

LG TA

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Technical Authoring Module

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What is a tank:

A tank is a name that can be applied to numerous vehicles depending on the definition it can capture vehicles that may not be considered tanks, such as a Toyota with a gun on it, and if the definition is restricted then vehicles such as the Mark IV, which being a design evolution from the Mark I, the first tank, you would be hard pressed to justify. [1]

Figure 1



For this assignment only vehicles characterised as a tank by the creating nation will be considered as tanks. The Bob Semple (Figure 2) will be considered as a tank and self-propelled artillery such as the Russian 2S19 Msta-S self-propelled howitzer (Figure 3) will not. Despite the former being a tractor with armour and machine guns welded onto it, whilst the latter is a tank chassis with a bigger less armoured gun attached. [2] [3]

(Figure 2)



Figure 3



History of tanks:

The military development of the tank started with civilian motorised vehicles, which first began to be armoured and armed for military purposes in 1902; This included both main guns and machine guns and served as a demonstration of the viability of motorised equipment in war. These are not considered to be tanks due to their use of wheels instead of tracks and their intended purpose to replace light cavalry in roles such as reconnaissance and patrols. [2] [4]

Figure 4 - FIAT Arsenale' in Libya, 1912. (The first use of armoured cars in a war)



The first true tank began development in 1915, as a program to find a way to avoid the difficult and costly infantry and cavalry assaults of the preceding months of World War 1, 49 of the best available design, named "Mother" were used on the 15th September 1916 in the first tank

assault at Flers-Courcelette. Following this all major powers involved would have their own tank program, though they varied in size. [1] [2] [5]

In the interwar period a wide variety of tanks were produced, varying in size and intended use. Notably this included the implementation of radios to some tanks and a gradual shift towards single turreted tanks, with fewer secondary weapons like machine guns or cannons. [2]

The Second World War saw both the escalation of tank size, and the lessons learned by the war regarding the flaws in this doctrine in tank design would result in the creation of the first main battle tank, the Centurion; Designs converged towards having a majority of tanks being able to do a variety of tasks rather than producing a variety of types of tanks that are specialised. [2] [6]

Post World War Two the trend towards the main battle tank model used today continued, implementation of drastic variation in tank design became uncommon, limited to things like reactive armour and autoloaders, which are not used universally. Some universally implemented major changes are such as thermal imaging and the use of cameras in addition to the traditional periscope and hatch based sights, now used for backup. [2]

Economic costs of tank production

A fundamental problem when considering the value of a military design or doctrine will always be costs: financial, material and temporal. A doctrine requires a certain number of tanks, the tanks must be suited to the roles it must serve in, and to do the money must be spent to pay for the materials and people to spend time to produce them. This limits how many tanks you can make for a given design and produces a trade-off that in turn limits what doctrines are viable.

There is only so much of a given resource and only so much can be done with them, because of this any individual view on how a tank performs individually is flawed; For example it took 300,000 man hours of work to produce a Tiger tank, but only 48,000 to produce a Sherman. A doctrine focused on equipping a large number of tank units with Tigers, spread across a front is far less viable than doing the same with Shermans. [6]

Iron Triangle:

The Iron triangle is the common tank design principal that a tanks primary considerations are mobility, armour and the main gun, and that optimal tank performance is defined by performing well in these regards.

Tank Armour:

In World War 1 tank armour began light, with 10mm thick steel on the Mark 1. Tanks designed later in the war had thicker armour, up to 30mm thick on some German and French tanks. This thin armour was sufficient to resist small arms fire and due to the rarity of dedicated anti-tank guns it was only easily destroyed by artillery fire, this lack of direct external threat meant that most tanks in World War 1 that were disabled were done so as a result of mechanical failure, it is for these reasons that armour was kept thin, as the lower weight reduced losses to engine failures or sinking into the ground more than it caused in destroyed tanks. Tanks produced in this time were generally rhomboid shaped, with relatively flat armour. [2] [1]

Whilst armour remained similar in most countries throughout the interwar period, France especially did produce tanks with notably thicker armour (40-60mm) but most continued to be around 30mm. [2]

By the end of World War 2 some heavy tanks had been developed with armour as thick as 185mm, to increase survivability against the increasing effect of anti-tank guns and other tanks guns; but a majority had armour only about 90-100mm, due to the same weight considerations that had lead to lighter armour in World War 1. [2] [5]

Tank Guns:

The weaponry on tanks started in World War 1 as a pair of artillery pieces, with lots of machine guns, however artillery shortages throughout the war lead to the production of many similar “tankettes” which were tanks that had more machine guns but no artillery pieces. The artillery pieces were used to destroy static defences such as bunkers or trenches. [2]

By WW2 guns had developed to use smaller guns more focused on combating other tanks; Resulting in British 40mm, French 75/47mm, German 20mm and 37mm and Soviet 45mm guns; These guns were smaller and less effective against static defences, especially trenches, but more effective at destroying other tanks. To reduce on complexity, weight and crew size most tanks were reduced to a single gun, housed in a turret on top rather than the sides to allow the single gun to cover all sides, and one or two machine guns, reducing the firepower a tank possessed. [7] [5]

To penetrate the armour of late war heavy tanks, the guns had once more moved towards bigger guns such as QF 17 pounders (76.2mm) and 88mm anti-tank guns. [7] [5]

Tank Mobility:

Tanks were initially very slow (slower than walking speed) very unreliable, suffering frequent breakdowns and struggled with any complications with terrain. This greatly imperilled there ability to serve as breakthrough vehicles as significant losses were faced to failures to cross trenches, whilst the slow speed gave enemies time to respond. This slow speed also meant they couldn't act as cavalry would and exploit any breakthroughs effectively. [2]

As time passed many technological improvements were made to engines; Tanks were improved in all these regards, and whilst heavier tanks still couldn't traverse any complexity in terrain they could reliably cross open ground and lighter tanks were designed specifically to further increase speed and traversal of gentle hills and sparse woodlands, these different types of tanks. Due to the peace of the time, the tanks were produced in smaller batches, by professionals, with no specific shortfalls in materials. [8]

In World War 2 the rapid escalation of tank armour and weapons led to many tanks growing increasingly unreliable and slow even with improvements the engine and the production of tanks in large number necessitate the work to be done by less skilled workers across Europe and with greater difficulty in getting some materials, namely for Germany. These problems and their consequences were observed by all parties and the need to ensure that tanks were not

overengineered and unreliable meant that some tanks developed at the end of the war focused on keeping a balance of the competition between escalating tank armour and guns, and their reliability. [5] [6]

Tank Doctrine

British Interwar Tank Doctrine

In World War 1 tanks were designed and used as an initial breakthrough vehicle, being used as a shield for infantry and a transport system for weapons to destroy fortifications and suppress enemy infantry. [2] [1]

Interwar tank doctrine moved to replace cavalry, producing cruiser and infantry tanks. That each replaced cavalry in a key job. [2] [8]

Infantry tanks were designed on the assumption that they only had to go as fast as the infantry and were a direct successor to tanks of the first world war and effectively did the tasks historically done by heavy cavalry, though they had ceased to be viable centuries prior. [2]

Cruiser Tanks were designed to take advantage of the increasing speed of mechanised warfare, acting to exploit breakthroughs and being more useful in unconcentrated skirmishes and patrols. [2]

German World War 2 Tank Doctrine

The main differences between German tank doctrine, often referred to as “Blitzkrieg” and other nations early tank doctrines was the use of air support, and a greater degree of operational independence, allowing for more rapid exploitation of breakthroughs. Another notable difference is that whilst the increase in the number tanks and their reliability since World War 1 had resulted in the spreading out of tanks across a theatre with other powers, German doctrine called for the heavy concentration of tanks. [8]

This independence was allowed by the vital implementation of the radio to tanks which, combined with political infighting creating a competitive environment, resulted in the great successes of Blitzkrieg, namely the 1940 invasion of France. The problem with this sort of system is that this competitive environment often incentivised risky offensive operations. [8]

Influences on modern doctrine

Since World War 2 the lessons learned regarding avoiding overengineering and reducing costs have been less relevant, the smaller number of tanks and lack of major conflicts halting access to resources have made the disadvantages of using more resource or time expensive designs less impactful.

The shift towards the use of tanks as in a more dispersed fashion as support for infantry and patrols as much as a tool for manoeuvre warfare is reminiscent of the ideas tried out towards the end of World War 2, much of modern tactics is similar for assaults too, as design choices that had been kept to such as the single turret model and the lack of specialisation for tanks. The most notable changes to tactics have been due to the further development in air power, but the change has largely been in the use of less tanks and more supporting vehicles and more accurate bombardment before an assault. [2]

The greater operational independence created by the radio is still a vital part of modern warfare, though methods to deny radio communication have changed that, especially in high intensity conflicts. [9]

Changes due to drones:

Of all modern changes to tank doctrine, the drone has been the most transformative, never has such an expensive weapon of war been so easy and cheap to destroy. Anti-tank guns are large and need to see the target, artillery are inaccurate, man-portable anti-tank missiles require typically require sight and are expensive, If less so than a tank. With a drone a soldier over the horizon can accurately target a tank, and though data for success rates is difficult to get, the low cost and risk of drones mean that the loss from a failure is little, and the benefits of a kill are great. [9] [10]

“It is estimated the drones make up 65% of all armoured vehicle losses in Ukraine.” [10]

This attrition of tanks along a front is severe, but does not, as some may argue invalidate the use of tanks, it has instead seen a shift in doctrine, to avoid the losses to drones, tanks have been seeing less use in spread out units and have been used mostly with heavy drone support. [9]

The benefits of concentration as opposed to spread out formations is not only in reducing attrition, during an assault a region only has so many drones, it only has so many operators, the damage drones can do over a time is limited and can take time to replenish, allowing for continual assaults to be less affected by these changes. [9]

These changes towards older doctrines show how the lessons from the designs and decisions of the second world war are still influential on the modern battlefield.

Figures

Figure 1 - A generic example of how a tanks definition can be varied.



Figure 2 - Bob Semple



Figure 3 - Russian 2S19 Msta-S self-propelled howitzer



Figure 4 - FIAT Arsénale' in Libya, 1912. (The first use of armoured cars in a war)



References:

References for analysis:

- [1] J.F.C. Fuller, *Tanks in the Great War 1914-1918*
- [2] The Tank Museum – *The Tank Book*
- [5] ‘Chariots of fire’: the evolution of tank technology, 1915–1945 | *Journal of Evolutionary Economics*
- [6] J. Mosser, *Principles of Modern Tank Design*
- [8] J. Barager, “The Shock of Blitzkrieg: Influence, Exchange, and Development of Ideas Relating to the use of Tanks in the Interwar Period.”
- [9] Are Tanks Still Relevant in Modern Warfare? Lessons from Ukraine – *DefenseFeeds*
- [10] Why FPV Drones Are Still Ukraine’s Biggest Tank Killers - *Forbes*

References for History

- [1] J.F.C. Fuller, *Tanks in the Great War 1914-1918*
- [2] The Tank Museum – *The Tank Book*
- [3] This Is Not A Tank! A Layperson’s Guide To Armoured Fighting Vehicles - *Forbes*
- [4] Filippo Cappellano & Pier Paolo Battistelli, *Italian Armoured & Reconnaissance Cars 1911–45*
- [6] J. Mosser, *Principles of Modern Tank Design*
- [7] *The Encyclopaedia of Weapons of World War 2*
- [8] J. Barager, “The Shock of Blitzkrieg: Influence, Exchange, and Development of Ideas Relating to the use of Tanks in the Interwar Period.”



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Advanced Physics Module

OME

FINAL GRADE

53 / 100

GENERAL COMMENTS

Hi Lucius,

This was a reasonable submission, drawing in the low 50th percentile. You clearly understand the concept of technical authoring, and can apply effective imagery to support argument, but there are some structural observations to address. You are super bright and this is not your best work.

The submission has no title. What are you writing about, and what is the task you need to complete? What you have provided is a list of information about tanks, culminating in drone warfare, which suggests its doctrinal advantage may be over with such advances in technology.

I liked the discussion on the iron triangle, and the doctrinal inference, but your submission ended quite abruptly with no conclusion. You must get used to doing this in technical writing. I agree with everything you are saying, but how are you pulling your observations together? Linking this back to an assignment title would have been useful. You also complete the submission with a title page for advanced physics, suggesting this was somewhat rushed.

You often write in incomplete or disjointed sentences. Do you need some help in this area? If so, please don't hesitate to ask or liaise with student services. Also, chat with me to consider how AI can assist you in this area. I see no problem in you using that tool if you need to, but this must be supported by student services.

Overall, I think you could have reframed this into an effective pice of writing, but I'm presuming other commitments prevented direct application.

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