

STATUS REPORT

Wednesday, 30 December 2015

Going Ballistic

Author: DK

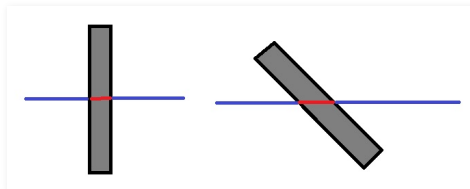
Special thanks to Captain Nemo and Vollketten.
Thanks to Rita Gamer for Edits and Publishing

Both Armored Warfare and World of Tanks have invented how certain shells work in the game that doesn't follow the real world model. In WoT's higher tiers this leads to medium tanks either feeling weakly armored, dissimilar to reality, or medium tanks getting buffed armor in the game compared to reality. Armored Warfare on the other hand has very low penetration guns compared to reality, with overarmored MBT sides and semi-historical weakspots.

Anyone who knows anything about Cold War tanks may be confused by the lack of armor in high tier mediums in World of Tanks. For instance, when a T-55 was driven onto an embassy during the 1956 Hungarian revolution, analysts were shocked by the T-55s 100mm of upper glacis armor. They realized how effective this would be at bouncing or absorbing shots, with the hull's front upper plate being angled at a very sloped 60 degrees.



The T-55 scare created the need for the famous 105mm L7 anti-tank gun and played a defining role in early western tank design. However, using trigonometry and middle school mathematics, anyone can find the hull of the T-55 is only 200mm thick in Line-of-Sight terms (henceforth known as LoS). A flat piece of 100mm armor is 100mm thick for a round hitting it at 90 degrees. Tilt that 100mm armor and the same shell hitting it from the same angle now has to travel through more armor. This is illustrated below.



200mm is very paltry considering even early Cold War guns had 300+mm APDS penetration versus flat armor. Why was this scare an issue if the T-55 was not really that protected? Were guns of the time, like the American 90mm T54 and the British (84mm) 20 Pounder, not already good enough?

In-game, you will feel that these tanks have no hull armor because World of Tanks, copy and pasted by Armored Warfare, chose not to implement sloped armor in a historically accurate way, they do not represent what shocked the analysts so greatly. The developers added a concept of normalization, where all shells hitting armor become 5 degrees less angled upon impact. This is simply opposite from reality. Many do not know that for all kinetic energy penetrators before APFSDS, armor was MUCH more effective than line of sight in terms of protection. The 200mm LoS hull armor (100mm actual thickness) on the T-55 hull is actually MORE effective than the 250mm+ LoS armor found on the turret. This can be imagined by thinking that APDS rounds fails to fully dig into sloped armor as if it was going straight through. Instead the round

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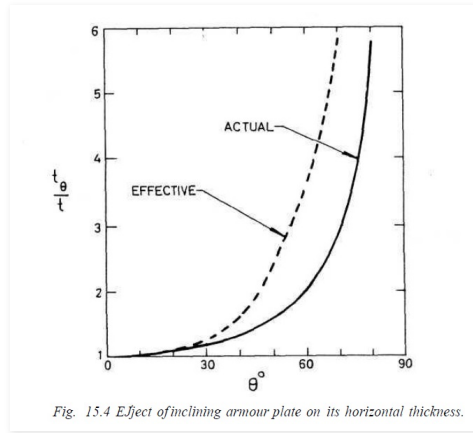
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has a tendency to slides along the slope while it is attempting to burrows into the armor.



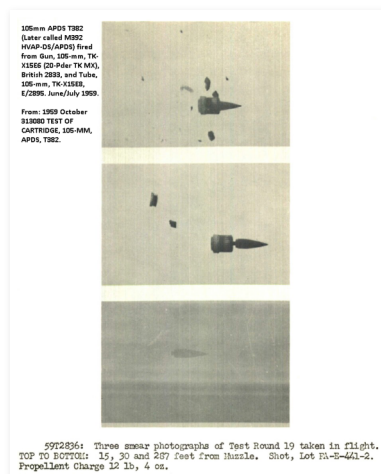
Above, you can see the true real life effectiveness of anything but modern kinetic penetrators (such as APFSDS) versus sloped armor, by following the dashed "Effective" line. APFSDS would follow closely to the "Actual" Line.

Many tanks, such as the Swedish Strv 103, took advantage of the sliding effect. It's armor was very effective versus 105mm APDS not because of its 200mm of LoS armor (40mm at a very high angle), but because the sliding principle allowed it to be 8.5 times more effective than the same thickness of a flat plate, over 330mm effectively thick in reality. Enough to bounce or ricochet all incoming kinetic shots. However, as soon as APFSDS was developed, the Strv 103's armor became only 200mm thick effectively, and combined with advanced gun stabilization on other tanks, it became horribly obsolete.



APDS

APDS is, in effect, a Tungsten Carbide bullet as seen here, where it discards its Sabot (Think of it like a case for a bullet) en-route to target. These rounds were very effective against flat plate, but could not dig into slopes, illustrated in the previous image for sloped armor. In this image serious you can see a flying APDS shell discard it's Sabot and prepare to hit it's target.



APFSDS

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The key advancement of APFSDS was not just straighter flight trajectory, but that it began ignoring this sliding effect and instead followed LoS thickness. APFSDS effectively “ignores” the extra slope and sliding effects. This did not reduce the slope past the LoS value, like normalization in Armored Warfare and WoT does, but merely makes it equal to it. In the graph above, APFSDS would perform similar to the “Actual” armor thickness line. This advancement partly plays into the role of modern tanks being very slab-sided and blocky, while having, in the case of the M1 Abrams, what looks like a shot trap. APFSDS, not accustomed to being bounced off armor, will usually break apart when it ricochets, which normally happens at about 8-10 degrees. In theory, shot traps on high tiers in Armored Warfare should simply not happen since the shells would be breaking up upon impact.

HESH

The other main anti-reality ammunition type in Armored Warfare is HESH. HESH does not actually rely on penetration in real life. For HESH calibers from 37mm to 165mm the penetration only increases by about 40mm. However, HESH is not specifically designed to penetrate solid objects. Regardless of caliber, it will blow in a pancake, also known as a scab, of steel from the inside of the impacted armor plate. This in turn would then fly into the crew compartment. This effect, as a general rule, was effective for HESH up to about 1.3x its caliber versus the attacked armor plate. Due to the shape of the explosion against the armor plate, flattening out and spreading as a loose circle, HESH also performs better versus heavily sloped armor plate. At least until it fails to fuse at about 85 degrees, 85 being where the fuse of the shell fails. Aside from exterior splash to composite armor and ERA, HESH performs poorly versus spaced armor and tracks. As in reality, HESH should be a true Anti-Armor round like HEAT or APDS in Armored Warfare, ready to engage all targets with thinner plates of highly sloped armor.

HESH is not designed to penetration, but it still can happen when it hits light armor. Ouch!



Modeling how ammo penetration works in Armored Warfare

In-Game, going to a realistic ballistic system would have a good impact on the game. It would provide a place for HEAT and HESH for more variety in ammunition, create a realistic weakspot system for low tiers (flat turret fronts, copied on high tiers by realistically weak gun mantlets), and allow for a huge upgrade in penetration mechanics when switching from APDS to APFSDS. In consequence, APDS could get much higher penetration values, and APFSDS could start making an appearance on later tier 4-5 tanks instead of tier 3, where it really does not belong.

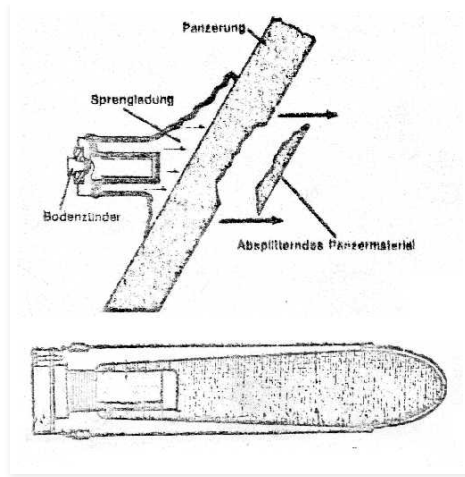
The correct way to implement HESH in-game would be somewhat as follows.

Assign 60% normalization to HESH shells. 60% of the impact angle is cancelled by the slope-negating impact.

Assign penetration of 1.25 times shell diameter. This is the exact number mentioned in a DTIC document overview. Make the damage superior to the damage of HEAT and AP, while keeping it below the damage of HE. This penetration RNG would not be done by pen number, but instead vary between 1.2 to 1.3 times the calibre, a number 100% correct to real life.

Upon non-penetration, assign a negative exponential splash damage curve, starting at 50% of the damage of a penetration hit, becoming fully ineffective at triple the shell calibre.

Here is a HESH shell in function



In the future, I do hope for a full review of Armored Warfare penetration mechanics. Although the game is still in its infancy, many mechanics, such as these and the consumable system, are too close to WoT in my taste, and too far from reality in this pair of mechanics. I hope you enjoyed this brief overview and I will be able to answer any questions below...

What would you like DK to "Go Ballistic" next on. Would you like to learn about HEAT rounds and how they developed from the 50s to the present day, or have the non-historical nature and function of high tier MBT armor explained in an article. Any other ideas? Let him know in the comments.

Posted by [Unknown](#) at 22:46

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