A century of the tank
Mark 1 vs Altay

Otokar
A century of the tank: Mark I vs Altay

Introduction

On 15th September 1916, the world’s first tank – the “Mark I” – conducted its maiden operation in the First World War as part of the Somme Offensive, marking a significant change in campaign warfare. Most of these innovative vehicles either broke down or were disabled by man-made and natural obstacles while less RESOURCE commanders fell by the wayside or got lost on the battlefield.

However, a number of Mark I tanks continued into action and achieved so much that the British Army’s Commander-in-Chief, General Sir Douglas Haig, elected to continue with the tank experiment for the duration of the war.

Deployment of the tank spread quickly beyond Western Europe with eight platforms deployed to Egypt in 1917, and a further tranche also taking part in the Second and Third Battles of Gaza in the same year before being returned to the UK.

Nearly 100 years on and the world has witnessed a dramatic evolution in the development of the tank into the contemporary “Main Battle Tank” (MBT). The brave soldiers who operated these first tank variants stepped into the unknown to operate the first Mark I variants but there is no doubt that if they were alive today, they would still recognise the design and utility of the modern MBT.

But what they would not perhaps have dreamt of, would be the capabilities provided to contemporary MBT operators in the realms of mobility, protection and firepower.

The latest MBT to enter the market is Turkish company Otokar’s Altay platform. Following a proud history which included the former’s tracks which ran right around the hull and suspension on board the Mark I model whose prototype was built in 1916 and was known as “Mother”, in a matter of months, the Mark I was conducting trial/briefing operations on the Front Line providing critical feedback to the British Army in the deployment of such an armoured vehicle.

Crude in design, the Mark I was very different in every respect to the modern MBT, requiring a crew of eight to operate it, most of whom had nowhere to sit.

Conditions inside were described as dreadful, with the Mark I engine housed in the middle of the vehicle, surrounded by the crew and the risk of fire very great indeed. The armour was relatively thin and not always bullet proof, while the crew, deafened by the noise of the engine, breathed ill and failed to prevent vibration of the platform as it moved at a top speed of 0.95km per hour. This Mark I crews would be anxious of the relative comfort enjoyed by Altay crews.

So it is with these particular areas of mobility and propulsion; protection; and firepower that this profile will assess the major differences between the Mark I and Altay platforms and how technology has progressed over the past century.

As emphasis shifts towards more military operations in urban terrain; “Altay will be backbones of the Turkish Armed Forces and will play a major role in all kinds of land operations. Being one of the latest designed tanks and with its ultimate capability of mobility, firepower and high protection against conventional and asymmetric war threats, it will significantly increase the overall capabilities of the land forces.”

“There is a great interest for Altay from various countries of the world. We have been approached by several countries asking for detailed information and requesting presentations and we believe that once Altay enters into service with the Turkish Army, there will soon be many armies folding this MBT,” it was added.

Such a structured growth pattern varies dramatically to the evolution of the Mark I model whose prototype was built in 1916 and was known as “Mother”. In a matter of months, the Mark I was conducting trial/briefing operations on the Front Line providing critical feedback to the British Army in the deployment of such an armoured vehicle.

Otokar’s Altay platform

According to Otokar, the manufacturing of armoured vehicles from 4x4 to 8x8 and 3/4 tonnes to 60 tonnes platforms, guided the company towards its first tracked product, the Altay MBT, so named after Turkish General Fahrettin Altay, who commanded the V Cavalry Corps during the War of Independence between 1919 and 1922. Altay’s Corps was famed for its role in the Battle of Dumlupinar where it operated behind enemy lines to disrupt Greek forces and cut supply lines.

In March 2007, the Turkish Ministry of Defence’s (MoD’s) Undersecretariat for Defence Industries down-selected Otokar as prime contractor in the Altay MBT Project Phase I which incorporated design, development, test and qualification of prototypes. A 78.5-month contract was signed in 2008, worth approximately USD500 million. A total of 250 MBTs is expected to be manufactured for the Turkish Land Forces with production due to begin early in 2016.

Stage I was initiated in January 2009 to comprise system requirement analysis and conceptual work, while Stage II included a detailed design stage and construction of two prototype test rigs (pre-prototypes) in 2012 for mobility and firepower testing. In the third and last stage, feedback was then used to develop prototype vehicles PV1 and PV2, which have been used for quantitative trials during the first half of 2015. This stage, concentrating on prototype development and qualification, saw the Turkish Land Forces Command participating in qualification tests and these will be critical in developing a future concept of operation for the modern MBT. This profile will also consider the future role and capability of the tank in an evolving operational environment.

According to Otokar, the Altay design fulfils a variety of operational requirements deriving from “technical and tactical demands of the Turkish Armed Forces, concentrating on survivability, firepower, mobility; command, control and communications; integrated logistics support; and ergonomics to enable a flexibility in varying operational environments.”

“In this scope, Altay has been equipped with the latest technologies that are used in the modern tanks and it’s anticipated that Altay will be one of the fundamental and deterrent assets of the Turkish Armed Forces,” a company spokesperson announced.

Otokar remains positive that the MBT will satisfy requirements in the future operating environment out to 2050, particularly as emphasis shifts towards more military operations in urban terrain; “Altay will be backbones of the Turkish Armed Forces and will play a major role in all kinds of land operations. Being one of the latest designed tanks and with its ultimate capability of mobility, firepower and high protection against conventional and asymmetric war threats, it will significantly increase the overall capabilities of the land forces.”

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MK 1 v Altay propulsion

The Mark I tank was powered by a 105hp gasoline engine built by the British company Daimler Motor Company. It comprised a six-cylinder, water-cooled unit and used the “Silent Knight” sleeve-valve system, allowing the engine to run much more quietly than the poppet valves normally used.

However, the Mark I had no silencer or exhaust pipe, meaning the burn of exhaust appeared as a cloud of smoke to give away the tank’s position on the battlefield.

The engine was noted for its ability to develop maximum torque at low revolutions which made it very suitable for its purpose. Exhaust pipes on the side of the engine were trunked into pairs and carried directly upwards, through the roof and into the open air. Each aperture was covered by an inverted V-shaped baffle but no effort was made to reduce the noise of the engine except when tank crews, on their own initiative, packed mud or damp cloth around the outlets.

Gasoline was carried in two fuel tanks situated on either side of the cab, representing a considerable fire risk. A gravitational trunked into pairs and carried directly upwards, through the engine casing with a metal object such as a spanner to and because they could not hear the driver speak over the noise of the engine except when tank crews, on their own initiative, packed mud or damp cloth around the outlets.

Gears were operated by two soldiers in the rear of the tank selected the required gears using pushrods. Forward gears were operated by two soldiers in the rear of the tank. In reverse, activated by a lever to the left of the driver who handle without its tail and if it was damaged or lost it made would not go any further. In fact, the tank was easier to to run much more quietly than the poppet valves normally used.

The Daimler gearbox offered two forward speeds and one in reverse, activated by a lever to the left of the driver who selected the required gears using pushrods. Forward gears comprised 1:1 and 1:1.75 while reverse was 1:1.4.

Gears were operated by two soldiers in the rear of the tank and because they could not hear the driver speak over the noise of the engine, they had to wait until the driver banged on the engine casing with a metal object such as a spanner to signal a gear shift.

The driver then locked the differential and the commanding officer, sitting next to him, applied a brake to the undriven track. The tank would then swing around, propelled by the driven track until the tank was on its new course. Then the driver unlocked the differential, the commander released the brake, the gearmen reset their gears and the tank moved off in the new direction.

Other steering options included utility of the brakes with two levers controlled by the tank commander who sat alongside the driver on his left. Each lever applied a track brake on one side or the other but a man needed to be strong in order to work them and the brake linings wore out quickly.

Finally, the Mark I’s tail was towed behind the tank, running on two wheels. It served two main purposes. It was connected to a hydraulic jack mounted on the back of the tank so that it could be raised clear of the ground and used to alter the tank’s centre of gravity when crossing rough ground. However, its main purpose was as an extra means of steering. There was a conventional steering wheel in front of the driver and this was connected by cables to the pair of wheels at the back of the tail which acted like a ship’s rudder.

Some tank crews believed that if a tank’s tail was damaged in action then the tank was effectively out of action so they would not go any further. In fact, the tank was easier to handle without its tail and if it was damaged or lost it made no difference at all. Before the end of 1916 tanks had been removed from all the tanks.

A total of 90 track plates formed a complete loop around the Mark I, with each plate measuring 52cm in width and 21cm in length. The tank ran along the tracks on 20 steel rollers, each side of the vehicle. Ten of those rollers were flanged, like railway wheels, and fitted with springs that pushed sideways to keep the tank on its tracks.

The Altay’s crew consists of four personnel including commander, gunner, driver and loader and in order to provide the tank with the intended performance in rough terrain, it is equipped with a 1,500hp diesel engine and transmission.

MTU of Germany supplies a Euro Power Pack which consists of a V-12 MTU MT 883 Ka 501 Common Rail diesel engine which develops 1,500hp at 2,700rpm and is coupled to a RENK HSNL 295TM fully automatic transmission with five forward and three reverse gears, hydrostatic/hydrodynamic steering unit and hydrodynamic retarder/disc friction braking system.

This particular power pack has a cooling system that enables it to operate at a very wide temperature range while the suspension system provides improved cross-country mobility in all kinds of terrain and climatic conditions, including a pre-heating capability for operations in cold weather areas.

The power pack also provides the Altay with a maximum road speed of up to 65km/h and a typical cross-country speed of 49km/h as well as 30km/h in reverse. It boasts a cruising range of 450km. Additionally, it allows for the powering of ‘standard equipment’ within the MBT which includes a laser warning system, CBRN protection system, air conditioning, battlefield target identification system, battle management and communications system, fire/explosion detection and suppression system and a 360° situation awareness capability.

A 17T auxiliary power unit is fitted which allows the main systems to operate when the main engine is switched off.

A hydro-pneumatic suspension system has been included for improved cross-country mobility with each side of tracks having seven dual rubber-tired road wheel stations with the drive sprocket located to the rear, idler at the front; and track return rollers. The track system allows for a gross vehicle weight of up to 68 tonnes. Tracks are double pin type and the track links are end pin connector driven. The Altay also boasts a fogging capability of 4 metres in depth.

“Altay’s suspension system minimises the shock and vibration from the ground by using the effective damping characteristics of damper and the spring characteristics of suspension unit, hence improving field travelling performance, ride comfort, manoeuvrability and fire stabilisation of the tank,” an Otokar spokesperson announced.

It has an acceleration capability of 0.32gph in six seconds with a capability maximum gradient of 60% and side slopes at 30%.

“Altay’s latest technology engine and transmission, which together form the Euro Powerpack, rank the MBT as one of the best of the new generation tanks in terms of mobility performance,” a spokesperson confirmed.
A century of the tank: Mark I vs Altay

SOMETIMES, IF A TANK WAS HIT, IT EXPLODED IN A BALL OF FIRE, CAUSED BY THE IGNITION OF FUEL AND AMMUNITION

The armour was crafted from individual panels of steel, cut to size and drilled for riveting or bolting, then heated and quickly cooled in a press filled with cold water. If the plate survived this experience without cracking or turning too brittle to be of any use, it was shipped to a factory in Lincoln or Birmingham where these panels of armour were then attached to a framework of angle-iron girders.

Most armour was riveted to the frame except on top of the tank where it was bolted on so that it could be removed if it was necessary to change the engine or any other part of the transmission. Armour was 10mm thick around the cab and vulnerable areas such as the sides and the sponsons but only 6mm in less vulnerable areas such as the roof, rear of the tank or its underbodies. Tank men were also provided with steel and leather masks to protect their faces.

Additionally, to counter the threat of German grenades being thrown on top of a tank, where they could explode and disrupt the armour, it was agreed to fit ‘burster plates’ on top of each Mark I tank. These plates would be made from panels of 4mm thick perforated steel, spaced about 30cm from the hull on extended bolts. However, some of this equipment was produced but never used.

As an alternative, some tanks were fitted with a bombproof roof made from a frame of wood with wire netting (chicken wire) stretched over it.

The idea was that if grenades were thrown onto the tank they would roll off again before they exploded, rather similar to the net and slat armour solutions integrated on board Mine Resistant Ambush Protected (MRAP) vehicles during the recent Iraq and Afghanistan campaigns, designed to stop rocket-propelled grenades.

Furthermore, some Mark I tanks used by the British Army in Gaza in 1917 had extra protection in the form of split logs from palm trees at the front to protect the crew.

However, these makeshift solutions as well as the base armour itself was not enough to protect a tank from enemy artillery rounds with the effects of a direct hit varying hugely. Sometimes, if a tank was hit, it exploded in a ball of fire, caused by the ignition of fuel and ammunition. Other times, a round might break through the armour and not cause any other damage. The tank and its crew would be more vulnerable but if the machine was still running it could withdraw from action and move to a place of safety.

Most often, if a munition hit and broke one of the tank’s tracks, it would be disabled and unless it was safe for the crew to demount and fix it, they had to wait inside the tank until help arrived.

Armour plating provided in the Mark I tank was very thin and only sufficient enough to provide protection from small arms fire from rifles and machine guns and shrapnel from shells exploding nearby. However, it was not thick enough to resist any sort of direct hit, even from relatively smaller calibre weapons.

The MK 1 v Altay armour

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Altay’s protection solution is based around a modular composite armour solution, signalling yet another major effort in the development of this particular next-generation MBT. Research and development into this realm was undertaken by Turkish company Roketsan with much work being undertaken by the company’s Ballistics Protection Centre (BPC) which was first launched in November 2008 as part of an agreement with the Undersecretariat for Defence Industries.

The BPC specialises in ballistic ceramic production as well as composite, reactive armour and hybrid armour production. It also concentrates on three-dimensional modelling and simulation.

Altay is protected against most of the current land mines that may be faced on the modern battlefield. Due to operational security restrictions, neither Otokar nor the Turkish Land Forces Command were in a position to comment on specifics although sources admitted that it would be able to protect against most known Kinetic Energy (KE) and Chemical Energy (CE) threats.

However, a company spokesperson revealed that no “special means” of additional protection was required on board the MBT due to already high protection levels achieved by its belly structural design.

The MBT has a specially designed hull bottom which comprises a combination of flat belly and special form of V-shape hull. A monocoque chassis, manufactured from Rolled Homogeneous Armour, ensures structural integrity and enhanced protection.

However, Otokar said the MBT could be fitted with an additional mine protection kit to counter the latest “severe mine threats” on the battlefield for improved high levels of protection.

The Altay MBT also comprises a passive protection system, achieved by a combination of various modular armour technologies including composite built-in and add-on armour modules and reactive armour modules.

An Otokar spokesperson said: “Altay is designed and developed with a modular armour concept and growth capability that will allow integration of future developments in the armour technologies. The modules can be replaced to improve the protection when new technologies are available. The existing primary protection systems effectively shelter the crew from the most modern types of munitions and threats.”

Looking to the future, Otokar revealed that an Active Protection System would be integrated on board the MBT and such technology was investigated and considered during the design phase of the programme with an integration infrastructure already included in the development.

ALTAY IS DESIGNED AND DEVELOPED WITH A MODULAR ARMOUR CONCEPT AND GROWTH CAPABILITY
A century of the tank: Mark 1 vs Altay

**Mk 1 v Altay weaponry**

A total of 150 Mark I tanks were built during the First World War, half of which were equipped with the 7.7mm Vickers quick-firing cannon supplied by the Royal Navy. One gun was mounted on each side of the tank with an arc of fire of approximately 100°. Each gun had a crew of two men comprising a gunner and a loader.

The gunner had to rotate, or elevate and depress the gun by the weight of his body with no mechanical aids to achieve this, although he was provided with a telescopic sight with a 30° field of view and x4 magnification. A ranging drum was also fitted to the left side of the gun mounting. An air-cooled Hotchkiss was also carried at the rear of the turret to shoot at, although the solid shot armour piercing rounds were available since there were no suitably hard materials available.

When mobile, it was nearly impossible to fire accurately at long range engagement was rare. At close range, the gunner had a range of 6,860 metres but in action it was found that long-range engagements were too much for a tank.

The Vickers machine-gun was a popular weapon, with a high first round hit probability against stationary and moving targets.

The Mark I male tanks also carried three Hotchkiss 7.62mm quick-firing cannon mounted in the sponsons, one on each side, normally in a 30° field of view and x2 magnification. A ranging drum was also fitted to the left side of the gun mounting.

Meanwhile, the armament of the "female" tank consisted of four 7.62mm Vickers water-cooled machine-guns, with two mounted on each side of the tank. The female sponson enabled the machine-guns to cover each side of the tank from front to back but it meant that the access/escape door in each sponson was very small and difficult to climb through. The Vickers machine-gun was a popular weapon, with a high cyclic rate of fire, although its maximum range may have been too much for a tank.

Two ammunition types were available to the loader, comprising solid shot and high explosive (HE). However, no armour piercing rounds were available since there were no armoured vehicles to shoot at, although the solid shot was capable of penetrating 30mm of armour at approximately 450 metres.

Each round weighed about 2kg so it could be loaded by hand. After the gun was fired, the breech was sparked and the empty shell case ejected. As soon as the casing had cooled down, the loader disposed of it through the bottom of the door at the back of the sponson. Each male tank carried 334 rounds of ammunition for the cannon, fitted into racks all around the tank. When those rounds nearest the gun had been used up, a gearman usually had to pass other ammunition forwards.

The Altay Firing Test Rig (FTR) began trials late in 2012 at the Sпрофил Firing Range, near Ankara. The main armament of Altay is Turkish company MKE's 120mm/55 calibre smoothbore gun suitable for various kinds of rounds including NATO STANAG 4385 compatible KE ammunition.

A new generation fire control system was also specially designed for Altay in order to control the main weapon and secondary armaments which includes a variety of machine guns.

The gun itself comprises a fuse extractor, thermal sleeve and muzzle reference system and is manually loaded. It also has the capability to fire a laser-guided missile. Ready-to-use 120mm ammunition is stored in the turret bustle and blow out panels are provided in the turret roof.

Meanwhile, the Altay is also equipped with FN MAG's 7.62mm coaxial machine gun mounted alongside the 120mm main armament with a further option for an additional machine gun which can be mounted on the left side of the turret roof and operated by the loader.

Furthermore, there is space for a roof-mounted remote controlled weapon station (RCWS) which has a capability to carry a 7.62mm or .50-cal machine gun or 40mm automatic grenade launcher which can be operated by either the tank commander or loader.

Banks of granade launchers are also installed on both sides of the turret towards the rear while all-electric gun control equipment is integrated into a computerised FCS to provide a high first round hit probability against stationary and moving targets.

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The MBT has many hardware and software configuration files each of which has its own distributed software architecture and the Vehicle Control System is the main gateway used to connect the systems to each other by means of Otokar's specially designed data interchange protocol.

Every single electronic unit uses this data interchange protocol to transmit data and receive from other systems while the integration of additional interfaces or new electronic systems can be managed by software updates for flexibility in future deployments.

The MBT incorporates Command & Control capabilities for Altay, and is also equipped with a Battlefield Management System (BMS) which "generates, executes and displays all the orders, messages, skeds and tactical-logic status data" from a single platform to tactical operations centre.

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Look at tank production and the flow of vehicles from the Soviet Union and now, from Russia. The new T-14 Armata tank is set to move from a concept design to reality and service: and with the new Altay tank by Otokar for the Turkish Army, a number of other countries have expressed interest from this new provider in the marketplace. Pure numbers of vehicles may have dropped since Cold War height, but the number of countries using tanks has gone up, not down.

So what is the reason for this? Quite simply, from evidence displayed at the Tank Museum, the adaptability of the tank continues to be paramount. It may have been designed for a particular tactical role in a clearly-envisioned scenario, but as the situation changes, sometimes with a few adoptions – an added piece of technology or a rethink in tactics, techniques and procedures (TTPs) – the tank has shown itself to quickly morph into a genuine aid in the fight, or by its very presence, can identify a necessity in many instances and then of course heavy armour would appear to have a role.

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The story continues and the debate should not be about the death of the tank and who can identify that last gasp, or tactics causing the momentary disadvantage to the tank. Often in the literature, the news is delivered in alarmist language or with a crusading zeal, leading on course to the authors’ proposed solution or product. But then of course there is a counter strategy available to the tank, comprising a clever rethink or revisit to learn from past tactics, or uplift in technology. This in turn re-balances the equation, tantamount to an ever-evolving arms race in equipment and TTPs.

Of course, military organisations worldwide all hope their own forces only have to engage for real at a point their technology and tactics are in the ascendency. But often it is only the reality of warfare that can really test the theories – and the human factor, as ever, will play a tremendously important part in any outcome. Howsoever sophisticated the tank in regards to technology and tactics, an unmanned or demobilised user can fall spectacularly when utilising it. Fashions and theories inevitably change – ‘go early, go light’ springs to mind as a laudable aspiration for interventions – but few countries now would actually go early and light in an age where coalitions need to be formed, whilst opinion and consensus is marshalled. Go ‘heavy and late’ seems an inevitability in many instances and then of course heavy armour would appear to have a role. There is also the longstanding issue with the tank that has seen it occasionally used in what seems completely inappropriate circumstances. Tanks have a physiological impact that means their very appearance at times can diffuse a situation or alter a balance. What better weapon system can you have than one that by its very presence means you don’t have to use it in a lethal manner?

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Otokar is the prime contractor in Turkish main battle project, Altay

The largest national and privately owned company of the Turkish defence industry

Otokar military vehicles are globally deployed in various operations under UN and NATO flags

The main supplier of the Turkish military and security forces for wheeled tactical vehicles

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