PROFILE

# AFV WEAPONS

18

# Chieftain and Leopard (Development)

Lieut.-Colonel Michael Norman, *Royal Tank Regiment*

*Chieftain.* (Army PR)

# Chieftain and Leopard Main Battle Tanks

Major Michael Norman, *Royal Tank Regiment*

A TANK has three main attributes: firepower, mobility and protection. Few would dispute the primacy of firepower to defeat enemy armour and provide direct fire support for other arms, although the maximum range needed for the former rôle is a matter of some controversy in itself. But it is over the best way of ensuring the survival of the tank that views tend to diverge most sharply. The British represent one school of thought which contends that protection is best ensured by armouring the vehicle to such an extent that it can absorb punishment from the majority of enemy weapons and enable it to manoeuvre or close with the enemy with relative immunity: tactical mobility can then take third place. This concept is hotly contested by the opposing school, the Germans being prominent members, which considers that so many weapons on the battlefield are capable of defeating the thickest armour at normal combat ranges that it is not worth protecting above a certain minimum level while a lower weight permits a freedom of manoeuvre and agility that more than makes up for the relegation of passive protection to third position.

Two modern tanks exemplify these different viewpoints, the British Chieftain and the German Leopard Standardpanzer.

## DEVELOPMENT HISTORIES

### CHIEFTAIN MAIN BATTLE TANK (FV 4201)

Conceived in 1943 to obtain a superiority over German tanks that had been almost completely lacking until then, the Centurion Medium Gun Tank first saw action in the completely different conditions of the Korean war, and in that same year, 1951, the General Staff in London started to plan for Medium Gun Tank No. 2 (Medium Gun Tank No. 1 being FV 221 Caernarvon). It was reasoned that while the Russian T-34/85 was still a threat (as it proved initially in Korea) it was out-matched by Centurion and that a successor, probably with a more powerful gun, must be nearing service. The now familiar warning against never knowingly being under-gunned was reiterated and a number of guide-lines were set out. As production of Centurion was then due to end in 1954, and that of Conqueror in 1957, it was suggested tentatively that the new tank could be available not long after this latter date. A maximum weight limit of 67 long tons was stipulated although it was hastily added that 45 tons should be possible. No increase of road speed over that of Centurion was looked for although the desired power to weight ratio of 20:1 indicated that acceleration and agility were to be more important than previously and an average cross country speed of 15 m.p.h. was asked for. Up to 80 main armament rounds were desirable, although 60 would be accepted, stabilisation of the weapon system was to be incorporated if it proved successful on Centurion (it did), a maximum rate of fire of 10 rounds per minute was specified together with a capability for aimed fire up to 1,000 yards by night. MGT No. 2 was also to be able to swim.

A study based on these criteria at Fighting Vehicles Research and Development Establishment (FVRDE) was completed in July 1951. A 105 mm. high velocity gun of U.S. origin was mounted on the top of a cleft turret, and as the gun was both longer and heavier than the current British 20-pdr. (84 mm.), it was suspended well to the rear in order to keep its point of balance as close to the centre of the suspension as possible. The breech was outside the turret ring as a

Above and below: *A Chieftain Mark 2* (right) *and a pre-production Leopard together for comparative trials.* (FVRDE, CCR)

result and an automatic loader had to be provided, operated remotely. A combat weight of 48 tons was postulated even when priority in protection was given to the crew rather than components and only 40 rounds were stowed, although a saving in space and weight would have been likely if the driver was moved into the turret. The running gear was to be modelled on the modified Horstmann system and resilient road wheels used in the FV 200 series (see Conqueror *Profile*) but there were to be no top rollers. The scheme was eventually dropped when it became clear that both the gun and its fixed ammunition were imposing unacceptable weight penalties. A joint investigation with the Armament Research and Development Establishment was then set in train to look into the possibility of using liquid propellant, but this too was discontinued in favour of research into the further development of the principle of using bagged propellant charges—not with the usual screw-type breech block—but a sliding block with obturation being obtained by an expanding steel ring, a method that had first been applied in the German 150 mm. medium howitzer 18/43 in World War II. Consultations with the Royal Navy also showed that bag charges were no more vulnerable than those enclosed in metal cases, as there is a significant pause between strike and ignition that will usually pass un-noticed in the latter container, and the possibility was mooted of having storage bins with vents direct to atmosphere in case of a fire.

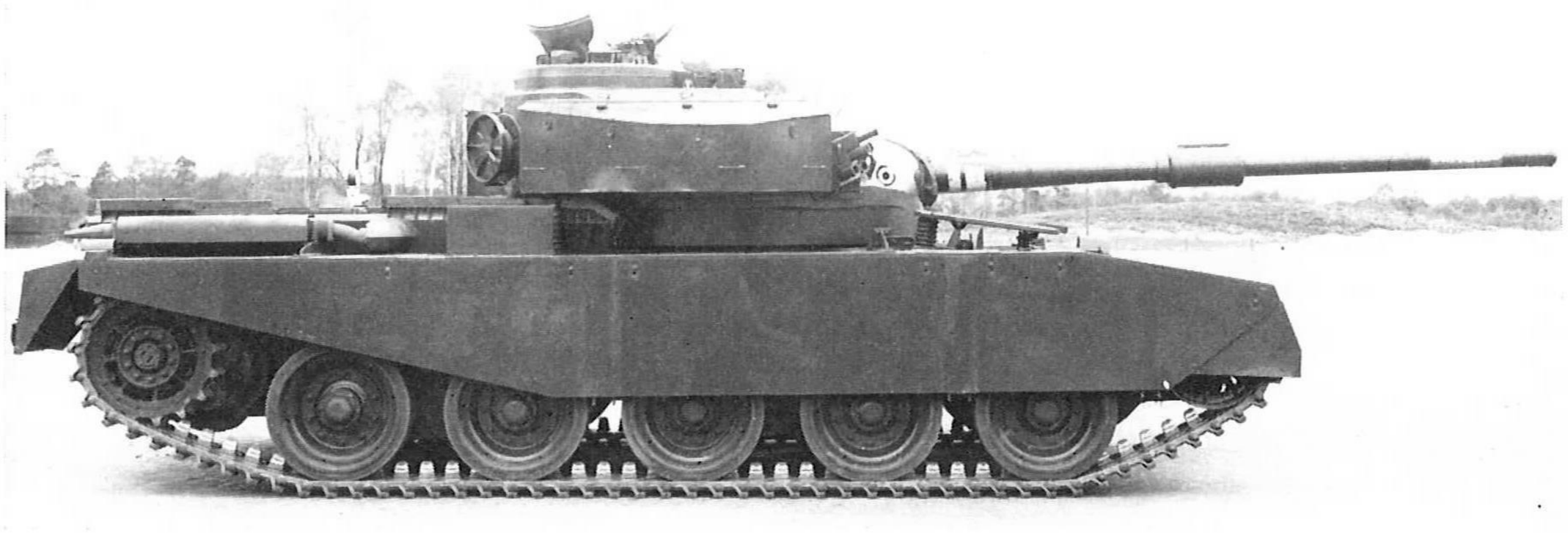
In 1954 the General Staff made it clear that the replacement for Centurion must have a more effective gun and armour with an automotive performance at least as good but, in the event, Centurion itself partially met these demands when it was up-gunned to 105 mm. and its protection improved. Up to then this calibre gun was the largest that could be mounted economically with an adequate number of rounds in a vehicle whose weight was limited to 100,000 pounds, but a thorough assessment was started that year to determine the optimum calibre for a tank gun to meet future N.A.T.O. requirements as the bagged charge system appeared to be significantly lighter than a more conventional one of the same calibre. A figure of 120 mm. was arrived at and a gun of this calibre was installed in a new design of vehicle whose driver reclined in the closed-down position, it being his sitting height that largely determines the height of the tank hull, and any reduction in that is a potential saving in weight. In mid-1954 a new V-8 engine was proposed to replace the veteran Meteor, the auxiliary generating engine being mounted in the Vee, together with an automatic transmission. The estimated combat weight of this vehicle was in the region of 47 tons although it was hoped to reduce this by two tons at least.

Above and below: *A small scale model of an early design for FV 4201 Medium Gun Tank No. 2. Note the similarity of the turret design to that on FV 214 Conqueror and the complex sloping of the glacis plate.* (FVRDE, CCR)

Leyland Motors had been nominated as the main design contractors for the new FV 4201 and they now started work, although they were still heavily involved at this time in the development of the Centurions 7 and 8. The first visible result was the appearance of FV 4202—the "40-ton Centurion"—which appeared in early 1956 to prove the feasibility of the driver's reclining position and a new design of turret which dispensed with the need for a mantlet. The development process was then slowed somewhat by a decision on the part of the United Kingdom and the United States to make certain assemblies interchangeable on their respective tanks and after a great deal of redesigning this was achieved for the turrets of FV 4201 and T95*. A further delay was caused by the N.A.T.O. decision in 1957 that fighting vehicles should have engines capable of running on a wide variety of fuels: the multi-fuel policy. This now necessitated a change of engine for FV 4201 and a German compression ignition

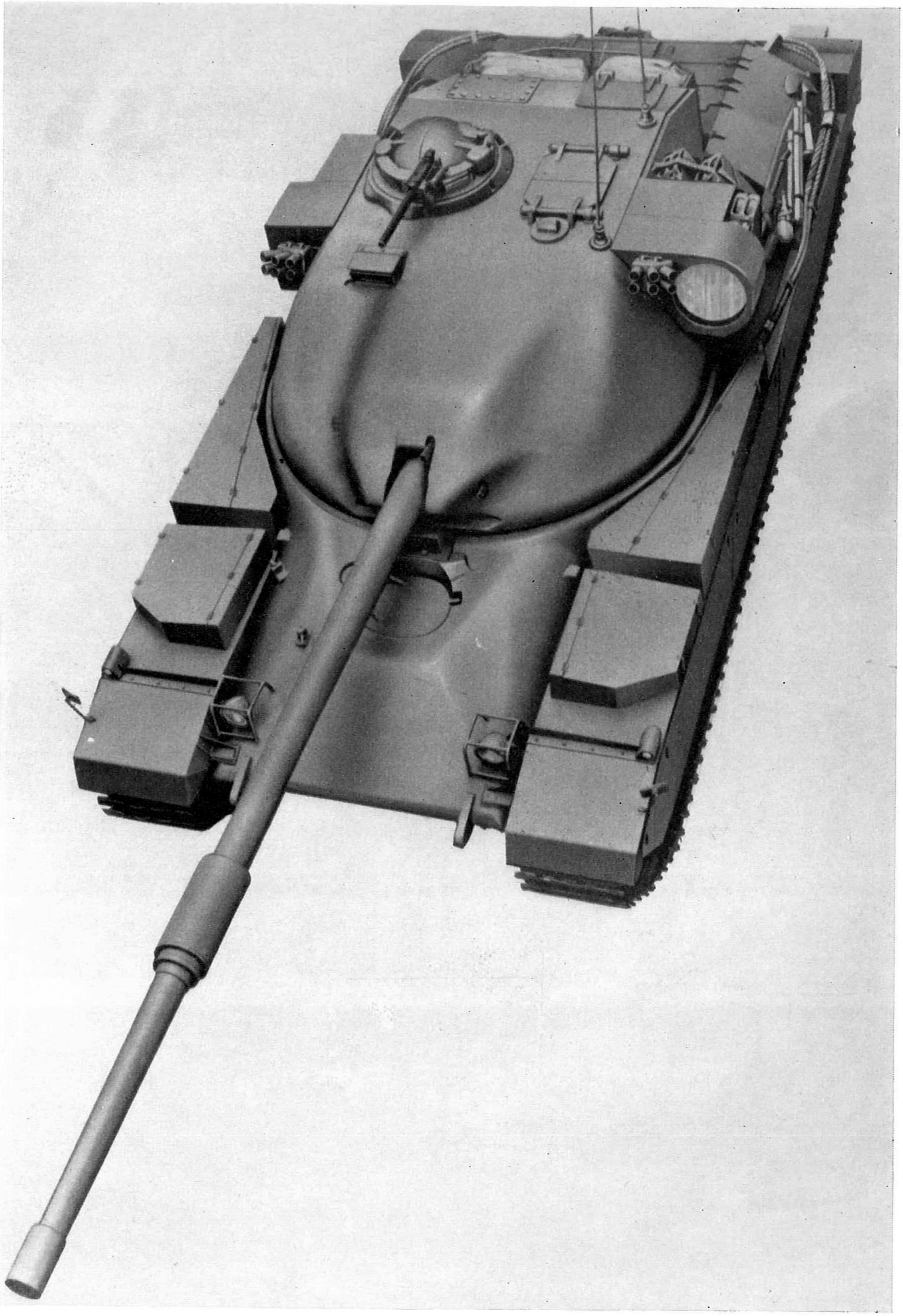
*T95 weighed 32 tons and included a number of innovations, among them being a smooth bore 90-mm. gun (later replaced by the 152-mm. gun/launcher used on M551 Sheridan and proposed for MBT 70), a hydro-pneumatic suspension which could be used to vary the vehicle's height as well as a gas turbine power plant. Visually similar to the Soviet T-54 and Japan's new ST-B the concept was eventually abandoned in favour of the more conventional M60.

Above and below: *FV 4202; the so-called 40-ton Centurion built by Leyland Motors to provide practical experience of a number of concepts intended for FV 4201, including the reclining position for the driver and the mantlet-less turret.* (FVRDE, CCR)



design was chosen for further development by Leylands under the designation of L60. The two-stroke, vertically opposed piston layout was favoured on the grounds that, not only did it give the best configuration for multi-fuel applications, but it was also easy to service, had few moving parts, low bearing loads and had good cold starting characteristics. Unfortunately its installation involved the complete redesign of the power compartment and another ton was added to the all-up weight which was now in the region of 50 tons.

The General Staff finally issued the military characteristics for FV 4201 on August 21, 1958 as a detailed guide to the attributes and performance required by the User. It was prefaced by a brief statement setting out the guiding principles which were to govern its design, whose chief characteristic was to be its highly effective gun/armour combination, followed by agility and a capacity for sustained action. In noting the need to start the destruction of enemy armour at the longest possible range, and withstand attack by medium artillery (a lesson learned in Korea), as well as from other weapons when closing with the enemy, a number of important increases in specification were demanded. Among these was a larger arc of elevation for the main armament, as the 7° or 8° depression available on Conqueror had proved inadequate to enable it to take up acceptable defensive fire positions, and more frontal protection. A rate of fire of ten rounds per minute for the first minute and six in each of the subsequent four minutes was also called for. An increase in the top speed to not less than 26 m.p.h. and a desirable radius of action of 300 miles at 15 miles in the hour also represented important increments in performance made necessary by the dispersion of forces on the nuclear battlefield. Yet, together with the addition of a number of other facilities, the tank's all-up weight was still not to exceed 45 tons, although this figure had reluctantly to be relaxed later to 116,000 pounds (51·8 tons) as



*The full scale wooden mockup produced for User acceptance in 1959. Although many changes were made subsequently the main features were firmly established at this stage.* (FVRDE, CCR)

*One of the first prototypes of Chieftain having the original low suspension.* (FVRDE, CCR)


*Prototype P5 completed in early 1962. Note the thermal sleeve fitted on the 120-mm. gun barrel.* (FVRDE, CCR)

*A line up, from left to right, of a Conqueror Mark 2, a Centurion Mark 7/1 and an early prototype of Chieftain.* (FVRDE, CCR)

insistence on the earlier figure would have resulted in unacceptable delays to the project pending further research and development.

Detailed design at Leylands really got under way in 1958 but in August that year Vickers-Armstrong at Newcastle were brought in to take over responsibility for the turret and installation of the weapons. Development of the L60 engine was being pushed forward meanwhile at Leylands and Rootes and it was decided to adopt the TN12 semi-automatic "hot-shift" gearbox that had been designed originally for the defunct FV 300 light tank series.

In the specification for the meeting convened in March 1959 to accept the design of the mock-up, the all-up weight was quoted as being around 100,000 pounds, the height to the turret roof 7 ft. 10 in., a hull length of 22 ft. 3 in., a ground clearance of 17 in., 60 rounds of 120 mm. ammunition, 250 imperial gallons of fuel, the engine developing 700 b.h.p. at a crankshaft speed of 2,400 r.p.m. and a power-to-weight ratio that had decreased to 15·5 b.h.p./ton. Among other features that were subsequently to change as development progressed, the gunner laid the armament by a peri-binocular sight with injected graticules, tangent elevation being applied automatically by cams appropriate to the nature of ammunition selected. The User accepted the mock-up in principle although the large number of modifications asked for involved structural alterations to both hull and turret designs.

The first prototype P1 was completed in September 1959 and incorporated a low-power L60 engine, the weight of the turret being simulated by a circular superstructure, and six more prototypes were delivered for troop trials between July 1961 and April 1962, production being shared equally by Vickers-Armstrong and the Royal Ordnance Factory at Leeds. Extensive automotive trials were being carried out meanwhile and a number of defects became apparent

*An early prototype showing its paces during a demonstration in August 1963. The cupola hatches are in the "umbrella" position to give the commander some degree of overhead protection and a better field of view than was possible with the early design of vision devices.* (Keystone)

*A prototype prepared for troop trials. Note the changes in the cupola assembly and the stowage racks on the rear of the turret.* (FVRDE, CCR)

*An early prototype negotiating a rough test track at FVRDE. The dummy bin on the front of the glacis plate and the cover on the nose of the turret were fitted during the first public appearance of the vehicle.* (Keystone)

*A prototype Chieftain starting a hill climb. One of the rear turret stowage racks has been replaced by part of the ventilation equipment, the exhaust system is still in the development stage and the light projector is not fitted.* (FVRDE, CCR)

*Mark 1 Chieftain. The external components of the ventilation equipment are fitted and a new stowage rack has been fitted on to the left rear of the turret. The split covers on the commander's cupola are open. None of the comparatively few Mark 1 versions was issued to the Service.* (CCR)

in the engine, caused mainly by excessive vibration. While these were cured by fitting dampers on the crankshaft their addition involved the lengthening of the hull. Overheating in the gearbox was overcome by increasing the oil flow in conjunction with the addition of a heat exchanger but these changes involved moving the exhaust silencers outside the hull structure into an armoured box bolted on the rear as well as increasing the size of the deck louvres. All these modifications added weight, which had by now risen to 49·5 tons in the prototypes, and as the running gear had been designed to the original limit of 45 tons, this too had to be strengthened. The need to limit damage to roads during exercises in Germany led to the addition of rubber pads on the tracks and raised the weight by a further 1,000 pounds. It was also found that the nominal ground clearance of 17 in. specified originally was too small and it was increased to 22 in. by fitting the same diameter road wheels that had been used for Centurion and raising the track adjusting wheel and final drive assemblies. This modification was achieved, however, at the expense of an increase in the overall height of only one inch.

Firing trials of the new L11 120 mm. mounted in the turret started in 1961 and proved very satisfactory, although the User asked for a number of changes in the commander's vision cupola for the Mark 2 version of what was now known as Chieftain Main Battle Tank. Forty vehicles were built to the Mark 1 specification, whose chief visible difference from the Mark 2 is the split hatch in the commander's cupola—similar to that used in Centurion Marks 8, 10 and 13—whereas the Mark 2 has a single hatch cover. The rear of the turret was also redesigned for this mark to incorporate CBR filtration and ventilation units and a number of detailed changes were made to the interior. A weight reduction exercise involved a slight reduction in the number of rounds stowed and modifications to the protection specification involved, *inter alia,* the armour on the light projector being removed. The rigid panel design of flotation equipment was also replaced by a schnorkel deep wading kit.

Some of the first Mark 1 tanks had been issued meanwhile to the 1st and 5th Royal Tank Regiments in Germany for troop trials, the design was accepted for service on May 1, 1963 and delivery of the first vehicles built to the production specification was made to the 11th Hussars in Germany in early 1967. The first Mark 3—incorporating an improved auxiliary generator, modifications to the main engine to increase its reliability, better stowage and a new commander's cupola—was delivered in September 1969 and weighs 53 long tons. The Mark3/3 will have further improvements to its automotive systems and to its range finding performance. In mid-1970 the Mark 5 was announced with its engine uprated to 750 b.h.p. and having a combat weight of 54 tons.

The development history of Chieftain clearly shows some of the influences that act and inter-act if the User is to get what he wants. Compromises will always be

Chieftain Mark 2—front view

*A prototype modified with the raised suspension system and incorporating the armoured cover for the exhausts.* (FVRDE, CCR)

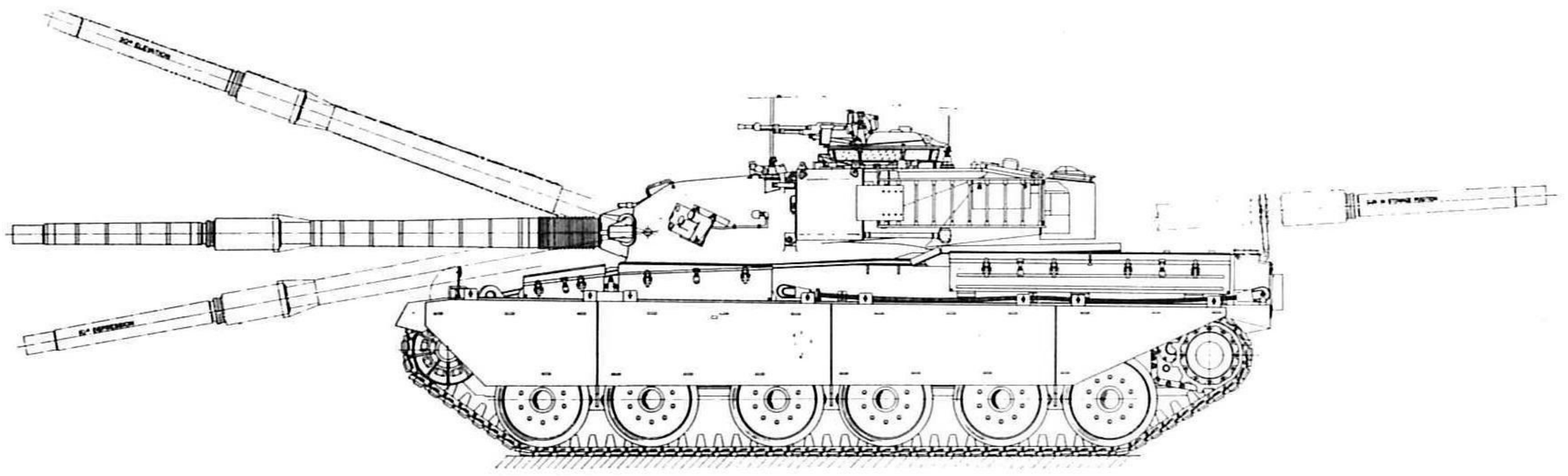
*Mark 2 negotiating a minor obstacle during a demonstration. This tank has the much-improved commander's cupola and the new hatch cover is apparent.* (FVRDE, CCR)

*The new periscopes in the commander's cupola and changes to the stowage on the turret are shown in this Mark 2.* (FVRDE, CCR)

*Mark 2 Chieftain moving at speed across rough ground.* (FVRDE, CCR)

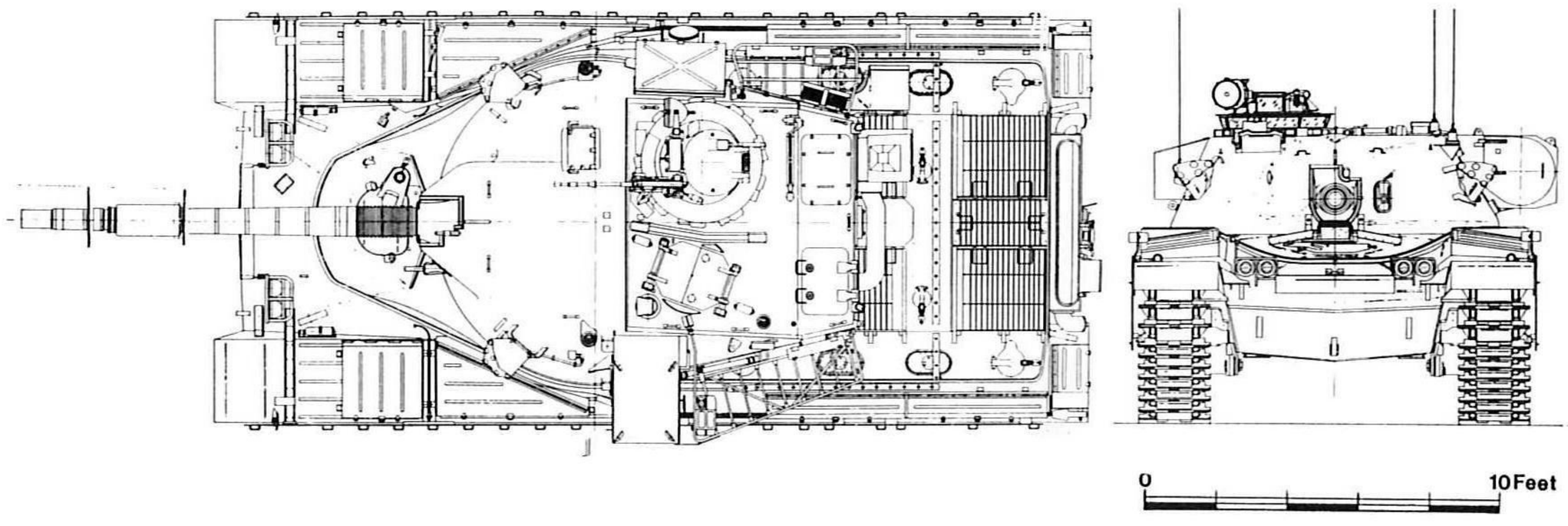
necessary as the requirements of firepower, protection and mobility are incompatible to a greater or lesser extent, regardless of the order of priority in which they are placed. But the length of time needed to bring a tank into service, especially in peacetime when the capital investment, development and industrial resources have to be won at the expense of more profitable civilian projects, force the User to forecast who and where the enemy will be, and how equipped, at least 15 years hence if the tank is not to be obsolescent when it arrives in service. The designer, for his part, has not only to compete with the changing views of the User but also must make his own forecasts to ensure that the engineering techniques and materials used are the best available when production starts, no mean task in an era when the growth of knowledge in these fields is almost exponential. Again, he must ensure that his design is capable of continuing development after the tank is actually in service to maintain its relevance to the tactical doctrine of the time: the history of Centurion and the modern Soviet Mediums illustrates this well. Production and logistic economics also dictate the desirability for standardizing designs on an international basis and this will usually entail the reconciliation, not only of the capabilities required, but also of differing engineering techniques. This was apparent in the development of Chieftain but even more so in the case of Leopard. With these factors in mind the development of the latter can be traced somewhat more briefly, although this by no means implies that it was necessarily less eventful than that for Chieftain, as a comparison of the original specification for the "European" tank with that for the production Standardpanzer will indicate.

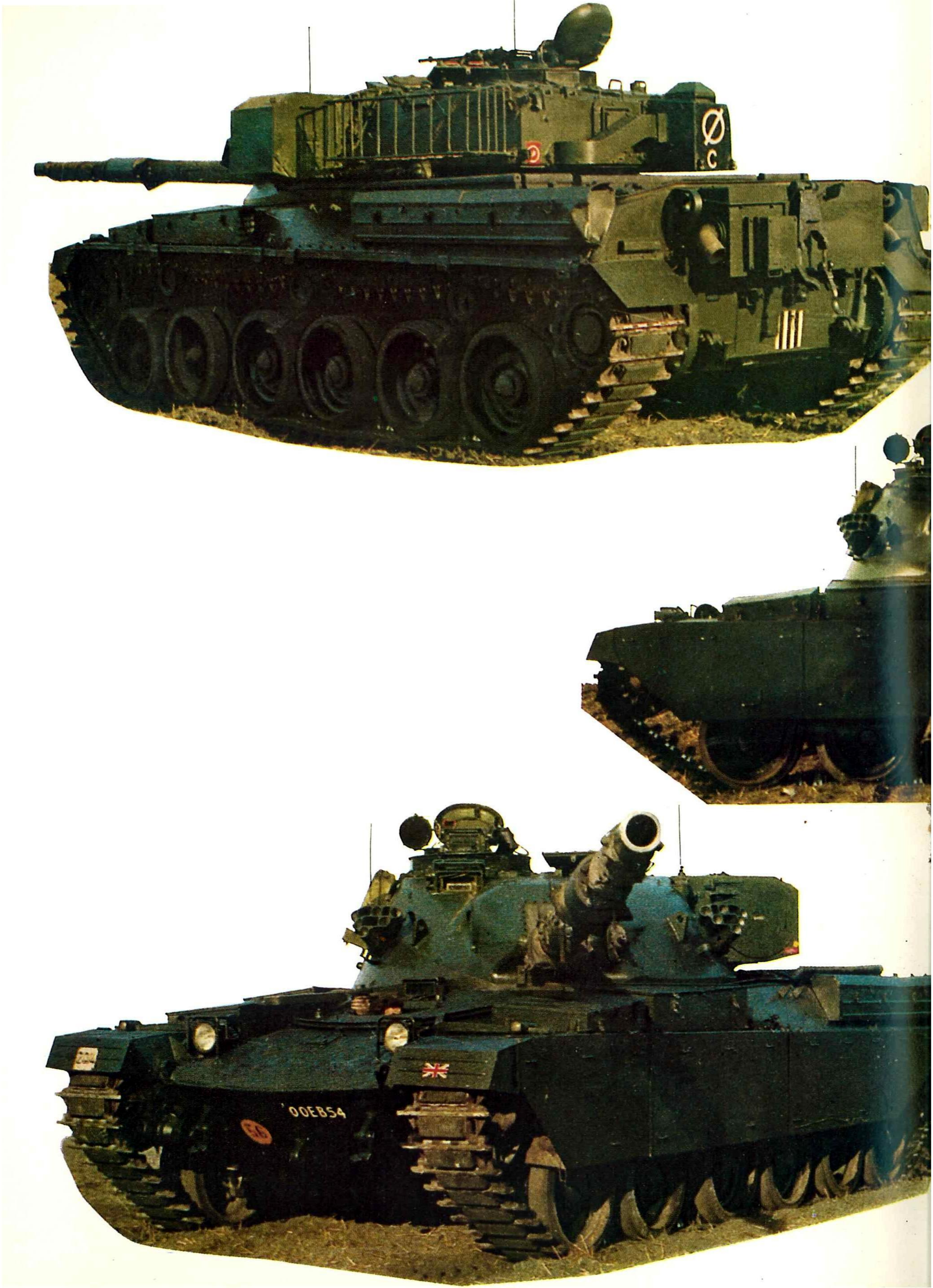
*Three views of a Chieftain and basic dimensions.* (COI)



## OVERALL DIMENSIONS

| | |
|---|---|
| Height (commander's spot light) | 115·9 ins. |
| Length with gun forward | 424·6 ins. |
| Length with gun stowed | 384·2 ins. |
| Width over skirting plates | 137·6 ins. |
| Width (including searchlight) | 142·5 ins. |
| Track centres | 107·0 ins. |
| Width of track shoes | 24·0 ins. |

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Chieftain Mark 2




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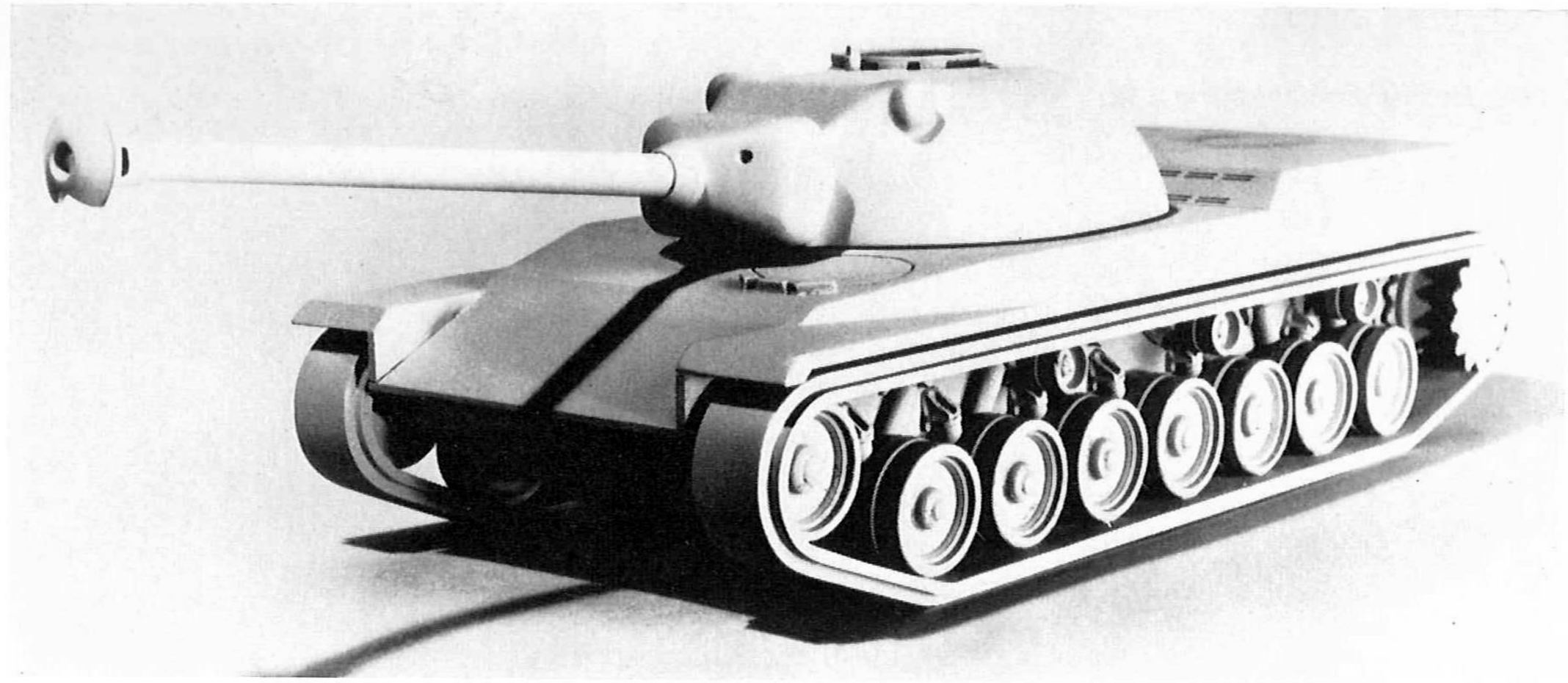
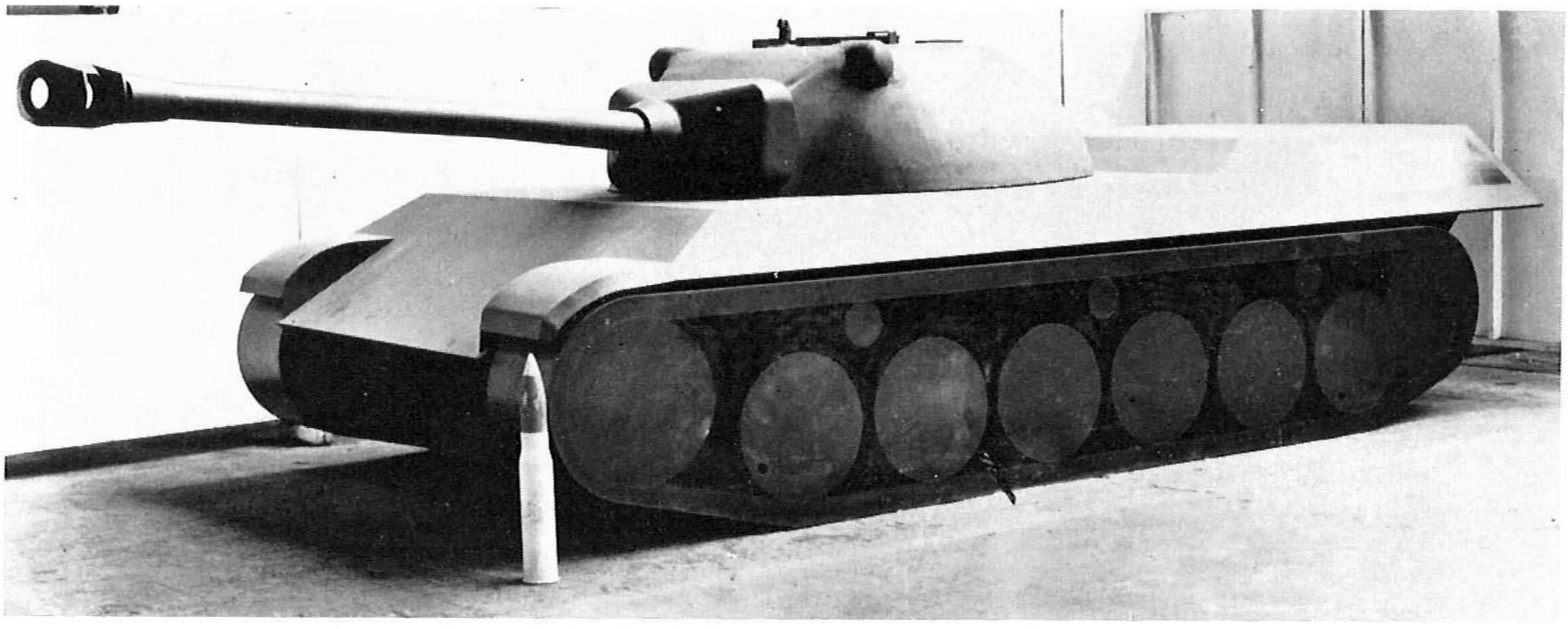


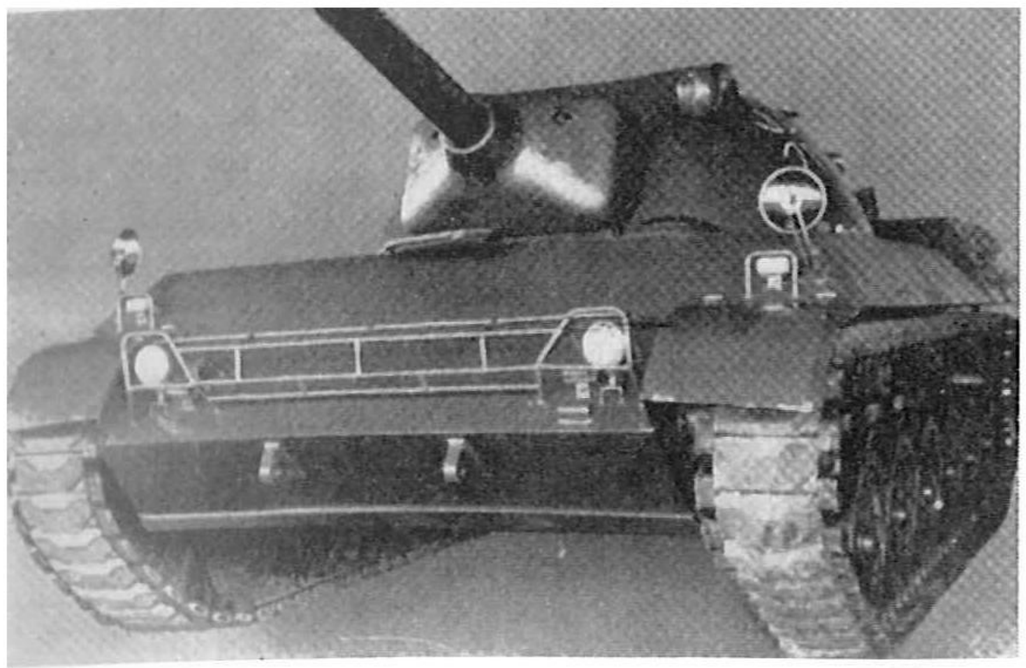
*Small scale model of the Porsche KG (Group A) design to the original tripartite specification. Although the Rheinmetall 105-mm. gun is installed the design of the tank as a whole bears a remarkable resemblance to the Standardpanzer in production.*



*The mockup for the Warneke Group B concept which was automotively the more advanced of the two although they both shared the common Type I turret.*

*Group A prototype I in 1961.* (Soldat und Technik)

*Prototype I of Group A mounting the British 105-mm. L7 gun. The driver's compartment had to be moved subsequently to the other side of the hull to make way for ammunition stowage for the gun which is loaded from the left.* (Soldat und Technik)



*Standardpanzer Prototype I from Group B.*
(Soldat und Technik)

(Soldat und Technik)

## LEOPARD STANDARDPANZER

The Bundeswehr was equipped on formation with a large number of American M47 Patton tanks which had the advantage of being very cheap and available in quantity. But their design was also old and somewhat unsatisfactory, and although the Bundeswehr had a number of the later M48A2 models, it seemed clear that the U.S. philosophy of tank design was not altogether compatible with German tactical ideas: a combat weight of the order of 50 tons was definitely thought to be too high, for example. This view was also shared by France and Italy, both of whom had also been equipped with M47s, and the three nations agreed to formulate jointly the military characteristics for a new European tank. Germany was especially anxious to build up her own armament industry again in order to take a greater share in international projects where the skills and efficiency of her heavy industry could be used to the best advantage.

The outline specification that emerged in 1957 called for a 30 metric (29·5 long) ton vehicle having a multi-fuel air-cooled engine, a power to weight ratio of 30 b.h.p./ton, a radius of action of 220 miles, an advanced torsion bar or hydro-pneumatic suspension, a maximum ground pressure of 11·3 lb./sq. in., its overall height not to exceed 7 ft. 2 in. nor its width 10 ft. 4 in. The gun was to be capable of defeating 150 mm. of armour sloped at 60° and a maximum range of 2,500 metres was envisaged. The ammunition capacity was not to be less than that for current American tanks and immunity was specified against 20 mm. rounds fired at short range. These parameters were strongly influenced by three main considerations: the need for excellent acceleration and agility across country, the results of a study which showed that the carrying capacity of bridges in Central Europe was predominantly in the 30 to 40 ton bracket and,

Top right and below: *Prototype type IIA with the cross turret rangefinder removed in favour of the 0·5-in. ranging gun.*
(German MOD)

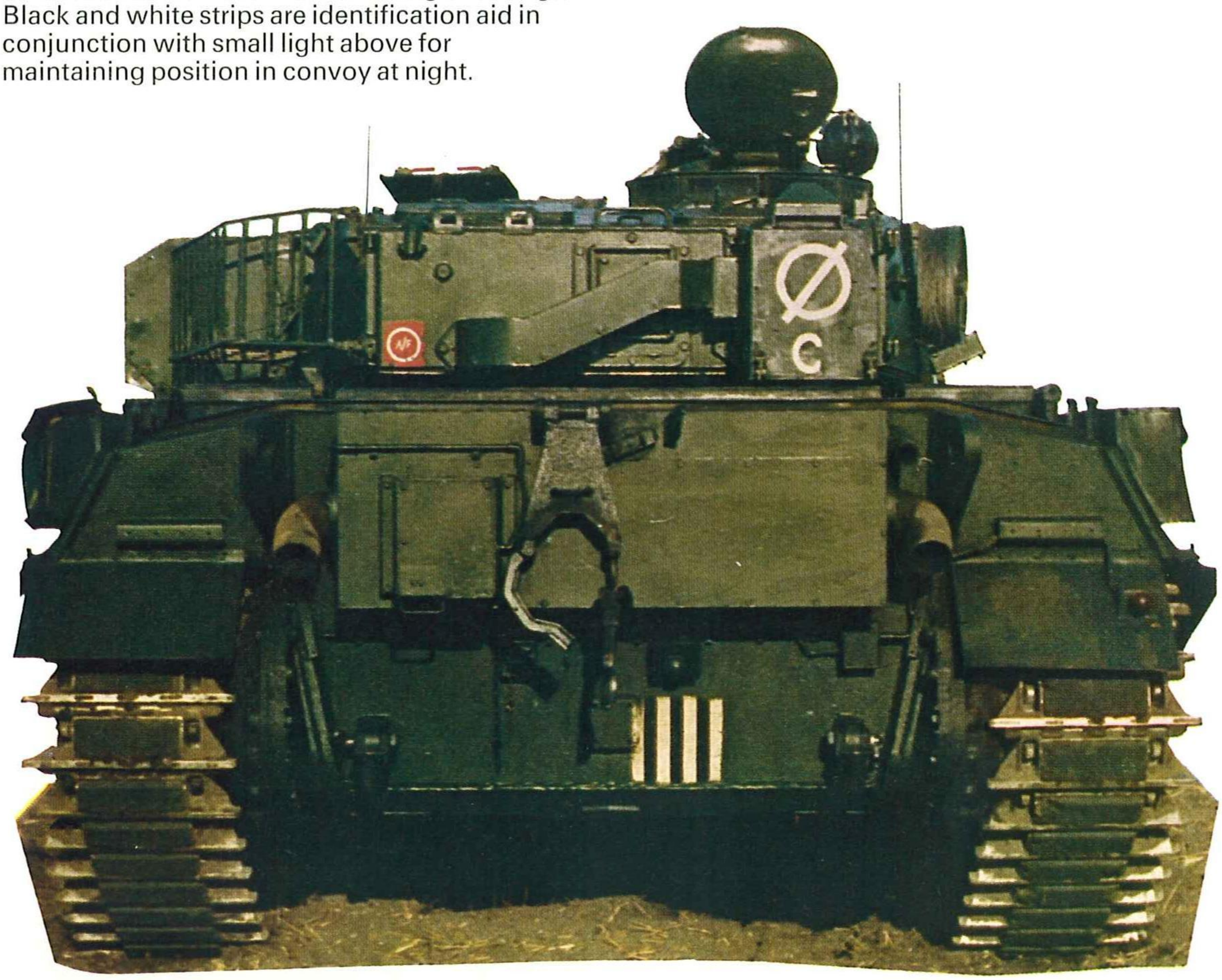
lastly, the view that development of kinetic and chemical energy ammunition had reached such a peak of efficiency that passive protection against them was subject to sharply diminishing returns in terms of combat efficiency. Agility was preferable to armour.

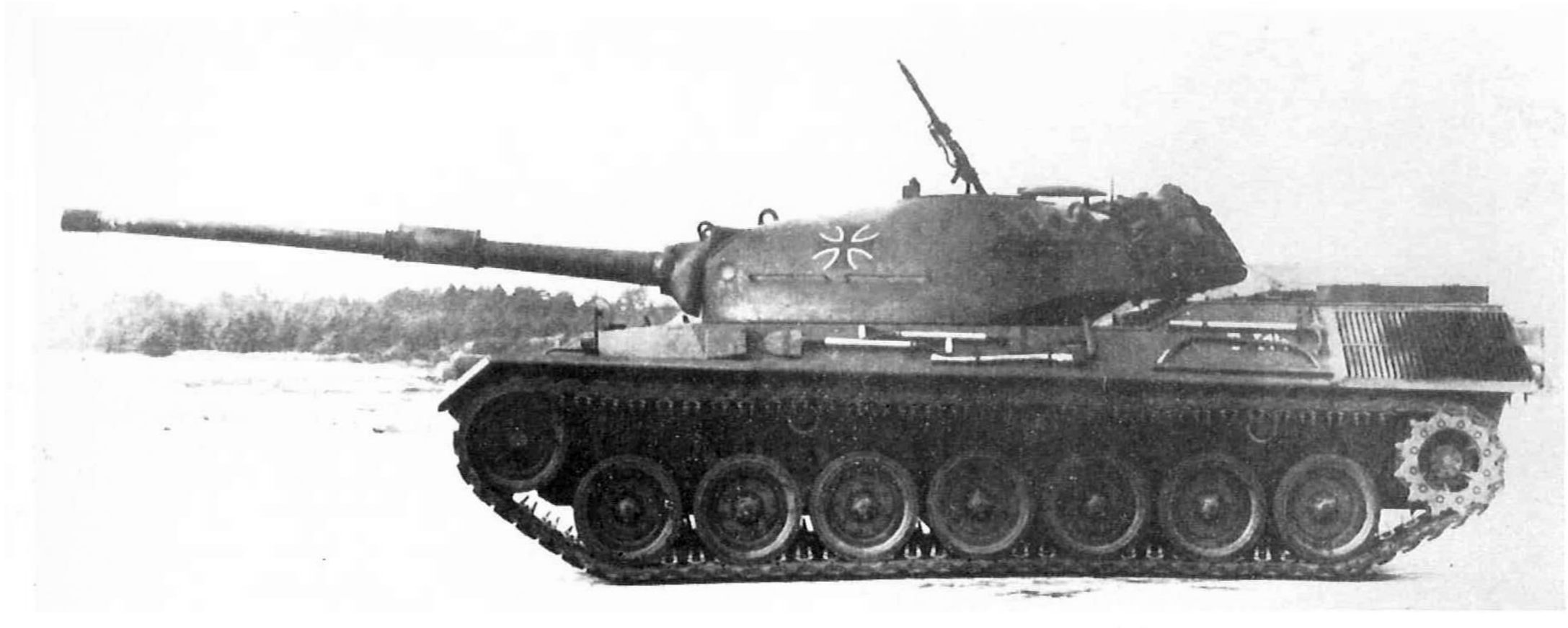
The defence ministries in France and Germany then authorized the construction of two prototypes from the state-owned Atelier de Construction d'Issy-les-Moulineaux (AMX) and from each of two German consortia. The forming of a consortium for a specific project is typical of the German approach in international development (it has been used subsequently in the case of the MBT 70 and a number of aerospace projects), and here consisted of Group A under the leadership of Porsche KG* and Group B under the Warneke office of Ruhrstahl. The contract for the development of a common turret was awarded to Rheinmetall GmbH. The two vehicles from Group A were delivered for trials in January 1961 and those from Group B in the following September. Both designs were similar in appearance but that from Porsche was slightly longer, heavier and better protected although both had started the almost inexorable climb in all-up weight, the Porsche having reached 32·5 tons. Both used the Daimler Benz 838 engine in the interests of standardizing on a basic design that was to be used in the lighter AFVs, and the parallel development of a two-stroke series by Rheinstahl-Hanomag was abandoned accordingly. Despite their outward similarity, however, the Warneke design was technically the more advanced, notably in its running gear which was to have a hydropneumatic system combining springing with shock absorption and the vehicle could be raised or lowered by altering the volume of oil in the cylinders. The alternative Dubonnet scheme regulated the distribution of the running load over the individual road wheels. The transmission was also of a more advanced design. Of the two turrets one mounted Rheinmetall's own 105 mm. gun in conjunction with an optical range-finder under the gunner's control and the other had the British L7 gun of the same calibre that had been selected for the Centurion, M60, the Vickers Battle Tank and the Swiss Pz 61. The British 0·50 in. ranging gun was also installed in this turret.

As a result of trilateral trials in Germany later in 1961 a number of changes to the specification were agreed, among them being a wading capability to a

*Professor F. Porsche was head of the Tank Commission until he was dismissed in 1943 after differences of opinion with Speer, although he continued to work as a consultant. The 185-ton Maus heavy tank project was under his general direction.

Chieftain Mark 2 rear view. A/F sign on turret shows that cooling system is permanently filled with anti-freeze, other turret marking is call sign. Black and white strips are identification aid in conjunction with small light above for maintaining position in convoy at night.

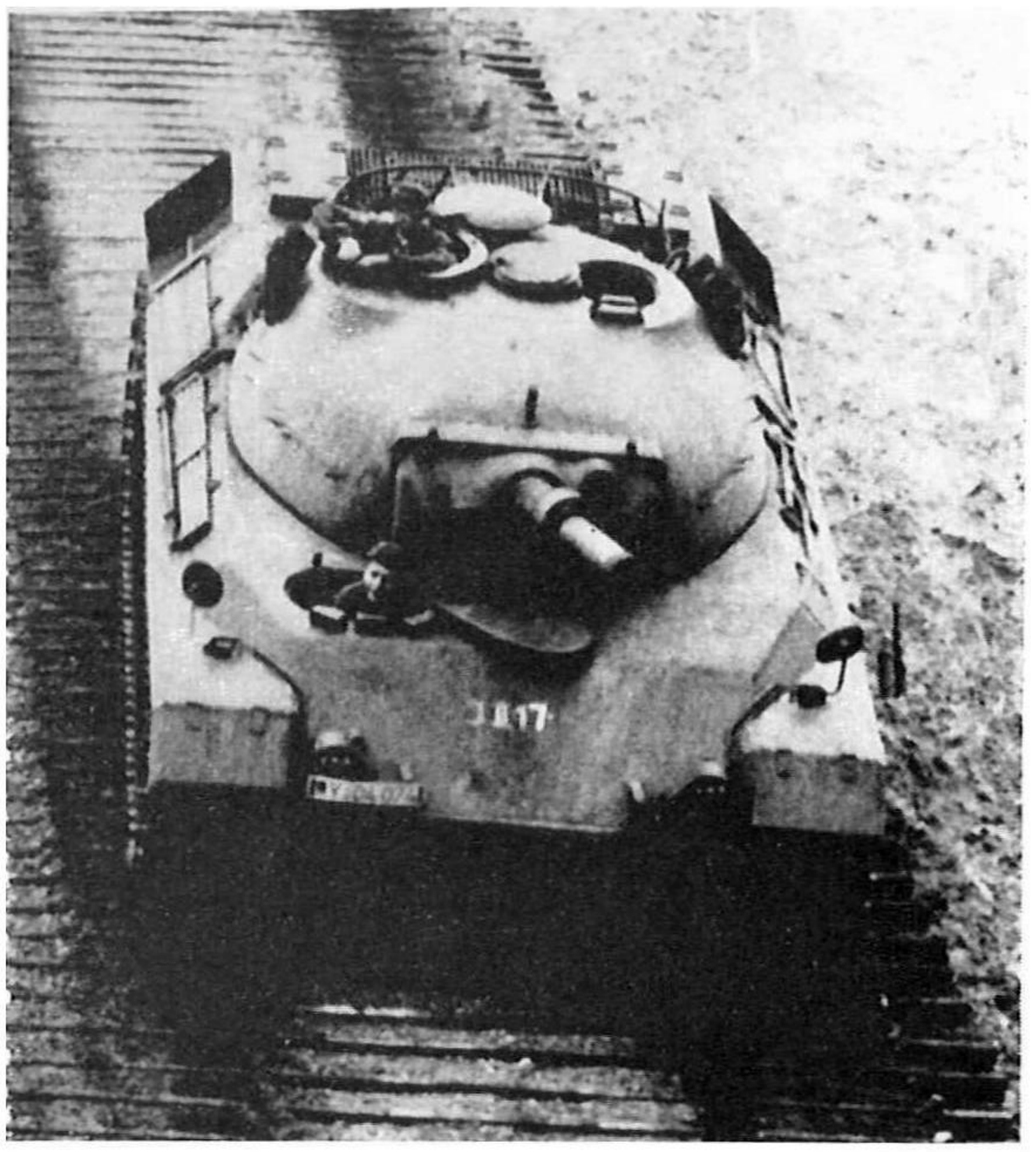




Above and middle left: *A Prototype IIA. Note the vertical louvres in the exhaust grille and the 7·62-mm. MG1 on the turret roof.*
(Soldat und Technik)

*Prototype IIA Leopards at the first public demonstration in July 1963. Note the re-positioning of the driver's compartment.*
(Associated Press)

*Prototype II Leopards during troop trials at the Panzertruppenschule II Münsterlager.*



Above and below: *Prototype II Leopards during troop trials at the Panzertruppenschule II Münsterlager.*

depth of 26 ft.* although the need to keep the weight within the original limit was reiterated. The first outwardly apparent split in the agreement arose in the following year when the French decided on the development of their own 105 mm. gun whose only tank-killing ammunition is a spin-stabilized HEAT round while the Germans preferred to have the three types of attack available with the British gun (APDS, HESH and the American HEAT)† as well as being attracted by the lower unit costs and standardization of logistical support within the N.A.T.O. alliance. The Group B automotive design was also abandoned as a result of evaluating a further 26 prototypes from Group A and four from Group B as it was clear that the complexity of the latter would result in delays into service. These 26 Group IIA tanks were sent to a special trials unit, the Panzerlehrbataillon 93 at the Münster Lager Panzertruppenschule II in the autumn of 1962 where the design became known as Leopard. The ranging gun was abandoned as a result of these trials in favour of the longer ranging capability of an optical instrument.

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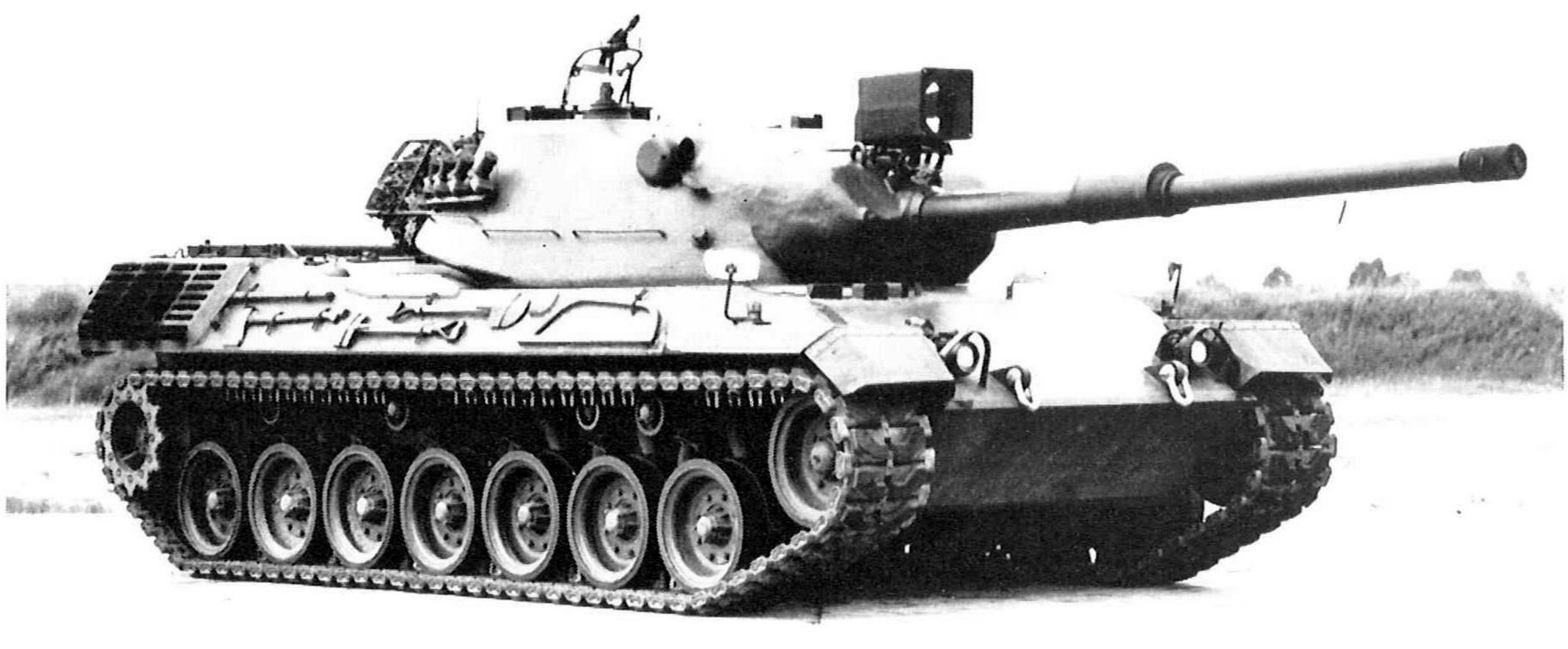
*As it had been for Maus. The requirement was later relaxed for Leopard to 16·5 ft.

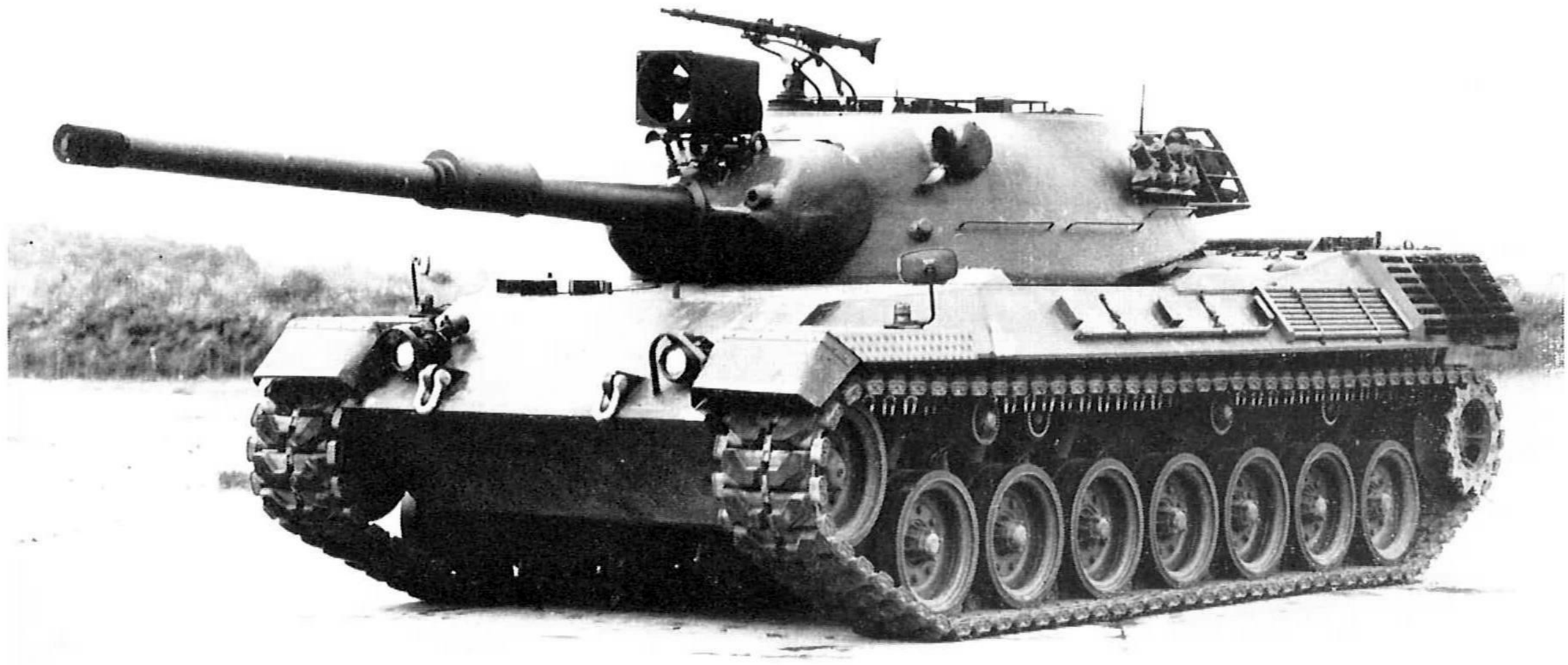
†APDS=armour-piercing, discarding-sabot. HESH=high-explosive, squash-head. HEAT=high-explosive, anti-tank.

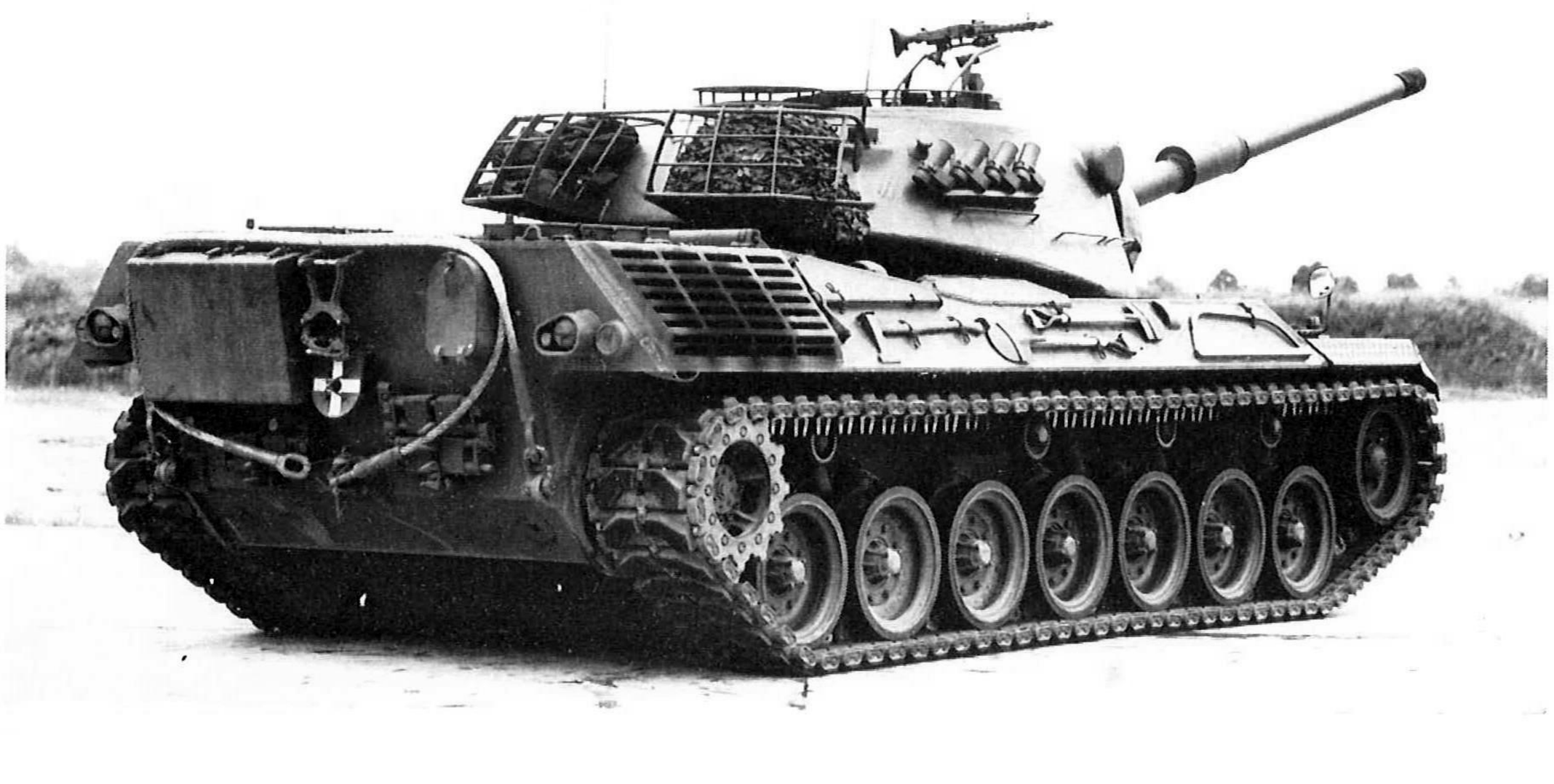
*A IA prototype compared with an M48A2 tank.*
(Soldat und Technik)

*Preproduction versions of Leopard and AMX 30 during comparative trials.*
(Soldat und Technik)



Above, below and following page: *Preproduction Leopard with Turret III. Note the reinstatement of the cross-turret rangefinder, the modified arrangements of the turret stowage racks to allow access to the ammunition loading hatch as well as the now horizontal louvres in the exhaust grilles.*
(German Army official)





Above and below: *Preproduction version of Leopard with the commander's panoramic periscope installed.* (RAC Centre)

Above and below: *Preproduction Standardpanzer with Series III turret.* (German MOD)

Left: *Preproduction version of Leopard with the commander's panoramic periscope installed and a coaxially-mounted IR searchlight on the centre of the mantlet.* (RAC Centre)

*Preproduction Leopard with turret III* (and on opposite page).

*Preproduction Standardpanzer with Series III turret.* (German MOD)

The final decision to develop a purely German design was taken in mid-1963 and procurement for the Bundeswehr was authorized in July. Apart from purely technical differences—which were fundamental enough in themselves—it seems that the decision was precipitated by a change in French defence policy so that funds for producing the new tank would not be available until 1965, whereas the replacement of the Bundeswehr's ageing M47s was becoming increasingly urgent. Krauss-Maffei AG of Munich was appointed as main contractor for the series, having considerable experience in tank manufacture, and the first Leopard left the production line on September 9, 1965, its combat weight having risen a full ten tons among many other changes to the original specification. A purely technical comparison in August and September 1963 had shown, however, that despite this increase in weight the Leopard was markedly more agile than the French version (AMX 30) and the L7 gun was judged to be the more effective. The original tripartite agreement finally disintegrated when the Italians decided to adopt the American M60 which they would build under licence, although they later agreed to procure the Leopard.

The order for 1,845 Leopards for the Bundeswehr was completed in 1968 but orders for 334 from Belgium, 78 for Norway, 415 for the Netherlands and 800 for Italy have prolonged the production run subsequently. Spain has also expressed interest in procuring this tank. At the beginning of June 1970 the total number of Leopards supplied and on order was 3,500—excluding the recovery and engineer versions.

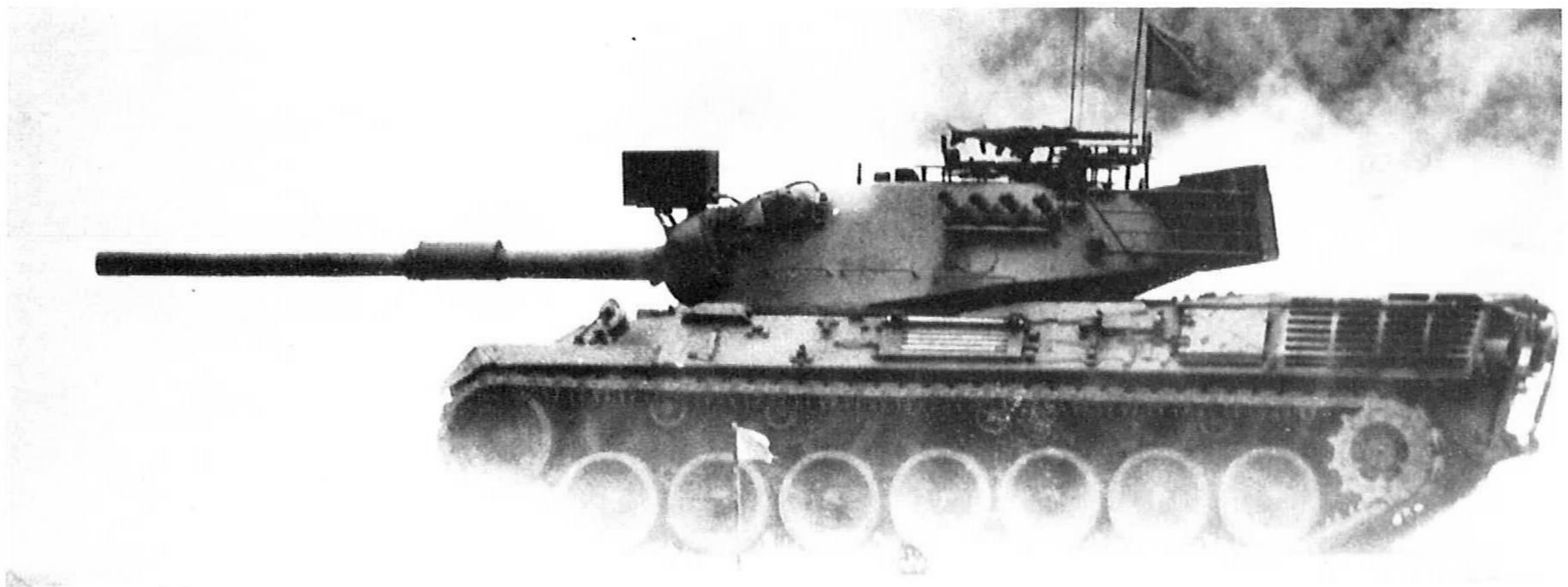
The cancellation of the joint MBT-70 project with the U.S.A. has left the Bundeswehr without a replacement for the obsolescent M48 tanks and a much improved Mark 2 version of Leopard is planned for production in 1975.

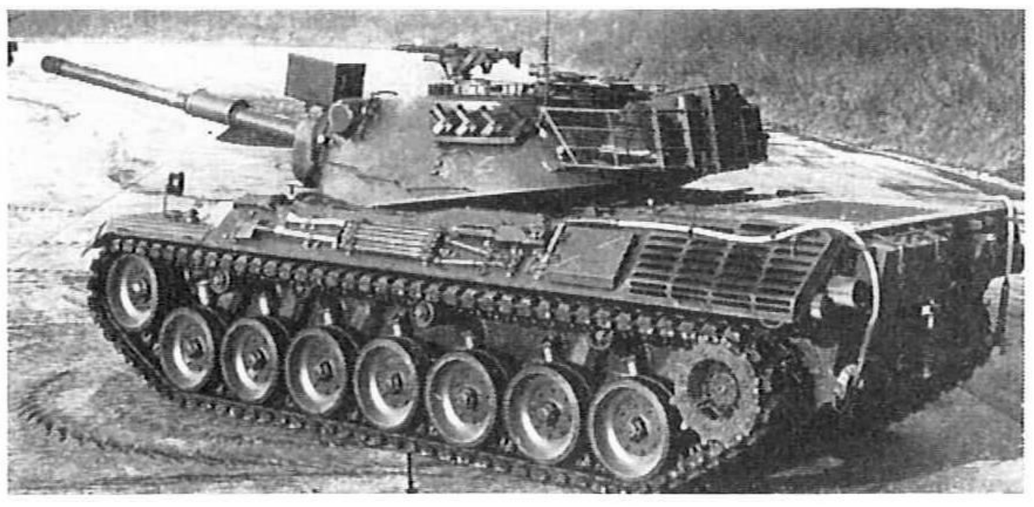
**AFV Series Editor: DUNCAN CROW**

*Panzerbataillon 83 at Lüneberg, the first service unit to be equipped with Leopard, parading in March 1966.* (DPA)

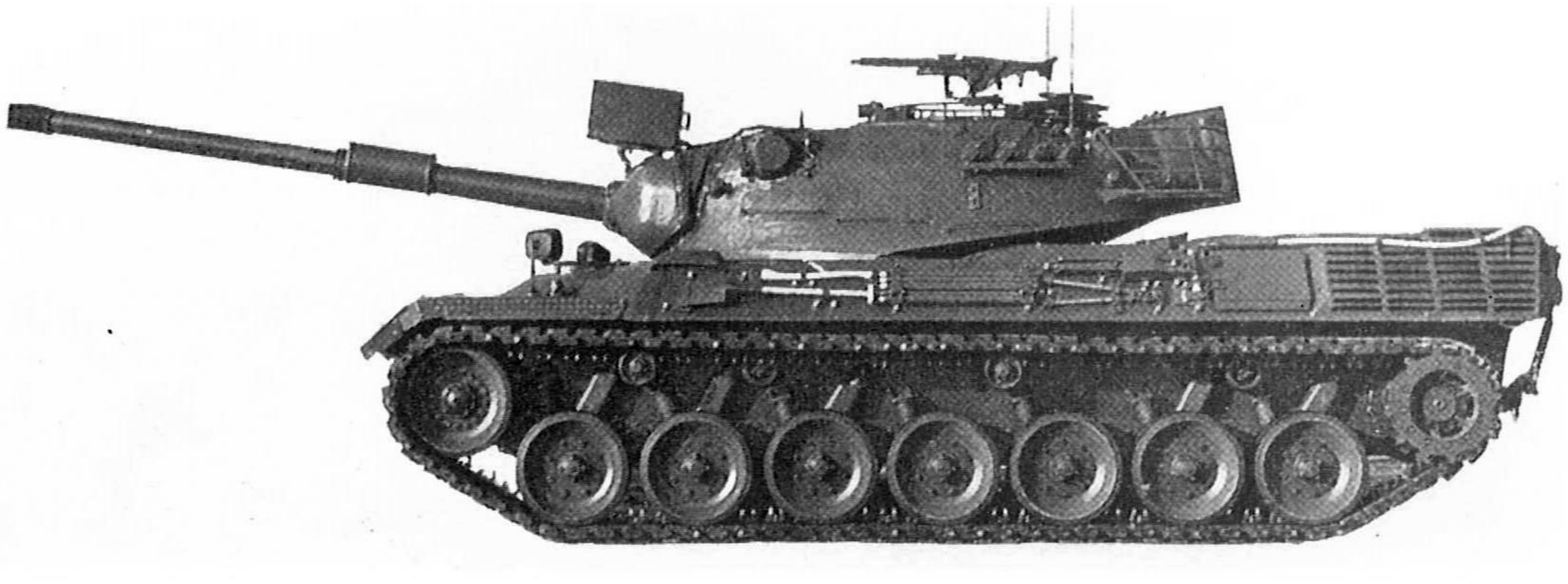
*The first Leopard to quantity production standards leaving the line at Krauss-Maffei AG in September 1965, watched by the then Minister of Defence Herr von Hassel.*
(Deutsche Presse-Agentur)

Above and below: *Leopards on manoeuvres.*
(Krauss-Maffei and German MOD)





*Three pictures show production versions of Leopard. Among the number of changes visible note the addition of a stowage bin at the rear of the turret where previously there had been an ammunition loading hatch.* (Soldat und Technik)



*Production versions of Leopard. Among the number of changes visible note the moving of the smaller searchlight to the left of the mantlet to avoid back-scatter of light into the sights.*

(Soldat und Technik)

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*Edited by DUNCAN CROW*

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