agricultural equipment, it has great significance for armored vehicles up to 30 tons because it delivers the comfort of wheels while preserving the utility of tracks.
- Band track virtually eliminates the on road advantage of wheels while being vastly superior off road.



Band Track, a continuous band of rubber composite with a steel core, gives a smoother, quieter ride, allows faster top speeds, and is lighter.

The Hybrid Electric option for the MTVL:

A hybrid electric engine uses an efficient, constant speed motor, to generate electricity, batteries to store it in, and electric drives to do the actual propulsion.

Toyota make such a vehicle for the consumer market.

The MTVL contractors, United Defense, have installed a hybrid electric engine in an MTVL with quite astoundingly successful results.

- Extraordinary acceleration.
- High speed both on and off roads.



- Reduced fuel consumption.
- Extended range.
- Very quiet engine.
- Silent running capability off batteries for limited periods.
- Silent watch capability because plenty of battery power for vehicle electronics, sensors and weapons.
- Extra internal space.
- Replaces separate generators and auxiliary power units thereby decreasing cost and logistic requirements significantly.



The choice of the right vehicle in peacetime is, more often than not, a political compromise. In wartime is, quite literally, a decision about life and death.

The choice of the right vehicle is, quite literally, a decision about life and death.

The above illustration shows part of the consequences of an ambush that took place on July 21 2003 in Iraq. The consequences were fatal because a Humvee has no resistance to an RPG. True, efforts have been made to up-armor Humvees, but these impact severely on both on-road and off-road mobility.

You *cannot* load extra weight on a wheeled vehicle and expect it to perform as it did originally. Wheels are just not too good at spreading weight.

Think of over-loading the family car. It may go but you can feel its suffering. The lesson is that we need RPG resistant vehicles in a combat zone.



Features of the Stryker compared with the MTVL:



Stryker. Note wheels and sheer size of the vulnerable near shoulder height wheel area.
Poor off road and urban performance.
Impossible to up-armor properly against RPGs.



MTVL. Note tracks.
Excellent off road and urban performance.
Tracks plus inherent design means can be up- armored against RPGs.
Turret is optional

This is not a full feature list but it focuses on the essentials as they relate to warfighting.

Firepower.

Stryker is equipped with either a .50 cal machine gun or a 40mm grenade launcher in a Remote Weapons Station (RWS).

MTVL, which has the advantage of being much lighter for the same degree of armor protection, yet more internal space, can be fitted with either of the above weapons as well plus a stabilizer mechanism. Better yet, it can also be fitted with a turreted 25mm cannon like the Bradley.

Advantage: MTVL

Maneuverability on and off roads.

Stryker is theoretically faster on a straight road in that its top speed of 62mph is higher than that of the MTVL at 55mph. However, in a recent Comparative Evaluation, a tracked M113, with a top speed of 45mph, beat the Stryker on a road race because it was faster on the turns.

Furthermore, the M113A3 is governed so that it cannot go any faster. Ungoverned, it could approach 55mph.

MTVL, even when only equipped with conventional track, has a top road approaching 55mph, which is close to that of the Stryker, but has the same turning advantage as the tracked M113. Where off road is concerned, there is just no contest. The MTVL is vastly superior.

Advantage: MTVL



Urban maneuverability.

Stryker has a 58 foot turning circle, is weak at pushing aside obstacles and cannot handle barriers of parked cars etc. It is also unusually wide.

MTVL can turn in its tracks (less than a 20-foot circle), push aside obstacles with ease because of its greater traction, and can ride over barriers made from parked cars with aplomb.

Advantage: MTVL



This is the MTVL surmounting the kind of vehicle barrier than is encountered in urban combat. The Stryker cannot do this so can be blocked or trapped.

Survivability.

Stryker starts off with the disadvantage of being a 50% larger target. It then suffers from armor vulnerabilities and the fact that the wheel well area – which comes up to chest height – is an extra area of special weakness. Then there is the issue of the tires and the fact that they can be set on fire. Following that is the fact that it is mainly road bound and cannot cross a wide variety of off road terrain with confidence. It has particular problems in an urban environment.

MTVL has a much lower profile than the Stryker for similar space under armor. It is easier both to armor and to up armor for RPG protection with little, if any, gaps in protection (and armored skirts can be added to protect tracks). It can maneuver both on and off road and thrives in an urban environment.

Advantage: MTVL



Tracked MTVL on left. Wheeled Stryker on right.
MTVL *looks* smaller, but it has same space under armor as the Stryker.
MTVL can handle RPG armor. Stryker cannot.
MTVL is C-130 deployable. Stryker is not.
MTVL has excellent off road & urban performance. Stryker does not.
MTVL is cheaper to buy, support and to operate.

Communications capability.

Stryker Much has been made of the Stryker's communications capability but the facts are that such devices are not vehicle dependent.
MTVL can carry exactly the same communication equipment as the Stryker.

Advantage: DRAW.

Reliability.

Stryker is currently proving to be extremely unreliable as is evidence by its high running costs of \$50 a mile. Problems include a poor power to weight ratio (the engine, transmission etc. are carrying too much weight), a complex height management system and innate design weaknesses.

MTVL is a direct evolution of the M113. Recent M113A3 costs came in at \$3.00 a mile. The fleet average is higher because many of the M113s are the A2 model and antique.

Advantage: MTVL

Air deployability by C-130

Stryker, for all practical purposes, cannot be deployed by C-130. Some variants can be lifted for a very short distance – under a 100 miles – if conditions are perfect – but other variants such as the Mobile Gun system, cannot be lifted at all.

MTVL, which has the advantage of being lighter and lower than the Stryker for the same protection under armor, can be deployed by C-130. Further, it can be driven on and off combat ready, and even air-dropped in combat configuration if required.

Advantage: MTVL



Logistically supportable.

Stryker Much is made of the fact that all Strykers in a Stryker Brigade will have substantial commonality of parts regardless of the variant so will be logistically easier to support. There is no data to support that view. It is merely an assertion and it ignores the fact that most vehicles in the Army are not Strykers. Then there is the demonstrated issue of the extraordinary wear on tires in places like Afghanistan and Iraq, and the poor reliability experienced with Stryker in general during training.

MTVL Because the MTVL is an evolution of the M113, which comprises about half the armored vehicles in the Army, supply systems are already substantially set up, and the substance of the vehicle is widely known already. Further, the MTVL shares much commonality with the M8 Armored Gun System.

Advantage: MTVL

Soldier friendly.

Stryker This refers to the many details of design, integration, finish and operational comfort and practicality which directly relate to the soldiers' ability to live, work, and fight both in, and from, such armored vehicles. In this respect, the one thing the Stryker has going for it is that is a more comfortable ride than the M113 *on* road (though the MTVL is another matter). However, that is rather neutralized by its deficiencies *off* road and by the many ergonomic weaknesses. And, bearing in mind the size of the vehicle, the armor weaknesses and wheel well vulnerabilities, is a more comfortable on road ride worth it if the limitations and targetability of the vehicle get you killed? I think not.

MTVL is less comfortable on road (unless using band tracks) but vastly superior off road and in an urban environment. Its ergonomics are noticeably superior (something best seen when contrasting the Stryker MGS with the M8 Armored Gun System).

Advantage: MTVL



Features of the Stryker Mobile Gun System (MGS) compared with the M8 Armored Gun System (AGS).



Stryker Mobile Gun System MGS



M8 Armored Gun System AGS

This is something of a stacked deck because, as has been shown elsewhere, the Stryker MGS does not work. However, even if it did work, as will be seen, the Stryker is a vastly inferior weapons system to the M8.

Firepower.

Stryker MGS is equipped with an M68A1 105mm cannon, a co-axial 7.62mm machine gun and a .50 external heavy machine gun.

The 105mm does not work. The gun is too powerful for the chassis. Further, there are problems with the autoloader and with the amount of ammunition carried. The MGS carries 18 in total of which only 8 are immediately ready for action and its autoloader cannot identify types with accuracy. Brass cased rounds are just not detected. **Also the Stryker gunner cannot set the fuse on anti-personnel rounds therefore the MGS cannot fire with soldiers to the front (a major capability limitation).**

Note. There is then the issue of stability. If the Stryker gun is fired at only a slight cant, the entire vehicle can overturn or cause the autoloader to malfunction. The center of gravity problem evidenced in the other Strykers is more extreme here because of the top heavy cannon. The Army Safety Board has also noted serious axle deficiencies. The axles are not strong enough for the weight of the vehicle. This is fundamental stuff.

M8 AGS is equipped with an M35 soft recoil 105mm cannon (which fires all standard US Army 105mm ammunition), a co-axial 7.62mm machinegun and a .50 external heavy machine gun. All work fine. 30 rounds are carried of which 21 are ready in the autoloader – which can differentiate them at will. This means that the M8 AGS carries nearly twice as much 105mm ammunition in total as the Stryker AGS and has



over two and a half times ready for action. That is a decidedly superior capability.

Advantage: M8 AGS

Maneuverability on and off roads.

Stryker MGS is not yet sufficiently proven for the top road speed to be ascertained. However, we do know that it will be lower than that of an ordinary Stryker because of the increased weight of the 105mm cannon. As to maneuverability, there are serious concerns about stability and off road performance.

M8 AGS, even when only equipped with conventional track, has a top road speed of 45mph, which is close to that of the Stryker, but has the same turning advantage as the tracked M113. Where off road is concerned, there is just no contest. The M8 AGS is vastly superior.

Advantage: M8 AGS.

Urban maneuverability.

Stryker MGS has a 58 foot turning circle, is weak at pushing aside obstacles and cannot handle barriers of parked cars etc. It is also unusually wide.

M8 AGS can turn in its tracks, push aside obstacles with ease because of its greater traction, and can ride over barriers made from parked cars with aplomb.

Advantage: M8 AGS



MTVL demonstrating its formidable ability to surmount the kind of obstacles used in barricades in urban warfare. They tend to be made of vehicles chained together, concrete filled barrels and so on. The intent is to block you, trap you and kill you.

The Stryker cannot handle these typical urban combat problems.



Survivability.

Stryker MGS loading system and gun are not fully protected by armor. Consequently any damage to the loading system, from, for example, artillery blast or machine gun fire, can render the gun inoperable and the vehicle entirely vulnerable. It then suffers from other armor vulnerabilities and the fact that the wheel well area – which comes up to chest height – is an extra area of special weakness. Then there is the issue of the tires and the fact that they can be set on fire. Following that is the fact that it is mainly road bound and cannot cross a wide variety of off road terrain with confidence. It has particular problems in an urban environment.

There is also the fact that it cannot be up-armored to be RPG resistant, both because of its design, and because the weight on the axles is too heavy already.

It has stability issues.

M8 AGS has three levels of Type Classified armor, including Level 3 RPG protection. It is easier both to armor and to up armor. It can maneuver both on and off road and thrives in an urban environment.

Advantage: M8 AGS

Communications capability.

Stryker MGS. Much has been made of the Stryker's communications capability but the facts are that such devices are not vehicle dependent. The Stryker has no data bus.

M8 AGS can carry exactly the same comms as the Stryker – or rather more, if required, because the M8 AGS has more space under armor. It is also equipped with the MIL-STD-1553 data bus, providing much more robust integration capability.

Advantage: M8 AGS

Reliability.

Stryker MGS is currently proving to be extremely unreliable starting with the fact that neither the gun nor the autoloader work. Problems include a poor power to weight ratio (the engine, transmission etc. are carrying too much weight), a complex height management system and innate design weaknesses.

M8 AGS is so robust, it can be and has been, airdropped. Its gun, its autoloader and all its systems work fine. It is Type Classified.

Advantage: M8 AGS



M8 Armored Gun System AGS shown here being air dropped. Stryker MGS is too heavy to be C-130 deployable – and does not work.

Air deployability by C-130.

Stryker MGS, cannot be deployed by C-130 at all. It is too heavy for the aircraft to lift it off the ground.

M8 AGS, which has the advantage of being lighter and lower than the Stryker MGS for the same protection under armor, can be deployed by C-130. Further, it can be driven on and off combat ready (though its heavy armor has to be carried separately). It has been parachute *qualified*.

Advantage: M8 AGS

Logistically supportable.

Stryker MGS has not reached the stage of working, let alone being logistically supportable.

M8 AGS Because the M8 AGS incorporates a large number of sub-systems common with the Bradley and M113 installed base, the supply systems are already substantially set up, and the substance of the vehicle is widely known already.

Advantage: M8 AGS



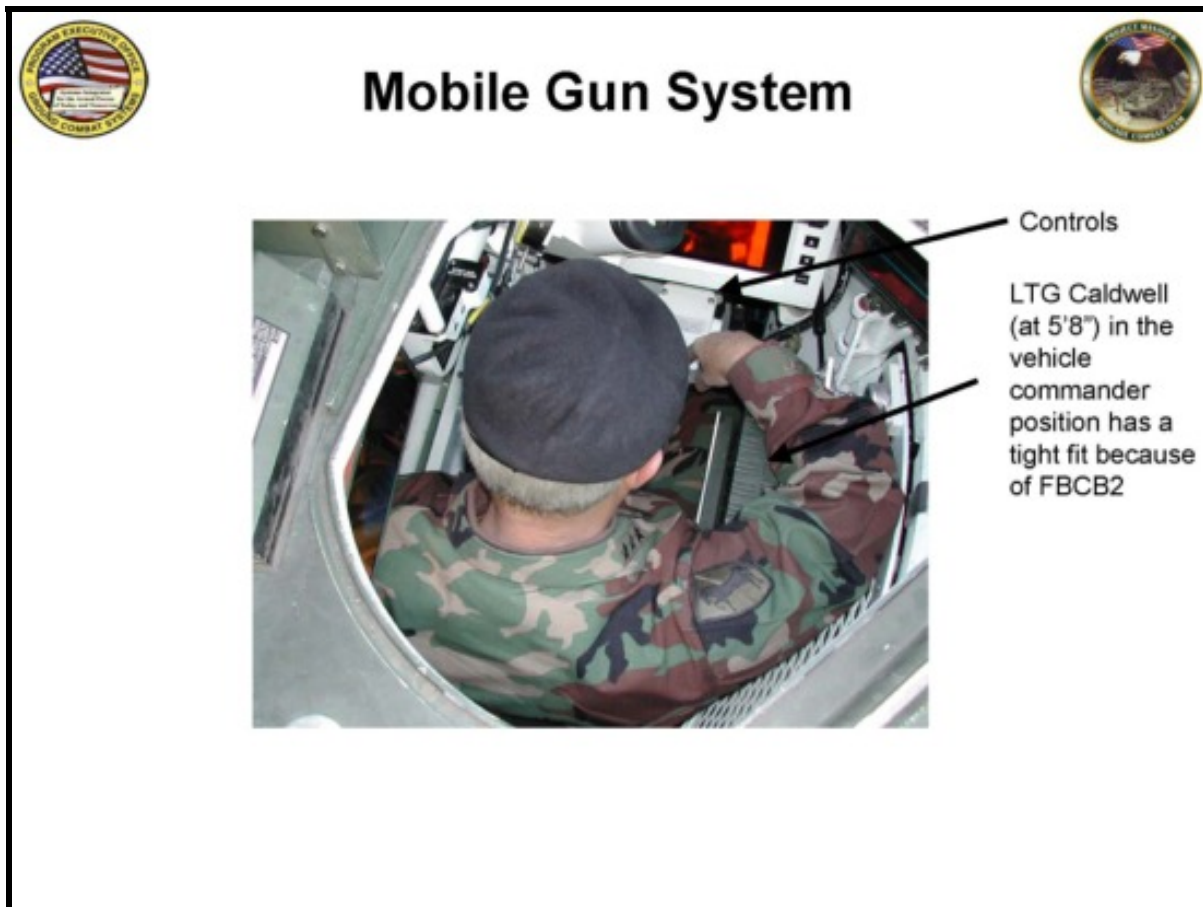
Soldier friendly.

This refers to the many details of design, integration, finish and operational comfort and practicality which directly relate to the soldiers' ability to live, work, and fight both in, and from, such armored vehicles.

Stryker MGS The evidence here from the Army board and other sources is that the MGS is about as Soldier Un-friendly as you can get. Not only does the main gun and autoloader not work but the ergonomics of the vehicle are so bad, most soldiers will not even fit into two out of the three fighting positions. And they wouldn't want to be there anyway when the gun actually fires.

M8 AGS Works just fine across the board.

Advantage: M8 AGS



This is a recent official Army photo of the Stryker Mobile Gun System showing the appalling human factors design.



A note on how the M8 AGS is armored. It is tailored for the fight.

The M8 AGS was designed *from the beginning* to have nearly the punch and mobility of a main battle tank such as the M1A1 Abrams but to be able to add armor as the circumstances dictated.

Specifically, it was designed to be parachute dropped, if required, so to achieve that capability it had to start off as light as possible. Further armor was designed to be added speedily in the field. It is a combat system.

Airdrop weight:	36,900 lbs
Level 1 Combat Weight:	38,800 lbs
Level 2 Combat Weight	45,000 lbs
Level 3 Combat Weight	52,000 lbs

This makes the M8 C-130 transportable or, indeed, air-droppable if required. Or it could be flown in fully armored in a C-17.



The M8 Armored Gun System can take the weight of full Level 3 Armor while still retaining full on road and off road performance because it has a powerful 600 HP engine and was designed to do so, and its tracks spread the weight.

The Stryker Mobile Gun System cannot get close to this capability.



9. RECOMMENDATIONS

- ◆ Freeze the Stryker buy at the level of existing purchases, and carry out a series of honest capability tests to determine an appropriate role for this vehicle.
- ◆ Cancel the Stryker Mobile Gun System immediately and substitute the M8 Armored Gun System.
- ◆ Investigate why and how the Stryker program got so out of control, and why the results of Stryker simulations were manipulated.
- ◆ Determine the true costs and outgoings in relation to the Stryker program, and the sources of those funds.
- ◆ Obtain accurate, independently verified data, on all aspects of the Stryker and make it available to Congress.
- ◆ Investigate the circumstances under which the original Stryker purchase decision was made with particular attention to the possibility of conflict of interest and/or outright corruption.
- ◆ Investigate why the statutory oversight mechanisms in the Pentagon have proved so ineffective.
- ◆ Discuss with the Joint Staff and services what kind of rapidly deployable global expeditionary force is both required and practicable.
- ◆ Given the Stryker saga, take a long and serious look at the reality of the Objective Force and the Future Combat System.
- ◆ Consider the significance of the Stryker debacle as it relates to the competence, integrity and culture of the Army Leadership.





10. CONCLUSIONS.

To have bought a small number of Strykers to evaluate as road patrol vehicles in a low threat environment might have made some sense (if one ignores their high costs).

To try and build no less than 6 complete fast deployable brigades around them, given their extensive limitations, and the fact that are too heavy to C-130 deploy, makes no sense at all. They are no faster to deploy than M1A1/2 tanks and Bradleys, bring far, far, less punch to the fight, have poor off road performance, poor urban performance, are not survivable, and are extraordinarily expensive both to purchase and to operate.

No mystery about the Stryker fundamentals.

There are unknowns and uncertainties about the Stryker story, especially in relation to the degree and extent of financial corruption involved, but there is really no mystery about the Stryker fundamentals.

This is a story is about a new Chief of Staff of the Army, General Shinseki, back in 1999, who wanted to establish his place in Army history regardless of the realities or, it might be thought, the welfare of his soldiers, and who pursued the direction he had chosen regardless of the growing accumulation of contrary facts.

Why? Blind ambition, fear of losing face, or merely a flawed management style. That is for others to judge. But whatever the inner motivation, aspects of this story are singularly unsettling.

His plan was that the Army was going to move to wheels for the Interim Brigade Combat Teams (which later became known as Stryker Brigades) regardless of the military logic, because such a change, along with the choice of the Black Beret, would show that the new Chief of Staff of the Army (CSA) meant business.

He would go down in Army history as ‘the Chief who made the difference.’

He would be the CSA who put the Army on wheels instead of tracks.

‘Irreversible momentum!’ But what about the Constitution?

In the fourth and final year of his administration he stated that his vision (Army for plan) had “Irreversible momentum” – an arrogant and truly frightening statement given that the Chief of Staff of the Army is entirely subordinate to civil direction under the Constitution and, that the President is Commander in Chief of the Armed Services. Then there is the issue of the Secretary of Defense, the Secretary of the Army, and the Defense Acquisition Executive to whom the Chief of Staff of the Army is clearly subordinate in this matter.





If the facts don't fit the plan, suppress the facts & shoot the messenger.

Where contrary views were advanced as to the deficiencies in the Army or the flaws in the CSA's vision, or the fact that there were other more urgent priorities, General Shinseki responded by terminating careers, cutting senior generals out of the loop and otherwise crushing opposition in such ways as were possible. He became extremely effective at keeping opposition suppressed, but in the process created a Command Climate that ruthlessly stultified innovation, initiative and fresh thinking – a frightening waste of human talent given that the Active Component of the US Army alone comprises over 480,000 men and women.

A reasonable person might be inclined to tap into such human potential. General Shinseki preferred to impose his vision and to ride roughshod over all opposition (This writer has talked to many serving senior officers including two 4 stars before reaching this finding).

Where the media were concerned, General Shinseki learned from his experiences over the Black Beret business. There, he was badly criticized over his decision to make all soldiers wear a Black Beret (an order that entirely ignored the fact that the elite 75th Ranger Regiment already wore the Black Beret as a symbol of their hard earned, and very special, status).

Next, control, or at least contain, the media. Infowar.

This time around, where the Stryker and his vision were concerned, General Shinseki determined to control the media through access, and other favors, and mounted a sustained and highly successful media management and manipulation campaign under the control of his aide, retired Colonel John Gingrich.

One general referred to this campaign as 'Infowar' and, based upon the investigations and experiences of this writer, that is a fair description. Colonel Gingrich had a special Strategic Communication fund stated to be approximately \$10 million to support his efforts. The true figure may well be higher.

The effect of this quite ruthless media campaign was, amongst many other things, to suppress the majority of stories which were negative to the Stryker and to foster those which were favorable. This enterprise was assisted by the efforts of the manufacturer of the Stryker, General Dynamics (as they are now).

It should also be said that there was also a desire by a number of journalists to support Army Transformation, especially in the light of the criticism of General Shinseki over the Black Beret issue. In effect, the Stryker decision achieved some degree of cover from the normal swing of the media pendulum plus patriotic fervor after 9/11.

Advance under cover of ignorance.

Throughout all this period, it should be realized that very few people had a completely clear idea as to what the Stryker actually was. Some understood the



principle of purchasing armored vehicles that were lighter than tanks but not many understood the details and even fewer had ever seen an actual vehicle. In fact, they could not see the Stryker as such because the LAV III, which had been chosen, was being modified by the various commands in ways which would lead to its becoming grossly overweight – too heavy to be C-130 transportable – and thus fundamentally undermine the whole project.

Alliances in Congress.

General Shinseki dealt with Congress by reaching alliances with Senator Inouye of Hawaii and Senator Stevens of Alaska. One brigade of these vehicles would go to each state together with substantial investments of about a billion dollars each for supporting facilities.

Other alliances were also made. In particular, a waiver was issued by Jacques Gansler, the Undersecretary of Defense for Acquisition, Technology and Logistics, to allow the Army to put the Stryker into Low Rate Initial Production (normally 10-15% of a planned buy) before being independently evaluated by Operational Test & Evaluation. That decision was stretched beyond prudent acquisition oversight to allow the Army to buy nearly *half* their planned buy of some 2,131 vehicles without any independent evaluation.

In effect, the normal checks and balances built into the procurement process were being bypassed.

Friends in high places.

One may well ask how General Shinseki and his Stryker team got away with this? Part had to do with his having friends in key places. Secretary of the Army White was one. A senior official in the GAO was another. Then there was the fact that he had enlisted strong Congressional support in key areas in a manner that effectively undermined the wishes of the Secretary of Defense.

In addition to all that, the time after 9/11 was a period during which there was a widespread feeling that the Armed Forces should be supported uncritically. After all, we were at war.

We still are at war.

None of this would matter if the Stryker had proved effective.

However reprehensible the behavior of General Shinseki and his colleagues, it would be of limited interest after his retirement in June 2003, if the Stryker had proved to be an effective vehicle. However, as has been shown in detail in this document, the Stryker family of vehicles constitutes an expensive fiasco where the outcome has been to produce brigades of vehicles which are too heavy to deploy by C-130 (even though that was a Key Performance Parameter), unstable, fail to provide needed protection, and which bring far less punch to the fight than the tanks and Bradleys in the so called Legacy Force.



Neither fish nor fowl. Too light and yet too heavy, but not lethal.

In operational terms, they are neither fish nor fowl. They are too heavy to deploy any more easily than the tanks and Bradley yet they are too light and vulnerable to do the same job. Strykers also lack the urban and off road capabilities of these vehicles.

Further, soldiers cannot fight this vehicle.

Worse yet, the Strykers are replete with problems from armor difficulties, to being under-gunned, to unreliability, to poor off road performance, to escalating costs – and so it goes.

The list is endless.

An additional dilemma is that Strykers are horrendously expensive to operate, so, if you put them somewhere which looks safe, to merely patrol, they still impact upon the fighting force because they eat up operational funds and drain external support agencies which could be put to much better use elsewhere.

Too expensive to run.

The issue of high Stryker running costs has not yet been faced up to by the Army. It is exacerbated by the fact that the Army chose not to buy the Technical Data Package which would allow competitive suppliers for spare parts to be solicited. That means that the contractor, as the monopoly supplier of parts, can charge what he likes.

This is folly.

A disturbing lack of intellectual honesty and moral courage.

A seriously disturbing aspect of this entire Stryker exercise has been the lack of intellectual honesty and moral courage that has pervaded the process. The Army Leadership made it clear from the beginning that this project was going to be pushed through regardless of any data indicating it should be stopped, or careers would be destroyed.

That is exactly what has happened.

Negative findings have been suppressed or massaged; negative reports have been re-written; concerned Army personnel have been broken or cowed; worried contractors have been dismissed or paid off; simulations have been re-run with more positive assumptions; tests have been rigged.

One may well ask why so many in the Army's Officer Corps went along with this corruption. Is not the West Point motto: 'Duty, Honor, Country?'

The reality is that the Army culture, where the Officer Corps is concerned, interprets 'Duty,' in the main, as unquestioning loyalty to one's immediate superior, regardless of the issue. There is the right way, the wrong way, and your superior's way.

Of course this is not just a cultural issue. There is a strong careerist element as well based upon the practical fact that an officer's promotion is



virtually entirely dependent upon the good graces of one's superior and a zero defect mentality.

In short, the system dictates, or can dictate, near mindless obedience; and precedent over decades shows again and again the unpleasant consequences of questioning the Army culture.

This system has fostered careerism amongst Army officers to an extent where it is becoming detrimental to National Security. 'Careerism' is defined as putting one's career ahead of the wellbeing of one's service or one's country.

Of course careerists do not see it that way. They argue that they are merely doing what is necessary to advance their interests because that is what the system demands, and personal ambition is part of the American way of life.

There is a well known saying about Army officers which is worth repeating: "An officer of the US Army will sacrifice his life for his country, but rarely his career."

Very true.

In practice, since the Army is not a democracy, a great deal depends upon the tone set from the top – or, what is known as the 'Command climate.'

If the Command Climate crushes dissent, dissent will be crushed. Such was the case when General Shinseki was Chief of Staff.

Not all CSAs are this way. Some years earlier, General Gordon Sullivan, when Chief of Staff of the Army, articulated the principle that "Disagreement is not disrespect."

Asked upon his retirement what achievement he was most proud of, General Ridgeway, the commander who stabilized the situation during the Korean War, commented: "Saving the mavericks."

That is a statement worth thinking about.

There is a further dimension that underpins careerism, and that is the fact that for senior officers, the Army, to an extent that would have been inconceivable decades earlier, has become a stepping stone to a lucrative second career with the defense contractors and consultants who proliferate around the Beltway.

If you question the system you are risking not one career, but two – and the second can be very lucrative where general officers are concerned. A general's star, today, can easily make you a millionaire.

It takes a great deal of moral courage to question the system when the rewards for conformity and subservience are so high.

The paradox is that the Army contains some of the finest people that you will ever meet, but independence of thought and moral courage would rarely be listed amongst the attributes of their character.

It is unfortunate, and it needs to be changed, but it helps to explain why fiascos like the Stryker are allowed to continue.

'Data-less analysis.' Who needs facts when you have vision?

The phrase 'data-less analysis' has been much used about the approach used by the Army Leadership in relation to the Stryker.



Unfortunately, that is putting an overly charitable interpretation on events.

The reality is that the Army Leadership have kept the closest control of the Stryker program and have been well aware of the facts, but instead of acting on them have chosen to deny them, and to proceed regardless of the consequences to their soldiers, to the taxpayers and to the National Interest.

'Irreversible momentum' to re-quote the phrase applied by General Shinseki to his vision for Army Transformation has meant, in practice, ramming through projects regardless of the facts.

Corruption of the process.

The process has been corrupted to an extent which is terrifying and it raises the most serious questions about the integrity of the Army Leadership, the effectiveness of civilian defense control and the oversight role of Congress.

Then there is also the issue that military equipment is bought for the reason that it is fundamental to National Security and that lives are at stake. The purchase of the wrong items or flawed vehicles is likely to result in the unnecessary death of American soldiers.

How we know what we know. Many concerned soldiers and citizens have tried to do the right thing.

Readers may well ask how do we know that the many statements made in this report are accurate, especially given the curtain of secrecy that the Army have endeavored to impose on the whole Stryker program (under the cover of a highly elaborate media blitz).

The answer is that despite the repressive Command Climate that existed under General Shinseki a great many of those directly involved in the Stryker project have tried to do the right thing, albeit without, in most cases, putting their careers at risk. As a consequence, a steady stream of information has been given to this writer and to others. In addition, there is a considerable amount of information in the public domain which, when added to the other data, adds up to a very clear picture. Further facts have been released by Army speakers at conferences who, perhaps, did not realize the significance of what they were saying or, perhaps, had more positive motives.

It has been our job to piece together the jigsaw.

Vast effort has gone into verifying our findings, normally by contacting friends in the Army. In addition, as can be seen in this report, we have been sent much photographic proof.

Piecing together the jigsaw has been time consuming but not that difficult. Simple physics underpins a great deal of our findings on the Stryker.

Overall, we are satisfied that the picture of the Stryker Program that we have painted, however disturbing, is accurate.

What is needed now is long overdue remedial action.

End.

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