PROFILE AFV WEAPONS 23

Soviet Mediums T44, T54, T55 & T62

by Major Michael Norman, *Royal Tank Regiment*

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A group of T-62 tanks during the occupation of Prague in 1968. The changes in configuration of the turret are clearly visible. The white stripes on turret and hull identified all vehicles involved in the invasion force. (Photo: dpa)

Soviet Mediums T44, T54, T55 & T62

by Major Michael Norman, *Royal Tank Regiment*

THE capitulation of the Third Reich and the occupation of Eastern Europe in the spring of 1945 offered an opportunity which the Russians were not slow to grasp. Three times they had been invaded from the west, twice within living memory by Germany, and one of the few factors that had saved them from subjugation each time was the sheer size of the country, although material losses were enormous and the political structure severely shaken. Expansion westward over the centuries had failed to find secure frontiers, but this time there seemed a real, if fortuitous, chance of establishing the next best thing; a glacis of subservient states to buffer the U.S.S.R. against the West, and especially against Germany.

This glacis had to be secured, both against the reluctance of Eastern Europe to be steered towards Communism and against the early predominance of the U.S.A. in nuclear weapons, and strong occupation forces were clearly seen to be necessary. As the Western powers had demobilised much more quickly meantime, these forces were in turn regarded as a direct threat to the security of Western Europe and the two opposing treaty organizations quickly followed one another into being. The present status quo had been reached.

Armoured forces had been largely instrumental in obtaining victory on the Eastern Front, but although there were some notable instances of the blitzkrieg technique being turned against its originators, much of the advance was dourly contested throughout. The swiftest campaign, in fact, was conducted in Manchuria in August 1945 where 6th Guards Tank Army advanced 510 miles in 10 days, although against very light opposition. An interesting feature of this whirlwind manoeuvre was the use of airborne troops to seize objectives ahead of the ground troops as well as supply from the air, and both these methods have been emphasised in post-war tactics as being particularly relevant to any future war in Europe.

The most numerous type of tank at this time was the T-34, which was developed from Christie's T3 model in the U.S.A., through the BT series, A-20, A-30 and T-32, to the T-34/76 introduced in 1940. The later changes to the T-34 involved the installation of a three-man turret, mounting an 85-mm. gun of roughly equivalent performance to the early German 88-mm., on a hull whose power plant, transmission and running gear had been brought to a high state of reliability. In no other contemporary tank had firepower, mobility and protection been so well balanced. This excellence had not been achieved by any revolutionary steps in technology; indeed the upheavals in the Soviet armament industry due to the wholesale removal of most of it eastwards would have precluded these anyway. It was due more to a fine judgement on what were the essentials for a fighting vehicle, and the need to use resources in the most economical way.

What are the parameters that the post-war tank designer in the U.S.S.R. has to consider now? Firstly, the sheer size of the area and climatic conditions

The T-44 showing the driver's vision slit in the glacis plate, tracks, and the frontal aspect of the turret strongly reminiscent of the T-34/85.

involved, from the permanently frozen tundra in the Arctic Circle, through marshlands, steppes and deserts to the high mountains in the south-east. Equipment must also be able to operate in extremes of temperature as wide as +40° to −70° centigrade. Apart from the distances, roads are relatively few and far between except in Central Europe itself and although economics dictate that movement should be by rail wherever possible (thus imposing severe dimensional limitations on a tank design), long distances may have to be driven on indifferent surfaces where repair and supply facilities are likely to be almost non-existent. Moreover advances across Russia and Central Europe in an east-westerly direction will invariably involve the crossing of some large waterways and a host of minor ones. As the civilian communication networks are relatively undeveloped tactical flexibility demands a self-sufficiency in crossing these obstacles even without the risk of enemy action.

The Russian tank-crewman is probably an adequate technician and civilian life has taught him to be adept at improvisation, but draconian discipline may often be necessary to overcome his natural distaste for routine or sustained exertion. He is taught that "the aggressive imperialist governments will attempt to unleash a future war . . . without warning, by means of a surprise attack"[1]. This must be countered by the use of nuclear and chemical strikes, followed by "mobile shock units operating . . . at lightning speed with rapid sorties penetrating the enemy positions to a considerable depth"[2], a doctrine which probably owes much to the influence of Frunze in the twenties who argued that the correct Marxist response to an attack was a swift and massive counter-stroke. These then are the conditions under which the Soviet tank must operate, some of them quite different to those to be considered by the designer in the West. The tactical doctrine itself highlights further differences and these will be returned to later.

T-44

The first new Soviet medium tank to be seen after the war was the T-44 although production had probably started in 1944. It was similar in many ways to the T-34 but the thickness of the glacis plate had been increased to compensate for its being at a steeper angle, the hull gunner had been displaced altogether (as he already had been in the heavy tanks) leaving a Degtyarev (DT) 7·62-mm. MG mounted rigidly alongside the driver and firing through an aperture in the glacis plate. The driver's hatch was moved to the hull roof and he had only a narrow vision slit in the glacis itself. The sides of the hull were now vertical and thicker in order to accommodate the wider traverse ring for a turret whose sides were at a greater obliquity than was the case with the T-34/85. The 85-mm. gun was unchanged, however, although two more rounds were carried and the space vacated by the hull gunner

[1]Marshal V. D. Sokolovsky (Ed.), *Military Strategy*, Pall Mall, London 1963, p. 273.
[2]Ibid, p. 292.

The first version of the T-54 having an oval turret with a distinctive cut-away shape at the rear. (Photo: Lehmanns Verlag)

A platoon of the first version of the T-54 tank to be produced in quantity on exercise manned by the Soviet Taman Guards. The design of the turret has been altered but the early 100-mm. gun, with its plain section barrel without a fume extractor, has been retained.
(Photo: Camera Press)

may have been used to stow ammunition or to accommodate extra fuel tanks. The V-2 diesel engine may have been mounted transversely or tilted as the overall height of the vehicle was reduced by between 4 and 10 inches. The running gear appeared to be unchanged although there was now a wider gap between the 1st and 2nd pairs of road wheels instead of the 2nd and 3rd on the T-34. The declared weight of 31·5 long tons is difficult to reconcile with the increase in armour thickness and a slight lengthening of the hull, despite the reduction in height, although all information regarding this tank must be treated with reserve as very few were seen in service and there is no evidence that they replaced the T-34/85 to any marked extent. Indeed, it was rumoured that there had been considerable problems with the running gear and transmission and it is possible that T-44 was a test bed for a number of new ideas which were to be incorporated in a major redesign which was soon to follow.

T-54

The T-54 was introduced between 1946 and 1949 and it was soon evident that this was to be the replacement for T-34/85. A completely new design of turret mounting a 100-mm. gun was its most noticeable feature but in most other respects the influence of T-34 and T-44 are very much in evidence, and at 35 long tons, 7 ft. 10 ins. high and 29 ft. 7 ins. long overall, it is surprisingly small to anyone accustomed to tanks of similar capabilities elsewhere.

The hull is constructed from welded rolled plate and the sides are vertical except for a small overhang amidships to accommodate the turret ring. The interlocking joint between the glacis and nose plates to strengthen this vulnerable area is a clue to the improvement in engineering over previous designs. The driver's hatch is again on the left front of the hull roof and there is an escape hatch in the floor between him and the gunner's position. A splash guard stretches the width of the glacis plate. The rear of the hull roof contains access plates for the power compartment and grilles for cooling air. Fuel and oil tanks, as well as stowage bins, are secured to the trackguards on either side and two brackets on the rear of the hull can be used either for smoke emitter cylinders, extra fuel drums, or both together.

The mechanic/driver's compartment contains the normal basic controls, although the steering levers have additional functions that will be described later. But there is a marked absence of other controls and gauges compared with modern tanks elsewhere, although unusual features include warning lights which

An early T-54 of the Egyptian Army destroyed during the Arab-Israeli war in 1967. (Photo: Interavia)

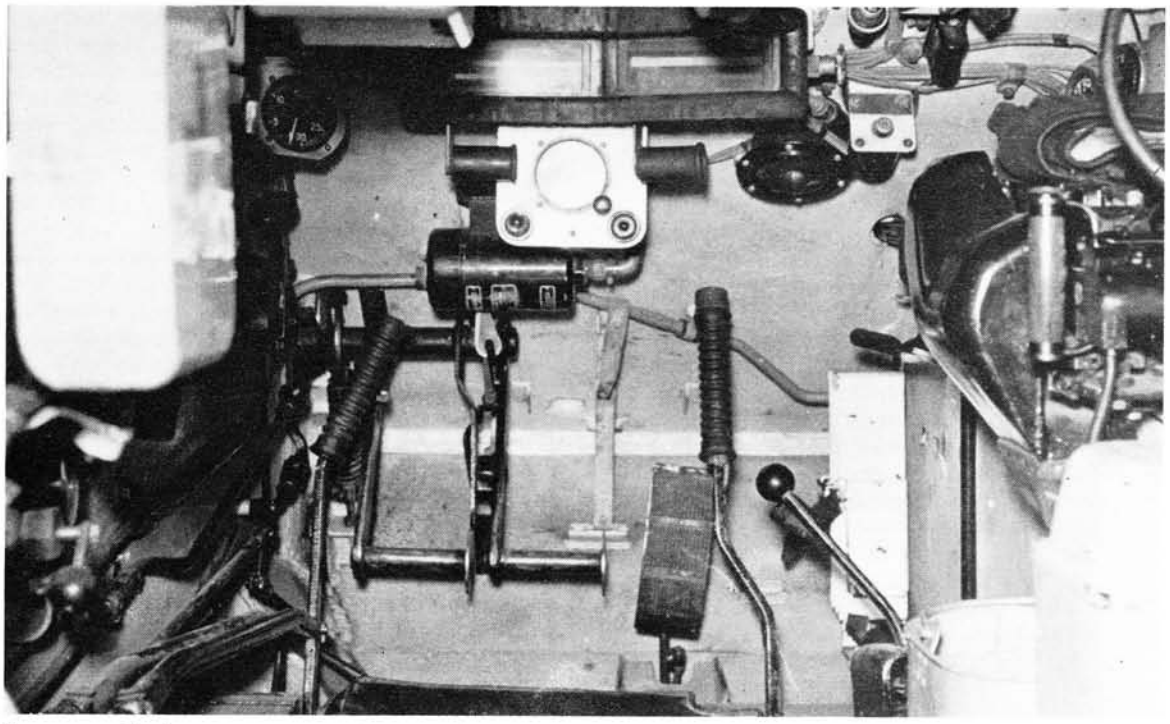
T-54A showing the mounting lugs welded on the nose plate for the attachment of a dozer blade, as well as the splash board on the glacis which was first introduced on the T-44. Note fume extractor fitted near the gun muzzle.

illuminate when the gun is traversed outside the width of the hull and remind the driver to make the appropriate allowances, and a gyroscopic drift indicator for navigation at night and under water. Another unusual feature which was first seen on T-44 is the 7·62-mm. MG (now an SGMT) on the right wall of the compartment and fired by a button on the top of the right hand steering lever. The seat is adjustable to allow the driver to sit "head-out", or fully down where he uses two periscopes. The space to his right is occupied by a fuel tank, the batteries, and ammunition for the 100-mm. gun.

The shape of the hemispherical turret has been aptly described as being like an egg, slightly flattened, and halved through its long axis. As such it represents a near ideal solution to the problem of providing the maximum protection for the minimum weight of armour but its internal volume is probably difficult to fill comfortably and economically with men and equipment. It is made from a single casting with a roof plate welded on, into which are fitted the two hatch assemblies. Some of the first vehicles seen had a slightly different, oval shape of turret with a small cut-away portion at the bottom rear, but these may have represented a pre-production series. A ventilator dome is on the top right and hand rails are welded on both sides of the turret for use by infantry. The commander and gunner are on the left of the gun, one behind the other, with the loader on the right. The main armament is a 100-mm. D-10T gun 1944 model, about 56 calibres long, and probably very similar to the D-10S mounted in the SU-100. In the case of the T-54A the gun barrel carries a fume extractor just behind the muzzle although the basic model of T-54 has a barrel of plain section except for a strengthening collar at the muzzle. The gun is mounted with the trunnions relatively far behind the turret front wall and it has an internal splash shield in place of a conventional mantlet. An elevation arc from $+17°$ to $-4°$ is available, the latter being too small by western standards. The breech ring contains a horizontally-sliding block and will be normally operated semi-automatically in that the block is opened and the case ejected onto the floor during run-out. The ammunition is fixed in design and probably includes a type of Armour Piercing Capped and HE for the earlier versions of gun. A rate of fire of 7 rounds per minute has been quoted but this seems very optimistic in the cramped space available to the loader. The second 7·62-mm. SGMT is mounted coaxially on the right of the 100-mm. cradle.

The main sight for the gunner is the TSh-22 articulated telescope and is similar in general design to that used in T-34/85. The range scales are on a ballistic

Smoke canisters are carried on brackets at the rear of this T-54A.



The interior of the driving compartment of a T-54A. The steering levers and foot controls are placed conventionally with the gear-change lever on the right. The two periscopes are below and forward of the hatch cover.

Czech T-54 tanks moving forward to a river crossing site with the folding schnorkel tube erected over the loader's periscope housing and with waterproofing equipment installed. The loader's cupola and the rear brackets for fuel drums appear to be different to those on T-54 tanks in Soviet service.
(Photo: Soldat und Technik)

Polish T-54A tanks taking part in an exercise involving a sea-borne assault. (Photo: Soldat und Technik)

Another rear view of a T-54A showing the schnorkel tube stowed beneath the smoke canisters.

Polish T-54A tanks showing the excellent ballistic shape of the turret without the cut-away portion of the earliest version. The 12·7-mm. DShK anti-aircraft MG is mounted prominently in front of the loader's hatch. Note also the lightly armoured fuel tanks on the rear of the track guard and the hand-rails on the turret for use by mounted infantry.

graticule in the field of view and the magnification can be set at either 3·5 or 7 times. The front of the sight is protected by a long perspex cover. Semi-indirect or fully indirect fire is possible using a clinometer and an azimuth scale on the traverse ring. The gunner also has an episcope for general observation. Traverse and elevation of the turret is obtained by either manual or electrical control, with an over-riding facility for the commander, and it seems likely that the T-54A has an electro-hydraulic stabiliser in the elevation plane only which will permit fairly accurate firing on the move, providing that the driver maintains a sensibly constant speed without making sudden changes in direction. It seems likely that the principle of operation involves the measurement of vertical movements of the gun relative to a given datum by means of a rate gyro whose signals are amplified and then initiate the appropriate correcting signals to the elevating motor. When the firing switch is pressed the gearbox is automatically locked for the instant of firing and then drives the gun back to the angle it was laid at previously. A traverse lock is provided to secure the turret at the 6 or 12 o'clock positions for travelling out of action.

The commander has a rotatable cupola which is again very similar in design to that used on the later versions of T-34/85. The target designating sight TPK-1 is a bi-ocular instrument and incorporates a graticule which can be used as a crude stadiametric rangefinder and for correcting fire at long range. By rotating the cupola until the TPK-1 is aligned with a target and then pressing a line-up switch on the instrument and holding this firmly, the turret will traverse until it is on the line of sight defined by the commander. The commander gives a verbal description of the target which has then appeared in the field of view of the sighting telescope, the gunner makes a final lay against the appropriate range scale and fires. Two other episcopes flank the TPK-1 in the commander's cupola and a further two (unlike the T-34/85) are provided in the hatch cover which hinges forward to open. He also operates the VHF radio equipment, assisted by the gunner. An inter-communication system is used within the tank and for the commander of infantry being carried on the outside of the vehicle, the earphones and laryngophone-type microphones being incorporated in the crash helmet worn by each crewman. The mounting for the rod antenna is left and forward of the commander's cupola.

The loader also has a rotating hatch assembly which incorporates a mounting and collimating sight for a 12·7-mm. DShK MG for use against low-flying aircraft. As such, this is an unusual arrangement in western eyes, where an AAMG is controlled by the commander, and implies that there is no question of the main armament having to be loaded at the same time. The gun is belt fed and the loader has presumably to expose much of his body in order to fire it. There is an observation periscope in front and slightly to the right of this hatch. Other features in the fighting compartment include a forced-draught ventilation system to clear gun fumes, as well as the usual stowage positions for ammunition and personal weapons. The main fuel tanks are immediately to the rear of the fighting compartment bulkhead, in the power and transmission compartment. About 180 imperial gallons of fuel are carried in all, using the internal tanks and tanks on the trackguards, although a further 88 gallon drum can be stowed on the rear of the hull, as already mentioned. Fully stowed thus, a T-54 has a remarkable range of about 380 miles on roads without refuelling.

The engine, again, is almost identical to that used in T-34 although the increase in width of the vehicle has enabled it to be mounted transversely, thus making a very economical use of the total volume available. Now designated V-54G, the four-stroke 12-cylinder 60° Vee diesel engine, with a capacity of 38·88 litres, develops 520 b.h.p. at 2,000 r.p.m. Starting is usually

A T-54A. Note the prominent gap between the first and second road wheels. The exhaust cowl is visible as the narrow oblong shape on the track guard just to the rear of the long stowage bin.

by an electric motor, although a compressed air system is available for emergencies or in very cold conditions. Air filtration is done in two stages, the first consisting of a centrifugal cleaner, which is kept clean by back pressure from the exhaust system, and the second of oil wetted elements. Lubrication is of the conventional dry sump type and includes a heater coil for use in cold weather, a similar heating element being also found in the pressurised cooling system. Both the oil cooler and coolant radiator are mounted horizontally above the gearbox. Exhaust gases are vented direct to atmosphere through a large cowl on the left trackguard.

Torque from the engine crankshaft is transmitted initially through a reduction unit which serves the double purpose of turning the drive through 180° and reducing its speed by 0·7:1. The clutch is of the multi-plate, steel on steel type and is attached to the gearbox casing: drive for the cooling fan is also tapped off at this point through a further friction clutch to avoid damaging the fan mechanism during sudden changes in engine speed. The main gearbox is manually operated and constant mesh in design providing five forward and one reverse gear with synchromesh on the top three forward ratios. Two steering boxes are fitted, one on either side of the gearbox, and are of the double stage planetary type with a single epicyclic geartrain and an interlocking clutch between the sun pinion and planet carrier. This arrangement enables the system to be used, not only for steering, but also as an auxiliary gearbox and main braking unit. The driver's steering brakes have three positions: when fully forward the interlocking clutches are engaged, the sun pinions and planet carriers rotate as one, the steering and main brakes are disengaged and drive is direct from the gearbox to the final reduction gears. If one lever is pulled back to the first position the appropriate clutch is disengaged and the tank turns in a constant radius. When both are applied in this manner a total reduction of 1·42:1 is obtained between the input and output shafts of the steering box which permits a brief increase in tractive effort without recourse to the main gearbox and is used to maintain momentum over minor obstacles and broken ground generally. If one lever is pulled fully back to the second position the main brake on that side is engaged but both clutch and steering brakes are disengaged and a skid turn is made in the appropriate direction, but if both are, or the foot brake is applied, the main brakes stop the vehicle, and if the steering levers are left in this position, act as parking brakes. Drive from the steering boxes to the sprockets is transmitted through a single stage reduction train with a ratio of 6·78:1.

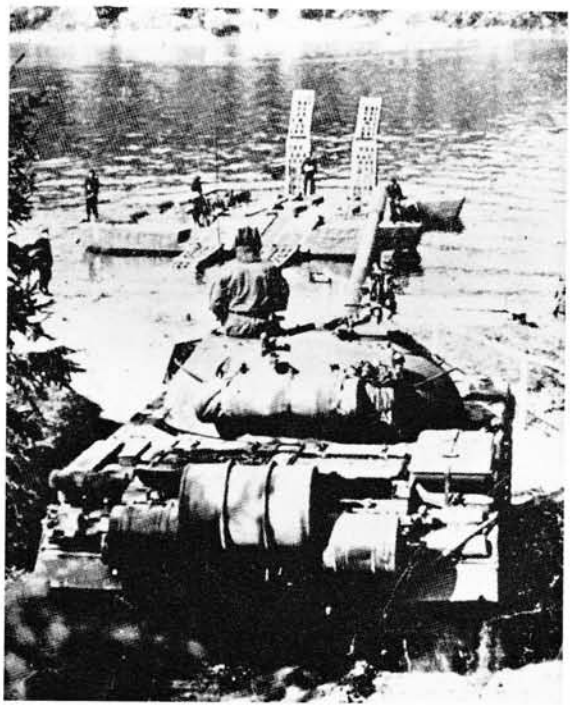
The driving sprockets and tracks are of conventional design, the original Christie layout having been finally abandoned. However, the dry pins are still retained in the same simple and effective way as used on the T-34, in that the heads, which are on the inside of the track only, are driven back into position if they tend to work loose by being struck by a cammed surface on the final drive housings. The road wheels are double rimmed with rubber tyres and are suspended on transverse torsion bars with hydraulic shock absorbers on the first and fifth stations. While the T-54 has a number of innovations compared with T-34—gun and stabiliser, turret design, transmission and running gear—Soviet designers have had no

T-54A tanks at Check-point Charlie in Berlin in October 1961. A presentation of bouquets to the tank crews is in progress. The ventilation dome in front of the loader's cupola is a distinctive feature of the T-54 series. (Photo: Associated Press)

A Soviet T-54A used in the occupation of Prague in August 1968. The radio antenna is on the left of the commander's cupola. Two large fuel drums are carried in addition to the smoke canisters with the schnorkel tube secured across the top. (Photo: Keystone)

A T-55, successor to the T-54 series, on exercise prior to the invasion of Czechoslovakia in 1968. Note the absence of the loader's cupola with its AAMG. (Photo: dpa)

T-55 tanks wading a river during an exercise. The disturbance to the water surface caused by the engine exhaust gases can be seen to the left of the tubes of the two leading tanks.



A T-55 equipped both with a fuel drum and two smoke canisters moving up to embark on an assault raft.

compunction in retaining old and well-proven components and the sequence of development has clearly been continuous.

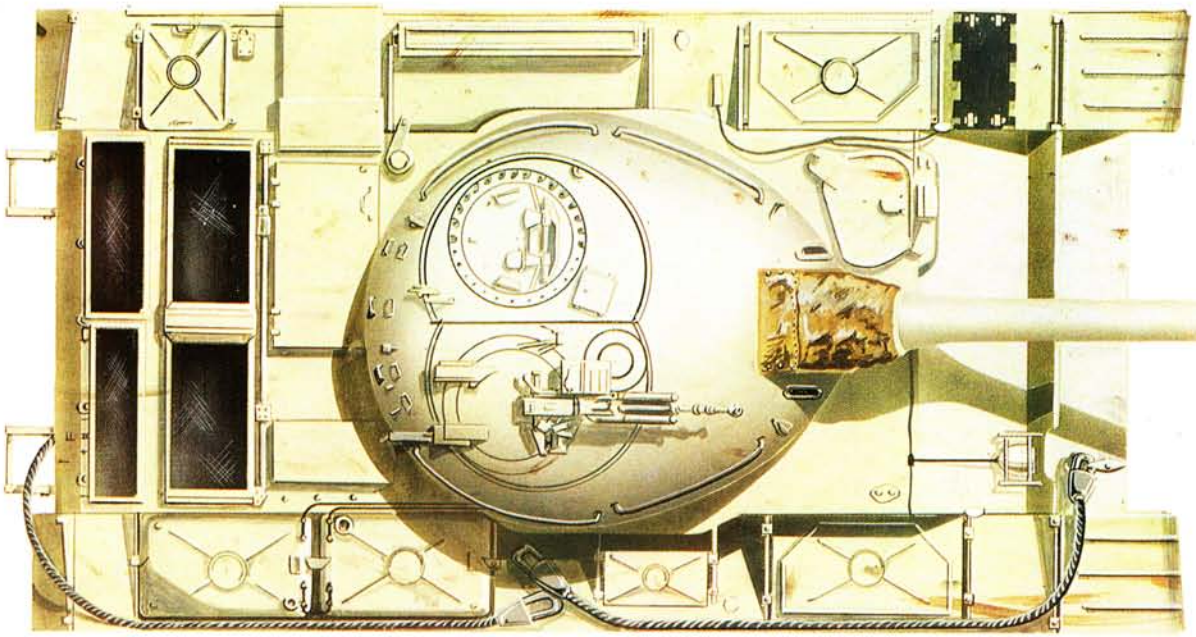
WATER CROSSING

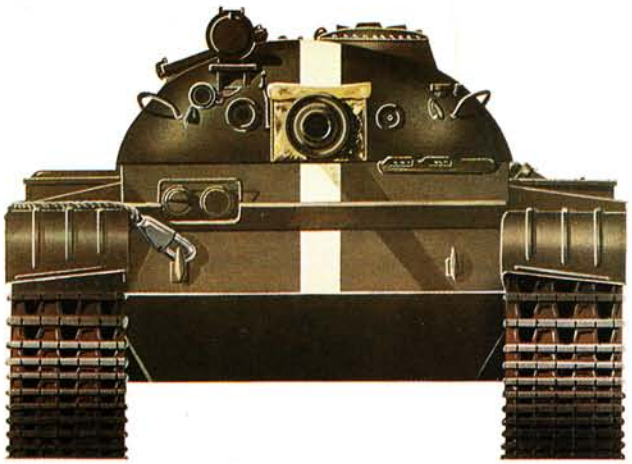
Two major steps forward were now to be made, and although neither actually originated in the U.S.S.R., it was there that they were brought into wide-scale and routine use: underwater wading, and infra-red night fighting equipment.

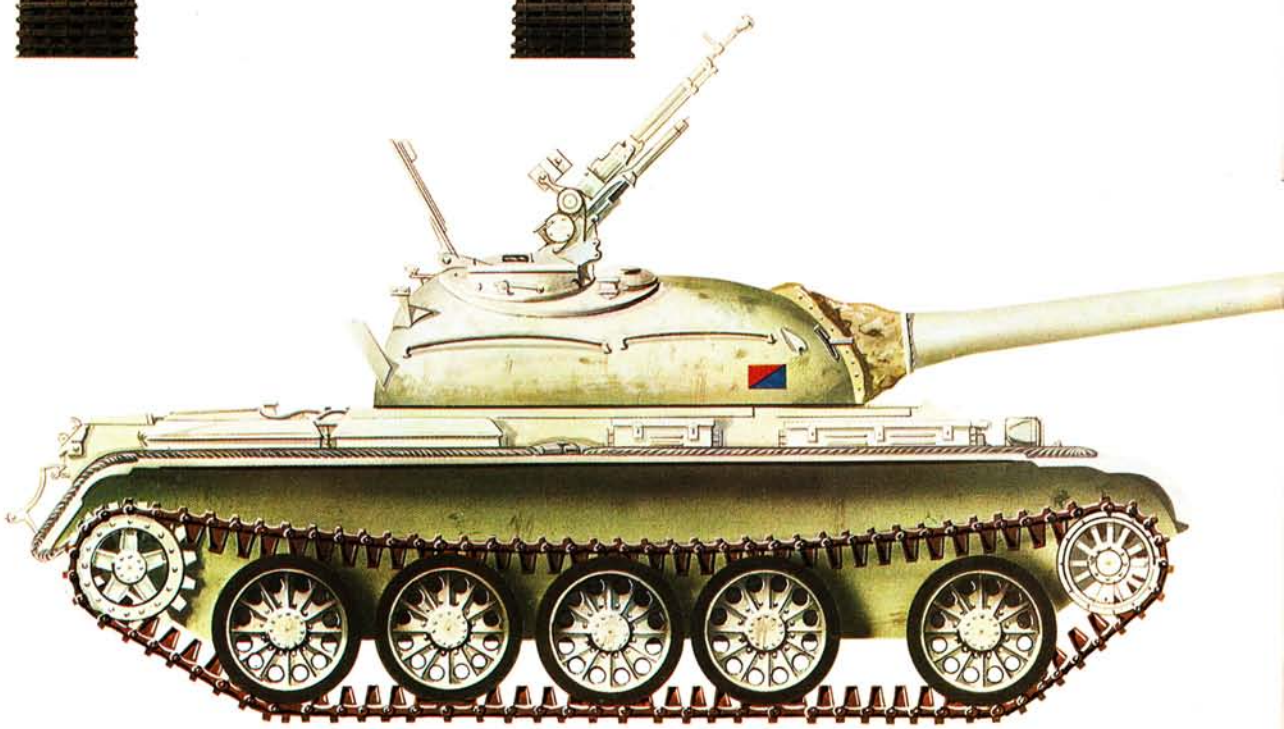
The importance of moving armour across water obstacles in the van of an assault has been recognised for almost as long as tanks have been a practical proposition. The first tank floated across a reservoir near London in November 1918 and development continued in a number of countries, including the Soviet Union with its T-38 and T-40 light reconnaissance tanks. But if the tank is to be small in volume compared with the weight of the equipment inside—as most users demand—then it will not be inherently buoyant and requires additional equipment to make it so, such as the canvas screens used on the Sherman DD tanks. The crossing of water obstacles submerged therefore had a number of clear advantages and both Britain and Germany appear to have started work on the technique in the late thirties. A British A9 cruiser crossed under the River Stour in May 1940 but more urgent matters were at hand and the project was abandoned. Indeed the Germans were even then planning to launch some of their leading PzKpfw III and PzKpfw IV tanks for the assault on Britain from landing ships standing off-shore, using a crude schnorkel device consisting of a flexible tube attached to a pipe kept afloat by a buoy and to a maximum depth of 42 ft. When this assault landing (Operation Sealion) was abandoned the Germans used the technique once only when making a surprise crossing of the River Bug on the first day of Operation Barbarossa against Russia.* The matter appears to have rested there, although some limited trials were carried out with Tiger tanks, until the Russians crossed the Vistula and Bug in 1944—in the opposite direction—when it is said that the T-34s waded using flexible exhaust pipes attached to floating bags and T-44s used two rigid vertical tubes, one for aspiratory air for the engine and crew and the other for the exhausts. Once again the matter seems to have rested, this time until 1958 when an increasing number of T-54s were seen using this technique.

The problem of sealing a tank against the ingress of water is relatively simple, as good ballistic and gas protection demands the minimum of apertures anyway. But the hatches and mantlet require additional sealing and the turret ring may be sealed using an inflatable rubber ring such as has been used on Centurion. The gun muzzle also must be plugged but this can be simply removed by firing a blank round. The engine compartment can either be allowed to flood or sealed by rubber matting as is the case with Soviet tanks. Exhausts are fitted with flutter valves which are held open by gas pressure when the engine is running but are closed automatically by springs should the engine stall. Aspiratory air is drawn through a narrow tube which is fitted over the loader's periscope mounting from which the instrument has been removed and it is steadied by stay wires. A marker buoy is usually attached to the tank tow rope via a light line attached to the top of the tube to facilitate recovery if the tank fails to complete the crossing. The radio antenna is also transferred to the top of the tube so that the crew can receive external guidance en route. This preparatory work is done in hides a kilometre or so from the crossing point. Using

*June 22, 1941. The equipment was used by the leading tanks of 18th Panzer Division north of Brest-Litovsk and enabled them to move through 13 feet of water—Editor.

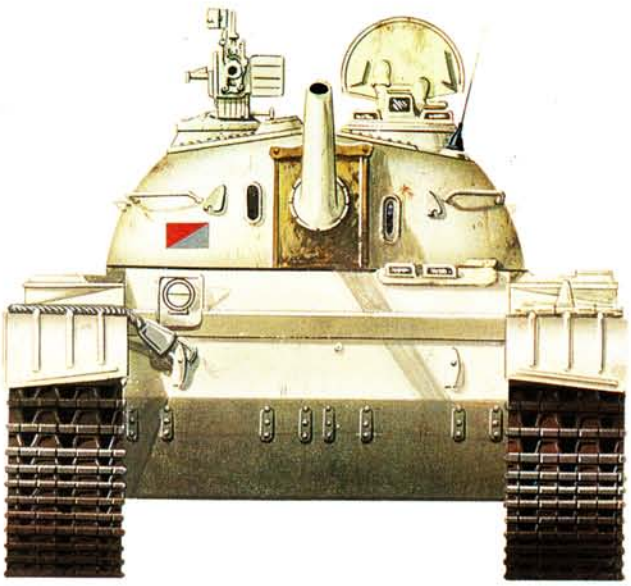


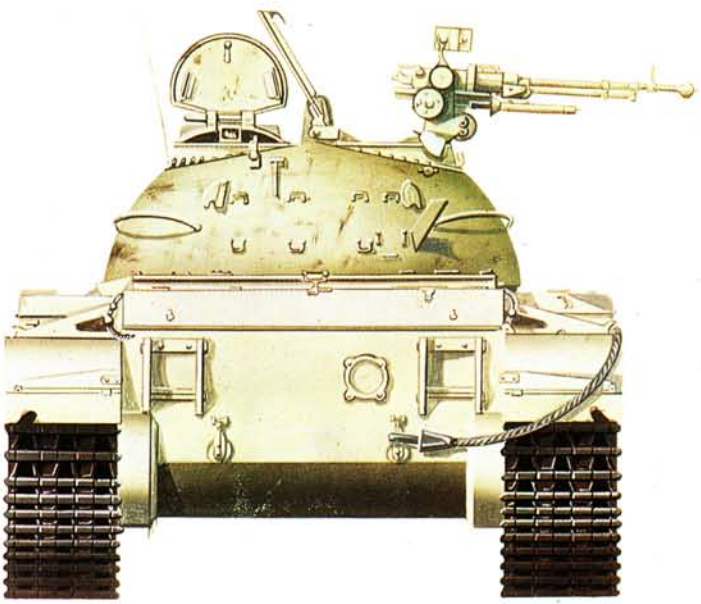




Four views of an early T-54 of the Egyptian Army in the Arab/Israeli War 1967.

Two views (*side/front in dark brown*) Russian T-62 in Prague 1968. The white stripes on turret and hull identified vehicles in the invasion force.





this method the T-54 can traverse wide rivers up to a depth of about 18 ft. after a preparation time of between 30 and 60 minutes, depending on the state of modification of the vehicle. But while there are relatively few problems in flopping a tank into the water, the actual crossing and getting out on the far bank is rather more difficult. Special preparation may be necessary on that bank to reduce the slope which will be awash with liquid mud as soon as the first vehicle has left and assistance may often be necessary at this juncture. With this in view, the T-54T recovery vehicle will usually cross first, equipped with winch and a specially wide schnorkel tube to enable the crew to climb in and out while submerged. A check of the bed of the waterway will also be necessary to establish that it is clear of obstacles and reasonably hard, because although submerged the vehicle acquires a certain buoyancy, thereby reducing ground pressure and therefore traction, while rolling resistance is increased by the tracks becoming tighter and through the displacement of the water. A further limitation is the speed of the current which will tend to push the tank down-stream. These checks will normally be done by specially trained and equipped engineers well in advance of the arrival of the tanks.

A large number of T-54 tanks were either modified for this task or had the necessary equipment installed *ab initio*. The schnorkel tubes could be carried in unit transport but this is normally at a premium and it is probably more usual to stow the tubes on the tanks themselves, in two sections, either above or below the rear fuel tanks. Crews are given comprehensive training in escape drills culminating in an actual crossing in a tank equipped with a wide tower, similar to that used on the ARV.

FIGHTING AT NIGHT

As with under-water crossing, so also with night fighting equipment: the feasibility of near infra-red devices had been realised for a number of years* but the equipping of T-54 tanks, again in 1958, heralded its first large scale use on the battlefield. A typical installation consists of a searchlight with a filter that blocks out the visible component of the spectrum but allows the longer wavelengths through. The reflected infra-red radiation is restored into a visible image in a converter tube in the special sight. A range of about 1,000 metres seems usual with the searchlight proper but only about 30 or 40 metres for a converted headlamp, although this is sufficient to drive by. Used against an opponent who is not similarly equipped the effect of being able to manoeuvre and shoot in apparently complete darkness is devastating, but where both sides have it a deadly game of "chicken" ensues. As a passive sight can detect an active source of radiation, such as a searchlight, at a greater range than the latter is able to

*The German UHU equipment being an example in which the battlefield was illuminated by a 60-cm. IR searchlight and tanks operated using passive viewers.

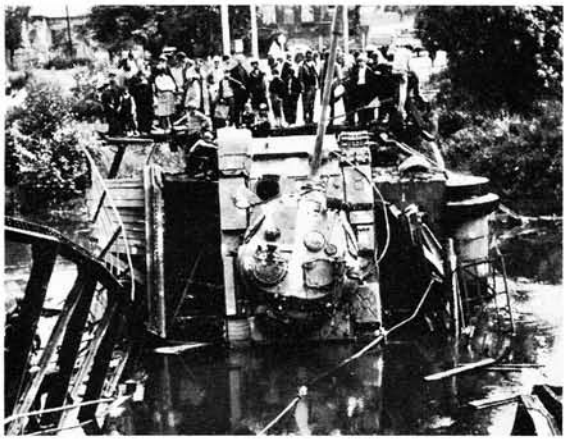
Top left: *T-62 tanks discharging a dense screen of partially burnt fuel oil from their exhausts.*

Bottom left: *A Top Sergeant commander of a T-54 using his TPK-1 target designating sight.* (Photo: Camera Press)

Below: *A T-54A(M) which mounts full IR night fighting equipment with the main searchlight mounted on a bracket on the turret and connected to the gun barrel by a parallelogram linkage. A smaller projector is mounted on the commander's cupola for shorter range surveillance. The long slit for the gunner's sighting telescope is also visible to the right of the 100-mm. gun. Note also the two driving lights, one white, one infra-red: the front crewman is sitting on the latter.* (Photo: Camera Press)

Two T-55 tanks from the Kiev Military District lead a column of motorised infantry which includes two BTR-50p APCs. An additional small IR projector can be seen to the left and below the main searchlight.

A T-54A(M) in Prague 1968. The long equilibrator tubes needed to balance the 12·7 mm. AAMG are visible under the barrel.
(Photo: Keystone)



A sabotaged bridge in Czechoslovakia 1968 allows one to see the plan view of a T-54A(M). The shape of the two turret hatches can be clearly seen, together with the "lift and swing" hatch for the driver. (Photo: dpa)

illuminate, each side tries to avoid using active sources as long as possible in the hope that the other will give his position away first. In general terms, therefore, the advantage tends to lie with the defence.

A typical installation on the T-54 has a large searchlight mounted on the right hand forward part of the turret, connected to the gun for elevation by means of a parallelogram linkage, a smaller light and viewer on the front of the commander's cupola for short range surveillance, and two driving lights, one white and one infra-red, together with an adapted periscope for the driver himself. Again, it is possible that this installation was a retrospective modification on many tanks although all built since the early sixties appear to have had it included in the basic specification.

A Soviet T-54(X), recognizable by its flush loader's hatch and by the fact that the main IR searchlight is attached to the gun barrel itself. The T-54B is similar except it has the normal cupola for the loader. (Photo: Camera Press)

T-55 AND T-62

Among these various changes to the basic design it became evident that a new version altogether had appeared and was in production under the designation of T-55. The first sign was the disappearance of the loader's cupola and the AAMG on most models, together with the ventilation dome on the turret. Other changes could include further development of the power plant and gun—both basically old designs by now—stabilization of the gun in two planes, and the stowage of more ammunition, as well as a form of over-pressurization ventilation system to enable the tank to operate in an area contaminated by nuclear and chemical weapons. It seems likely also that the original smoke emitters have been replaced by a method of injecting vaporized fuel into the engine exhaust, and a T-55 using this system when moving at speed is reminiscent of a warship making smoke. Although it does little to conceal the laying tank it provides a reasonable screen behind which others can manoeuvre or infantry advance and has the advantage of being cheap.

In 1961 an unmistakably new version appeared called T-62. This tank probably mounts a 115-mm. gun with a smooth bore—which could indicate the use of fin-stabilized ammunition—and the fume extractor has been moved further back from the muzzle. The shape of the turret has been modified, the hull is a little longer and the overall height lowered. The suspension has been altered to accommodate this increase in length and there are now prominent gaps between the last three road wheels. But in most other respects it is very similar in appearance to its predecessors.

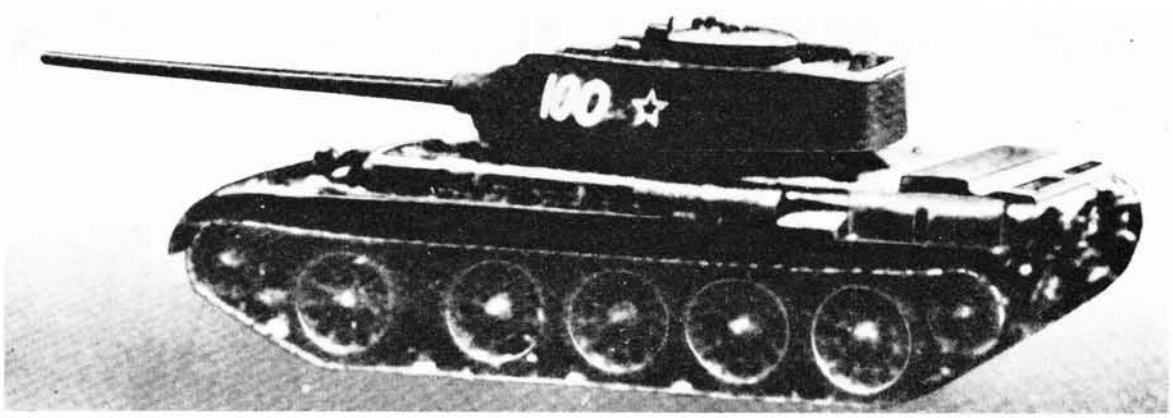
VARIANTS

The use of the T-54T armoured recovery vehicle in assisting at water crossing operations has already been noted, although it is also used for the more mundane field tasks. A less radical modification consists of the fitting of a dozer blade onto the nose plate of any standard gun tank. This T-54/BTU *(Buldosernoje Tankowoje Ustrojstwo)* is used for digging defensive positions and the preparation of river crossing sites as well as for clearing rubble and other obstacles. The height of the blade is controlled hydraulically and a shoe protrudes from the centre, probably to define the maximum depth of cut. Standard gun tanks can also be fitted with PT-54 mine rollers which are similar in concept to those used with the T-34. A heavy frame is attached to the front of the hull and two sets of four serrated wheels are aligned in front and in line with the tank tracks. Another version may consist of two serrated ploughs which can be lowered hydraulically in front of the tank tracks.

Most of the waterways in Central Europe consist of drainage ditches or steep-sided streams, rather than rivers or canals, and it would be either impossible or uneconomic to cross them under-water. These will therefore be crossed with the aid of the T-54/MTU *(Mostoukladtschik Tankowoje Ustrojstwo)* which consists of a turret-less T-54 onto which is mounted a rigid bridge span some 43 ft. long. On reaching the

A T-55 fording a shallow stream. As well as the absence of the loader's cupola and the ventilation dome, note the change in design of the commander's cupola and his new sight.

T-62 tanks marching past at the end of the Warsaw Pact exercises in 1967. (Photo: Associated Press)



The basic resemblance to the T-34/85 is evident in the interim T-44 which mounted the well-proven 85-mm. gun.
(Photo: Lehmanns Verlag)

T-62 "953", with its gun traversed to the rear, being pelted by an angry crowd in Prague. Note the sloping and flush-fitting loader's hatch.
(Photo: dpa)

T-62 tanks in parade livery marching past Lenin's tomb in Moscow. The change to a circular aperture for the gunner's sighting telescope can be seen on the nearer vehicle.

A T-54/MTU on the move with its 43 ft. rigid bridge span. (Photo: Lehmanns Verlag)

obstacle the span is winched forward on a launching frame pivotting on the forward end of the hull roof until the nose of the bridge grounds on the far bank. The frame is then disengaged and the launcher either crosses the bridge or waits to recover it after other combat units have used it. An obvious advantage of this method of launching is that the operation has a better chance of remaining undetected, although, against this, the length of span that can be carried and launched in this way is obviously less than that for one of scissors construction, for example.

The ZSU-57-2 *(Zenitny Samokhodnaya Ustanovka)* is another radical conversion in which a shortened T-54 chassis with only four road wheels mounts a light, open-topped turret containing twin 57-mm. anti-aircraft guns. But the lack of a sophisticated fire control equipment, and the more recent appearance of the ZSU-23-4 based on the PT-76 chassis and having its own radar set, indicates that the ZSU-57-2 is probably obsolescent, although it still could be a potent weapon against APCs.

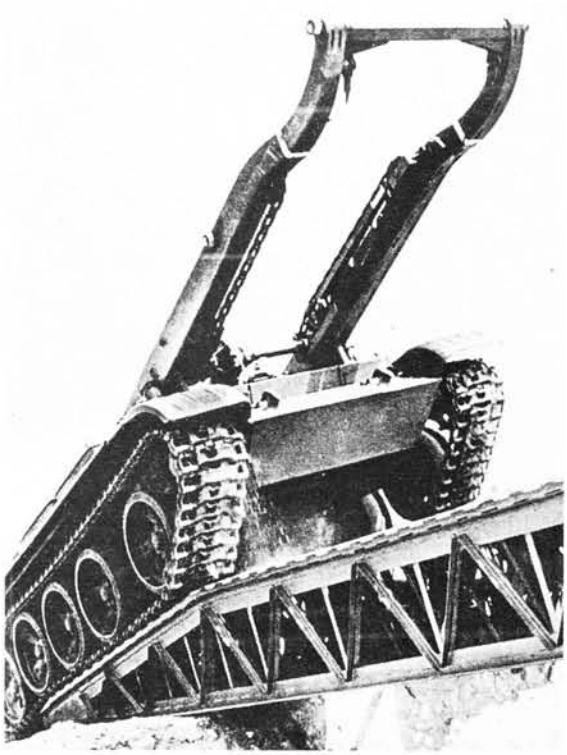
Trials may also have been carried out on an assault gun version based on the T-54 chassis but it seems likely that the standard tank is now considered to be more effective.

TACTICAL DOCTRINE

The strategic background to Russian tank design has already been outlined and one is left in no doubt that armoured forces would play a leading part in any future war, which could well involve the use of chemical and nuclear weapons at a very early stage. Their excellent mobility which is enhanced by a relative independence of bridging and night fighting equipment—coupled with good protection and firepower—make the Soviet medium tanks ideal weapons for this type of war in view of Frunze's exhortations to operate offensively as soon as possible. Armoured forces are trained to exploit the shock and surprise of an enemy subjected to massive nuclear and chemical strikes by manoeuvring boldly, ignoring open flanks and gaps between formations and bypassing minor opposition in the best *blitzkrieg* tradition. Only when organized defences cannot be bypassed will attacks be mounted deliberately but, again, these will be planned and executed with the least possible delay, the troops often being deployed directly off the line of march. A standard of 100 kilometres (62 miles) in 24 hours has often been stated to be the necessary speed against opposition but this seems unduly optimistic by any criteria, even in the light of the Manchurian campaign already quoted. Momentum will be maintained by the use of parachute and helicopter-borne troops to seize key objectives ahead of the advance and cause confusion among the defenders while the main forces will be deployed in echelon, so that when the leading elements suffer heavy casualties or run out of fuel and ammunition fresh formations can be passed through to take over the lead.

Reconnaissance troops also operate well ahead of the main body to find the enemy, bypass him if possible or pin him until an attack can be mounted. These forces will be equipped typically with the amphibious BTR-4OP (or PB) scout cars, whose four main wheels can be supplemented by a further four lowered hydraulically to assist in crossing soft or rough ground, and the PT-76 light amphibious tank, simple and lightly armoured, mounting a low-velocity 76-mm. in a conical turret. Although the mobility of the latter is excellent, particularly in the water where it uses a very effective hydro-jet propulsion system, its effectiveness as a reconnaissance vehicle must be qualified by the apparent lack of any night fighting equipment and the fact that the commander also acts as gunner. Specialist engineer and chemical-cum-radiological survey teams are often attached to these forces which may also be supported by medium tanks.

Once the enemy is found, tanks will rarely stop to fire—hence the use of stabilizing equipment—as a large volume of somewhat inaccurate fire from a mass of moving tanks is considered to be more effective, both physically and psychologically, than better aimed shots from static positions at longer ranges; indeed, even pinpoint targets will rarely be engaged at more than 1,000 metres range and crews are probably still reminded that the tank track is itself a very important weapon when closing with the enemy. If tanks in the second echelon are available within range, however, they may be used to fire HE indirect in support of the attack. Tactical manoeuvres are usually carried out according to strict and well-practised drills and radio commands will then be limited to pre-arranged codewords. Tanks will



A T-54/MTU crossing the bridge that it has just laid. The launching frame is clearly visible.

normally lead the assault with the infantry in their APCs following closely behind. If the opposition is light the infantrymen will remain in their vehicles to fire their automatic weapons through ports in the side armour but will dismount for an assault if more determined resistance has to be overcome.

The defensive battle is regarded only as an unavoidable pause before the resumption of the offensive. Wherever possible the tanks are dug into ambush positions, preferably on reverse slopes or to the flanks with planned secondary positions available, although a large proportion will be held in depth to act as a counter-attack force.

In theory these tactics seem unbeatable but their effectiveness is almost certainly diminished by an over-centralized command structure and a rigidity in putting them into practice which would lead to opportunities being missed and costly or ineffective actions pursued. The constant pressure to advance regardless gives commanders at the lower levels little chance to reconnoitre and plan, while the need to conserve the resources of the formations following behind will probably lead to their moving in vulnerable columns rather than being dispersed. All these factors favour a defender who is prepared to stand firm.

The actual use of the modern Soviet mediums so far has fortunately fallen well short of these aggressive tactics. Both T-44s and T-54s were used to suppress the uprising in Hungary in 1956, suffering a number of casualties at the hands of the insurgents in the bitter street fighting, and T-54s were again in evidence

The T-62 mounting a new 115-mm. gun.

in Berlin in the autumn of 1961, including an anxious few hours when they confronted American M48A1 tanks of 40th Armor at Checkpoint Charlie. The Six Day war in 1967 saw T-54s and T-55s pitted against military forces for the first time but their performance against Centurions armed with the 105-mm. gun, M48s and even modified Shermans was indifferent enough to give Soviet designers and users some cause for concern; and indignation when the tanks captured intact have been used by Israeli crews. All three types were represented during the invasion and occupation of Czechoslovakia in 1968.

It is notoriously difficult to obtain reliable data on Russian equipment but tens of thousands of these tanks must have been built for the Soviet Army alone, apart from those supplied to other countries. As well as all the Warsaw Pact armies, customers have included Cuba, North Korea, Finland, Yugoslavia, Iraq, Syria, the United Arab Republic, India, Algeria and Morocco.* China has built a number of T-54As under the designation of T-59 and sold some to Pakistan. Otherwise, as only Czechoslovakia, Poland and possibly East Germany have limited armament industries in Eastern Europe, the Soviet Union is in the happy position of being able to maintain long production runs with consequently low unit costs and having a number of clients who often have little choice but to accept obsolescent or surplus equipment.

**The Military Balance 1969-70*, Institute for Strategic Studies, London.

The T-54/T armoured recovery vehicle with its wide-diameter schnorkel tube in the travelling position.
(Photo: Soldat und Technik)

Standardization to this extent also eases the logistic load within the Warsaw Pact itself, a situation which its western counterpart may envy with reason.

The modern Soviet mediums appear to combine the attributes of mobility, firepower and protection in a remarkable if rather austere form. Reliability is inherent in the design of components which are both well-tried and under-stressed. The wide radius of action and the ability to cross water obstacles and fight at night favour the aggressive and wide-ranging tactics in nuclear and chemical conditions which feature regularly in the settings for Warsaw Pact

The PT-54 mine roller equipment based on an obsolescent T-54.

(Photo: Lehmanns Verlag)

ZSU-57-2 self-propelled AA guns based on a shortened T-54 chassis with four instead of five road wheel positions.
(Photo: Associated Press)

exercises, and there is no reason to think that the parameters for the successor to these vehicles will be essentially different or that revolution rather than steady evolution will mark its design. Arguments that a tank must be capable of engaging enemy armour at long ranges, thereby requiring sophisticated fire control devices, a large load of ammunition, a high rate of fire and the ability to take up hull down positions by virtue of having a large angle of depression for the main armament, are all probably irrelevant in Soviet eyes. More pertinent criticisms can be levelled, however, at the extremly cramped conditions in the fighting compartments which must inevitably lead to losses in efficiency in protracted operations, as well as the vulnerability of ammunition and fuel, bearing in mind that much of the latter is not stowed under armour.

Continuous development and the ruthless rejection of inessentials have been the hallmarks of an almost unbroken series of successful designs which originated in the workshop of an American engineer in the early thirties, led the world in the forties, and have been the spearhead of one of the most potent forces in the world ever since.

A Chinese version of the T-54A sold to Pakistan under the designation of T-59. The Chinese may also have developed a considerably smaller version of this tank although visually it retains nearly all the characteristics of the original.
(Photo: Associated Press)

TECHNICAL DATA ON T-54A

Dimensions and Weights

Length overall	:	29 ft. 7 in.
Length of hull overall	:	20 ft. 7 in.
Width overall	:	10 ft. 9 in.
Height to top of commander's cupola	:	7 ft. 10 in.
Distance between track centres	:	8 ft. 8 in.
Ground clearance	:	1 ft. 5 in.
Track width	:	1 ft. 10 in.
Length of track on ground	:	12 ft. 7 in.
Inside diameter of turret ring	:	5 ft. 11 in.
Weight combat loaded	:	between 34·9 and 35·4 long tons
Ground pressure	:	11·4 lbs./sq. in.

Fuel and Ammunition Stowage

Fuel (Imperial Galls)		
Internal tanks	:	117
External tanks	:	66
Rear drum(s)	:	88
Total		271 imperial gallons

Ammunition (rounds)

100 mm.	:	34 (20 HE, 14 AP)
12·7 mm.	:	500
7·62 mm. SGMT	:	3000
7·62 mm. for personal weapons	:	300
Grenades	:	20

Performance (all figures approximate)

Fuel consumption:		
Roads	:	0·7 m.p.g.
Cross country	:	1·0 m.p.g.
Range using all available fuel:		
Roads	:	385 miles
Cross country	:	270 miles
Speeds:		
Maximum	:	30 m.p.h.
Roads	:	21 m.p.h.
Cross country	:	16 m.p.h.
Maximum slope	:	30° (58%)
Maximum ditch width	:	9 ft.
Vertical Step	:	2 ft. 7 in.

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