LETTERS

Crusader Mobility Systems

Dear Sir:

We would like to thank you for your article on the Crusader System which appeared in the Nov/Dec 95 issue of *ARMOR*. It stated the case for modernizing the capabilities of the current U.S. self-propelled artillery force very well. Team Crusader (The Project Management Office, U.S. Army Field Artillery School and Contractors) is dedicated to providing the very best system for not only the Field Artillery, but for the Army and the U.S. taxpayer as well.

Toward this end, we conducted thorough studies and analyses prior to Milestone I to assess a variety of Crusader design approaches and alternatives. Among the alternatives considered were systems employing multiple variations of the M1A1 Abrams chassis, including the unmodified chassis, and the chassis with both minor and major modifications. Based on our analysis, we found that the design constraints imposed by the unmodified Abrams chassis compromised the overall design, resulting in a system incapable of meeting many of the user's most critical requirements. Modifications to the Abrams chassis alleviated some constraints and allowed for improved system performance, but it was still well short of user requirements.

In addition, our analyses provided several important pieces of information, some of which are outlined below.

- Replacing the Abrams torsion bar suspension with hydropneumatic suspension units (HSU) requires significant structural modifications within the lower hull; this has been verified during tests of an Abrams chassis modified to accept HSUs.
- Designs using the Abrams chassis cannot be reconciled with the user's combat loaded weight requirement of 55 tons. The basic Abrams hull structure (without armor boxes) carries a significant weight penalty due to the thickness resulting from the Abrams survivability requirement, a requirement which is not shared by the Crusader. The AGT-1500 power pack carries a fuel consumption penalty, particularly at idle which is a significant self-propelled howitzer operating mode.
- Extensive redesign of virtually all Abrams auxiliary systems, including fuel (tanks and lines), hydraulics, and cooling, is required for an Abrams hull-based howitzer application.
- New driver and crew stations are required to accommodate Crusader-unique crew requirements and operations/employment techniques.

With respect to the author's concept, we are obliged to note that the space claims for the AGT-1500 power pack necessitate transverse power pack mounting to fit within the allocated space, an approach requiring significant engineering development at a considerable cost.

We acknowledge the benefits of commonality and plan to capitalize on existing commercial and combat vehicle systems (including the Abrams) whenever it is prudent to do so. Studies performed by the Program Executive Officer for Armored Systems Modernization (ASM) during AFAS/FARV Concept Exploration/Development revealed that component commonality offers the greatest cost and logistical contributions. Even if the Crusader chassis is not common with existing combat vehicles, many of its major components can be, including the track, road wheels, road wheel hubs/bearings, and drive sprockets, to name just a few.

In conclusion, although we have conducted extensive studies, including using the Abrams hull as a common chassis for Crusader, the concept of using this proposal introduces unacceptable operational performance deficiencies that become significant to overcome. Meanwhile, we welcome any fresh insights and cordially extend an invitation to Dr. Sharoni and Mr. Bacon to contact the Crusader Project Manager's Office if they wish to discuss the matter further.

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LTC, Armor
Product Manager
Crusader Mobility Systems

ROBERT D. FREEMAN
LTC, Field Artillery
Cannon Branch Chief,
TRADOC Systems Manager-Cannon

M1 Chassis AFAS Would Have Too Many Limitations

Dear Sir:

As a former active duty field artillery officer, I was assigned to the Gunnery Department of the Field Artillery School (USAFAS), and have monitored the progress of the Advanced Field Artillery System (AFAS) with much interest. Therefore, I was glad to see that the future of this program has captured the attention of the armor community as revealed in the article, "The Common Chassis Revisited: Should the Next Howitzer Be Built on the M1 Tank Chassis?". However, my opposition to several of the points made in the article, has moved me to write in response.

In my opinion, the article's authors are possibly trying to further their own personal agenda at the expense of future readiness in the artillery branch. Their main points seems to be that, due to the expense and hard research involved in developing the technology which makes up the AFAS system, we should instead settle for a "jury-rigged" weapon made up of components which are readily available now. While I do agree that some of the AFAS technology (such as the Regenerative Liquid Propellant Gun, RLPG) needs more time to "mature)." I also feel that the risk involved in investing in the development of the program, is outweighed by the possible benefits it will bring. Even the authors agree that AFAS will serve as a "technology carrier" which could produce innovations used in future combat vehicles.

In principle, I agree with the authors on the concept of a common chassis, and the benefits derived from commonality among combat vehicles in our future heavy units. However, I do not beliieve that the M1 chassis is the vehicle that will carry the army in the future "Force 2000." The M1 is a remarkable, battle-tested system, but it is now reaching the limits of its potential for development. The authors admit that the M1 should be out of active service around 2020-2025. Between now and then, the current M109A6 "Paladin" howitzer system should be able to adequately support an M1A2-equipped force. The Paladin is more than equal to the task and will be fully fielded soon. To settle for an M1-based AFAS as a quick fix would be selling ourselves short in the long run.

I believe that investing in the development of an entirely new chassis for the AFAS and FARV could provide a candidate future armored family of vehicles for 2020 and beyond. In times such as now, when R&D funding is scarce, we need to cooperate as branches for the good of the entire force. AFAS is one of the few weapons programs that still has avid support from the congressional defense policy makers. With the support of the infantry and armor community, the Crusader program may prove to be the best possible "testbed" for the development of the next generation tank or infantry fighting vehicle.

The authors' support for the 155mm L52 cannon coupled with the Modular Artillery Charge System (MACS) as the armament for the AFAS shows the nearsightedness of their thinking. I feel that this strategy is better suited to an armament upgrade of the M109A6 Paladin. We should commit ourselves to developing Regenerative Liquid Propellant technology. Bringing this system to maturity would allow us to set a future standard. It would also be the greatest innovation in cannon technology since the introduction of smokeless powder. In the interim, the AFAS developers have already identified the need to procure the "Unicharge" system as a backup to augment the RLPG.

While my main opposition to the proposed M1 AFAS is based on the philosophy behind its development, I have also noted some technical problems with the de-

Continued on Page 47

LETTERS (Continued from Page 3)

sign. A major drawback is the traverse limitations caused by the placement of the main armament. AFAS must have 360-degree (6400 mil) traversing capabilities in order to be able to support the maneuver commander on a fluid battlefield of the future. The M1 AFAS's 30-degree (531 mil) azimuth limitation would make it less versatile than the current Paladin. This limitation seems to be caused by the basic design of the M1 chassis, which more than likely can't be overcome.

Ammunition resupply of the M1 AFAS by a similarly designed FARV would be difficult. Any resupply operations would be hindered by uneven or non-uniform terrain. Both AFAS and FARV would have to have a highly developed hydropneumatic suspension system similar to that found on the Bofors S-Tank. The suspension system would have to be capable of adjusting not just elevation/depression, but also adjusting vehicle cant. Once again, the amount of flexibility in the design requirements seems to exceed the M1 chassis modification parameters.

The article raised my interest in aspects of the design which were not described in any detail. Reading about the "integral ration microwave heater" is fine, but I would have liked to read more about the weapon's fire control system. No mention was made of what the weapon's self-location capability would be. I assume it would be equivalent to that of the Paladin, but it should be even more developed (utilizing GPS).

In the final analysis, I feel the M1 chassis AFAS has more limitations than it does advanced capabilities. I welcome the authors' interest in this vital weapons program, but I also feel that the plan they have put forward does not fit the bill. Some of their ideas have merit and could possibly be incorporated in AFAS design. However, I feel we can get a better overall system by continuing research into new technology. As the main customers of the fire support system, infantry and armor commanders should demand more versatility in this cannon system of the future.

ROBERT W. NEGRO
CPT, Infantry
NCARNG

M1-based Howitzer Makes Sense

Dear Sir:

Comments on the cover story and kudos to your staff artist, Mr. Jody Harmon, on his excellent work. As a Redleg, I have more than a passing interest on any new howitzer system and have worried over the speed limitations of both the Paladin and Crusader systems for some time. The innovative design shown using an M1 chassis and the MACS solid propellant for the howitzer make a great deal of sense. The material-handling equipment suggested would improve high-tempo operations greatly. The consolidated crew compartments in both vehicles are logical extentions of the MLRS cab design. I'd personally add a 40mm Mk-19 grenade launcher and 7.62mm minigun (perhaps an upside-down AH-1 Cobra chin turret) on the commander's station and a large-caliber chain gun at the second position. I'd also consider placing half the six notional antiair missiles on the left side of the turret well to allow more tranverse capability (80^{o} off center line on either side) and to allow more flexibility in fire support. I'd also consider using a lightweight panel system to provide a stand-off portable overhead and side cover for the vehicles, something that would detonate shaped charges before contact with actual vehicle armor.

The RCLR article was excellent. If you mate the 106mm RCLR with a laser rangefinder and SACUMS, the maximum effective range can be greatly extended. 1100m is the burn-out of the .50 cal spotter rifle tracer round; maximum range of the 106mm RCLR is 7700m. Since HEP and HESH rounds are not velocity-dependent for terminal effect, any items that can extend effective range are welcome. If beehive has a time fuze mode, indirect and/or long range attack becomes more effective against light infantry and thin-skin vehicles. A hard-shell HMMWV might mount 2, 3, or 4 RCLRs (an ONTOStita?) for rapid fire on multiple targets. I'd consider converting half the vehicles in the antiarmor company to RCLR; 2 out of 20 doesn't sound like near enough to me, considering likely foes and roles for light forces in future conflicts. If you figure that one TOW costs the same as a gun mount kit, we get more bang for the buck from RCLRs. Mr. Sparks' comment on the lack of sea-based gunfire support is another subject I've worried about for years, and yes, I do have a solution.

With the apparent, final demise of the AGS, the need for the 82d and 2d ACR to have some mobile firepower is past critical. I suggest the LAV with a 105mm soft recoil cannon, already developed and tested, or even using the ARES 75mm dual-purpose auto-cannon. The LAV is also amphibious, which is another pet peeve of mine, but more on that later.

LARRY A. ALTERSITZ
LTC, FA, USAR
Cdr, Det E (Marksmanship)
1182d Reinforcement Training
Unit, USAR

Don't Dismiss External Guns

Dear Sir:

I found Don Loughlin's article on the External Gun Turret to be incredibly naive. This sort of logic also opposed the machine gun and the airplane.

Contrary to Mr. Loughlin's claim, the external gun has not been extensively tested. Such tests as have been conducted to date indicate that external gun arrangements can provide a major gain in survivability at a weight reduction that greatly enhances deployment. Such arrangements also appear to be less expensive than the usual, ordinary full-turret schemes. To dismiss those gains because of imagined vision problems and fanciful mechanical difficulties is cavalier in the extreme.

What motive might prompt an attack, such as Mr. Loughlin's, on any probable solution to cost, weight, and deployment challenges is difficult to understand.

JEFFREY A. BOUCHER
U.S. Army, (Ret.)

External Guns Have Real Benefits

Dear Sir:

It was with great dismay that I read Mr. Loughlin's article on external gun turrets. I have never read such a collection of misinformation, disinformation, sour grapes, and downright drivel. The author would have us believe that external gun turrets have been extensively tested and rejected, and this is simply not true. It is quite obvious that he has no experience in a real external gun low profile turret (not a remote gun as in the Tank Test Bed). This would explain why each one of his numbered points are not true and have no validity in fact. The one truth is that every new weapon design or concept has had a host of "authorities" who have condemned the new as bad and pointed the way straight to the status quo that gives us the feeling of security while we stagnate.

Warships should be of wood, not iron; sails, not steam; the soldier cannot safely handle a self-loading pistol; magazine-fed repeating rifles will cause the troops to waste ammunition; biplanes are superior to monoplanes; I won't be able to see out of an enclosed cockpit; the guns should be in front of the pilot so he can clear any jams; the M1 will never replace the '03 Springfield; submarines are unfair weapons only useful in coastal waters; tanks are expensive, unreliable, awkward white elephants; and the aircraft carrier will never replace the battleship! Do these sound familiar? They should, if you have studied military history to any extent.

To dismiss the external gun, low profile turret prior to the extensive testing/field evaluation that the author erroneously implies has already been conducted is to bury our heads in the sand and add ourselves to that sad list described above. The low profile turret concept provides a number of very real survival, mobility, and lethality

benefits, and almost none of the drawbacks attributed to it by the author. I had the pleasure to serve as the Marine Liaison Officer on the Armored Family of Vehicles Task Force under MG Robert Sunell, an officer that many considered to be the top expert on armor in the Army. General Sunell endorsed the external gun, low profile turret concept, and it did become one of the designs examined as part of the follow-on ASM program. Far from invalidating the concept, it was a recognition of the many advantages to be gained by adopting it. However, I am sure that the author knows much more about this subject than all of those experienced senior officers who examined the competing concepts presented to the AFV Task Force.

The search for increasing levels of protection while reducing vehicle weight will not be solved by some new wonder armor (unobtainium) that weighs less and keeps out more. The solution will come from innovative design concepts like the low profile turret, autoloaders, composites, hydropneumatic suspensions, electric drive, height control, modular armor, low observables, electric guns, and other upcoming technologies that will allow the designer to strike a workable compromise in the vehicle design. We must examine all of them but not from the viewpoint of "that's the way we always did it," for that is the least supportable answer. With that thinking, the Wright brothers would be little-known bicycle repairmen. Let's not listen to the voice of the reactionary; let's look to the future, even if it is unfamiliar and uncertain. Our forefathers did, and developed the weapons we have today, and we owe the future soldiers and Marines the same consideration.

R.G. DUVALL
MAJ, USMC (Ret.)

Digitization Could Exclude Allies

Dear Sir:

I'm coming up on the Net responding to ARMOR's call for SITREPs from the force. I have been tracking the progress of Force XXI through the numerous articles in our professional journals and concept papers, such as TRADOC Pam 525-5, *Force XXI Operations*. It is difficult not to use the cliché of "working in dynamic and exciting times," but certainly there have been few times in history when an Army has had the opportunity to conduct the intellectual staff rides the U.S. Army is doing.

As an exchange student in a foreign staff college, I have had a unique opportunity to interact with many officers, representing military forces from around the world. Many of their armies are also looking inward as the decade ends. The end of the century seems analogous to a danger area, a symbolic fold in the ground, in which units have conducted a short halt to assess the situation, take stock, and attempt to scan as far forward as their sensors will let them, before launching out into unknown territory. Maybe "halt" is not the best term. We know that we can never truly halt on this battlefield.

I can report that there is a great admiration of our Army's boldness of embracing the Information Age technology. There is no doubt that as we enter the 21st century, we will continue to be the premier land force. Our friends recognize this, but I would like to share some observations of their concerns.

Our doctrine recognizes that future operations will, more often than not, be pursued by some form of coalition. (Most OOTW missions almost guarantee that we will operate with foreign armies). We have always recognized the challenges of combined operations, and I have gained invaluable insight into their planning, especially after Operation Desert Storm. However, new challenges are emerging. Herein lies one of the great concerns. Allied armies currently do not have the resources to pursue Information Age technology, specifically digitization, to the extent that the U.S. Army is doing. Coordination between Allied units, even in the days of compatible communication systems, was always a tough nut to crack. What will happen when units cannot share the kind of battlefield information that digitization can provide? Perhaps an Allied unit only a few kilometers away, cannot share a critical SPOTREP in a timely manner. As any potential OPFOR develops courses of action, he will certainly target the physical boundary between U.S. and Coalition forces. Boundaries have always been vulnerable areas, but due to this incompatibility of battle command systems, they seem to be even more assailable, both physically and intellectually. Simply put, there is a concern that Allied forces could find themselves literally "out of the loop."

One doctrinal answer to this challenge lies in the use of liaison officers. In my observation, we seem to overlook this critical mission in peace-time training. Honestly, most units can ill afford to put their most experienced officers in these positions. Perhaps, during operations, they can't afford not to. Interestingly, many World War II veterans recall that, often, only the most combat-seasoned officers were LNOs. LNOs who knew their jobs permitted great flexibility in fast-paced operations. I can only offer that we need to emphasize the importance of LNOs in combined operations. We must take a hard look at the MTOE. Perhaps one LNO, a HMMWV, and SINCGARS radio is not sufficient. The Force XXI LNO Team will require a C^2 hardware package that ties in with current battle command systems. This package could include a number of appliques or remotes that an Allied CP could use on a mission-by-mission basis.

There is a tough mission ahead. It will be a truly major effort just tying in the battle command systems of our sister services, let alone our Allies. However, we must recognize that coalition forces can and will operate on our flanks, front, or rear. We can assume that in the near future, they will not have the resources to field significant numbers of digital systems and thus, they cannot fully share in our technological advantage. Although we may be familiar with their doctrine and procedures, disparity of battle command systems will pose a significant challenge to the Force XXI commander.

BART HOWARD
MAJ, Armor
U.S. Exchange Student
Australian Army Command
and Staff College

MG Grow Misidentified in Photo

Dear Sir:

I read with great interest "The End of the Ride" by Dr. Denver Fugate in the November-December 1995 issue. As one who rode with GEN Patton and MG Robert Grow, I wonder if the photo (top) on page 11 is accurate.

I knew GEN Patton and MG Grow from 1939 on. I consider them the two greatest soldiers of WWII. I served under GEN Patton in Europe when our division was part of Third Army. I served under MG Grow from 5 May 1942 on.

I do not believe the brigadier general shown in the photo is really Bob Grow. He does not look like the Bob Grow I knew. Besides, he was promoted to major general in June 1943 and served in that grade until his retirement. If it is General Grow, he was wearing someone else's helmet.

JOHN J. FLYNT, JR.
COL, USA, (Ret.)
6th Armored Division

- Colonel Flynt is correct. Our archived photo had a label identifying the general officers as Patton and Grow. While the helmet on the man standing next to Patton appears to have only one star, the original photo indicates two, although some glare does obscure one of the stars. However, the man holding the trophy fowl is MG Ernest Harmon. We apologize and have relabeled the photo.

- Ed.