# The big bang theory: planning future MBT armaments



**Next-generation MBTs are due to enter service from the 2040s, and planning for their core capabilities will be needed in the near term. *Jon Hawkes* and *Neil Gibson* investigate potential future weapon technologies that could be installed on these vehicles**

As main battle tanks (MBTs) and associated heavy armoured systems return to the spotlight in a post-Afghanistan world featuring a resurgent Russia, expansionist China, and nuclear-armed North Korea, there are discussions around what the next generation of MBTs, expected to have an in-service date between 2040 and 2050 in most Western countries, will look like.

*Russia's now-cancelled developmental T-95 'Black Eagle' MBT, which was to be fitted with the 2A82 152 mm smoothbore gun. (Christopher F Foss)*

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After focusing heavily on asymmetric peacekeeping and counter-insurgency capabilities, users across the West and the wider defence market are making significant investments to revitalise their conventional combat vehicles to maintain pace with developments in Russia and China, who have variously unveiled new and much more capable vehicles in recent years.

Such discussions are of course speculative, but core concepts and technology areas are relatively predictable, with firepower and protection capabilities expected to be significantly increased via the development and the adoption of new technologies already in service with some users.

The main armament for the next generation of MBT is almost certainly going to be a large calibre gun, more than likely a conventional smoothbore gun using a solid propellant charge system, rather than a more radical technology such as liquid-propellant, electrothermal chemical (ETC), and electromagnetic (EM) 'rail' guns, or even laser-based technologies. Although considerable work has been undertaken in the past on all of these more radical technologies, other than some possible ETC technology being used with a mostly conventional gun design, none of these technologies are likely to equip the new tank generation unless considerable effort and money are thrown at them.

Since its first operational introduction in the late 1970s, in the form of Rheinmetall's L44 120 mm smoothbore main armament for the Leopard 2, manually fed 120 mm smoothbore guns in a three-person turret have, with few exceptions, been the preferred armament for Western tanks for almost 40 years. Similarly, since the 2A46 gun was fitted to later versions of the T-64A in the early-1970s, Russia and China have standardised around the 125 mm smoothbore calibre, typically fed by an autoloader in a two-person turret.

With significant advances in armour technology since its initial introduction, in order to remain effective and able to counter this improved protection, a continuous combination of projectile and propulsion (charge) technology developments have been undertaken. For the German 120 mm smoothbore gun, additional changes have been made, including lengthening its tube from 44 calibres to 55 calibres and slightly increasing its operating design pressure. Even with these changes and improvements in the ammunition, the 120 mm system is deemed to be nearing its capability limits and a larger-calibre weapon is therefore desired for the next generation of MBT designs.

**140 mm**

Developments toward guns for tank-to-tank combat using a calibre larger than 120 mm are not a new initiative, with the Russian 122 mm D-25T and German 12.8 cm Pak 44 developed during the Second World War and various large-calibre weapons developed during the Cold War. A notable example was the 152 mm calibre XM150 gun for the American-West German MBT-70 project. This weapon fired the ammunition suite that was developed for the shorter 152 mm M81 gun/launcher of the M551 Sheridan Armored Reconnaissance/Airborne Assault Vehicle (AR/AAV), along with a gun-specific armour-piercing fin-stabilised discarding sabot (APFSDS) kinetic energy (KE) anti-armour round.

Due to gradual increases in the then-Soviet Union's armour technology, the West began research into guns of a larger calibre than 120 mm in the early 1980s. The fear was that the next generation of Soviet MBT might have been fitted with an explosive reactive armour (ERA) and base armour package that would be capable of defeating the current and later NATO 120 mm APFSDS and high-explosive anti-tank (HEAT) ammunition. It was also thought that the vehicles would mount a powerful high-pressure and high-performance 152 mm smoothbore weapon that would out-gun the West's 120 mm systems.

In 1988 several NATO countries began discussions on developing a new tank gun with a calibre between 130 mm and 140 mm: the programme to be known as the Future Main Tank Armament Program (FTMA). Later in the same year four NATO countries (France, Germany, the United Kingdom, and the United States) signed an agreement for the FTMA programme, harmonising details including the calibre of 140 mm, chamber dimensions, bore profile, gun design pressure, and

system dimensions. On 16 May 1990 the quadripartite FTMA group signed a memorandum of understanding (MOU) to co-operatively develop the new tank gun.

In Germany and Switzerland extensive efforts were made in the late 1990s on larger-calibre guns as potential upgrades for their respective Leopard 2 fleets, which led to the research and development (R&D) of a 140 mm smoothbore gun under the Kampfwertsteigerung (KWS) III programme, with the accompanying KWS I and KWS II programmes going on to produce the Leopard 2A6 and 2A5 respectively. Concurrently RUAG initiated a similar effort, producing the Pz 87-140, an up-gunned version of the Swiss Pz 87 variant of the Leopard 2, fitted with an all-new turret mounting the new armament and a fully automatic loading system in the turret bustle.

A range of issues halted development into 140 mm armaments, primarily surrounding the practicality of personnel handling and storing the larger ammunition within the confines of an MBT turret. With strictly limited storage volume available in a tank, the number of rounds that can be stored in a typical Western MBT (typically around 40x120 mm rounds of single-piece ammunition) is reduced by 25%, as well as the total weight of these rounds increasing by 50%. It was stated that the overall weight increase to move from 120 mm to 140 mm for the Leopard 2 could be as much as 14 tonnes.

Israel too would start developing a 140 mm tank gun, although details of it are scarce and it is not known if an operational weapon was ever fully developed.

**130 mm**

Russia's weapon rearmament programme, which included new and improved protection AFVs, along with its aggressive use of force in regions such as Crimea, resulted in a renewed urgency to improve the capabilities on Western tank guns. In Rheinmetall's case, conventional development of its 120 mm tank gun family had, without greatly increasing its operating pressure or utilising more extreme technology and ETC improvements, come to a practical end.