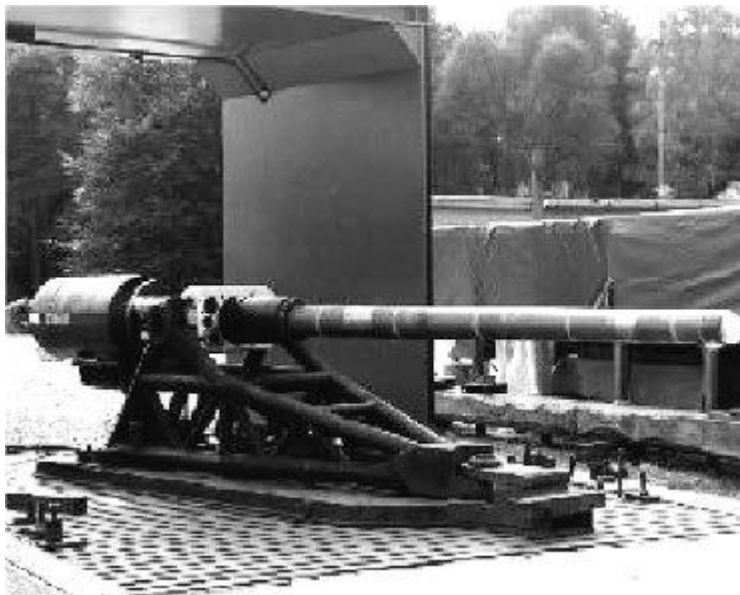


## ***Experimental Technologies - Liquid propellant***

The idea of using a measured charge of liquid propellant in a weapon has been around for a long time (the first successful trials being in 1955). Measuring the precise amount required for each shot however has been a problem. This affected not just the accuracy but also increased pressure frequently caused damage to the chamber. Other difficulties included the volatile nature of the propellant (binary versions were tried but proved to be unreliable in mixing at the speed required), variations in density due to temperatures and the reliability of the pumps in a vehicle moving cross country (there were also linked problems with the corrosive nature of the propellant then being considered). It was trialled by the US for an M109 replacement but this was dropped in June 1993.

In December 1995 a Soviet design team felt they had finally cracked the problems. One of the biggest changes from western research was a move away from using plasma to ignite the charge in the chamber to using an electrical charge to ignite the propellant at the base of the projectile. This was found to give more replicable results although it is slightly less effective. In order to supply the correct amount of propellant, a differential piston with a number of different sized holes was used. In trials a Rapira 3 anti-tank gun was converted to liquid propellant. Despite the trials showing the system worked, it was found that it was next to useless on a towed weapon due to the bulk of the propellant tank and the lack of a laser rangefinder to calculate the range in order to set the correct amount of propellant. It was felt however that the system would work on a vehicle and a T72A was converted as Object (Ob'yekt) 426. The propellant tank was initially stored externally with a hose leading

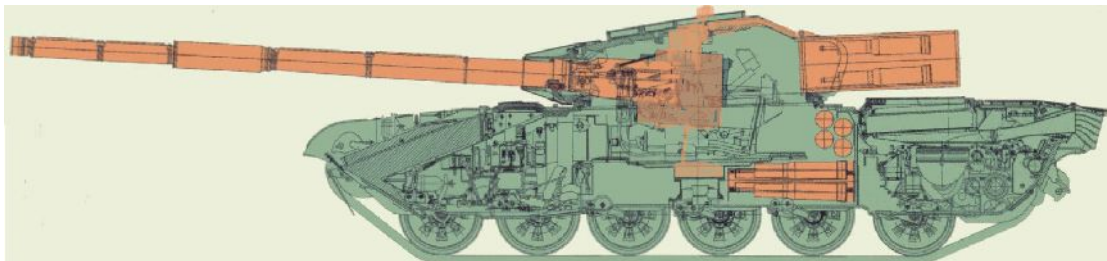


*Illustration 1: Photo released under the 30 year rule of a British obtained photo of the Soviet experimental system. How it was obtained is still classified. (HMG Archives)*

tank with an armoured hose running into the turret rear.

into the turret. The new computer system and rangefinder were used with the computer being stored in the reworked ammunition compartment. These trials were felt to be a success and the initial production run was authorised known as the T72A-L. The T72A model only was used (perhaps because the new hybrid gun/missile of the B model would have difficulty accommodating the missiles with the propellant chamber) and featured the external fuel tanks and their mounts being replaced with a non jettisonable single

Sent to Poland in early 1997 for field trials, these tanks were disliked by their users, whilst more accurate, the turret could only rotate to the rear due to the hose, to pass the rear the turret had to be fully rotated in the other direction. The propellant tanks were also found to be inadequately protected by their location on the rear hull (the designers had considered the location to be adequate protection). This model was quickly withdrawn from the front. Further design had however already continued and the T72AL2 soon appeared, again using the T72A as a basis (along with the K command variants – the T72AK1L2/T72AK2L2 T72AK3L2 depending upon command level). This version redesigned the internal stowage and placed the propellant inside the hull. An automatically rewinding reel type hose allowed the turret to rotate up to 540 degrees before locking the turret (although after 360 degrees there were major feed problems with the propellant). Production of this vehicle was extremely limited however and it is unknown how many were produced (most estimates place it as under a hundred). By the time it appeared at the front, the supply situation was so bad that few tanks were unable to procure any of the liquid propellant. A further developed version was also seen (the T72AL3) which moved the propellant tank into the turret leaving the separate projectiles in the hull. The few versions of this fielded were disliked as the crews hated the idea of the propellant being in the turret as they felt that any penetrating hit would prove fatal. Details of a further version the T72AL4 which had an armoured box on the turret rear with blow out panels (similar to the M1) have been seen but this never left the drawing board. In all versions after firing the gun elevates to 3 degrees to refill the reservoir used to provide the liquid propellant (in a similar way to the normal T72 autoloader). The breech may be opened at this point in order to reload the gun if the autoloader is disabled.



*Illustration 2: Ob'yekt 426M4 (T72AL4)*

There is also a self-propelled gun using liquid propellant, these appear to have been made specifically for the weapon system. Here a T54/T55 hull had a built up armoured superstructure housing the Rapira 3 in a limited traverse mounting. Here the difficulties of using a hose were easily overcome as the traverse was not a problem and the liquid could be stored in the purpose built superstructure. In a new refinement, the propellant tank was surrounded by an outer shell containing a binary agent designed to react with the propellant and make it inert. This was never 100% successful as the velocity of a high velocity object carried it far into the propellant before the liquids had a time to react. Of more success were the thin blow away roof panels (although these did sometimes result in a higher loss rate to top attack rounds). One feature of the design however that was extremely popular was one of the best heating and cooling systems found on a Soviet vehicle as a by product of the need to maintain the temperature at a set level for maximum liquid propellant efficiency (on the T72 variants this was done using a more complex computer control of the amount of propellant relative to its density). This vehicle known as the ISU125 was fielded in

moderate numbers from early 1998 in Europe and has been reported in Iran. It is not known to have been used on the Chinese Front.

All of these vehicles were resupplied in the same way. A wheeled armoured resupply vehicle based on the BTR70 known as the KC70 (корабль снабжения – logistics vehicle) was part of the logistics tail which carried both the projectiles and the propellant (held in an inert binary combination). This



*Illustration 3: ISU125*

would draw up alongside, connect the hose and fill the tank with the now live mix while the projectiles were man-handled into the vehicle.

One of the great mysteries is why the Soviets never adapted this system to where it would have been easiest to use, artillery. Here many of the problems would have been easier to overcome. Perhaps in future years documents may surface showing why this was not done.