

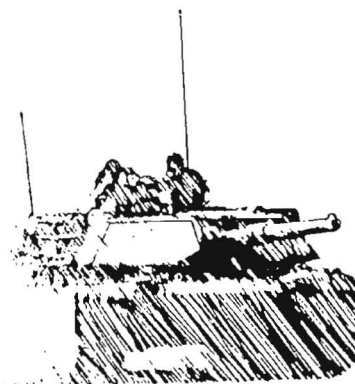
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March 1995

# *Museum Ordnance*

*The Magazine for the  
U.S. Army Ordnance Museum*

*Promoting the preservation and collection of information and artifacts of military ordnance from around the world.*



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# The Curator's Column

For those visiting the museum within the near future will notice that the interior of our cases has changed colors. For a long time now I have been unhappy that we have had dark weapons displayed in a dark case with a dark background. Thanks to the Marine Detachment here at Aberdeen Proving Ground that situation is well on the way of being solved. The Marines have painted the backs of the cases a light gray and the difference between the way they were before and now is striking. We are also in the process of updating our Vietnam Exhibits and that project should be completed soon.

One of the important roles the museum plays is to act as a repository of foreign weapons that were used against us in the past. In Vietnam, one of the most important long range weapons the NVA and VC used was the 122mm rocket. There is renewed interest in this old weapon and we have placed on loan to "other agencies of the Federal Government" our launchers for this weapon to be used in non-consumptive testing. Upon completion of the test the launchers will be returned to us and will be returned to their display stand.

Several people have asked me to comment on the future of the United States Army in the 21st Century. The world has entered into a new phase of history where the old rules no longer apply and people are concerned as to where we are going. It is always dan-

## Museum Ordnance

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# The IS-3 Series Soviet Heavy Tanks

by  
Stephen 'Cookie' Sewell

By the winter of 1941-42, the Soviet Red Army realized that it had made a mistake in the production of the KV series heavy tanks. Rushed into production after their apparent success in the late stages of the Soviet-Finnish Winter War of 1939-40, the KV-1 had proven itself mechanically unreliable and underarmed for its immense 51.8 ton bulk. It was underpowered and slow, and while tales would grow of its immense armor thickness and resistance to punishment, what tended to be overlooked was the fact that many of them had broken down, which necessitated their becoming such immobile pillboxes in the first place. The even heavier KV-2 had a more powerful 152mm howitzer, capable of destroying any tank in the world at that time, but its low production rate and nearly immobile turret doomed it to failure.

The KV series was the result of a hasty attempt to curry Stalin's favor



*The IS-3 at APG. Note the homemade rear drive sprocket.*

and beat the rival Khar'kov Locomotive Works (KhPZ, designers and producers of the BT series of fast light tanks) to the

contract (and glory) of the main Red Army tank. The Kirov Works, located in Leningrad, was noted as the producer of some of the biggest tanks the world had seen, such as the T-35 series and the three-turreted SVK tank design. The latter emerged as a two-turreted tank after Stalin saw a model of the prototype and asked, "What's this, a department store tank with a gun for every occasion?" The KV prototype of 1939 was a cleaned up and lightened version of the SVK (which stood for Sergei V. Kirov).

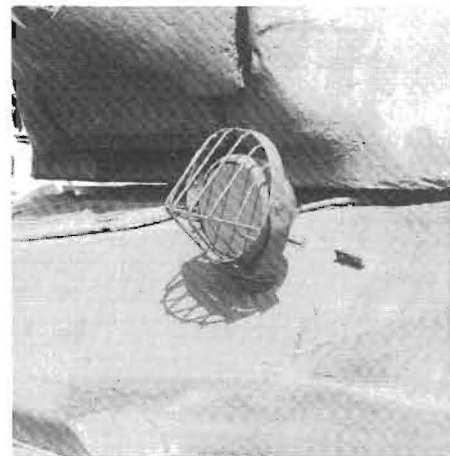
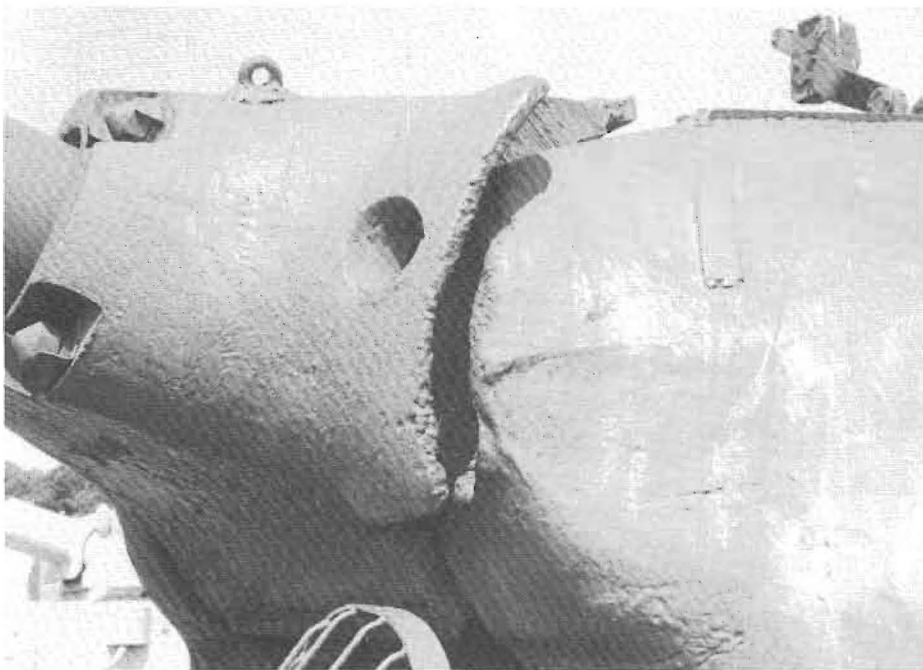
In fact, one of the main reasons that the KV series made it into production was the apt choice of name (KV for Kliment Voroshilov, the commissar for defense production under Stalin) by the head of the Kirov Works design bureau, Zhosef Ya. Kotin. Ignoring the fact that Voroshilov was Kotin's father-in-law would be to avoid one of the main reasons that the tank found favor at the top.

But it was in heavy competition with the T-34 Model 1939, a brilliant design from Mikhail Koshkin, chief of



*The heavy casting of the turret mantlet and the flat driver's hatch are evident here.*





*A close look at the left side headlight and guard.*

the KhPZ design bureau. Even after attempts were made to quash the T-34 in favor of the KV, Koshkin fought for his design. The crowning blow was when Koshkin and the staff of the KhPZ drove the two prototypes to Moscow from Khar'kov in the winter of 1939 and demonstrated their superiority over the clunky KV in Moscow. But while Koshkin proved his creation's abilities, he also caught pneumonia, which killed him six months later.

Kotin was furious over the turn of events — especially when the only suitable engine for the KV turned out to be

the legendary V-2 diesel engine used in the T-34! He still maintained that the Kirov products were superior to the Khar'kov ones, but when the KV showed itself to be a disaster on the battlefield, he was in a bind as to what to do next. (Recall that lesser men had been summarily shot in peacetime for more trivial offenses, even when well connected in the Party as Kotin was.)

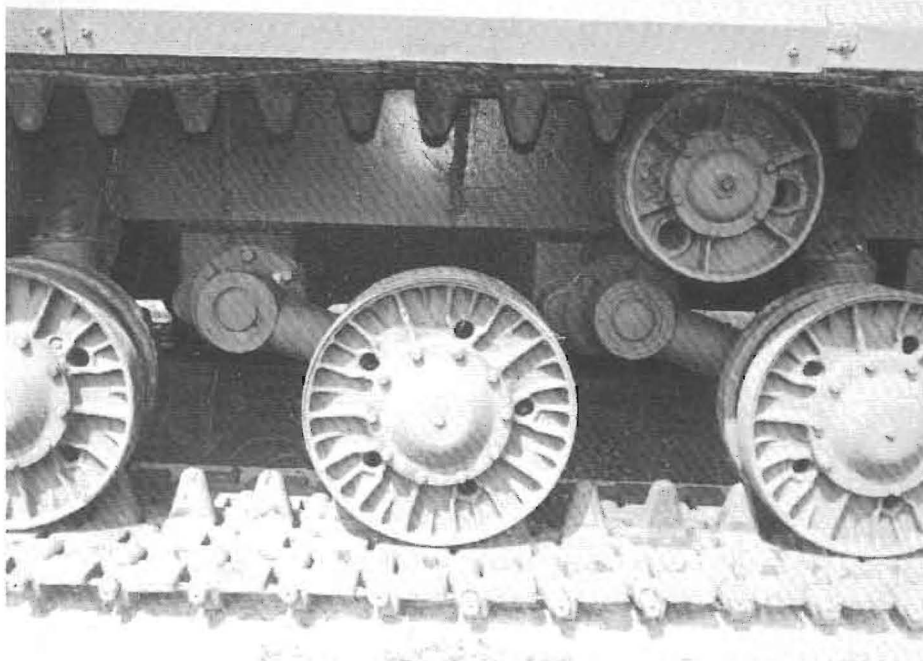
The "White Knight" that rode to Kotin's rescue was one of his top subordinates, Nikolai Shashmurin. Shashmurin took over the KV project and proceeded to really work over the

unhappy KV-1. He designed a new, more reliable transmission; added a smaller, lighter turret; pared off some of the armor thickness; and made scores of minor improvements. The result, the KV-1s (for Skorost'noi or Fast) was not an ideal solution, but it made the KV-1 a functional tank at last. Even with its lighter armor, the KV-1s still was a 46.3 ton tank and had massive frontal and turret armor.

But Kotin remained fixated on "crushing" the upstart T-34. In April 1942, he sat a team of designers, under the direction of N.V. Tseits, to building a better medium tank along the lines of the KV-1. The project, known as the KV-13, was to be Kotin's T-34 killer. A smaller, lighter version of the KV-1, the KV-13 used new cast components to ensure reliable armor and at the same time keep weight down. Work on the KV-13 proceeded in parallel to the Shashmurin KV-1s project, but because that one did not disrupt the flow of tanks to the front and used most of the same KV-1 components, it was allowed into production.

But the big let-down was yet to come. After thorough testing of the KV-13, the State Committee on Defense rejected the design with one basic conclusion: it offered no advantage over the T-34, then in high rate production. Kotin was so shocked that his "baby" was rejected out of hand that he went into the warehouse where the prototype was stored and just sat with his tank for hours on end.

But there were better things on the horizon. The design bureau resurrected the KV-13 design for a new tanks series (now to be called IS for Iosef Stalin, which the factory felt was a sure bet this model would get into production!)





The projected new models, a 41.9 ton version called the IS-1 which used an F-34 76mm cannon, and the IS-2 with a U-11 122mm howitzer, used 120mm frontal armor castings and the KV-13's five roadwheel per side chassis design. This was found to be too short and light for the new armor. Also, parallel upgrades to the KV-1s, resulting in a new turret with an 85mm gun in mid 1943 as the KV-85, caused the team to re-think its choice of weapons. The new, extended chassis resembled the KV-1s/KV-85 chassis, and the IS-1 now mounted the KV-85's turret. However, by this time the T-34 gang had worked up an 85mm turret design for its tank, and once again Kotin was faced with rejection of his new tank, which offered no real advantage over the T-34 series..

The solution was to find a bigger weapon which the smaller T-34 could not realistically carry. The secondary objective was to find a "Tiger tamer" which could stop the 62 ton German tank at long range. Happily, cannon designer F.F. Petrov thought that the 122mm corps field gun could be adapted

to the tank, which he did as the D-25 cannon. This weapon on test in a prototype of what would become the IS-2 was astounding: at 1,500 meters the shell penetrated the glacis of the Tiger I, traversed the crew compartment, penetrated the firewall, traversed the engine compartment, and blew the stern

plate of the tank completely off, coming to rest some 15 meters behind the target hull. Now Kotin had a weapon.

The main reason that the IS-2 was as good as it was appears to have been Nikolai Shashmurin. His well thought out and laid out design was relatively light — at 50.7 tons it was 11 tons lighter than the Tiger I — and was a nearly instant success. All Russian and Soviet historians list the IS-2 as one of the true "Weapons of Victory," and it was so good that many were upgraded after the war to IS-2M standards. The IS-2m production variant was an IS-2 with a modified turret and new cast front end, with a better ballistic shape than the KV-13 bow which Shashmurin had to use in early models. A number had been cast up in advance due to overzealous predictions by Kotin on that design's acceptance, so early IS-2s made use of the KV-13 parts.

But Kotin was not one to leave well enough alone, as he still wanted to eliminate his rivals from the Ukraine. They were working on new ballistic shapes and designs, some of which

were noted in their stillborn T-43 design and became apparent in the T-44 prototypes being tested towards the end of the war. Kotin turned to a new team led by N.L. Dukhovyi (as were most of the heavy tank projects) and a new lead designer, M.F. Balzhi. The project tank they proposed, called the Kirovets-1, was a true monster.

Using components from the IS-2, the new tank had a bow shaped like the nose of a river pike. Three 120mm plates, sloped at 60 degree angles, joined at a sharp point. The upper hull swept down and in so that the sides were narrower at the bottom than the top, and the large, flat turret overhung the sides. Turret thickness at the mantelet approached 250mm. For the first time since the T-35, a hull entrance hatch





was provided for the driver-mechanic. While the Khar'kov series of tanks now switched to a transverse engine layout, the Kirovets kept the in-line layout of the KVs and IS-2. Eventually, and to ensure its "salability" to the State Committee on Defense, the tank was renamed the IS-3.

The new tank was ready in October 1944, and soon underwent its state trials in the Moscow training area. The new tank entered production just prior to the end of the war. While some Soviet historians claim that the tanks were initially used in combat in Hungary in 1945, no existing photos show early production IS-3's in that area.

The first showing of the new tank was at the May 1945 Allied Forces Victory Parade in Berlin. The IS-3 stunned Western observers, and the image of that low, ominously flat tank with the "frying pan" turret was to be fixated in the mind of every Cold War general up until 1967. But only around 2,300 were built. Arguments were in place even before it went into production that it would be an unsuitable design (mostly from people like Shashmurin, who, after all, had a stake in this choice; successful designers got state prizes, money, cars, dachas, and glory; unsuccessful designers could be purged...) Shashmurin and his crew lobbied for the larger IS-4, which was an evolved version of the IS-2. But only 250 of those were built, and their only brush with notoriety was in being sent to the Korean border during the Korean war.

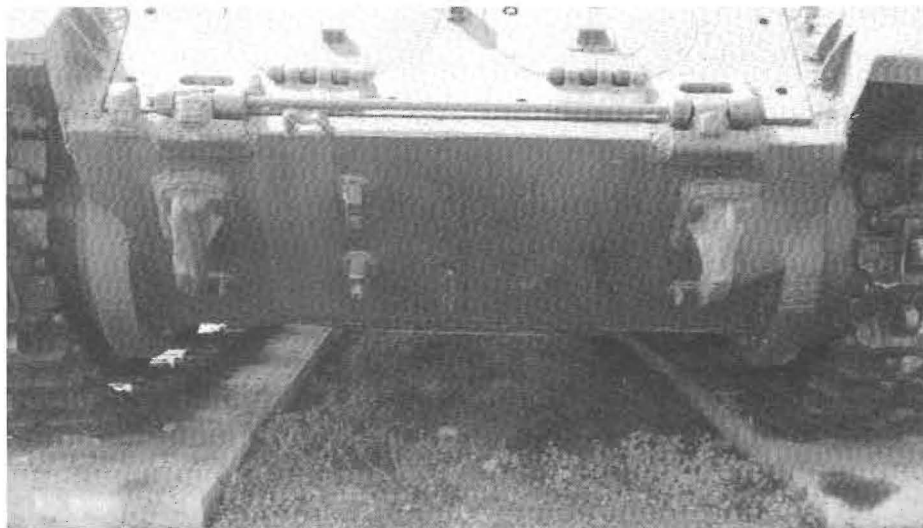
Shashmurin did continue as a designer; he worked on the IS-7, which was felt to be the only tank of the period which could have given the Soviets true supremacy well into the 1980s with one tank. He did work on the T-80 for

the Popov Bureau (who succeeded Kotin) before his retirement.

The IS-3, however, turned out to be as big a dud as Shashmurin said it would be. First off, the tank used the IS-2 hull with some unpleasant changes. The sides were made thicker at the top, under the hull side bulges. But to keep weight down, the result was that the lower hull had to be notched between the torsion bar mounts. This resulted in the engine mounts being weakened, and the lower hull flexing too much under load. All of this meant that the weld beads tended to break under prolonged punishment, and that four 50 x 50 mm steel stiffeners had to be added under the hull. New engine mounts were added, but the IS-3 was not as sturdy as the IS-2. The turret was viciously cramped inside, and many crews felt that it would be impossible to fight in the slanted and shrunken environment. Finally, many of the mechanical bugs from the KV series found their way back into the IS-3, and the tank

was a real monster to maintain.

To add insult to injury, the crews hated many of the other features of the tank. One of the chief ones was that there was no storage for any spare parts or tools anywhere on the early production tanks! Most of the tanks were fixed in depots by cutting off the outward screens over the tank's "secret" armored sides and welding a new panel with three stowage bins per side back over the resulting hole. Later, fender extensions were added to the sides of the skirts, similar in design to those in use on the T-10 series then in production. In 1960, most of the IS-3s were taken in hand and remanufactured as the IS-3M. This tank received many new features: new side panels with four stowage bins, new front fenders with stowage boxes, a V-54K-IS engine of greater power and reliability, modified engine mounts, new air filters, a pre-heater, a DshKM replaced the DshK 12.7mm AA MG, an R-113 FM radio replaced the 10RT AM radio, and a







TVN-2 night vision device for the driver. Weight rose from 50.2 tons to 54 tons, mostly due to the added sheet metal and the engine and transmission bracing. Many of these tanks were still nominally in service in 1991 in the Soviet Far East.

The US and Britain designed "Stalin Killers" at the height of the Cold War in the form of the US M103 series and the British Conqueror. Both weighed over 60 tons and mounted a massive 120mm weapon. But there were less than 500 total of these two dinosaurs, and the Soviets had then built many more T-10 types. The solution to all of these problems were the modern ammunition types for the new 100mm and 105mm weapons, and of course ATGMs which were not fazed by massive conventional armor thicknesses.

#### The IS-3 at the Museum

The IS-3 in the collection here in Aberdeen is, to put it bluntly, in a sorry state. While the museum has kept the vehicle in relatively good condition, it was a mess before it got here and continues to be one today.

The reason for that can be traced through its apparent history. This tank was an IS-3 which was upgraded to an IS-3M in 1960 while still in Soviet service. After that date, and to make points with the Arabs, the tank was one of those sold to Nasser by Khrushchev during the period of the Egyptian buildup prior to the 1967 "Six Day War", in which the tank was captured

by the Israelis.

After that, the tank appears to have been gutted for use as a pillbox along the Bar-Lev line. The engine appears to have been removed, and the driver's escape hatch was cut away with a torch for easy access and exit via a tunnel or trench line. Apparently overrun during the 1973 war, the main gun appears to have been "spiked" by jamming it in the position artillery engineers call "Full Battery" — i.e., when the weapon is at full recoil — and it is thus some 500mm shorter than it should appear in normal condition.

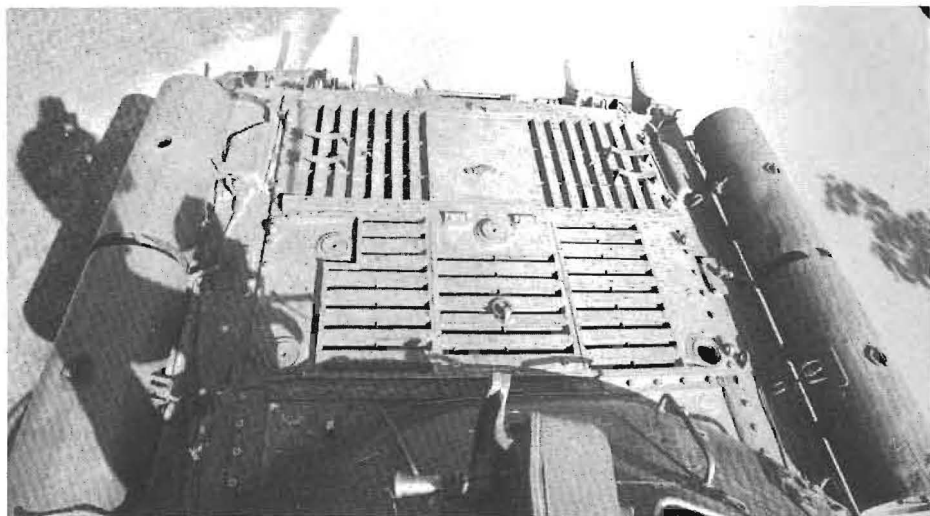
The Israelis appear to have tried to make it presentable before giving to the Ordnance Museum. One of the drive wheels was replaced by cutting a copy

out of a sheet of 25mm thick mild steel plate. The engine deck is off a T-54, and appears to have been added to hide the gaping hole left by removal of the engine. While some sources claim that it is a "special" model with the complete T-54 power pack and transmission, this will not fit in the IS hull under any attempt at shoehorning it in. Also, the radiators of an IS-3 are located next to the engine in classic Kirov style and use reverse flow cooling to enhance operation. This is not possible with the venting that currently exists on the tank.

Still, this tank offers a chance to examine the details of a fascinating, if deadend, design in the history of armored vehicles and the Cold War. The sides show above the "sham" steel plates on the side, and the actual construction details of the armor and its welding can be seen. The "drop tanks" are in place, but the Israelis removed most of the fuel intake and ejection mechanism when they converted the tank into a pillbox.

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Tckhnika-Molodezhi; "T-M's Historical Series Number 3: The IS-3 and IS-4", March 1990, and "T-M's Historical Series Supplement 3: The IS-3, IS-3M, and IS-7", March 1991; both by Sergei Gryankin with illustrations by Mikhail Petrovskii



*This photo illustrates what the rear deck of an IS-3 should look like. The rear deck on the APG IS-3 is from a T-54 which was welded in place to cover the hole left when the real deck was removed.*



## Museum Ordnance's Bookshelf Book Reviews

### STEEL WIND

#### Colonel Georg Bruchmüller and the Birth of Modern Artillery

By David T. Zabecki

197 pages, 9 photos, maps, & charts

1994 ISBN 0-275-94750-5 (soft cover)

Praeger Publishers

88 Post Road West, P.O. Box 5007

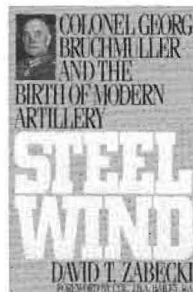
Westport, CT 06881

1-800-225-5800

\$19.95

(Also in hard back for \$65.00

ISBN 0-275-94749-1, 224 pages)



Crediting one person as the individual responsible for giving "birth to modern artillery" is a lofty task, but one undertaken by Zabecki in this fast flowing work. His entire premise really is summed up in his introduction when he states that a artilleryman of today would find little in common with the men, tactics, or equipment of August 1914. However, by the beginning of 1918 that scenario would change and the modern gunner would find many similarities with his Great War counterpart.

Bruchmüller's military career would hardly make him an early candidate for the role he would later play. A mediocre officer with various artillery field and training assignments, as the war started he found himself as a major commanding a fortress normally reserved for a Captain. As the war rapidly progressed, German manpower needs forced more and more under his command. During this time, the first several years of the war, what was an average peacetime officer, displayed a true flair for military field operations.

The basic premise of his philosophy would best be described in modern terminology as "fire and movement."

The book takes you through his early ideas and the resistance from other artillery officers to the changes that he was abdicating. There was a strong rivalry between the different artillery commands and central control was unheard of. Bruchmüller realized that by combining all of the artillery assets and allocating them on an as needed basis, with a centralized, pre-planned fire command he could utilize the potential that artillery support represented.

With a strong host of supporting data, generous use of end notes, an artilleryman's glossary, and a detailed bibliography, this book is the result of a well researched effort by Zabecki. The book is easy to read as the author explains some of the major battles as Bruchmüller used his new philosophy and how that philosophy evolved. He makes comparisons along the way to better understand the changes that were taking place instead of waiting for the last chapter to bring it all together.

Not a WWI fan, this is the first book that I enjoyed reading on the subject and would recommend, especially to artillery historians who should know this story.

### CUBA AND ANGOLA

#### Response to the South African Escalation

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To fully and completely understand an historical event, you must first realize the events as perceived by both (or more) sides to the conflict. This video is a rare look into the Angolan War during the South African-led attacks towards Cuito Cuanavale in 1987/88.

The video starts in Cuba with the initial Cuban reaction to the South African thrusts. Showing units in Cuba being mobilized and moved to the docks for loading. Although the quality varies throughout the roughly three-hour video, the color shots of Russian-made Cuban equipment is interesting. The preparation for the battle and the "co-operation" with the FAPLA (Angolan army forces) comrades is played up

heavily.

Although the video lacks hard details about the actual combat leading up to the finale when the South Africans were either defeated (or accomplished their limited objectives, depending on who you read), it does cover the conflict in broad strokes with glimpses of the Cuban Army in Angola.

Without a doubt this was developed by the Cuban government as a propaganda tool for its citizenship back home. There is ample coverage of the good food, efficient supply system, and high morale of these loyal comrades against the "racists" and "bandits" from South Africa. Once you get beyond the rhetoric, this video really is very good.

The narration is done in English (the video is also available in Spanish) over top of the Spanish which can still

be heard in the background. Some of the translations are awkward and strained and the conversations take on an almost comical tone. This is especially true with some of the briefings and meetings that Fidel Castro is a part of. (Can it be true that Castro did not know it was dusty in Angola?) Some of this can be blamed on the problems of translating a fast moving dialogue from Spanish to English.

There is plenty for the equipment afficionado to see: T-54/55s, BMP-1's, ZSU-23's, MTLB's, Engesa trucks, and bridging equipment are there for the Cubans and Oifants, Ratels, Panhards and Unimogs are shown for the South Africans (although most of the South African footage is of poor quality because it came from secondary sources).

Although this video would be hard pressed to stand alone as a historical perspective of the conflict, it is a must as a companion for the Cuito Cuanavale battles. As I said once you get beyond the strong-handed propaganda machinery, this provides the best insight into the "other side of the story." Well worth the price and highly recommended!

# AMMUNITION LOADING SYSTEMS FOR TANKS

## Introduction

The past three decades have witnessed a profound and ever broadening interest in the development of automation for armored combat vehicles. This has evolved through "human factors engineering" to "man-machine interface" to "Manprint," with the ultimate goal being to achieve autonomous operation of many complex subsystem functions with minimal labor or human intervention. The major drivers in this trend toward autonomous operation have been lethality, survivability and strategic transportability, as well as the ever-increasing complexity of combat vehicle systems introduced by rapid technological change. One of the last frontiers in the U.S. main battle tank is the inevitable automation of the Ammunition Loading System (ALS).

Advanced electro-optics, fire controls, kinetic penetrators and turret stabilization systems enable the crew to acquire, engage and destroy targets at greater ranges while aggressively moving cross-country. This accurate, fire-on-the-move capability is now limited only by the loader's ability to ram another round into the breech while undergoing the disorienting effects of roll, pitch and yaw in a 40 m.p.h. capable M1A1/A2 Abrams tank! Automation can provide consistent and high reload rates under fairly extreme cross-country conditions.

One of the advanced survivability features of the current Abrams tank is the compartmentalization of the 120mm ammunition, which affords the crew a high level of protection from the effects of secondary explosions if the magazine is penetrated. This protection is diminished during round transfer for loading, at which time the large magazine door is briefly opened. Automation of the loading process can reduce the time period of exposure, as well as reduce the area which must be opened to handle the round.

Future tanks will be required to provide the same (or higher) level of crew protection as the M1A2 Abrams, but at a substantially reduced gross vehicle weight (40-50 tons). Some

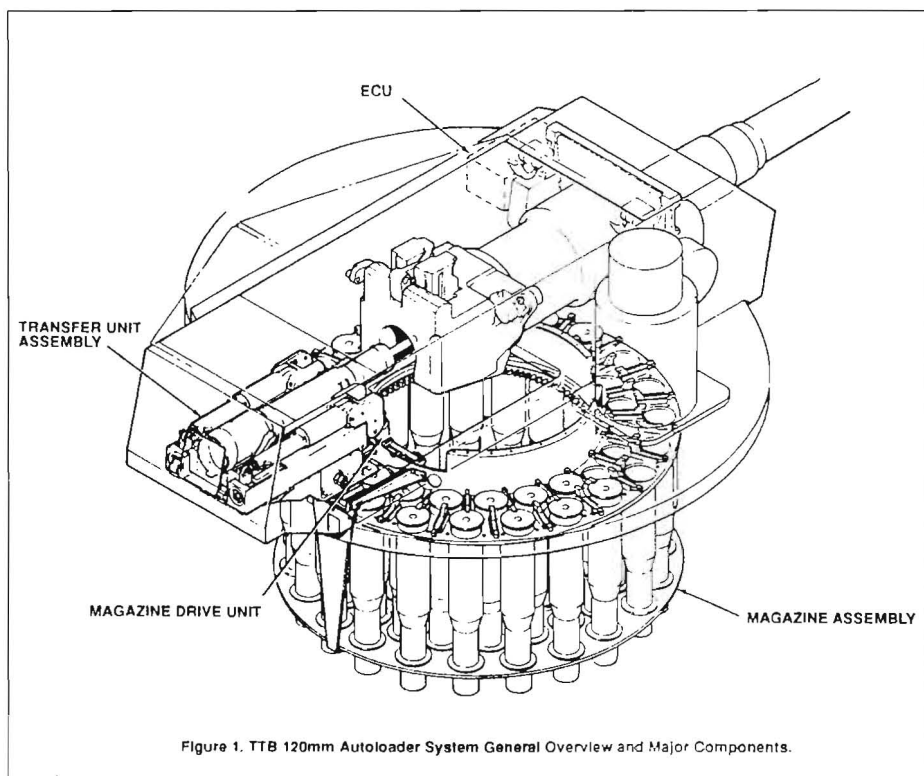


Figure 1. TTB 120mm Autoloader System General Overview and Major Components.

weight reduction will be realized through advanced composite armor and active vehicle defense systems, but most weight savings will be realized through the reduction of the overall armor envelope. This means lowering the crew size, which in turn requires reducing the crew's workload and enhancing

crew efficiency and combat effectiveness through automation. The reduction in tank size will positively effect survivability and significantly enhance the ability to deploy U.S. based combat power abroad.

The Future Main Battle Tank (FMBT) must capitalize on a revolu-

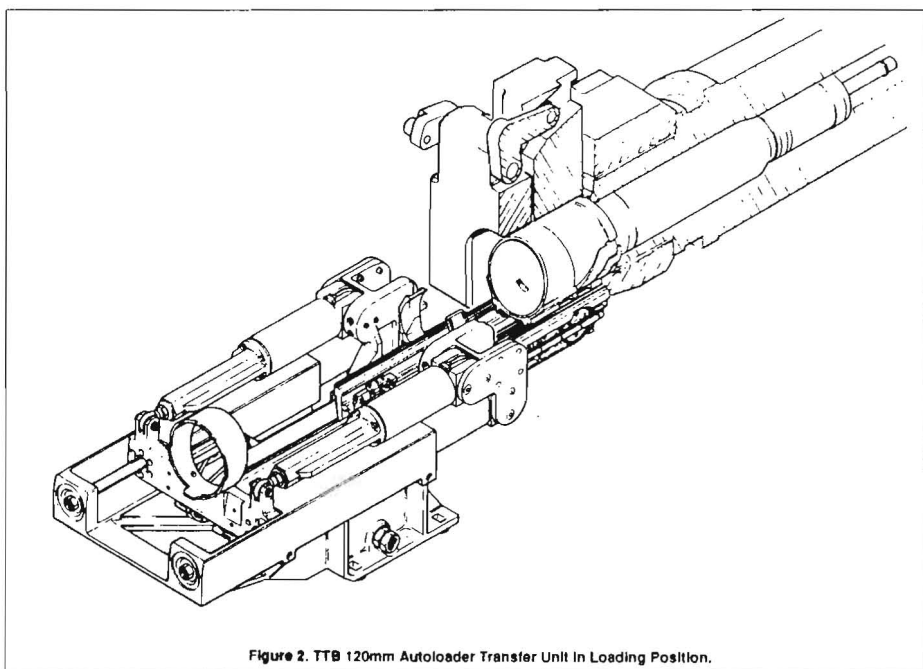


Figure 2. TTB 120mm Autoloader Transfer Unit in Loading Position.

By  
Dr. Asher H. Sharoni and  
Lawrence D. Bacon

tionary design and development philosophy as a completely integrated, multipurpose weapon system. Since one of the principal contributors to lethality is the main gun rate of fire (ROF), it must be considered as a major design driver for any future tank configuration. Consequently, future tanks (and major upgrades to existing tanks) will most likely be equipped with an Automatic Loading System (ALS) that reduces crew workload and allows an unprecedented, continuous rate of fire while on the move. The main gun and the ALS must be considered as a fully integrated weapon system to reflect the close interrelationship and dependency between the gun, ammunition and lethality. FMBT's and major tank upgrades will be equipped with state-of-the-art Battlefield Management Systems (BMS) and fire control systems.

These systems will be comprised of multi-sensor targeting and fire control with automatic air/ground target acquisition through thermal imagery and/or millimeter-wave radar processing and tracking. The BMS will provide a day/night integrated armament system capable of automatically engaging multiple targets, with the option of no human intervention. A high rate automatic loader must be incorporated to fully exploit the capability of modern battlefield management systems and "fire-on-the-move" lethality. Automation lessens the crew workload and makes it feasible to contemplate novel tank configurations and smaller tank crews.

An automatic loading system permits development of an unmanned turret and lends itself favorably to the reduction of the four man crew. It substantially increases the rate of fire under all conditions, provides the capability to rapidly engage multiple targets and ultimately contributes to the tank's overall survivability. An un-

manned turret dramatically reduces volume and weight, yielding a much lighter tank with a smaller silhouette. If the conventional manned turret arrangement is maintained in the future, or if an automatic loading system is introduced into an existing tank turret, the fourth crew member's role could be expanded to data management and target acquisition, or else eliminated. For example, the introduction of battlefield management into the M1A2 may be best exploited by a full-time data manager. Tank maintenance, perimeter security and the 24 hour battlefield are other considerations in establishing crew size (the three-versus-four-man-crew is a doctrinal issue and should not be driven by engineering considerations).

Since lethality is a principal design driver, any rational design approach for a future main battle tank will commence with the selection of the armament system, to include the main gun and the ALS, continue with the selection of a conventional or unmanned turret, and conclude with the remainder of the tank literally "built" around the integrated weapon system.

The purpose of this article is to discuss various design approaches to Automatic Loading Systems (ALS) and to outline the effect they may have on the overall tank configuration and its combat effectiveness. Our commentary will be based upon the design experience accumulated through sixteen years involvement in various U.S. ammunition autoloading development programs, and through expertise the authors have developed over a career of involvement with main battle tanks of European, U.S. and Soviet design. In the discussion of different design approaches, we will provide a brief overview of previous experience in various ALS design and development programs undertaken for the U.S. military.

### **General Dynamics Tank Test Bed (TTB) Demonstration Vehicle**

In 1983, the U.S. Army Tank Automotive Command (TACOM) awarded a contract for design, fabrication, and demonstration of a "brassboard" 120mm autoloader transfer mechanism. This device was required to cycle ammunition from a designated storage position to a simulated gun breech and back, at 12 rounds/minute, while leaving no witness marks on the fragile combustible case after the completion

of twenty loading repetitions per round. Following successful demonstration of this "proof-of-principle" device, a follow-on contract was awarded to design, build, and test the full-up autoloader in the Tank Test Bed turret.

The TTB Autoloader, as depicted in Figure 1 through Figure 3 (showing the autoloader major components and the Transfer Unit in particular), was a conspicuous success. The system consisted of a 44 round capacity "carousel" type mechanized magazine, located in an unmanned turret basket; a fully articulated Transfer Unit (including a Rammer) positioned at the rear of the M256 120mm cannon in the turret bustle; and a microprocessor-based, Electronic Control Unit (ECU). The system was electrohydraulically powered to utilize the existing turret power supply, and established a new performance baseline in the heretofore unpretentious field of ALS.

The TTB Autoloader successfully performed an entire array of designated functions which are typical requirements for a "generic" main battle tank autoloader:

- Rapid fire reloading of the M256 cannon at a maximum rate of 12 rounds/minute.
- Automatic ejection of spent stub cases through a small door at the rear of the turret.
- Ejection of misfired rounds.
- Restoring and optimally rear ranging (inventorying) unfired rounds in the carousel as a result of a cease fire or change of fire command.
- A "soft-present" mode of operation which allows the crew to easily and safely download ammunition from the weapon station through the ejection door at the rear of the turret.
- An upload mode, also performed at the rear of the turret at a rate of 6 to 8 rounds/minute.

The control system performed an inventory management function allowing it to quickly cycle to the nearest available selected round while minimizing center of gravity offsets and power requirement fluctuations. The system incorporated complete actuator redundancy which allowed continued operation, albeit at a lower rate, when a single point actuator failure occurred. This added reliability feature proved the feasibility of a remotely operated weapon system, and allowed

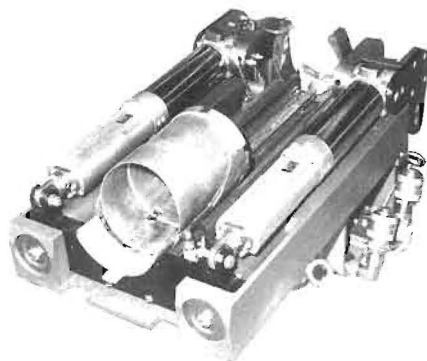


Figure 3. TTB 120mm Autoloader Transfer Unit Assembly.



Figure 4. Tank Test Bed Turret on Vehicle Motion Simulator at TACOM.

consideration of a three man vehicle crew as well.

System cycling tests exceeded 66,000 total rounds loaded and were highly successful in their results. Testing included an extensive demonstration period completed on the TACOM Vehicle Motion Simulator, during which ammunition was cycled while the weapon station was concurrently being "shaken" in a true fire-on-the-move simulation as depicted in Figure 4.

The Tank Test Bed system consisted of two major mechanical subsystems:

- 1) A rotating magazine below the turret ring that stored 44 rounds of ammunition; and
- 2) A Transfer Unit assembly which

provided all functions required to load, unload, present, on-load, off-load and immediately dispose of spent stub cases and misfires.

The autoloader was designed to accommodate a sustained rate of fire of 10 rounds/minute (with a maximum of 12 rds/min.) and had an empty weight of less than 1400 lbs. The 44 rounds stored in the magazine were individually protected, supported and isolated by full length canisters, which enveloped and supported the rounds. The magazine design allowed ready capacity expansion to 48 rounds, if required, and up to a 60 round complement was feasible. Electric power con-

sumption was negligible, limited to that required to command pilot operated servo valves and low power sensors. The system was unique in that it was a "no-spring" design and did not rely on spring loaded components of any kind for autoloader operation.

The transfer unit featured a hydraulically actuated rammer system designed to limit tensile loads applied to the stub-case to 110 pounds maximum (approximately 2 g's including gravity) and to limit compression loads applied to 220 lbs max (approximately 4 g's). Stub-cases and misfires were ejected overboard at a velocity of approximately 11 ft/sec. Ejection was due aft and level through a single ejection port/loading access door.

### FASTDRAW Mechanized Magazine

In the mid 1980's, an alternative ammunition handling system was considered for the M1A1 which incorporated a mechanized rotary magazine as depicted in Figures 6 and 7. Developed in cooperation with General Dynamics, FASTDRAW was an extremely lightweight, robust, and reliable system with numerous important advantages over "traditional" stationary rack-type storage systems. The 36 round system (identical twin magazines) was designed for the 120mm equipped M1 tank series, but can feasibly be reconfigured for a reduced ammunition complement in lighter vehicles and in smaller (105mm) caliber ammunition. The most consequential features of the FASTDRAW approach to tank ammunition storage were:

- Significantly reduced blast door complexity and sealing requirements which yielded enhanced crew safety and survivability.
- Complete separation of the two

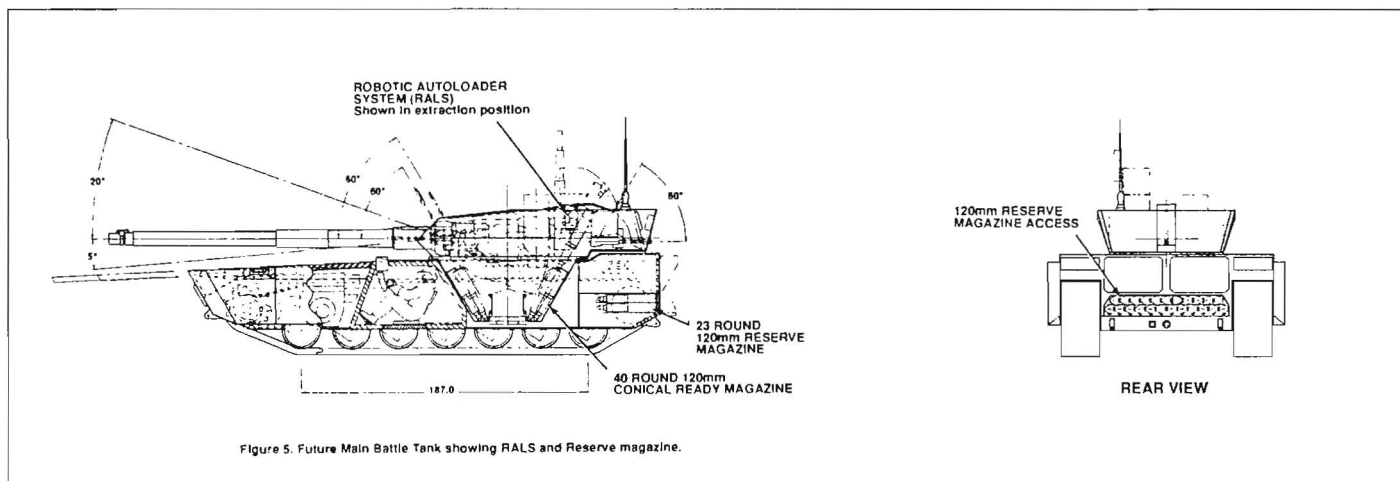


Figure 5. Future Main Battle Tank showing RALS and Reserve magazine.



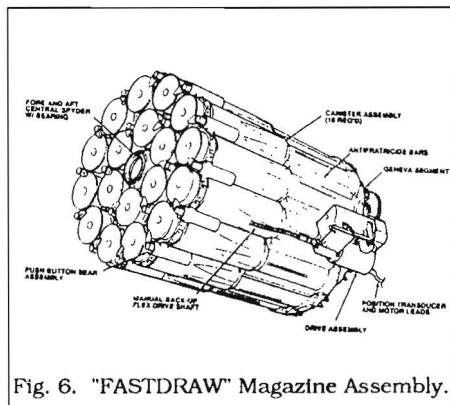


Fig. 6. "FASTDRAW" Magazine Assembly.

ammunition compartments by a solid armored wall, which would provide enhanced vehicle survivability and fightability in the event of an ammunition compartment penetration.

- Automatic presentation of the selected type of ammunition to the loader as opposed to the loader searching the rack for the required type of round.
- Reduced bustle structural weight and complexity - in the case of the M1A1 tank, 350 lbs.
- Instant accessibility of all of the stored rounds, no "disassembly" of the rack required to reach rounds in the corners of the bustle.
- Complete inter-round fratricide protection.

FASTDRAW could have been powered either electrically or hydraulically through a simple, precise Geneva drive mechanism. FASTDRAW's light weight advantage resulted from the honeycomb-like structural assembly, wherein the canisters themselves provide mutual support and rigidity, eliminating the need for heavy fore and aft structural support plates.

The FASTDRAW approach also provided the intrinsic benefit of built-in growth options, or pre-planned product improvements. The function of the carousel(s) bringing the ammunition to a single extraction point, lends itself favorably to the replacement of the fourth crewman with a robotic ammunition transfer unit. This transfer unit would work the same way as the TTB device, with the exception of an additional lateral pair of actuators required to shift the transfer unit from the magazine pick-off plane to full alignment with the gun tube and breech at the loading position.

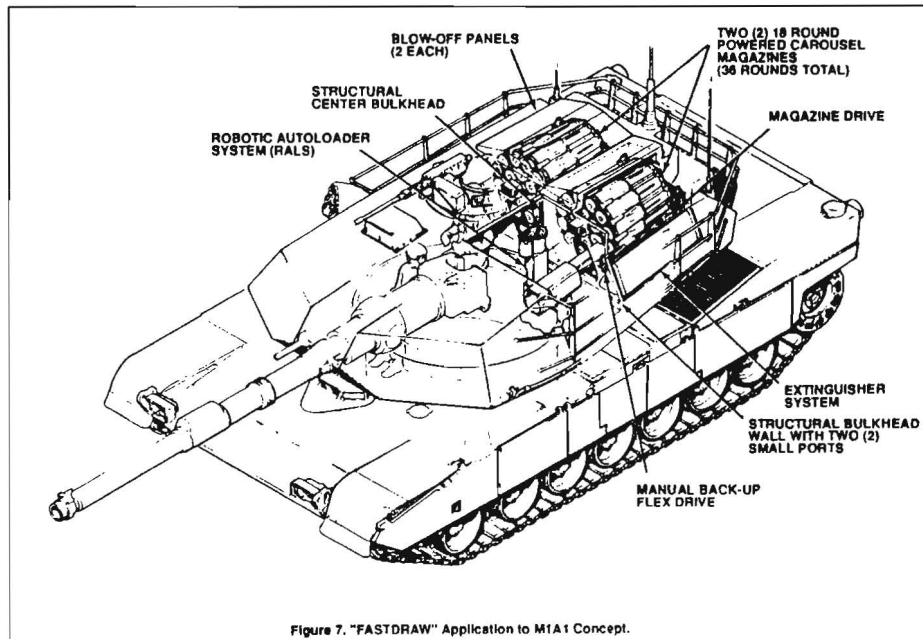


Figure 7. "FASTDRAW" Application to M1A1 Concept.

### Block III Tank Autoloader

The joint venture company AVTA (FMC/General Dynamics Land Systems), was awarded a contract for design, development, prototype fabrication and test of a next generation main battle tank, which incorporated a 140mm autoloader system. This highly complex requirement involved storage, transfer and loading of an extremely fragile, "two-piece" 140mm round that measured 1.5 meters in overall length. The round's fragility required particular attention to shock and vibration during storage, handling and transfer, with emphasis on controlled deceleration to ensure "soft stops".

Figures 8 and 9 are illustrations depicting several conceptual Block III designs which took into consideration an overall vehicle integration approach. Figure 8 depicts the ALS with a 40 round capacity transverse magazine arrangement, a "round swapper", a 4-round carousel and a transfer unit. The principal round path is from the storage magazine through the swapper, to the carousel to the transfer unit, and finally to the gun. Figure 9 depicts a different configuration of the ALS with a longitudinal magazine arrangement, turntable, dual round swappers, an elevation rack mechanism and a transfer unit. Both approaches utilized a canister (which may or may not be an integral part of the ammunition packaging) that provides the necessary protection and ensures round integrity at all times. The introduction of the canister concept requires the utilization of

a swapper to swap full with empty canisters. The concept depicts a well integrated ALS in the tank and shows the feasibility of such a system when incorporated into a new tank design configuration.

The Block III Tank Program was terminated due to reprioritization of the threat, although the 140mm cannon development will most likely continue. Due to the still-current sensitivity of the technology involved with this program, much detail of our ALS design cannot yet be released.

### Future Main Battle Tank (FMBT)

Figure 5 shows a conceptual design of an ALS for a FMBT based on the TTB autoloader prototype. This concept was a winning entry in a contest held by *Armor* magazine for the design of a FMBT (their winning entry was printed in the May 1994 *Museum Ordnance*). This innovative derivative provides continuous theoretical 15-16 rounds/minute loading rate capability. The system is automatic, compact, computer controlled, electrically operated, lightweight, highly reliable and remotely operated. It stores forty (40) rounds of all types which are readily available in a rotary, conical shaped magazine with anti-fratricide provisions. The autoloader is integrally installed in an unmanned, turreted "Weapon Station" with maximum protection for the crew and ammunition by way of compartmentalization and positioning of warheads as low as possible in the hull, adjacent to "blow-off" panels.

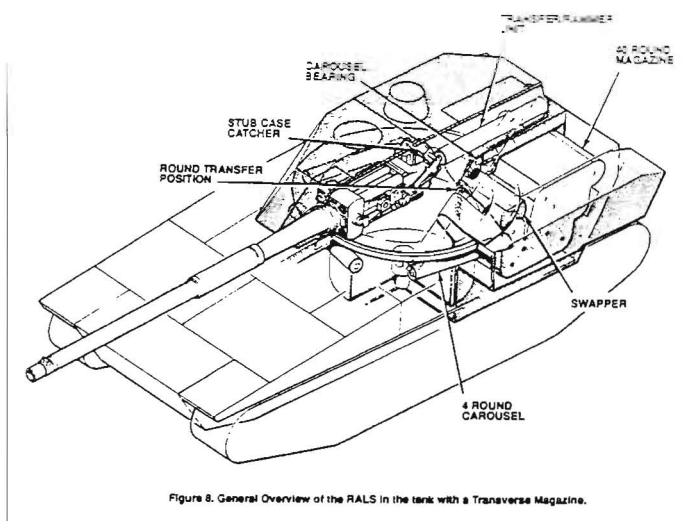


Figure 8. General Overview of the RALS in the tank with a Transverse Magazine.

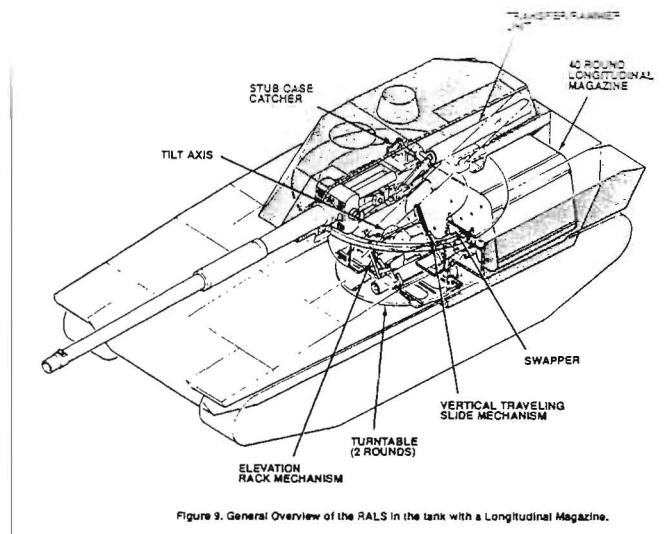


Figure 9. General Overview of the RALS in the tank with a Longitudinal Magazine.

This conceptual system offers full inventory control, optional round replacement and a misfire ejection port that will interface with an automated reload system such as the Future Armor Resupply Vehicle (FARV). An additional 23 rounds are stored low in the rear of the hull in a reserve magazine. An additional transfer mechanism can be devised to automatically transfer rounds from the reserve magazine to the ready magazine. This arrangement would make the entire complement of 63 rounds available to the ALS without the crew leaving its compartment. This feature is particularly important when the tank is operating in a contaminated, NBC environment where leaving the crew compartment in the tank is undesirable. The ALS and the Battlefield Management System combined provide a superior kill capability and substantially increase shock effect and weapon system lethality.

## Conclusion

The main battle tank will remain a viable, necessary weapon system for the foreseeable future. Continued technological improvements will result in reduced volume, lighter vehicles, but the tank's historical mission will remain the same: shock, mobility and firepower. Automatic loading systems will become standard, providing reliable, rapid reloading thereby increasing lethality. Crew member duties will be readjusted to address other battlefield management technological needs. Efforts at TACOM and Picatinny Arsenal for a 120mm compact tank autoloader and a 155mm howitzer autoloader are indications of this development trend. Just as we would never consider sending an infantryman into battle with a bolt-action rifle, future tank designs will fully automate the loading function.

Western Design Corporation (WDC), a small defense company in Irvine, California, specializes in the design, development and production of ammunition and material handling systems for the U.S. and International military markets. WDC's track record includes a variety of air, land and seaborne weapon systems which require automated feed, resupply and optimized ammunition packaging.

Mr. Lawrence D. Bacon is the Director of Graphic Arts at WDC where for the past 16 years he has been responsible for creating numerous concepts for automatic ammunition handling, loading and storage systems.

Dr. Asher H. Sharoni is the Director of Engineering at WDC. He holds a Sc.D. in Mechanical Engineering from MIT and a M.Sc. from the Technion, Israel Institute of Technology. Dr. Sharoni is a former Colonel in the Israeli Defense Forces, where he was involved in various armored weapon developments.

# Tech Intell

During World War II, the United States Army deployed small teams of ordnance personnel throughout the European and Pacific theaters of operation. The task of these teams was to report on each type of enemy ordnance and equipment as they would encounter it in the field.

Their reports and summaries were sometimes the first information available on a vehicle, gun, tank, or other system. Each report was usually accompanied by several photographs and a description of the subject. These reports were not compiled in a rear area motor pool but right on the front lines.

Darlington Productions has put together a selection of these reports in Volume 1 of **TECH INTELL**. This soft-cover book is 132 pages long with 141 photographs. Formatted with the look of the original reports, these reports have not been altered or edited and appear as they did in 1944/45.

Included in Volume 1 are reports on the Mautier armored half-

track, Tiger II, Panther disguised as an M-10, Sd.Kfz 251 with a flatbed cargo deck, Bergepanther, Sturmgeschütz disguised as U.S., Pz.Kfz IV observation tank, German radio vehicle on a French half-track, Flak towers on railway cars, Panther pillbox, "new" German full-tracked carrier, Jagdtiger, Sd.Kfz 251 with PaK 40 75mm, Sd.Kfz 140/1, Flakdrilling on U.S. M8 armored car, an RSO with PaK 40 75mm, "German Automotive" material, Tiger B transport trailer, among others.

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# C<sup>3</sup>I

Sharkhunters International, a global organization dedicated to the preservation and study of submarines, their history, and their men, is organizing a trip to Russia planned for late July. From the date of departure to the date of return is sixteen days.

The trip plans to visit a number of naval installations and vessels in St. Petersburg, Simpheropol, and Sevastopol. The trip also includes a visit to Moscow with days planned at the Kubinka Museum and the Air Force Museum at Monino. The group has been told that at least one T-34 will be available for "tank rides" while at Kubinka.

The tour costs about \$3995 (all inclusive). For more information contact Harry Cooper at Sharkhunters, P.O. Box 1539, Hernando, FL 34442 for more information and details.

If you do travel with the group, please tell Harry that you are from *Museum Ordnance* and he will make a \$100 donation to the Ordnance Museum Foundation in your name.

The East Coast Branch of the Western Front Association will be holding their Winter 1995 meeting at the Aberdeen Sheraton on Saturday, March 4.

Some of the seminars at this meeting of WWI historians will be: The Blockade and Destruction of the German Light Cruiser *Konigsberg*; Tunneling in France; Verdun and Battlefield Visit; America at War, plus several others.

Registration for this one-day event is \$15.00 per person.

For more information contact the Western Front Association, P.O. Box 2305, Elkton, MD 21922.

By looking at the ad for back issues on page 31, you will note that quite a few issues are sold out. I do not have any more copies of these issues, although some of the hobby shops that carry the magazine may indeed have some of them.

Unfortunately, it is not convenient for me to honor requests for photocopies of these sold out issues. Therefore, and on strict conditions, I am allowing *Museum Ordnance* readers to

advertise for, and sell photocopies of the issues of *Museum Ordnance* that are sold out. No reproduction is permitted for issues that are still available and offered by Darlington Productions.

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Recently in Iran, Brig. Gen. Ahmad Dadbin announced that the Army had developed a new main battle tank (MBT) to equip its armed forces with. At that time, no other details or information was provided. It was widely speculated that this new tank would be built around Soviet T-72 technology and frame.

However, Jane's Defense Weekly has published a photo (albeit a poor one) and has stated that the new tank is built around the M47/48/60 technology and frame. The tank is to be called the Zulfiqar.

In its inventory it is believed that Iran has about 270 of these US-built series tanks with the balance of their 1250 tank inventory being made up mostly of Soviet T-54/55/62/72's with some-British-built Chieftains as well.

While researching material for the Tech Intell series of books, I was made aware of museum of military and technical intelligence in Largo, Florida. Owned and operated by Col. William Howard, himself a former technical intelligence officer, he has turned his house into a collection of weapons, radios, uniforms, photos and many other items of US and foreign materiel.

Howard has also put together several spiral-bound publications that give historical perspective to the role played by T.I. with the US Army.

For more information on the collection, or to arrange a visit contact William Howard, 219 Harborview Lane, Largo, FL 34640 or call at (813) 585-7756. Tours must be arranged in advanced and tour sizes are limited.

Armed Forces Day at Aberdeen Proving Ground is scheduled for May 20, 1995. As usual this is not the day to visit the



museum and take pictures of the collection — there are just too many people for that. However, it is a good day to see the wide variety of historic military vehicles brought by various collectors and clubs for the military vehicle rally (last year included a Saladin armored car). Combat Systems Test Activity (CSTA), which is the arm at Aberdeen that actually tests all of the vehicles that are brought here, will bring out many of them for display. For example, last year the M109A6 Paladin, a LAV, the new light howitzer and the Fox NBC vehicle were on display — photo takers welcome!

Unfortunately, at least as of right now, there are still no plans to reinstitute the live fire demonstrations that proved so popular and a big attendance draw to Armed Forces Days' of several years ago. But still there is much to see and do. The wife and kids will also enjoy it so it can be a great family day as well.

Stephen 'Cookie' Sewell, a well-known armor modeler is in the process of collecting information on the location and types of armored vehicles on display around the world.

The purpose is to produce a Worldwide Armor Directory of armored vehicle that would allow a researcher to determine where a specific vehicle is located, what condition it is in, and how accessible it is.

There are a tremendous number of small museums and collections, not to mention the 'gate guards' and city square monuments that have military vehicles on display. This might be the best opportunity to create a single directory of these and spread the information to all that want it.

If you would like to help and can provide information from your local area or from areas you are familiar with contact Mr. Sewell at P.O. Box 331, Darlington, MD 21034.

# Curator's Column

(Continued from Page 1)

gerous to ask a trained historian to comment on the future because we are much more at home in the past but I'll give it a shot.

Very much like the old world before the "end of history" the three major threats to the United States remain the same: nuclear, biological, and chemi-

cal weapons (NBC); standing military organizations of foreign powers; and irregular forces ranging from ethnic militias to terrorists. The NBC threat, while still out there, is very much lessened with the demise of the Soviet Union. The danger is now that a third world country will obtain these type weapons to equalize their military power vis a vis the United States. No single foreign military organization will be able to beat the United States on the battlefield within the foreseeable future. This does not mean that this threat has gone completely away. If a

regularly constituted force could prolong a conflict with the United States, and inflict numerous casualties on us, the American public may well decide the contest is not worth it. I think the lesson of Vietnam and Desert Storm that our potential enemies have absorbed is that you cannot take the United States on in a symmetrical battle, however, an asymmetrical fight involving irregular forces is one that they can potentially win, if not on the battlefield, at least at the negotiating table. This fact may then argue well for irregular forces being used in conflicts with the United States. Paramilitary forces and militias such as those found in Lebanon, rogue militaries such as Haiti's and Panama's, bandits, terrorists, and narco-criminals will probably constitute the most challenging threat to the Army in the future. While they do not threaten our national survival they can, at least, embarrass us internationally. Adding to the difficulty in fighting such a force is the fact that they are unrestrained by the laws of land warfare or, in the case of terrorists and criminals, an ethical code. The United States Army is bound by an internationally recognized standard of conduct. The American people are, quite rightly, repelled by the thought of torture and inflicting casualties on noncombatants. Yet, in a war where one side is constrained by the rules of the game and the other is not, invariably, after a time, the conflict degenerates into one of the lowest common denominator. (As an example, study the French experience in Algeria.)

This then is the threat. To answer the threat the United States has had to revise its national military strategy and to redefine the capabilities necessary to execute that strategy. We are on the verge of a new wave of warfare. Let me illustrate with a paradigm drawn from history. Before 1864 war was said to be in the "agrarian" stage. Starting in that year General Grant utilizes the industrial capabilities of the North to grind down the agrarian South. We then enter the "industrial" age of war which has lasted up to about 1989. With the start of Operation Just Cause (Panama) and Desert Storm (Kuwait) we are entering the "informational" age of war. (If you want to read more on this subject I recommend — A. and H. Toffer, War and Anti-War, 1993.) We have gone from a time when information available

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(Continued on Next Page)



to the commander was measured in days and weeks (agrarian war), to one measured in hours and minutes (industrial war), to now one of observations in real time (informational age war). The United States must be prepared to fight and win on the informational age battlefield against an enemy that is as technologically sophisticated and be able to meet the threat posed by technological midgets. More likely, we will face an enemy that has a foot in the agrarian age and the informational age. For instance, how do we fight a foe armed with rather primitive weapons but communicates on cellular telephones and has as his primary intelligence source CNN?

The most important element of the Army in the 21st Century is the American soldier. Today the quality of our soldiers, sailors, airmen, and Marines is the most educated and most disciplined in our nation's history. They are easier to train and can perform increasing complex and highly skilled tasks better than their predecessors of just ten years ago. To quote General Gordon R. Sullivan—"War is a human endeavor, fought by men and women of courage. The machines, the technology, help; but it is the individual's skill and courage that make the crucial difference." Training is the key to the future. Soldiers in the future will have to deal with ambiguous situations where there is no "school solution." They are going to have to think for themselves. Having enough money to train realistically is another problem altogether. You, as a citizen, have a stake in this future. You need to keep yourselves informed as to the state of our national defense and speak out if necessary.

There are many many other issues that can be talked about and I'll do so in future columns devoted to the Army of the XXIst Century.

**Darlington Productions is seeking to expand its series of Museum Ordnance Specials.** If you have an idea for a Special, which is a heavily illustrated, magazine-format publication focusing on a particular vehicle, or series of vehicles, contact Darlington Productions for more information. The address and phone number can be found at the bottom of page three.

## Sd.Kfz 251, Ausf. C: A Selection of Interior Photos from Aberdeen

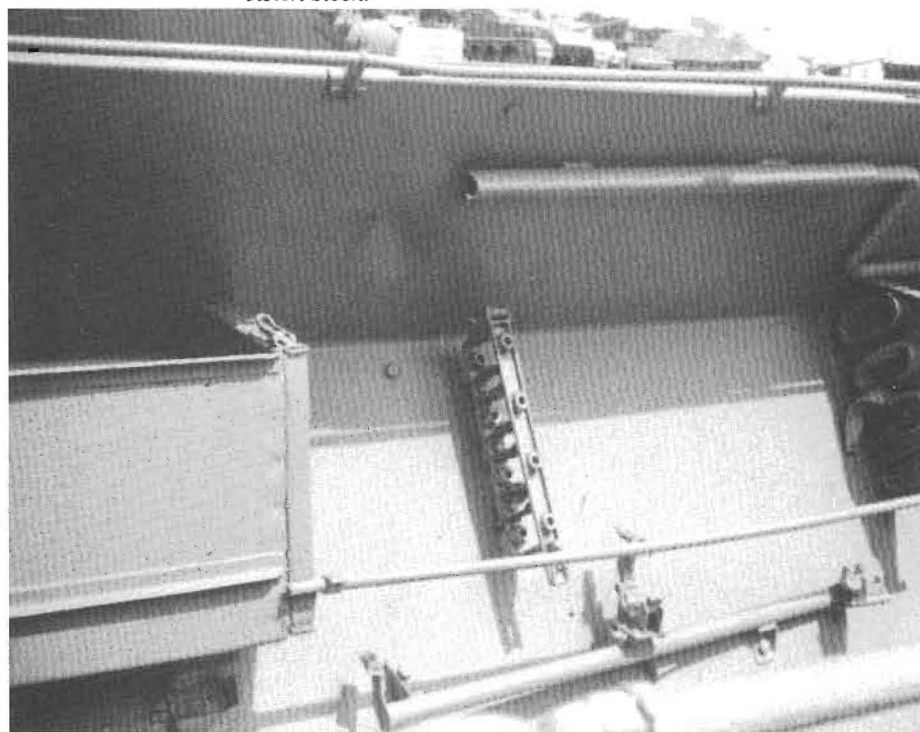
Photos by Steven Andreano

Although the 251 is no longer at Aberdeen, you can not get enough pictures of this ubiquitous beast. The "C" version was the most widely used of the four 251 models (A, B, C, and D).

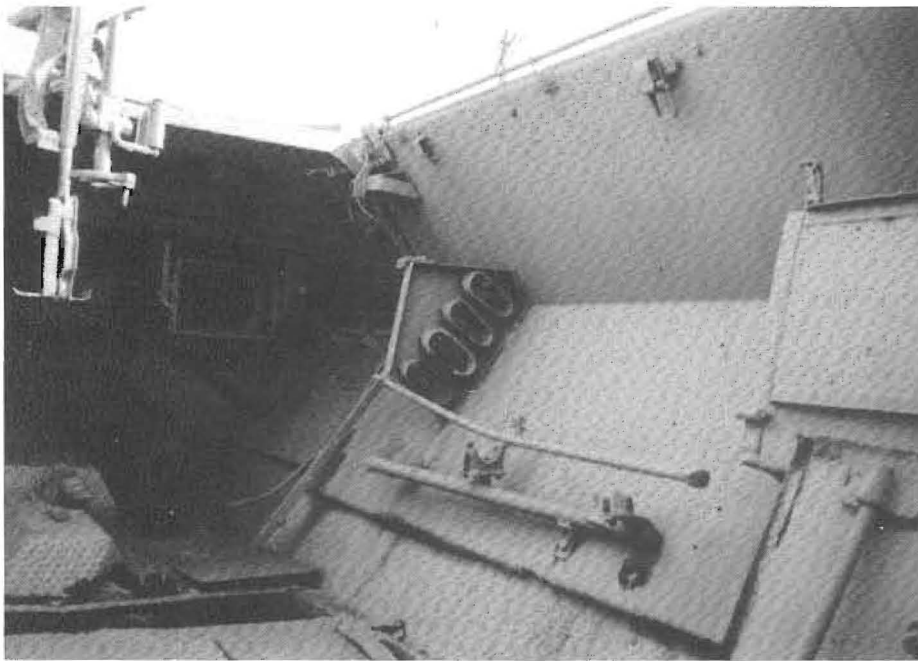
We have provided several useful interior photos of the Aberdeen 251 before it was shipped out.



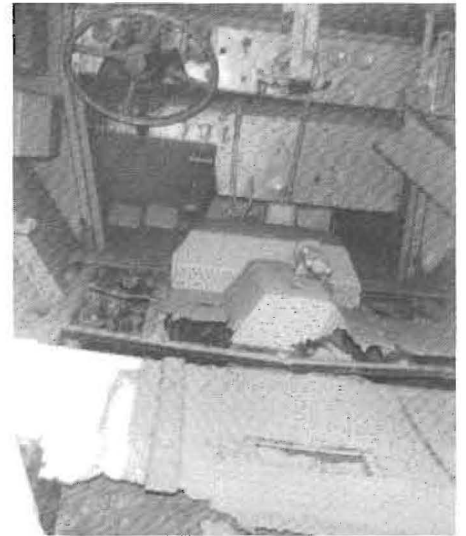
*Another close view farther forward on the right side. You can clearly see the holders for the butt end of the rifles. This rack would normally have a padded wall on the outside that would form the back rest for the bench seat along the side. The frames and clips along the right side of the commander's position (along the side wall) were for stowage of an MP40, ammunition clips and other crew items. Also on note is the radio cable lead and junction box in the upper center and the side vision block.*



*The left side again showing a rifle. Also visible is the rod for attaching various crew items along the top edge of the vehicle, the manual starter crank, and the rack for one of the MG34's below the rifle rack.*



*Looking along the right side of the interior you can see the rifle rack on the side wall and the radio rack suspended from above the vehicle*

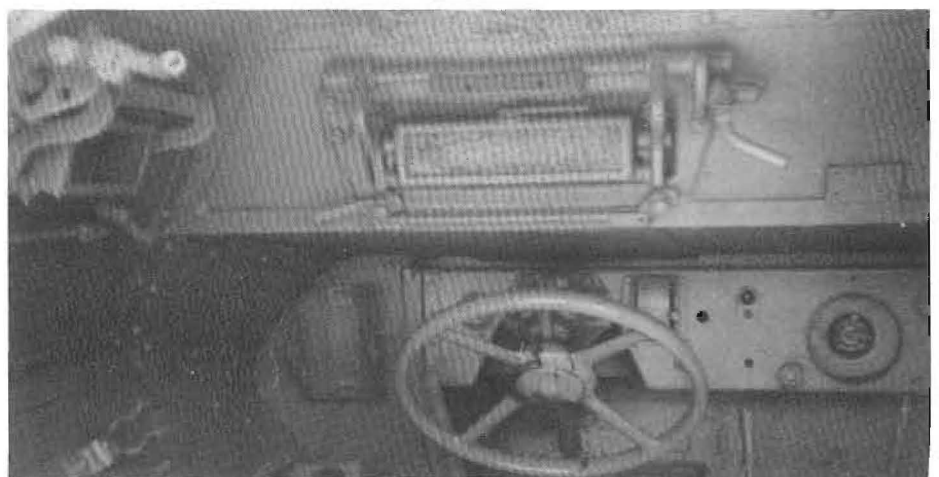


*In this view you can see (well, almost) the unusual angle that the steering wheel was aligned at, roughly a reverse downward slope. In the center you can see (from right to left) the gear shift lever, the transfer box lever, and the hand brake. Also visible is the distinctive design of the accelerator pedal.*



*One major improvement that was a long time in coming to the museum was the construction of the concrete pads. Until they were built, the artifacts not only were constantly exposed to the elements (which they still are) but they also sat inches deep in the ground. You can also see that the front tires are held off the ground to help slow the decay.*

*Of real note in this photo is the framing around the separate plates that were riveted together on the 251 body. Above the driver's visor and especially to the driver's left the frame is very visible.*



# THE AMERICAN SCOUT CAR S1

Australia received much US-manufactured equipment during the Second World War, generally as part of Lend-Lease arrangements. Many armored vehicles were included in these deliveries, in particular the M3 Light and M3 Medium series of tanks, and Staghound T17E1 Armored and M3A1 White Scout Cars. Little mention is made of the Reverse Lend-Lease Scheme, whereby Australia provided vehicles to the United States Armed Forces in Australia (USAFIA). These were generally for "domestic" purposes in the form of passenger cars, utilities (pick-ups), and conventional trucks.

In an unusual reverse Lend-Lease scheme, the Australian Government built some special scout cars for the

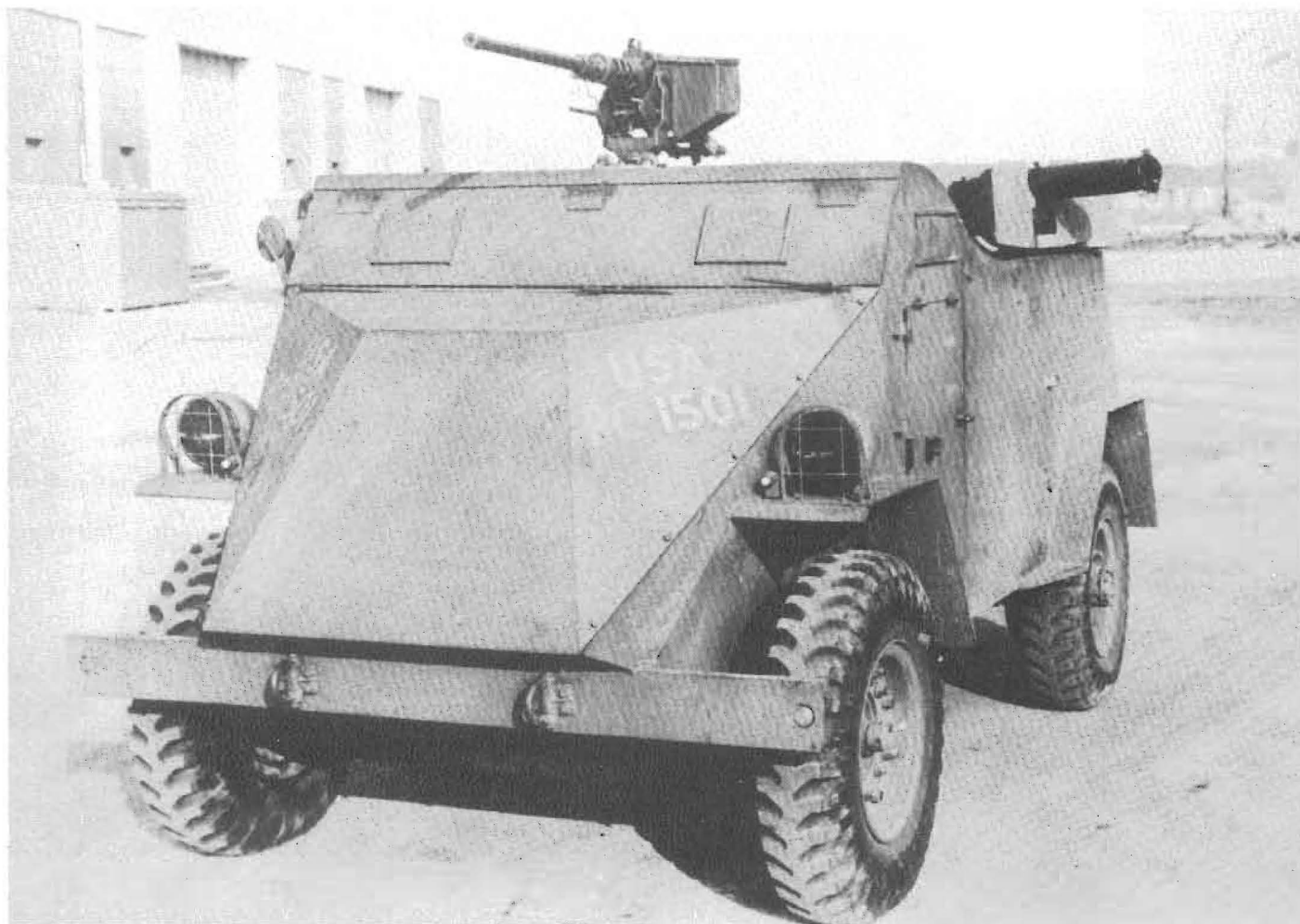
United States Government, to be used by the USAFIA. US Forces began to be stationed in Australia from January 1942, and during April an order was given to the Australian Directorate of Armoured Fighting Vehicle Production (DAFVP) to build an experimental scout car for the United States Army. This was to be manufactured at the Victorian Railways Workshop at Newport. The pilot model was built from mild steel plate, had an open top and mounted two or three machine guns. The chassis used was a Canadian Military Pattern (CMP) Ford 15 cwt 4 x 2 type (F15). The vehicle was completed by the end of May 1942.

The mild-steel pilot model was tested by the Ordnance Section of the USAFIA, and an order for five vehicles was given to the Australian Ministry of Munitions, with a further order of 45

being given during June 1942. The armor plate used for the construction of the vehicles was known as ABP 3 - Australian Bullet Proof - which had been developed in Australia for the manufacture of light armored vehicles. A feature of this plate was that it was homogeneous machinable armor and could be welded. This greatly simplified the process of fabrication of hulls for armored vehicles, which was very important considering the small size of Australian manufacturing industry at that time.

The vehicle was variously shown in publications as Scout Car S1 (American), Scout Car SC4, and Scout Car (U.S.A), with the S1 designation being the most common. The Canadian chassis had a wheelbase of 101 inches and was powered by a 95 bhp Ford V8 engine and used a four speed manual

By  
Paul D. Handel



*The Scout Car S1 front left view. The windscreen visor is in the closed position. It is thought that this vehicle is the prototype, with the registration USA RC -1501.*





*The prototype viewed from the right side. The stowage of the machine gun tripods on the rear hull, and the pioneer tools on the right side can be seen.*

transmission. The tires were 9.00 x 16 Runflat. The body was open-topped and similar in concept to the M3A1 White Scout Car. Access was via two side doors, each with a hinged flap and visor which could be dropped in a similar manner to the M3A1 Scout Car. An armored visor was mounted over the windscreen, and again this could be raised and lowered. The bonnet was bolted to the front cowl, enabling removal to service the engine and other mechanicals. In the forward section of the interior was a driver's/commander's compartment, with one seat either side, of the transmission. Instrumentation was standard Canadian Ford, and the steering wheel was mounted on the right hand side, as with all Australian-made vehicles.

A skate rail was mounted around the inner top of the hull, and on this could be mounted standard skate mounts, capable of mounting machine guns. Armament carried on the vehicle comprised a .50 cal. M2 air-cooled machine gun, two .30 cal. M1917A1 water-cooled machine gun, and a .45 inch sub-machine gun. Small shields

were used on the .30 cal. MG's. The rear compartment had three stowage lockers, one on the left side and two on

the right. Three crew seats, one each facing right, left, and to the rear completed the interior. It appears that the



*The 4 x 4 vehicle with canvas canopy erected. Note that this has full mudguards on the front. The driver's visor is open and the driver's door flap is down.*



fuel tanks were located under the floor, as a lift up panel was located behind the left front seat.

External stowage was limited to pioneer tools carried on the right side, and three tripods for the machine guns was carried on the sloping rear plate.

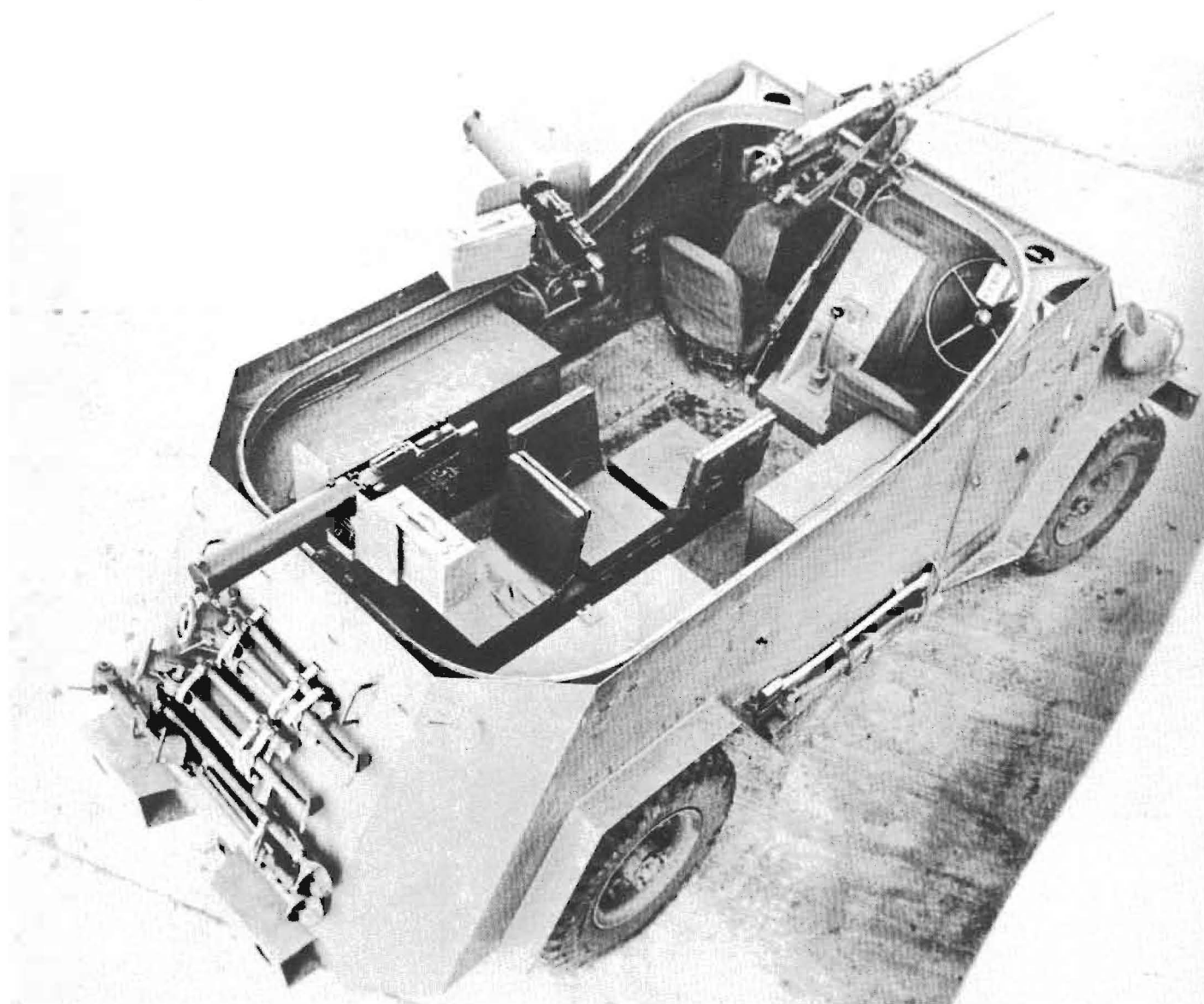
Production began at the Victorian Railway Workshops in mid-July 1942 with the five vehicles of that order being completed by the end of August. In early August, production commenced on the second order for 45 vehicles at the Ford Motor Company's plant at Geelong. The armor plate sets arrived on time from the Lysaght's Newcastle Works, but delays in the supply of gun rail/mounting drawings from the US Ordnance Services and modifications required to the gasoline tanks meant that the first vehicle from Ford was not delivered until early December.

The use of a 4 x 2 chassis was probably made, on the basis of expediency, being immediately available. As the vehicle probably weighed over four tons, its performance would not have been brilliant cross country. It was this poor performance which prompted a request from the US Army in February 1943 to complete one vehicle in 4 x 4 configuration. Accordingly a Ford 15 cwt 4 x 4 chassis (F15A) was used for one vehicle, although nothing is known of its capabilities and performance.

The project was completed in early May 1943. Very little is known of the vehicles' use by the US Forces. Several were photographed in US vehicle parks in Brisbane, during 1943. Most vehicles were returned to Australian authorities during 1944, and these were to be credited to the U.S. account under the Lend-Lease Scheme.

The U.S. registration numbers were allocated to the vehicles. Typical numbers were U.S.A. U 601030 to U.S.A. U 601044 and U.S.A. U 604005 (this was the 4 x 4 version) to U.S.A. U 604007. One vehicle, most probably the pilot model was numbered U.S.A. RC-1501. (Can any US reader shed any light upon the U and RC prefixes so often seen on Australian vehicles supplied to US Forces?)

It is possible that the vehicles were used for defence of installations and airfields, but nothing definite on their use, has come to light. If any reader can locate anything in US records on these vehicles then the author would like to hear from them. The author is indebted to Laurie Wright and Major Fred Crismon for their assistance in compiling the story of this unusual vehicle.



*An overhead view showing the internal layout of the vehicle. All machine guns are mounted. Note the right hand driving position.*

# The Alkett Minenraumsfahrzeug

The Military History Museum of Armored Vehicle Technology (Voenno-istoricheskogo muzeya BTVT) is Russia's largest and most comprehensive armored vehicle museum. It is located in Kubinka, about 40 km southwest of Moscow on the main Moscow-Minsk highway.

The museum was established after World War II as an exposition for Soviet military engineers working at the Scientific Research Institute of Armored Vehicle Technology (NIIBT) that occupies the main base at Kubinka. As related in an earlier issue of *Museum Ordnance*, Kubinka was closed to foreign visitors until recently. Since 1991, I have visited the museum on three occasions, and have been allowed to

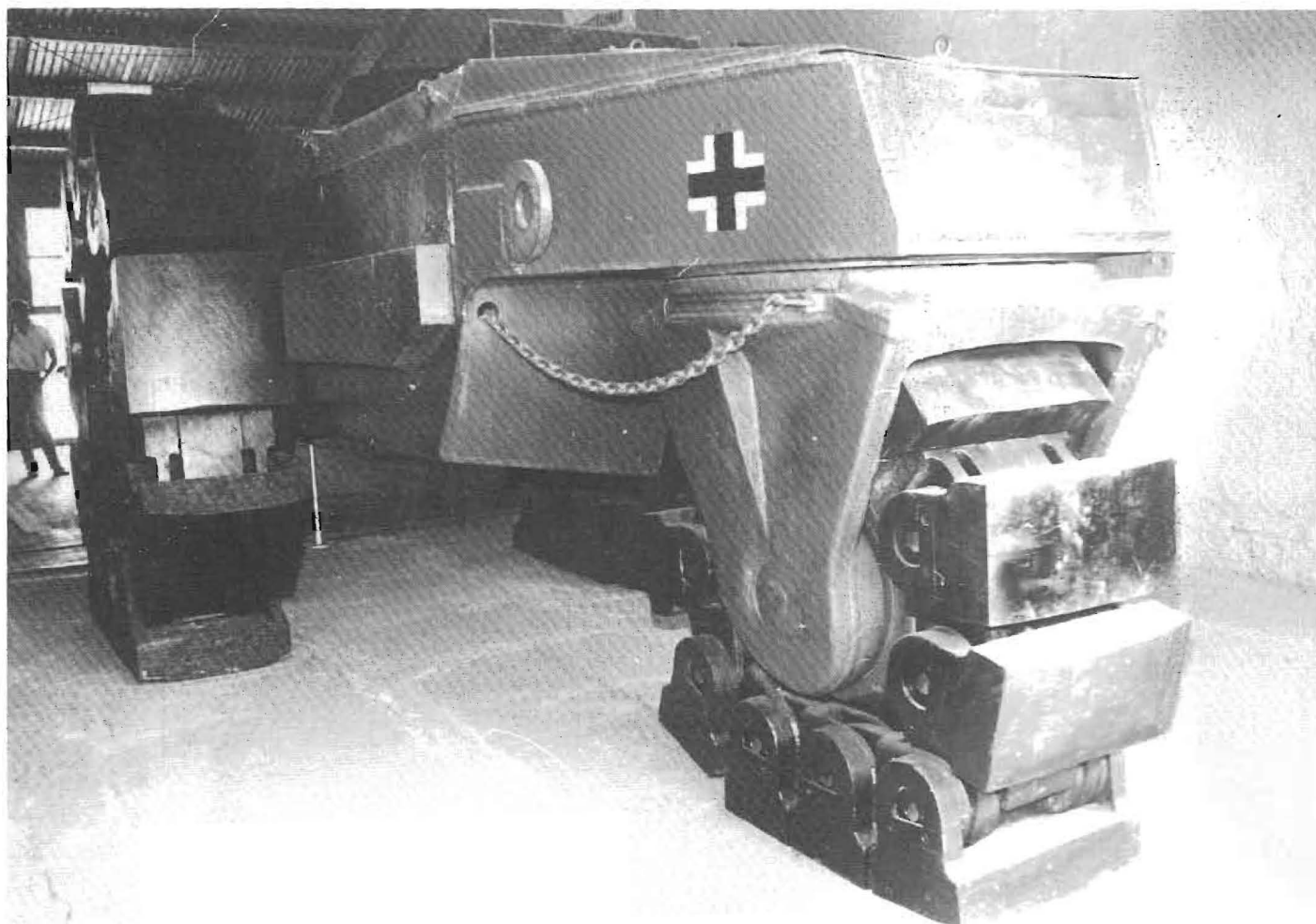
photograph most of the exhibits during some of my trips. This is the first article of a series on some of the lesser known vehicles contained in this extraordinary Russian collection.

Although the subject of German World War II armored vehicles is more thoroughly covered in English language accounts than any other subject, some mysteries do occasionally crop up. When I first visited Kubinka in 1991, I was confronted with several German vehicles I had never seen before, the Alkett mine-roller being one of the strangest.

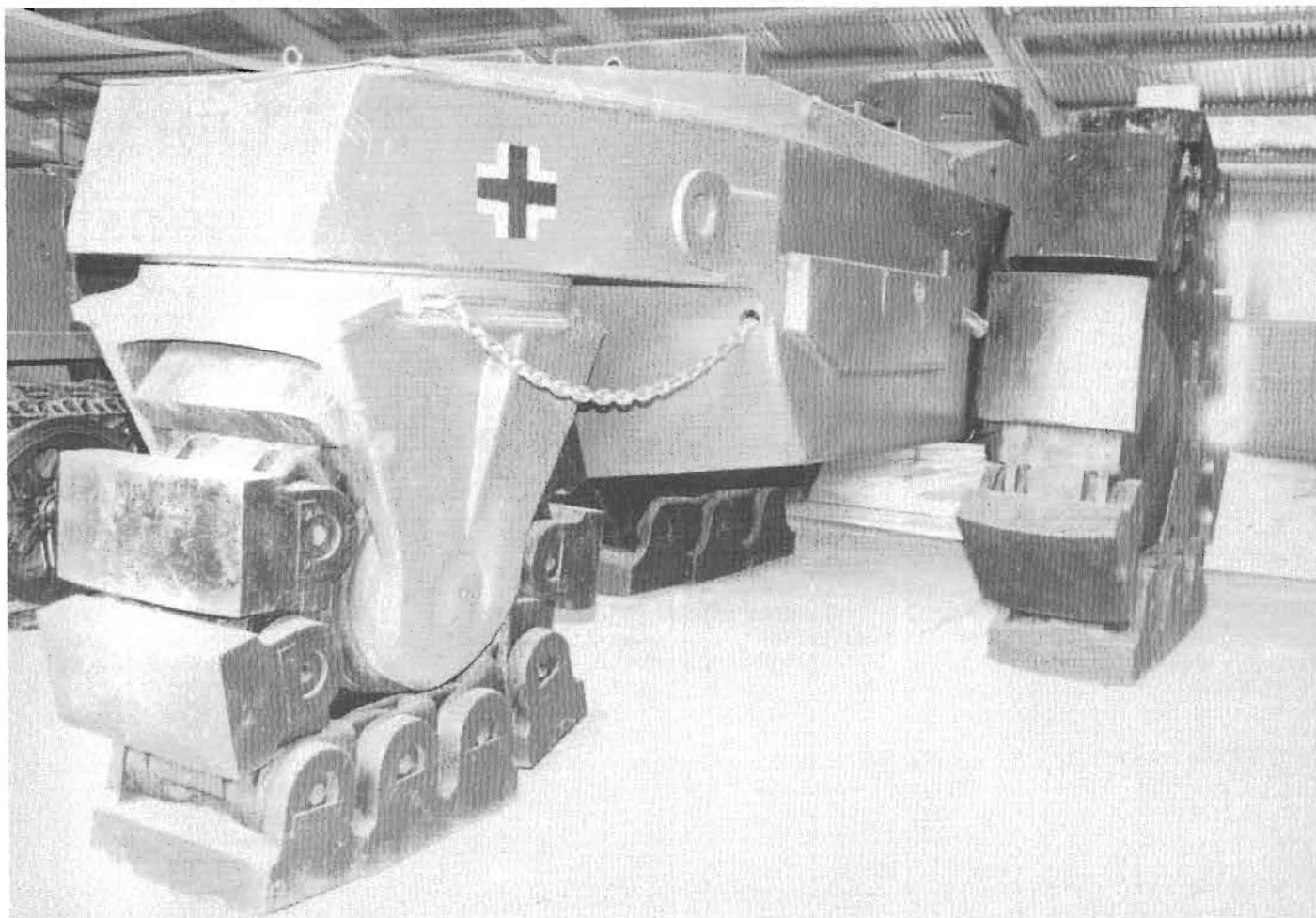
This vehicle is in fact a large, armored tricycle. It was part of a 1943-44 German program to develop a vehicle

capable of breaching minefields. Two competitive prototypes were developed, the Alkett mine-roller, and a more conventionally configured, articulated vehicle by Krupp, called the Raumer-S. The Krupp Raumer-S is the better known of the pair, as the prototype was captured and photographed by the US Army in 1945 and can be found in the better reference books on German AFVs. The Alkett vehicle, on the other hand, seems to have slipped from the pages of history until the Kubinka museum was opened.

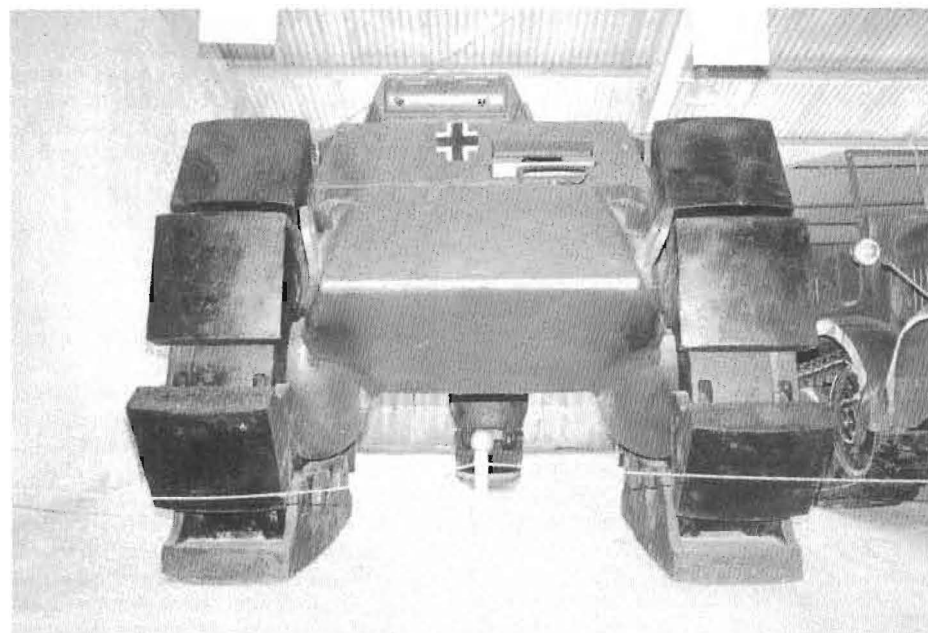
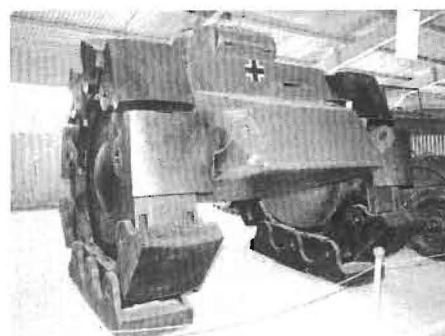
Very little is known about the vehicle, and Russian sources provide no information on whether the vehicle was captured in combat or located after the war at a German test establishment.



*This terrific view of the left-side rear of the Minenraumsfahrzeug clearly shows the heavy cleats that made up the "wheels" of this minefield-breaching vehicle. Also clear is the steering chain.*



*To date this vehicle has asked more questions than it has answered. Another view of the rear, this time from the right side.*



*Whole new meaning to the phrase "big wheel!" The turret appears to be a standard Pz. I.*

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# A LETHAL TYPHOON

by Jeffrey McKaughan

Shortly before the crossing of the Rhine in early February 1945, the British Coldstream Guards Armoured Division came up with the novel idea of mounting the air-to-ground rockets, of the kind used on British Typhoon fighters, to Sherman tank turrets. Research does not really indicate the who or whys for the idea, but it seems limited to the Coldstream Guards. David Fletcher, librarian at the Bovington Tank Museum in England, believes that it was probably limited to the Sherman V's of the 1st Battalion of the Coldstream Guards.

The mountings used were the standard Typhoon rails and accessories which consisted of two straight tubular rails (about 1 inch in diameter), connected about midway along the length and attached to a turntable above the rails. The turntable appeared to be a fitting used to align the rails when mounted under the wing of a Typhoon and were used on the Sherman as an attachment point to the turret. Two struts were simply welded to the turret and the turntable.

The rails were capable of elevation and depression via a simple turnbuckle attached to the rear end of the rails and to the rear struts welded to the turret sides. This arrangement allowed for tangent elevations between 125 mils and 190 mils. Based on trial and error it was agreed that one rocket would be set at 150 mils and the other at 160 mils. All things being equal (meaning the tank is on flat ground, stationary,

and aimed at a target at the same elevation), the first setting would hit targets out to about 400 yards while the second would go out roughly 800 yards.

The attached sketches give the general layout of the arrangement. The front of the rails sit about level with the mantlet. The minimum distance for the rails from the sides of the turret is twelve inches. The overall width of the tank was increased slightly as the rails overhang the hull sides slightly.

Firing controls for the rockets were affixed to the commander's cupola. Power was supplied from the tank's battery to a standard two-volt electric primer. There were two firing buttons, one controlling the rocket on either side of the turret. It was possible to sling an additional rocket underneath the rocket mounted to the rail. The two rockets on each side were fired simultaneously when the button was triggered.

The effects of the rockets were devastating, however, accuracy was never their strong suit. Keeping in mind that the rockets were designed to be fired in flight from a fighter at speed in a slight dive (speeds in the 400 mph range). These same rockets were now expected to fly from a standing start. The first ten yards or so saw the rocket take a sharp drop until sufficient speed was attained for some degree of horizontal flight. To compensate for this, the rockets were angled at varying degrees, depending on the range. Basically you didn't aim the rockets — you just pointed them in the general direction and hoped!

Another solution suggested was to strengthen the shear wire that held the rocket onto the rail. A stronger wire would keep the rocket in place longer until higher thrust was built up before it snapped and released the rocket with a higher "muzzle velocity." Reports do not seem to indicate whether this was tried before the experiments terminated or not.

To reload the rocket rails or to adjust the turnbuckle (if the elevation was to be changed) required the commander,

## Rocket Firing Shermans

or other crew member, to climb from the tank and handle the job. Obviously this was not envisioned in combat situations. Once the rockets were fired they would not be reloaded until it was safe to do so. I also could find no information as to whether the Shermans carried spare rockets with them or if they came from a supply vehicle that followed.

The rockets seemed to have had the most effect against targets either in buildings or wooded areas. Again owing to the lack of precise accuracy, these types of targets presented themselves as large enough to hit and still cause sufficient collateral damage to demoralize the enemy. One report indicates that a Squadron had fired "all its rockets," at a German barracks causing 40 dead. The concussion effect of the rocket was tremendous.

The British also reported that the rockets appeared safe from accidental detonation from either small arms fire or sympathy explosions caused by hits on the tank itself. Two Shermans that had been hit and gutted by fire, still had the rockets attached and intact when the tanks were recovered. The brackets and shear wire, which held the rocket on the rail, were adequate enough to keep the rockets in place while the tank employed either road or cross country movement. In fact, the only ill effect reported was that anything stored on the rear deck was "scattered to the four winds."

The experiment seemed to have slowly withered away as the original group of tanks outfitted with the rails were damaged in combat or suffered mechanical failure. The effect on morale seems to have been the rockets biggest claim to fame: strengthening that of the British soldiers while breaking down that of the Germans who were targeted.

Little else resulted from the tests although it was noted in the report that by mounting four or even eight rockets to individual tanks, the resulting short range firepower would be tremendous and more than compensate for the slight inaccuracies of the system.

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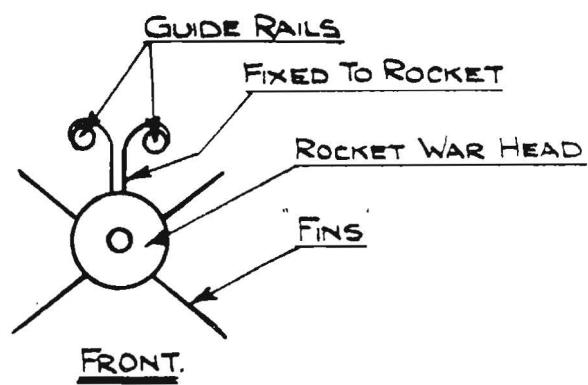
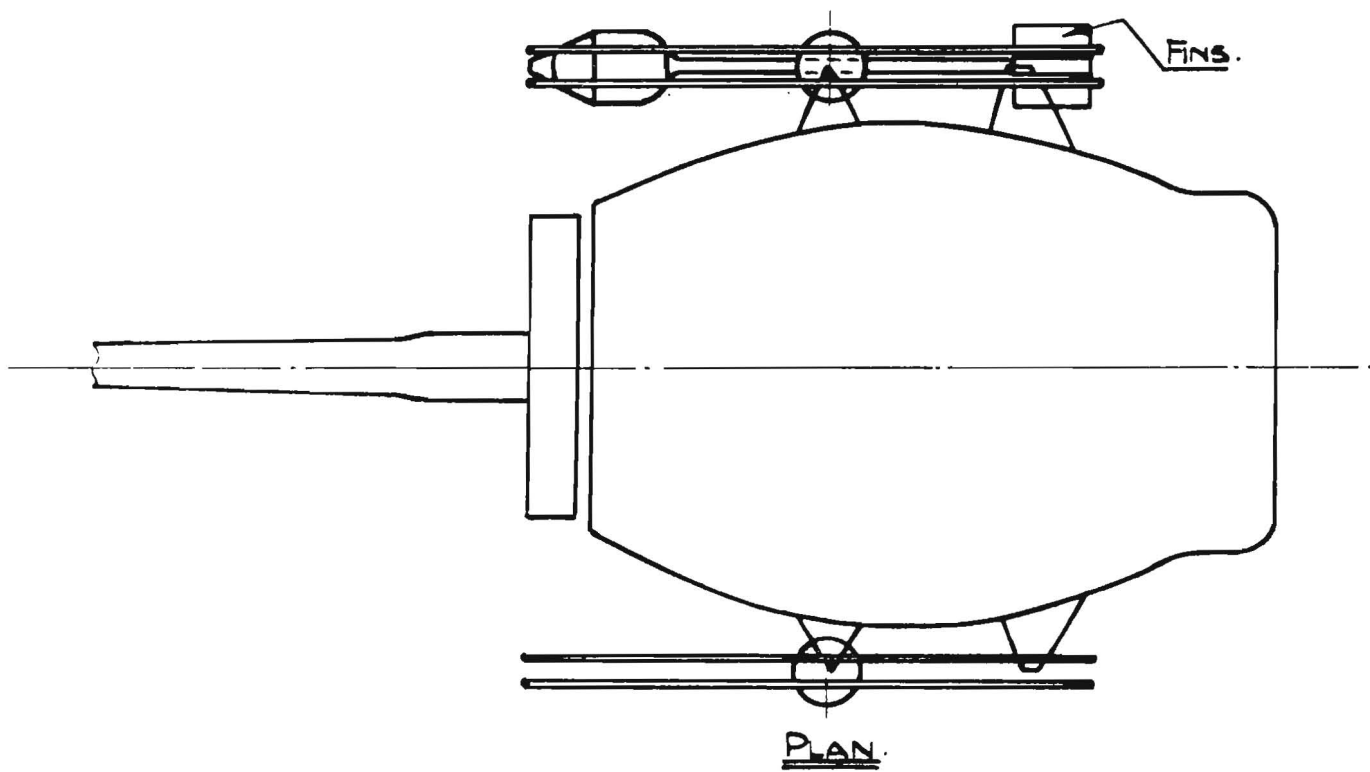
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## History on Canvas

# The Artistry of John Wynne Hopkins

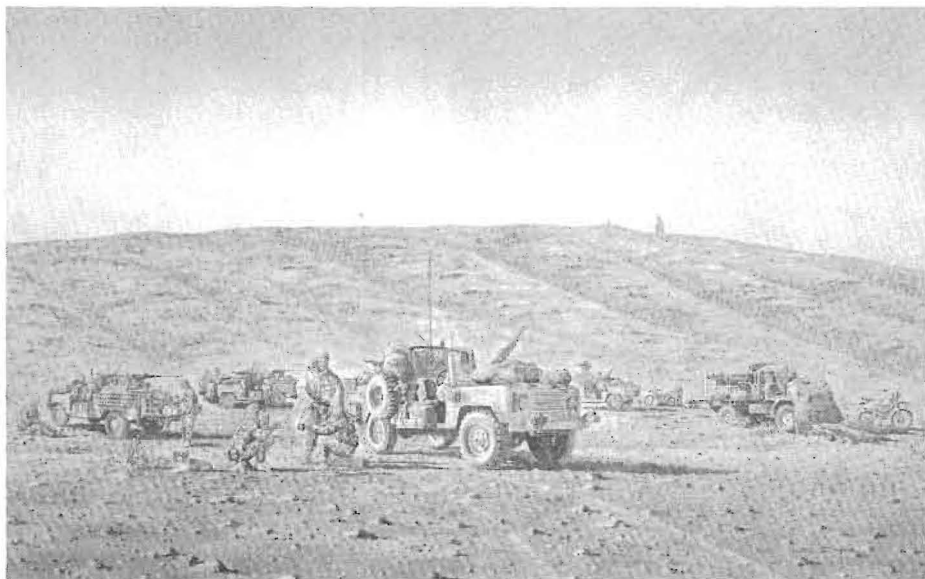
While I spend much of my time looking at and for photographs, nothing can catch your eye like a well done painting. And while a crisp autumn landscape or a still mountain lake shrouded in an early morning mist may adorn the family living room, the walls of your work room, office, or study should define your interests.

I have recently had the great opportunity to view a number of painting by a Rhodesian-born painter, now living in England, John Wynne Hopkins. Now many of you who know me, know of my tremendous interest in Rhodesia/Southern Africa, but it was John's Gulf War painting that caught my eye.

It is not unusual to see military aviation scenes depicting fighter combat, Civil War engagements, or tall-masted sailing ships having a go at each other. However, it is not all that common to find an artist that can present a view of a war from the vision of the soldier on the ground. Perhaps it lacks the "romance" of the young, Top Gun fighter-jock and is perhaps closer to the reality of war as evil and distasteful, but it takes a special flair to bring all of the images to canvas with flair and in an accurate manner.

The Gulf War painting illustrates a rest stop for a long range patrol of 22 SAS somewhere in Iraq. A variety of equipment is shown ranging from motorcycles, Land Rovers, and an Unimog truck, not to mentioned the variety of "uniforms."

by  
Jeffrey McKaughan



The other two paintings of his that caught my fancy had, yes you guessed it, Rhodesian themes. The first showed several Rhodesian African Rifles (RAR, with whom John served while doing his National Service in Rhodesia) while an ancient C-47 "ParaDak" drops a "stick" in the distance as a helicopter gunship circles. The other shows a troop deplaning from a G-Car (an Alouette III troop helicopter). Both are very well done and really leave you with a lasting impression of the action depicted.

A number of his other painting depict British helicopters in action in the Gulf and in Northern Ireland. Except for the Gulf War, which shows a number of heavily armed Lynx helicop-

ters on patrol, most show the helicopters on the ground with soldiers and other details.

If you are considering putting some sad old bowl of fruit up on your wall, I highly recommend that you contact this artist before you do. I think you will find some fairly modern military scenes that, although the wife wouldn't want over the bed, would be very tasteful in your "castle." He also does commission work so if there is something in particular that you are looking for he just might be able to deliver. (oh, and just for information, John also does your basic wildlife and pretty landscapes, especially those of the rolling Welsh countryside.)

Most of his prints sell for between £20-25 with an additional £5 for overseas postage. For more information write to John directly at 'Gatooma' 58 Queen Victoria Road, LLanelli, Dyfed, SA15 2TH, Wales, UK.



# The Ordnance Museum Foundation

## Executive Director's Corner

P.O. Box 688  
Aberdeen Proving Ground, MD 21005

### Fellow Members:

There is a little more to report this time, especially about internal developments. We held the election of Trustees in early December at the Foundation's Annual Meeting. Jeffrey D. McKaughan was re-elected to the Board and Richard Carnegie was elected as the Board's newest member.

Mr. Carnegie is a professional engineer who, we expect, will be of significant help in development and improvement of the building plans. He has a lot of energy and many ideas that should help us move toward our goals. He has been appointed the Foundation Project Manager for the building construction project. His expertise in project management and his years of experience will stand us in good stead as this design progresses. He will be the liaison between the architects, builders, and base personnel.

Steven Oluic, a technical advisor to the Board, continues to try and obtain the basic data that we need about the museum grounds and environmental constraints. It seems that the more we learn, the more complicated those issues become. An environmental engineering group has been surveying the museum site and has offered, at Dr. Atwater's request, to include the necessary foundations and supports for the new museum building as part of its design for a concrete pad designed as an abatement measure to prevent the migration of hazardous chemicals from the museum site. We had high hopes for this avenue because the concrete foundation and pad represent some of the highest costs in our proposed construction. We have just recently learned that this environmental project is now on hold. We do not know the details of the problems but the Foundation is hopeful that the "powers that be" will recognize that a pad with supports can go a long way towards preserving the environment and historical artifacts at the same time.

Finally, Mr. Carnegie, Elliot Deutsch, and I had a productive and promising meeting with Maryland State Senator William Amoss. The meeting was requested by Sen. Amoss as he wanted an update on our project and ways that he could be helpful in working at the state level for funding. Sen. Amoss is a true friend and supporter of the Museum and the Foundation. We will keep you up to date on what develops here.

Thanks for all of your support and kind words.

*Ron Lehman*

### Brigadier General Lloyd J. Faul (Ret.)

The Foundation would like to publically recognize Brigadier General Lloyd J. Faul (Ret.) for his generous donation to The Ordnance Museum Foundation of \$1,025.00. Charitable acts such as this will help the Foundation realize its goal and preserve the history of the Ordnance Corps, its artifacts and its significance to the United States.

The following Foundation members have joined the Company Commander's List

Maj. Gen. James W. Monroe  
John B. Sledge, Jr.

The following Foundation members have joined the Battalion Commander's List

Maj. Gen. E.J. Gibson (Ret.)

## Join The Board

Over the past several months several Board of Trustee members have relocated and/or changed jobs, and as a result they have resigned from the Board.

This is an open call to any Foundation member living within reasonable driving distance to the museum who would like to join the Board and take an active part in the projects that we have underway. We meet once a month and you can donate as much time as your schedule will allow.

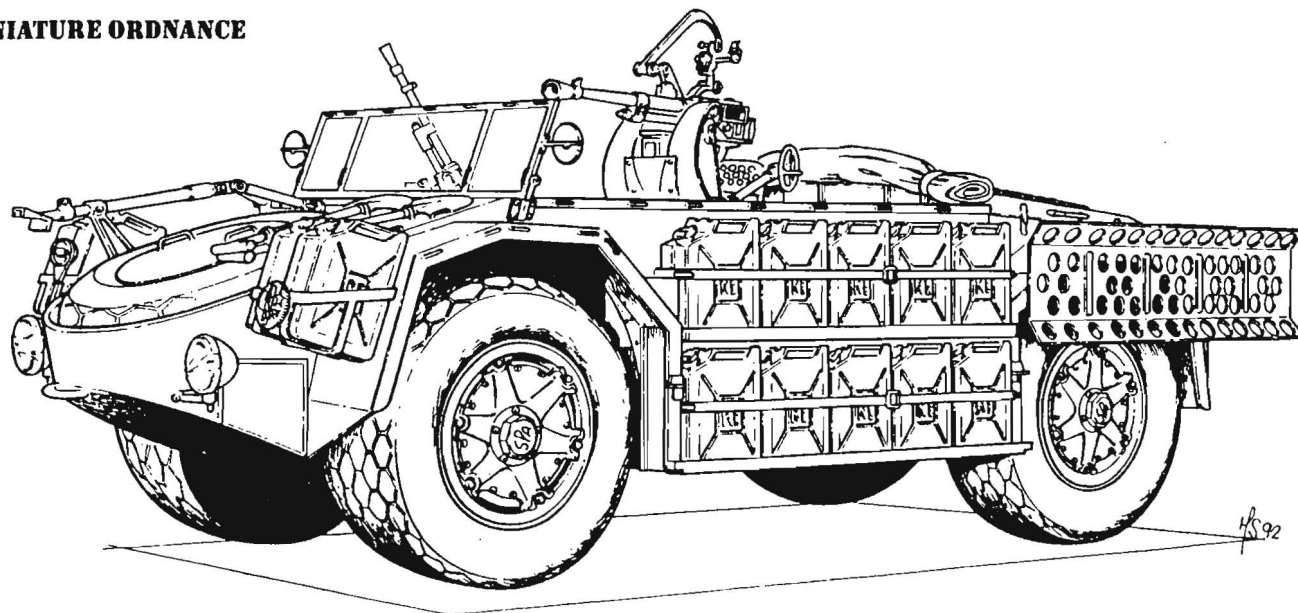
We really are in need of members to help and any time that you can give will be greatly appreciated.

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Ordnance Company Commander Membership  
\$100.00

Ordnance Battalion Commander Membership  
\$250.00



# 'The Italian Rat-Killer'

by  
Adam Geibel

This bizarre looking, bath tub shaped scout car was a highly successful modification of the Italian Army's AB41 armored car. Unarmored, the Sahariana sacrificed protection for range (approximately 500 miles, though the side racks of fuel must have made impressive targets), lack of which was one of the serious drawbacks of previous vehicles used for recon work.

When the AS42 was delivered to Italian forces in North Africa in early November 1942, Axis forces were in retreat and dogged by Commonwealth reconnaissance units like the LRDG. It was used for reconnaissance patrols, pursuit of LRDG raiding parties, and even the Italian's own limited clandestine efforts behind enemy lines.

Outside of North Africa, the Italians used the AS42 in the defense of Sicily and Rome, while the Germans used it for anti-partisan work on the Eastern Front and even the Ardennes Offensive.

After the war the AS42 was drafted by the Italian Police for anti-riot duties, where it received a distinctive coat of mauve paint.

Approximately 200 were built and armament varied as widely as those on LRDG vehicles; 8mm Breda 38 machine guns, 13mm Breda heavy machine guns, Solothurn 20mm anti-tank rifles, Breda 35 20mm automatic cannon, 47mm anti-tank guns, and a few rumored 37mm PAKS. Photos also show captured Vicker's K guns mounted.

## ITALSEDI'S KIT

Quite frankly, I've grown tired of seeing kits of LRDG jeeps and Chevies. With the amount of press the Allies received, one would think that there was never a counter-recon battle fought out in the desert wastes and if there was one, it was managed single-handedly by Afrika Korps' Captain Dietrich of 'Rat Patrol' fame.

The Italsedi kit is as detailed as any Italeri injection-molded model, but the buff colored resin parts are delicate and there is a fair amount of flashing to remove. The tires are black vinyl.

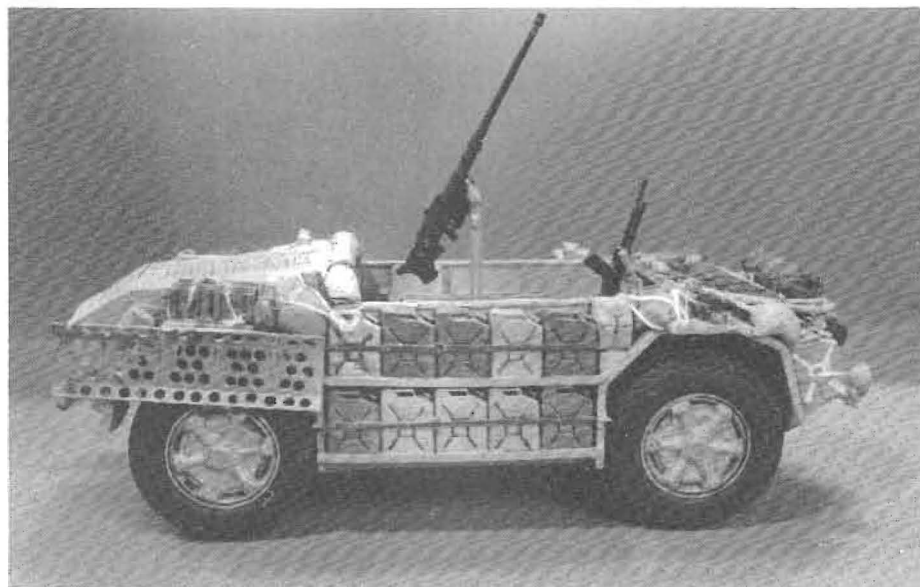
Dimensions conform to the FIAT factory blueprints (not surprising considering that the FIAT museum is so

close to Italsedi).

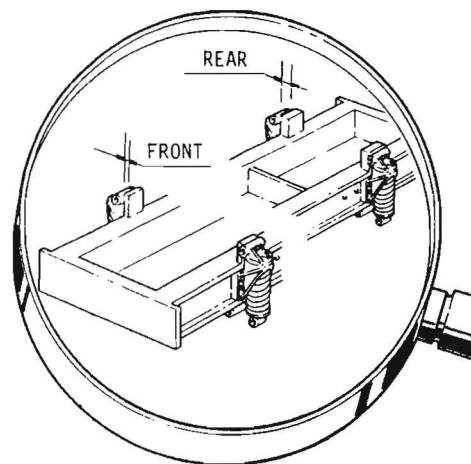
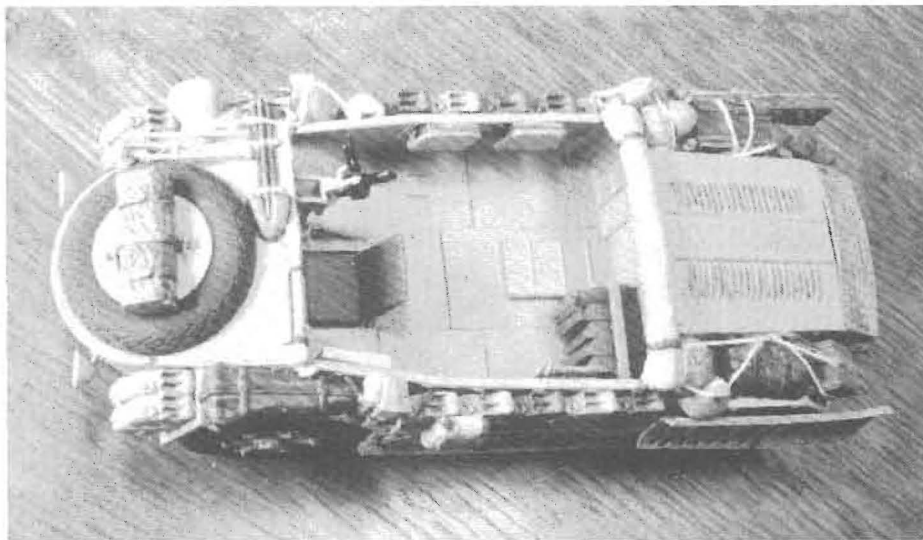
Fit of the major body parts was almost flawless, though there was one gap to the rear of the engine hatches and another on the floorboards, alongside the shift box. British reports from the period remark upon the poor fit of even the armored plates of the AB-41, so these small flaws could be considered quite realistic.

The sand channels are rather ragged, but when properly weathered appear to be "well-used".

Unless one is very careful, the independent suspension assemblies can be misaligned so that the wheelbase distance appears too short (between the trailing edge of the front tire and the







leading edge of the rear tires).

The model was primed first in flat black, sprayed desert yellow (FS 33037) then finished in LIFECOLOR 'Giallo Saba' (Sand Yellow: RE04) and highlighted in progressively lightened shades of sand yellow mixed with flat white.

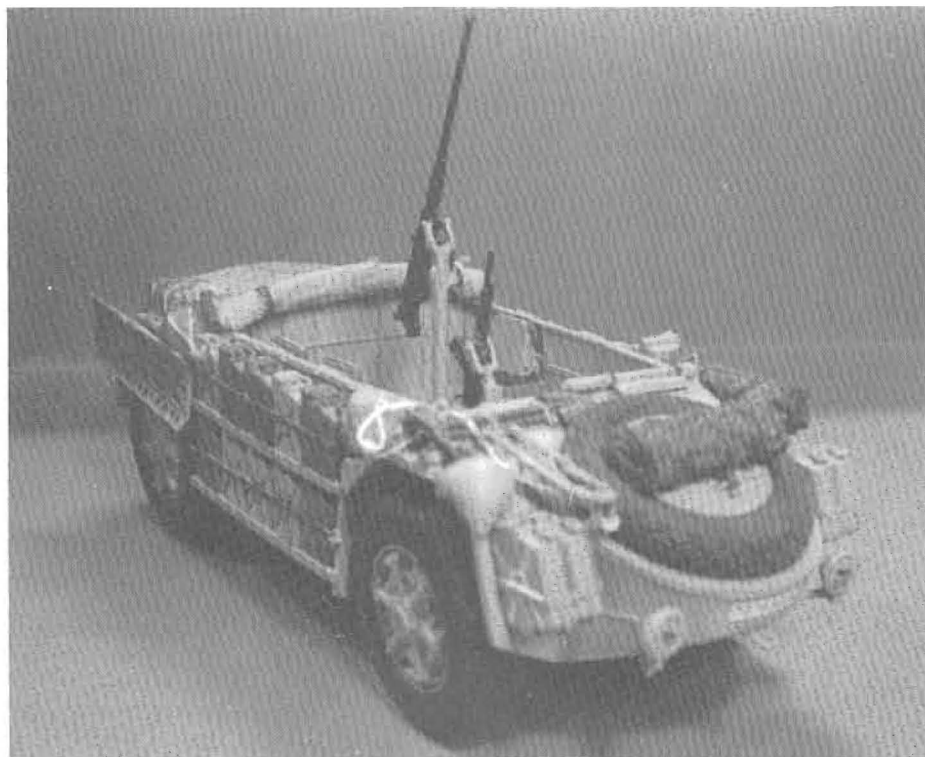
Some of the jerry cans were left in factory issue dark grey-green (LIFECOLOR RE01) but the fender-mounted water cans should always be in sand yellow (marked with white crosses to prevent accidental contamination).

When fitting out the vehicle, I took the perspective of Tony, the poor vehicle commander. Many of the existing Saharina photos (circa Winter 42-43") show only a moderate amount of stowed gear and have barbed wire in the background indicating that they were probably staged for propaganda reasons, right outside of some Italian base camp. Photos from earlier Italian recon formations show vehicles crammed with external stowage.

I fitted my Sahariana with the crew's personal gear and helmets (actually DML Israeli infantry pots), bags of tools or rations and boxes of ammunition, as well as German and Italian pattern water canteens.

I also deleted the large front windscreen and replaced it with a smaller field modification. In reality, such a large piece of glass would only become a deadly beacon of reflected sunrays and thousands of glass splinters waiting to spray the scouts.

Kit armament consists of a 20mm M35 Breda and a 8mm M37. Three machine gun mounts are also supplied (one forward facing to the driver's right,



two rear on either side) but I elected to replace the Breda 20mm with a pintal-mounted 20mm Solothurn AT rifle, from Rhode Island-based S.O.G. Models. This piece, fitted with a bracket and topping a 2mm aluminum tube.

## Specifications

Weight	4 tons (apx)
Length	5.75 meters
Width	2.15 meters
Height	1.85 meters
Engine	6 cylinder SPA
Max Speed,	
cross country	30 km/hr
Max climb	30%
Fuel capacity	400 liters
Reserve jerry cans	400 liters
Range	800 kilometers
Crew: depending	
upon mission	2 to 4
Armament:	Varies

An M38 from Italeri's M13 kit was substituted for the M37. Both kit supplied machine guns and cannon were set aside for a future project.

All in all, a very good kit but one so esoteric that it might only appeal to those interested in Italian armor. This kit is now distributed by PD Models, via Bedin 45/47, 36100 Vicenza, Italy.

## SELECT BIBLIOGRAPHY

KNOW YOUR ANTITANK RIFLES. E.J. Hoffschmidt Blacksmith Corp.

HOLLOW LEGIONS. Advanced Squad Leader Supplement, Avalon Hill.

THE RAIDERS - DESERT STRIKE FORCE. Arthur Swinson, Ballantine.

LA CAMIONETTA DESERTICA MOD.42 (Sahariana)'N. Pignato Italian IPMS Vol. 9.

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**Wanted** Bellona Military Vehicle Data pamphlets #'s 1, 2, 5, 10, 11, any beyond #13. Also Bellona Military Vehicle Prints series #13, any beyond #16. Scott Moore, 12614 Pinecone Road, Parker, CO 80134. 5/95

**Researcher seeks** photos and information on the deployment and use of the atomic cannon. Ron Lehman, 2 Farm Lane RD #1, Lincoln University, PA 19352, (610) 255-4914. 3/95

**Wanted:** Collector will buy/trade WWI-II U.S. Army Tank Corps and German Panzer Corps uniforms, memorabilia, etc. Dirk Caltrider, (410) 848-7424. 3/95

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**AFV-G2:** Looking for issues of this magazine. Scott Fotinos, 6530 Adams St., Lincoln, NE 68507 2/95

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