

# THE EXTERNAL GUN TURRET: “Often a Bridesmaid, Never a Bride”

by Don Loughlin

Over the years, I have seen a number of articles about the external gun turret (EGT), or external gun mount, in military magazines. As the saying goes, “There is less to the idea than it appears.” When someone does build one in a one-off experiment, it ultimately goes away; whether it be a Tank Test Bed, an AMX-ELC, a UDES-19, a Surrogate Research Vehicle, or whatever. The reason that they go nowhere is because of the very serious limitations of the concept:

**1. Commander and gunner have been removed from the turret and buried in the hull where system survivability is poor due to lack of direct vision.**

The idea of burying the crew down in the bowels of the hull, where the commander has no direct vision from the top of the turret, is a *very great net loss* to survivability! The crew may be better protected there from a hit, but the loss of the commander’s direct (eyeball) vision from the highest point of the vehicle means that they are much more likely to blunder into a disaster; be it a minefield, a steep vertical drop-off not detected by indirect vision (whether it be ‘hard optics’ or electronic sights), an unseen, well-camouflaged antitank system, or any other undetected disaster. Even in a conventional turret, it is difficult to detect these hazards on a clear day with 20-20 vision from a position 8-9 feet high, especially when moving rapidly. It’s worse if there is heat haze, maybe dust from wind and other vehicles, and perhaps smoke from muzzles, explosions, or smoke generators.<sup>1</sup>

Another bad idea related to the ‘crew buried in the hull’ is placing them in a row, where a single penetrator can take

out all three at once. The designers may suffer from a death wish, but they shouldn’t impose it on the crew.

Contemporary thermal imaging sights are marvels of technology, and I wouldn’t want to be without them, but they can’t *replace* the human eye in three respects: resolution, field of view (and the combination of both), and its marvelous working with the brain. For example, try this experiment: focus on a specific point at long distance and try

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## ON HULL SEATING:

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to remember just where it is. Then close your eyes and turn your head away as far as it will go. Next, with your eyes still closed, turn your head back to where you think you were originally looking, and open your eyes. You should be looking right where you started.

Consider next just how complicated, large, and expensive it would be to manufacture a sight to do that — and you already have the capability, ‘for nothing.’ (This has been called ‘kinesthetic orientation,’ which is a great expression, and I wish I knew who created it.) Remember also that, when you opened your eyes, you had a view combining excellent, detailed resolution at the center with a very wide field of view. This is what you have now, supplemented by hard optics and elec-

tronic sights. Should you give it up and be without that eyeball at the top of the turret? Not likely!

I tried for a long time to understand how such a fundamentally wrong idea as having the crew buried in the hull could last for so long; when it shouldn’t have survived the first user conference. I finally remembered that it was originally sold as part of the early days of the Armored Systems Modernization (ASM) study, got high level support because of its association with ASM, and became an article of faith in a theology that is dubious at best. Once it became politically correct, who would challenge so central an element of orthodox dogma? Certainly not someone who wished to remain in business! And certainly not someone who would like to be promoted at least once more.

Since I am now retired, and more politically incorrect than ever, I say to the world: “The emperor has no clothes!” What we should do is to defrock ASM (if not done so already) and let individual ideas compete on their merits. When we have reached that point, dissenters will no longer run the risk of being accused of blasphemy or heresy, and we can start engineering again.

The winning entry of the 1993 *ARMOR* Magazine Tank Design Contest, Western Design Corp., was a clever design that wisely avoided the pitfalls of the elevated gun, but still bought into the bury-’em-in-the-hull syndrome. Too bad! Otherwise, it looked good, except for all those goodies that they claim will fit inside it. If they can really do that, and still meet the volume and weight claims, then we should put them to work on solving the problem of the national debt.

## External Guns - Tested and Rejected

### 2. Elevated gun position decreases survivability due to high silhouette and exposed mechanisms.

In a conventional turret, the turret need not be much higher above the hull roof than the vertical height of the gun. Since the gun breech of an EGT can not ordinarily drop down below the hull roof (unless a depression is built into the top of the chassis, which will need a cover to keep out water and contaminants, including dirt and debris<sup>2</sup>), the trunnions must be raised accordingly, which raises the gun height.

The elevated gun position means that all kinds of mechanisms that would ordinarily be under turret armor are now exposed, where they are vulnerable to shot, bullets, blast, fragments, weather, and the occasional tree branch, small and large. By the time the system is detail-designed (as compared to that nice, clean generalized paper concept picture), there will also be all kinds of reentrant angles and surfaces to accommodate various sights, coax MGs, hatches, and access doors, etc., that will make the turret a mobile shot trap and generalized rain catcher. It will be an especially good rain catcher when it gets on in years, the seals are compressed or torn, and the hatches and latches don't work that well anymore. Think how well the re-entrant surfaces will trap and leak CBR contaminants, and how they will then leak into the interior. Think about the difficulty of decontaminating that surface. The caustic decontaminating chemicals will also get inside the vehicle, where they will cause their own unique problems.

### 3. Excessive complexity due to the need to remote the operation of subsystems.

As an example, let's review the coax MG installation in a conventional turret as compared to an EGT. In a conventional turret, a turret crewman can replenish the coax ammo supply, clear gun stoppages, change barrels, help to adjust boresight or zero, and do other tasks. But, in an EGT, there is no direct



Among many vehicles that have explored the concept of external guns were the General Dynamics Armored Gun System candidate, above, and the HIMAG (High Mobility Agility) vehicle, shown at left being tested in 1980.

access, so these operations must be removed at the expense of increased complexity, accompanied by increased weight, volume, and cost. And you may be certain that none of this complexity will be revealed in concept drawings or magazine articles describing how great the idea is. (A nice feature of concept drawings is that one can label a component or subsystem as being present with a barely existing volume and weight allowance.) Don't forget that the complexity will increase the maintenance and logistic burden, as well as decrease reliability. The coax is just *one* simple system. Now consider all the other subsystems that must be removed and you will have another reason why you don't see any EGT in production.

As another example, let's look at the turret drives, which must have a manual backup mode. An EGT that is remote (the gunner and commander are

stationary in the hull, and do not rotate with the gun) must still have manual turret drive. Manual turret drives for such an turret are feasible, but are complicated, meaning heavy, bulky, and expensive. Manual turret drives for an EGT that is not remote are less complicated than for the remote turret, but still more complicated than for a conventional turret.

### 4. Loss of interior volume and mounting surface area.

These are some of the worst features of the EGT, and are, unlike the issues described above, the only problem areas that I haven't seen commented on before. The EGT proponents say that what we need to do to have an 'advanced' vehicle is to get rid of the heavy turret and cram the crew and a bunch of other stuff that used to be in the turret (well, approximately half of the turret crew's volume was in the turret) into the hull. The hull was already

## All That Stuff Has To Go Somewhere...



An M1A1 crew from 1-35 Armor pauses during Desert Storm. Note the external turret stowage space unavailable in an EGT design.

crowded, and the alleged advantage of eliminating the conventional turret basket volume in the hull (with its fictional free volume) for the remoted

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### ON STOWAGE LIMITATIONS:

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EGT is an illusory advantage. The space in the basket that was previously occupied by seats, ammo, turret drive motors, pumps, control handles, a bunch of electronic control boxes of varying sizes all interconnected with cables, and only half of the volume of the turret crew's body, will now have to accept the volume of all those same items (minus the volume of the gun breech when the muzzle is elevated), plus now the entire volume of the turret crew's bodies and a lot of the componentry that used to be in the turret — more control boxes, cables, control panels, fire control items, etc. Combine that complexity with the fact that the EGT will impose its own set of additional complexities. There is just not

enough volume to be able to do all that and still have a credible design approach.

Another aspect of turret and vehicle system design in which the EGT unnecessarily degrades the designer's options is the lack of turret surface mounting area, *external as well as internal*. All those turret control panels and handles, electronic boxes, and other gadgets listed above must all be attached somewhere; and all that material shown on the OVE and OVM lists must be stowed somewhere, inside or out. Where will it go on a vehicle with an EGT? The top of the hull cannot be used, as it would block gun motion. On a conventional turret, the turret bustle area is normally used, but its use would eliminate many of the claimed advantages of an EGT.

The photo above shows a typical M1-series Tank in DESERT STORM, all dressed up and ready for a fight, with all kinds of things on and in it that are not on the OVE/OVM lists. Note how cluttered the real vehicle is.

Where would we put all that material on a vehicle with an external gun turret? The proponents of the external gun turret seriously underestimate both the internal volume needs of any combat vehicle, as well as underestimating the impact of the loss of turret wall surface for mounting all the items they don't talk about.

### Conclusion

During the design phase of a new turret, or a new vehicle system, the experienced designers in the business (those who are left) examine many different approaches for meeting the user's requirements for performance, reliability, survivability, weight, and cost. The EGT has not yet passed that test, and that is why it is still "Often a Bride-maid, Never a Bride."

### Notes

<sup>1</sup>An experienced turret designer who reviewed this paper made the comment "...Have you ever seen an animal that didn't have its eyes either at, or very near, the top of its head? Even a flounder has both its eyes on the top of its body!" A good point.

<sup>2</sup>The resulting product will probably look and operate like a poorly designed turret.

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