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## FEATURES



## DEPARTMENTS



### On The Covers

FRONT
Left side view of the AN/MLQ-34 TAC JAM electronic warfare VHF jamming system as used by the 503st MI Battalion in Kuwait during Desert Storm.

BACK
TOP LEFT: A Marmon Herrington Mk IV on display near the front of the Martyr's Memorial in Amman, Jordan. The vehicle is in a typical Jordanian camouflage pattern.

TOP RIGHT: A front view of the AN/MLQ-34 TAC JAM.

MIDDLE: Right side view of a Jordanian Saladin armored car in front of the Martyr's Memorial.

BOTTOM: An FSV emerging from the Georges River near Holsworthy after an exercise. The track shrouds are fitted, the engine screen protection is raised, and the trim vane with extension piece is deployed. An empty oil can sits behind the turret, attached by a length of rope. This is a 'marker buoy' in case the vehicle sinks.


*FSV callsign "41 Alfa" stopped by a road in South Vietnam in late 1971, while a convoy of 105 mm M2A2 howitzers drawn by Australian International Mark 5 six by six trucks passes. The sponson reinforcement above the first three road wheels and the missing smoke grenade dischargers are points to note.*

# M113A1 Fire Support Vehicle

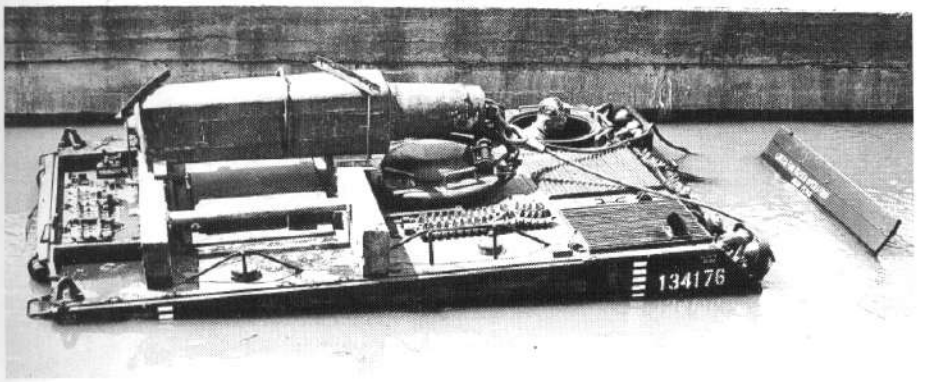
By
Paul Handel

During 1962 and 1963, the Australian Army conducted trials of two types of tracked armored personnel carriers, the FV432 "Trojan" from the UK and the M113 (with Chrysler gasoline engine) from the USA. The M113 was selected as the vehicle to replace the family of wheeled AFVs then being used in Australia — the Ferret Scout Car, the Saracen Armored Personnel Carrier APC), and the Saladin Armored Car. Deliveries of the M113A1 version with the Detroit Diesel engine commenced in 1964.

In 1965, the Australian Army committed an armored unit to an overseas theatre of war for the first time since the end of the Second World War. The eight M113A1 vehicles of the APC troop initially employed were the first of a large range of such vehicles to see combat in South Vietnam over the next seven years. The initial deployment of carriers quickly grew to a full Cavalry Squadron. As the lessons of combat using these vehicles were learned, so followed modifications to provide them with additional protection and firepower. Gun shields, machine gun turrets, sponsor reinforcement, and belly armor were but a few of the official modifications. Unit modifications were many and varied. The need for mobile heavy fire-support was soon realized for the Cavalry Squadron.

In 1966 a requirement was produced by the Army for an Air Portable Armoured Fighting Vehicle (APAFV), and two M551 General Sheridan light tanks from the USA were tested here during the 1967 and 1968. Even before the trials commenced, it was known that the Sheridan would not be available for purchase for some time, should it be chosen, and so an interim solution for the APAFV was sought. The Army Design Establishment (ADE), now Army Technology and Engineering Agency (ATEA), produced the design for an interim solution by mounting a 76 mm gun turret from a Saladin armored car onto the hull of an M113A1 APC. ADE worked in conjunction with the M113 manufacturer, the Food Machinery Corporation (FMC) of San Jose, California, who had produced similar proposals on paper in 1964 and 1966.

One of the major concerns was for the amphibious capability of the vehicle to be maintained. (This requirement continues to be a factor in the Australian Army's planning when using light armored vehicles.) An M113A1 APC was fitted with a large billet of cast iron on the hull roof behind the commander's cupola, and trials held to determine the effects of an additional two tons on the vehicle's amphibious capabilities. These trials apparently were successful, and by mid-1967 the Ordnance Factory at Maribyrnong, Victoria had produced a pilot model interim APAFV, subsequently designated M113A1 (FS) (FS for fire support). The M113A1 vehicle had a major portion of the hull roof




*The initial trial M113A1, with cast iron billet attached to the hull roof, being flotation tested in the wading pool at the Proving Ground, Monegeeta.*

*The prototype FSV after being fitted with a turret giving a good comparison of height with a Saladin armored car.*

removed and an adapter plate with riser turret ring fitted, and the turret from a Saladin armored car installed. The Saladin was at that time in the process of being phased out of service, along with the Saracen, as the M113A1 family of vehicles became more widely available. The mating of the M113A1 hull and the Saladin turret caused some problems, particularly in the compatibility of US and British electrical systems.

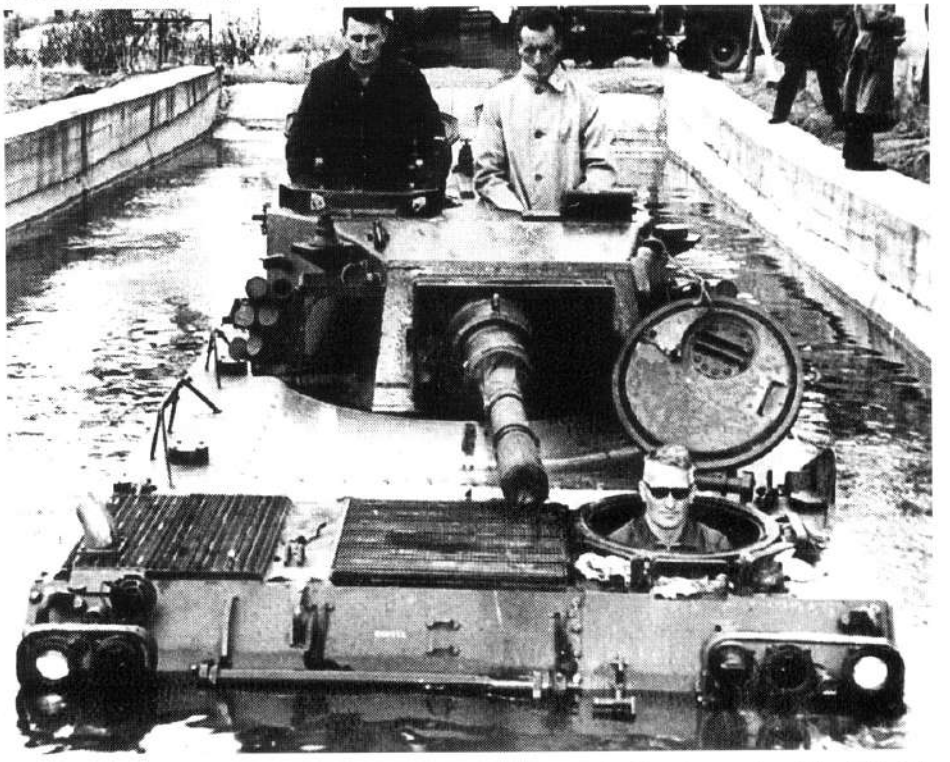
Internally, the M113A1 had all crew compartment bench seats removed, and a support mounted on the floor to carry the electrical cables from the turret into the hull. A false floor was fitted to the rear portion of the hull, under which ammunition for the 76 mm gun was stowed. In each sponson, forward of the fuel tank on the left side and of the battery box on the right side, were fitted racks to carry twelve rounds of 76 mm ammunition each. These racks were inclined at approximately fifteen degrees to the vertical. A total of fifty-five rounds for the main armament were carried. A modified driver's hatch, which lifted and pivoted, was also fitted to the production vehicles, as the movement of the standard hatch interfered with the turret when traversed.

The vehicle's road performance suffered slightly, being about two tons heavier than the standard vehicle. In addition, the swimming capabilities were severely reduced. The vehicle sat very low in the water, with only some 150-180 mm of hull out of the water. An additional piece of sheet metal similar to that fitted to the trim vane of the Fitters Vehicle was added to the trim vane, to assist forward movement in water.

Trials of the prototype vehicle began at the Armoured Centre at Puckapunyal, Victoria, in October 1967, but were suspended after a week when the vehicle sank in the Goulburn River, as the turret was traversed slightly to the right whilst the vehicle was maneuvering in the water. After repairs were effected the trials recommenced at Puckapunyal and continued until the end of 1967. About this time the vehicle was christened the "Coleman Cruiser", after the then Director of Armour, COL K.R.G. Coleman, but this name did not last long and it became simply known as the FSV — Fire Support Vehicle. In early 1968, troop trials commenced at A Squadron 2nd Cavalry Regiment, Holsworthy, NSW, and these were completed in the April. The evaluation of the trials results took some time, and there were a number of modifications made to the prototype to bring it up to an acceptable standard. It was not until mid-1970 that the then Director of Armour, COL J.M. Maxwell, recommended the vehicle for service use.

A total of fourteen vehicles were converted from new M113A1 vehicles of 1969 vintage, by 4 Base Workshop RAEME at Bandiana during 1970 and 1971. The conversion kit, comprising the hull top plate with riser ring, ammunition racks and turret were provided by the Ordnance Factory Maribyrnong. About this time the prototype vehicle, originally carrying the registration number 134176, was renumbered 134700, and all fifteen FSVs carried consecutive registration numbers up to 134714. (The number of vehicles produced was limited by the quantity of Saladin armored cars in the Australian inventory.)

Although the armored contingent in South Vietnam had been expecting the FSVs since 1968, the first four vehicles did not arrive until July/August 1971. These vehicles all were fitted with sponsor reinforcement plates and bolt-on belly armor. Initially they were formed into a Fire Support Troop of A Squadron 3rd Cavalry Regiment, under the command of LT Ross McCormack. Initial gunnery training was conducted on the AFV range near the eastern gates of Nui Dat, as "full bore" gunnery had not been used by the cavalry/APC units deployed in South



*The wading pool of the Proving Ground again is the location for flotation testing of the FSV. The unmodified driver's hatch can be seen tied to the turret aerial mounts.*

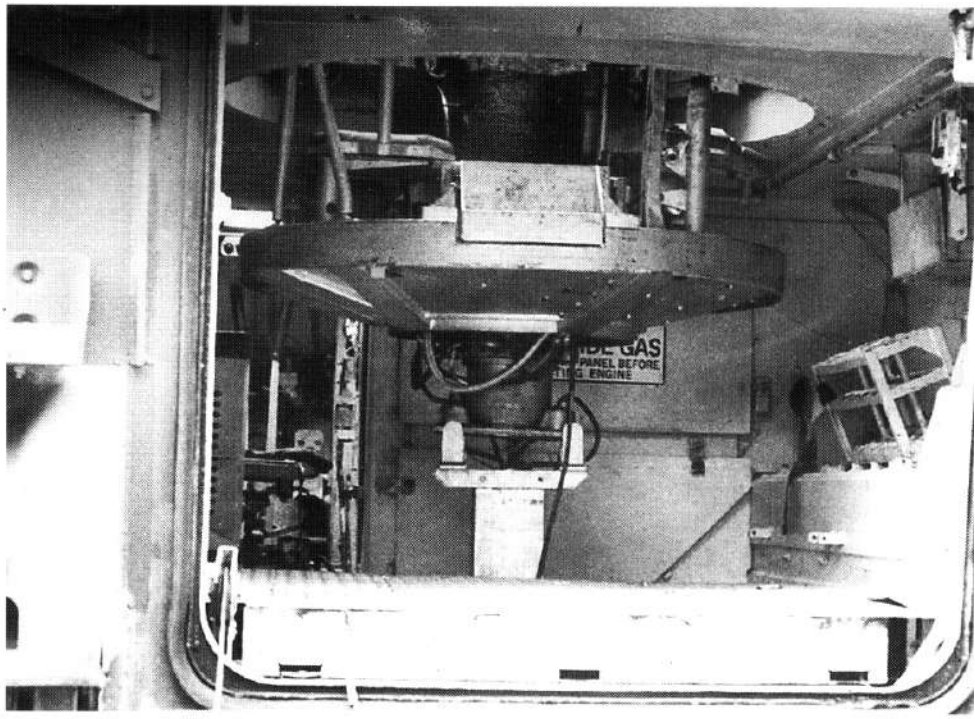
Vietnam prior to the FSVs becoming available.

The first trip "outside the wire" for the FSVs was to Baria, Dat Do and back to the Horseshoe feature, nearly all the way on sealed roads. Initially the vehicles were given limited exposure to the possibility at contact with the enemy. Ross McCormack remembered ". . .I think it was policy not to get the vehicles involved in situations where they might sustain damage. Those vehicles were not tanks and with the amount of ammo that was carried they probably would have gone off with a bang if hit with an RPG." The vehicles were used in the defence of fire bases, general convoy escort, night patrols and ambushes. As with the Centurion tanks serving in South Vietnam, the FSVs had the smoke grenade dischargers removed from the side of the turret, as these caught in vines and overhanging tree branches when operating in heavily timbered country.

Later in 1971, a further two FSVs arrived at the Squadron, and a reorganization took place. Three reconnaissance troops were formed, each having two FSVs with two or three standard M113A1s. This reorganization allowed reconnaissance patrols to be conducted away from Nui Dat. The FSVs were withdrawn from South Vietnam in late 1971, and the Squadron itself was withdrawn in the following year.

After the withdrawal from South Vietnam, the FSVs served with regular Cavalry Regiments (mainly 2nd Cavalry Regiment) and the Armoured Centre until 1979, and continuing in service with reserve units for a further few years, until being declared obsolete in 1986. During their service the vehicles were known to the troops as "Beasts".

Shortly after being withdrawn from service, six of the vehicles were de - turreted and the hulls with a plywood covering were sold to the New Zealand Army. There they were returned to standard M113A1 configuration, mounting cupolas, and used by the RNZAC School of Armour as driver training vehicles. The deployment of an NZ infantry company to Bosnia was accompanied by a number of APCs, one of which was an ambulance conversion of one of the ex-Australian FSV hulls. It was fitted with belly and hull armor as well as an ACAV kit for the commander's cupola.



*The interior of a production vehicle showing the Saladin turret basket, ammunition racks in the sponson, and the step in the hull floor containing ammunition racks.*

The Saladin-turreted M113A1, although not an ideal conversion and not provided in great numbers, served the Royal Australian Armoured Corps (RAAC) well, and it was no doubt due to its success that another Fire Support Vehicle, this time mounting a Scorpion 76 mm turret, was developed in the mid-70s and served in the RAAC until 1996. But this is another story.

ACKNOWLEDGEMENTS

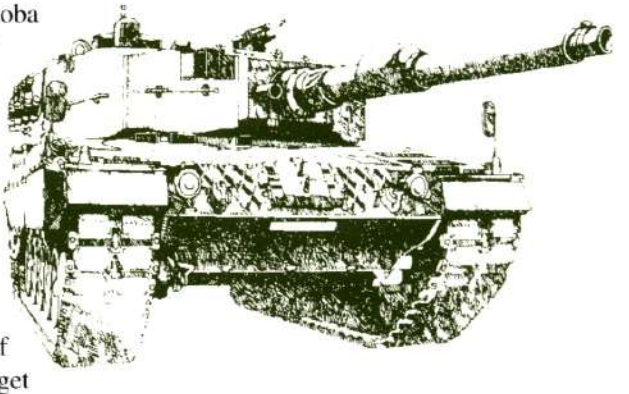
The author wishes to thank Colonel D.H.R. Bourne (RL), MAJ R. McCormack (RL), the late Mr. J. Nuttall and Mr. L.A. Wright for their assistance with information and photographs used in the preparation of this article.

*Two FSVs of the 2nd Cavalry Regiment leading a reconnaissance troop during exercises at Holsworthy, NSW in 1973. The commander's 0.30 inch Browning flexible machine gun is mounted and the folded extension to the trim vane can be seen.*

# JoMO Bookshelf G-2
# news and notes about AFV resources

by
Tom Laemlein

If there is one publisher out there who truly has AFV fans best interests at heart, it has to be JJ Fedorowicz Publishing (Winnipeg, Manitoba Canada 204-837-6080; website: http://www.websolutions.mb.ca/~jjfpub/). It's a small operation that creates some of the biggest, best books in the business. Frankly, many AFV fans feel that as soon as a Fedorowicz publication comes off the presses, it's already a collector's item.



Case in point is the recent publication of Karlheinz Munch's "Combat History of the Schwere Panzerjager Abteilung 653". This includes hundreds of previously unpublished photos from private collections, particularly of the Ferdinand/Elephant tank destroyer. Granted, these huge photo volumes don't come cheap (the history of Panzerjager 653 goes for around $105), but in this case you truly get what you pay for.

Keep your eyes peeled for another massive photo volume, "Tigers In Combat 2" due to be published in late spring. Later this year look for the following titles to be released: Panzer Aces 2", "SS Photo Album", and "Panzer Photo Album".

In addition to their own publications, Fedorowicz handles high-quality imports, including the French Heimdal Series. These rival Fedorowicz's own books in quality (and price), but most have French text only, although a few have English captions. The following titles, along with a number of others, are available at $108 each: "Invasion Journal 6 June to 22 August 1944" (over 1,100 photos), "The Battle of Caen 6 June to 15 August 1944" (over 850 photos), "12th SS Panzer Division HitlerJugend" (600 photos), "History of the Panzer Lehr Division" (over 500 photos), "Liebstandarte SS" (over 1000 photos), "Divisions of the German Army 1939-1945" (840 photos, many previously unpublished from French archives).

Eastern European book importer Derek Frost has put up a website with an on-line catalog (http://www.geocities.com/Pentagon/Quarters/4820/). Some interesting currently listed titles on his site are: "The Czechoslovak Army in 1939" ($30), and two new books in the Militaria armor series (published in Poland): "Ferdinand/Elephant" and German 8-Wheeled Armored Cars" (each at $16).

The Military Book Club continues to offer an improving selection of arms and armor-related titles. Recent listings include an exclusive offering of a reprint of Chris Ellis' Tanks of World War II" ($29.95 suggested retail), the only book I know of that covers the major fighting vehicles of the Second World War using nothing but color profiles. Military Book Club is also offering: "The Military Book Club Encyclopedia of Infantry Weapons of WWII" by noted arms author Ian Hogg. An ambitious title, but it delivers—it's certainly worth a look.

Squadron-Signal continues to produce armor-related titles, albeit at a snail's pace. The latest is "US Tank Destroyers In Action", and it should be in your favorite hobby shop or bookstore by the time you read this.

A number of folks have been asking lately if the "TigerFibel" was ever translated into English. The answer is yes, and it was very well done. It's a little pricey ($48) for a softcover, but you can address your inquiries to: Wulf-D Brand, PO Box 3061, Newport News, VA 23603 USA.

Finally, there have been numerous rumors (for several years, actually) that there is a major film project in the works about the life of Tiger Ace Michael Wittmann. It's a neat idea to AFV fans, but not to the folks in Hollywood. Don't expect such a project to ever come to fruition, at least not without the help of an extremely wealthy producer (the rare kind that does want to get his money back, and then some). Until that day, we'll have to content ourselves watching the cobbled-up "Tigers" from "Kelly's Heroes".

# Ukraine Produces Main Gun for T-80UD

The 1996 deal worth about $650 million between Ukraine and Pakistan for the delivery of 320 T-80UDs main battle tanks (MBT) ran into trouble almost from the start. Russia a long supporter (supplier) of India objected to the Russian designed T-80UDs being sold to India's neighbor and sometimes enemy. Russia threaten to stop the supply of key elements of the T-80UD, including the main gun, which is assembled in Kharkov, Ukraine.

From parts produced at the Malysbev factory in Kharkov, Ukraine recently announced that they were now manufacturing a 125 mm cannon for the T-80UD at the "Bolshevik" plant in Kiev. The KBM-3, as the gun is called, is purpose-built as a substitute for the Russian-made 2A46M1 main gun.

There is also speculation that there is a locally developed fire control system that might be substituted for the Russian system.

In other Pakistani MBT news, at the recently concluded Formation Commanders Conference, several tanks were displayed, including the modernized T-59, the "indigenized" MBT-2000 Al-Khalid (Chinese Type 85), the T-80UD, and a locally developed armored command vehicle.

*The T-84 shown here is basically identical to the T-80UD. The obvious external difference is the welded hull of the T-84.*

# STEALTH WARRIOR

Developed as a reconnaissance vehicle, GKN Defence took a Warrior APC, shortened it by removing a road wheel station, thus creating the framework for the Stealth Warrior.

A number of other modifications were made to enhanced its battlefield recce performance. The exhaust was moved to the rear and the air os cooled to reduce the thermal footprint. The hull sides are sloped slightly inward to lower the radar signature. The suspension is covered by flaps made of radar absorbing materials, while the road wheels have 'hub caps' to smooth them over.

There is a mast-mounted Radamec sensor package including day/night and thermal sights, laser rangefinder, and a battlefield surveillance radar. All of this information, including photos, can be transmitted to a central command post.

# *WOLVERINE*

## New U.S. Army Heavy Assault Bridge

General Dynamic Land Systems, Sterling Heights, Michigan, has being awarded a $33,321,436 modification to a firm-fixed-price multi-year contract for eight Wolverine Heavy Assault Bridge (HAB) Systems. Work is expected to be completed by November 30, 2001.

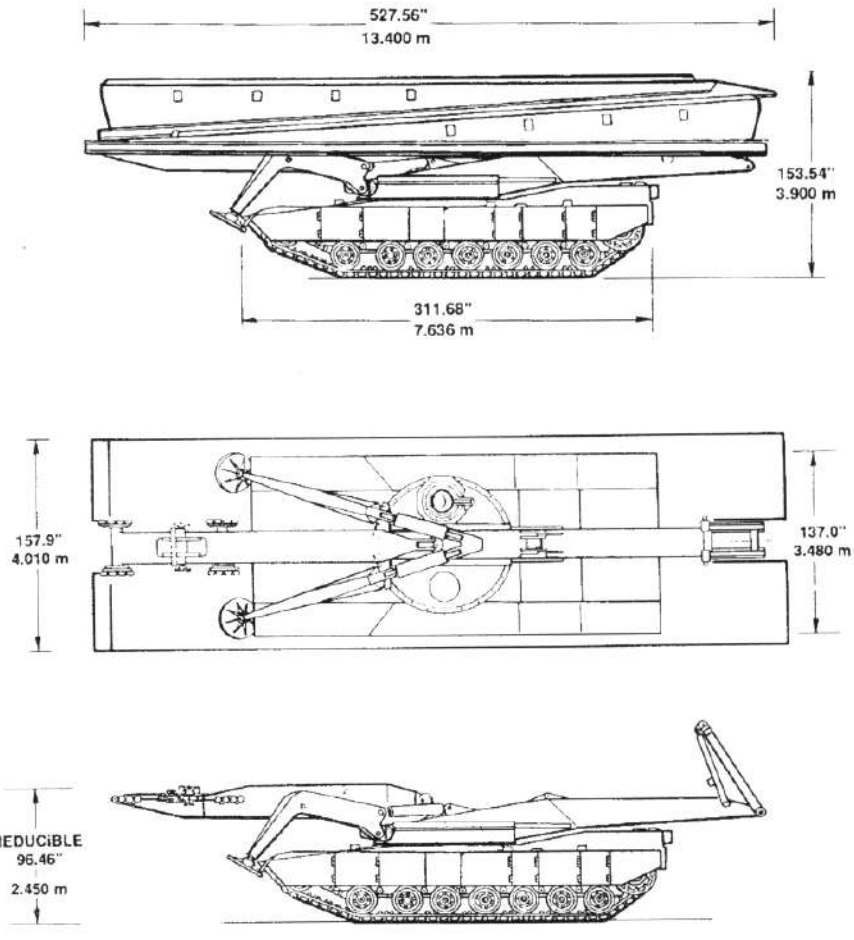
The Wolverine HAB by GDLS combines the M1 tank chassis with an MLC 70, 26 m bridge and launcher by Leguan. The Wolverine beat out a scissors prototype, also on an M1 chassis, built by United Defense LP (formerly BMY).

The HAB uses the same powerpack as the standard M1, which gives it a maximum speed of the forty-five mph. There is also an auxiliary power unit (APU) which powers the bridge launcher and provides silent watch capability for the vehicle. GDLS claims that the Wolverine is 95% compatible with the standard M1 and bridge system.

As an enhancement to survivability, none of the hydraulics or electronics are on the bridge itself. Likewise none of the hydraulic bridging system is in the crew compartment or with the powerpack.

Reportedly, the HAB can launch and recover in less than five minutes. The Army's requirement was a five minute launch and ten minute recovery.

The United Defense (BMY) proposed HAB used a scissors operation to launch the bridge, which was also an MLC 70 class, 26 m bridge spaning a gap of 24 m. It had a launch time of three minutes and a recovery time of seven minutes. This option provided with a shorter overall length, as there were three hinged sections to the bridge, instead of two sliding sections on the Wolverine. Above shows a bridge launch with the stabilizing foot in place and the bridge opening. The third section can the seen unfolded.




# NORINCO Wants HK to Return Confiscated Troop Carrier

Just a few weeks after Hong Kong was returned to China on July 1, 1997, a vehicle armed with a machine gun and smoke carriers, worth 5.7 million HK dollars, was confiscated by Hong Kong Customs House. China North Industries (Norinco), a government-owned arms dealer, was found to have shipped the armored vehicle into Hong Kong and was trying to transport it to southern China without a license from trade authorities. The discovery of the attempted shipment was seen as an embarrassment to both China and Hong Kong.

AFP reports that Norinco, the owner of the armed vehicle, lodged a petition with Hong Kong Chief Executive TUNG Cheehwa to to hand back the vehicle in late January 1998. The South China Morning Post says that sources said Norinco's petition to Tung was in accordance with laws governing forfeited items. Reports say that the People's Liberation Army (PLA) has not, so far, got involved in the matter. (Bo XIONG, Ray ZHANG). From CND Report.

# El Wak — 1998

As a fitting follow-on to Adam Giebel's recent article on the Battle of El Wak during the early stages of WWII, that same small crossroad town is in the news again. In mid-March militiamen of the Somali National Front were defeated at El Wak despite reports of arms being supplied by Ethiopian troops that crossed the border.

# Notes on US Armor Markings
## Infantry Tanks 1920-1940

By
Charles R. Lemons
Curator
Patton Museum, Ft. Knox

*M1917 of A Company, 1st Tank Regiment, 1931. Painted on the front and on the sides of the engine compartment would be the vehicle's linear number within the company.*

With the demise of the Tank Corps in 1920, all responsibilities for tanks and tank training was transferred to the Infantry Branch, with the branch sub-designator of Infantry (Tanks).[1] The Tank School remained at Fort George G. Meade, Maryland, with the 16th Light Tank Battalion and 17 Heavy Tank Battalion assigned, while the 15th Composite Tank Battalion was posted to the Infantry School at Fort Benning, Georgia.[2] The remainder of the tank companies and platoons were dispersed among the various Corps Areas and state National Guard units. During this early period tactical markings, per se, were not used to any great extent, and unit markings were still in the process of being standardized. In 1929 the Army consolidated several of its tank battalions into two tank regiments, one of light tanks and one of heavy tanks.[3] However, due to equipment and monetary constraints, these units rarely operated above a battalion level. In fact, the heavy tank regiment never exceeded battalion strength. In 1931, the Tank School and its associated tank regiment, was transferred from Fort George G. Meade to the Infantry School at Fort Benning, Georgia.

In late 1932 the two tank regiments, now headquartered at Fort Benning, were redesignated as Infantry (Tanks) regiments. The 1st Tank Regiment was renamed as the 66th Infantry Regiment (Light Tanks), while the 2nd Tank Regiment became the 67th Infantry Regiment (Heavy Tanks). These two regiments would constitute the backbone of the US Army Infantry (tanks) until the activation of the National Guard tank companies in 1940.

The transfer of responsibility for tanks to the Infantry Branch did not initially affect the basic organization of tank units. The Light Tank Company in the period of 1919 to 1932 continued the wartime organization of twenty-five tanks divided between a Headquarters section and three line platoons. Each of the line platoons was made up of five M1917 Light Tanks, two armed with the 37 mm gun and the remainder armed with a .30 caliber machine gun.[4] The Headquarters section contained one light signal tank (M1917) and also the company's supply of nine reserve tanks (four armed with 37 mm guns and five with light machine guns).

The Light Tank Battalion was made up of three light tank companies, and a headquarters and headquarters company. The battalion headquarters company had only the single signals tank with no other armor attached. This gave the battalion a total strength of seventy-six light tanks and signal tanks.

The Heavy Tank Company also retained its wartime table of organization, consisting of a Headquarters section and three line platoons. However, the heavy tank platoon contained only three tanks rather than the five in the light tank platoon. This, added to the six reserve tanks and the single converted signals tank assigned to the company headquarters section, gave the company a strength of sixteen Mk VIII heavy tanks. The Heavy Tank Battalion had three tank companies with a total combined strength of forty-eight heavy tanks.

The color of American armor from 1919 and into the early 1930s continued to be

*M1917 belonging to the 40th Tank Company, California National Guard. Note the color patch of the 40th Division and the lack of other markings, circa 1930.*

*M1917 light tanks of B Company, 66th Infantry Regiment loading onto transporters, circa 1932. Note the crossed rifles on the turret and the large number on the rear of the engine compartment. Although difficult to see in the photo is a band of color around the base of the turret cupola.*

Quartermaster Corps olive-drab (OD): basically a muddy, grayish-green color.[5] The interiors of the vehicles were normally painted white, with the doors being painted OD on both the inside and out.[6] This practice of painting tank interiors white continues to this very day. In 1928, the Ordnance Committee recommended that spar varnish be added to, or applied over, the olive-drab paint used on Ordnance Corps vehicles to "give them an attractive appearance in time of peace." This treatment gave the paint a glossy appearance as opposed to the flat finish which was normally applied during war time.[7]

A garish camouflage paint scheme was used briefly during the early part of this period, but apparently was restricted to tanks of the 16th Tank Battalion at Fort George Meade. The three color paint scheme, which was developed by the US Army near the end of WWI, was used into early 1919 and perhaps even into the early 1920s. In addition to the camouflage scheme, each tank was painted with a company number on the upper front plate (12-14" tall) and on either side of the engine compartment in 24" numbers.[8]

Tanks during the 1920s did not always receive unit markings, due to a proviso written into the army regulation governing the marking of property.[9] If they were marked, the markings were in white and were placed on the side plates of the turret (in the case of the light tanks) or on the sides of the sponsors (in the case of the heavy tanks).

If markings were used, there was a choice of two marking systems under AR 850-5. Under the first system, the marking for tanks consisted of the Infantry crossed rifles, approximately thirteen inches wide and nine inches tall, with the appropriate unit numbers and letters in three inch stencils above or below the insignia. The second system called for a straight line marking placed between two white horizontal lines. A color rendition of the parent unit shoulder patch was painted to the left and the unit designation was stenciled in white to the right. Numbers and capitals were three inches tall, while the small letters were one and one-half inches tall. These markings were applied on both sides of the tank turret.

The first system of markings seems to have been the most popular, since it called for a simple stencil and only one color, while the second system did not gain widespread popularity until around 1935. In any case, the use of both of these marking systems continued until the eve of WWII. Some of National Guard and Regular Army tank companies did adopt a variation of the second system, which involved painting the unit markings on the upper front nose plate of their light tanks.[10] Another marking, which was used by the 35th Tank Company Missouri National Guard, was the tricolor armor triangle painted on the upper front nose plate.

In 1927, the 16th Tank Battalion (Light) at Fort George G. Meade began using a system of home grown tactical markings to identify its tanks.[11] Under this system, each tank within the battalion had a color stripe painted around the base of the tank tower to designate the company to which it belonged; red for "A", yellow for "B", or blue for "C".[12] In addition, each tank assigned to a combat platoon was equipped with two twelve inch diameter metal plates, painted in the platoon color; red for 1st platoon, yellow for 2nd platoon, or blue for 3rd platoon. These plates were marked with a black or white number (depending on the background color), from 1 through 5, to designate the vehicle's linear number within the platoon and were designed to bolt into the loop holes (pistol ports) at either side of the turret. Because they were removable, this allowed the vehicles to be transferred between the Reserve and Training section, and the combat platoons within the company. The company tanks were also marked with a three inch tall number (from 1 to 25) on the front and a twenty to twenty-four inch number on the rear of the vehicle in the company color.[13] It is not known positively whether this marking system survived the formation of the two tank regiments from the existing tank battalions however, photographs of the 1st Battalion, 66th Infantry Regiment (Light Tanks) shows similar stripes being used on their M1917 Light Tanks.[14] However, many tank units did not mark their vehicles with unit designations until the late 1920s.

By the late 1920s and early 1930s the number of units painting their vehicles with unit markings was on the rise. Photographs of several tank companies show the units using a variation of the second marking system which was authorized by Army Regu-

*M1917 signal tanks from A Company, 1st Battalion, 66th Infantry Regiment, circa 1932. Note the large numbers on the engine compartment and the turret markings.*

lations. Under this variation, the markings were painted on the front hull armor, and took the form of the divisional patch, in color, with unit designation below in white.[15]

The 1st Tank Company, 1st Division, Regular Army on their M1917 Light Tanks, used another variation, which consisted of the unit insignia, a red "1" surrounded by a black outline of a shield and surrounded by a white wreath, painted on either side of the turret beneath the pistol port. The unit linear number was then painted in white on the front hull armor and on either side of the engine compartment.[16]

Tanks were not subject to being marked with registration numbers until 1936, as until that year, only Quartermaster maintained vehicles were assigned US Army registration numbers. When tanks were finally included in the registry, they were stenciled in three inch white numbers and letters. The code number assigned to armored vehicles was "30" and the numbers were normally applied to the sides of the hull, but occasionally they were painted on the sides of the turret.[17] Armored vehicle registration numbers for vehicles, such as combat cars and armored cars, were prefaced with "40". This system survived until the late 1950s, early 1960s, when it was replaced by the present system.

In 1931, a change to AR 850-5, required that all US Army vehicles be marked with unit markings. As part of the change, a special branch insignia was prescribed for the Infantry (Tanks): the emblem of crossed rifles with a Mark VIII Heavy Tank. For the M1917 Light Tank, the marking was stenciled in white on either side of the turret, just below the pistol port. On the Mk VIII Heavy Tanks, it was stenciled in white on each side of the main turret directly below the outlook turret. In addition to this branch marking, a three inches tall company identification number was applied to the outside armor, centered on the nose of the M1917 Light Tank, and within the triangular splash angle at the front of the Mk VIII Heavy Tank.[18] In the 1st Tank Regiment, all of the light tanks were stenciled in accordance with regulations, with a white three inch tall "1" above the tank emblem and a white three inch tall company letter below. Few photographs of the independent tank companies exist, but it can be assumed that their light tanks were marked in a similar fashion, but with the company number painted at the bottom of the Infantry (Tanks) marking.

*M1917 signal tanks from the 1st Battalion, 66th Infantry regiment, circa 1932. Note the crossed rifles and numbers.*

When the 1st Tank Regiment was redesignated in late 1932, the tanks were remarked to reflect the change in unit designation.[19] However, photographs from that period show the use of the Infantry crossed rifles rather than the Infantry (Tanks) crossed rifles with the silhouette of a Mk VIII Heavy Tank superimposed. The markings were of the size called for in AR 850-5, and were painted in white with "66" above and the company letter below the emblem. In addition to the three inch tall linear company number painted on the front armor slope, the number was also painted on either side of the rear of the engine compartment in twenty to twenty-four inch tall numbers in the company color or in white.

The 2nd Tank Regiment, which was equipped with Mk VIII Heavy Tanks and consisted of only a single active company, marked its tanks with the unit's crest rather than the branch insignia. This crest was painted in full color on both sides of the tank on the gun sponsons, eighteen to twenty-four inches tall, with the vehicle serial number painted in white four inch numbers on both sides near the rear of the vehicle, as well as the three inch tall company number on the front triangular plate.

By 1936, the composition of the Infantry (Tanks) units had begun to change. The demise of the antiquated Mk VIII heavy tank eliminated, for all practical purposes, the Heavy Tank Battalion and Regiment.[20] In the wake of this action, the 67th Infantry Regiment (Heavy Tanks) was redesignated as a medium tank regiment. The unit continued to suffer from lack of equipment and was equipped, for the most part, with what few experimental medium tanks the US Army possessed. This lack of medium tanks meant that the US Army now had to depend almost entirely on its light tank forces.

The introduction of a new generation of light tanks in 1935 allowed for changes in the formation of the Light Tank Company. More mechanically reliable than the M1917, the M2 Series of light tanks enabled the Army to do away with the reserve tanks of the Light Tank Company Headquarters section. On paper, an independent Light Tank Company now contained only eighteen tanks instead of twenty-five, with the tanks being divided between three combat platoons and a Headquarters platoon.[21] Each combat platoon of the independent Light Tank Company still consisted of five tanks, but the Headquarters platoon strength was reduced from ten tanks

*M2A2 light tank belonging to the 2nd Tank Company, 2nd Division, Regular Army. Note markings on the turret and front of the sponson, circa 1936.*

to three.

The Light Tank Battalion was also reorganized to reflect this influx of new vehicles. Although it continued to contain three Light Tank Companies, these companies now contained only seventeen tanks each, rather than the eighteen tanks of the independent Tank Company. Each of the tank platoons consisted of five light tanks, but the Headquarters section of each company contained only two light tanks. The Battalion Headquarters Company contained an additional three tanks for a total of fifty-four (as compared to the WWI battalion with seventy-six tanks).[22] However, with the exception of the Regular Army's two regiments assigned to Fort Benning, the independent tank company was the predominant organization in the Infantry (Tanks).[23]

Almost as a reflection of the new times, the color of US Army vehicles changed during this period from the QMC olive-drab of WWI to a dark olive-drab, similar to that later used during the Korean War and Vietnam War periods. By 1935, unit tactical markings began to reappear, with most light tank units adopting a system which utilized the same three basic geometric figures which were used during WWI (square, circle, and diamond), but without the card figures. The geometric figures were used to designate the platoons within a company, and an additional figure, the triangle, was added to designate HQ section vehicles. First platoon was designated by a diamond, the second platoon by a square, and the third platoon by a circle.

The tactical markings were approximately ten to twelve inches tall and, for the Independent Tank Company (as per regulation), were nearly always painted in white with the tank number (1, 2, 3, 4, or 5) in black, six inch numerals.[24] Headquarters section vehicles were marked "C" for commander, or "S" for signals, painted in black on the white triangle. The location of the markings was fairly standardized for the M2 series light tanks. All of the tanks had the markings painted on the front of each side sponson, however the additional locations of the tactical markings varied from unit to unit. Some units placed an additional marking on the rear of the hull, centered near the bottom and often painted on the round projection present on the M2A2 tanks. Others painted the markings near the rear of each turret, but closed to the outside. Another unit also placed the marking on the side of each air cleaner. The geometric figures were usually finished with a one half inch black border. Some units painted these markings on a larger scale, up to eighteen inches square, with the inside markings made proportionally larger.

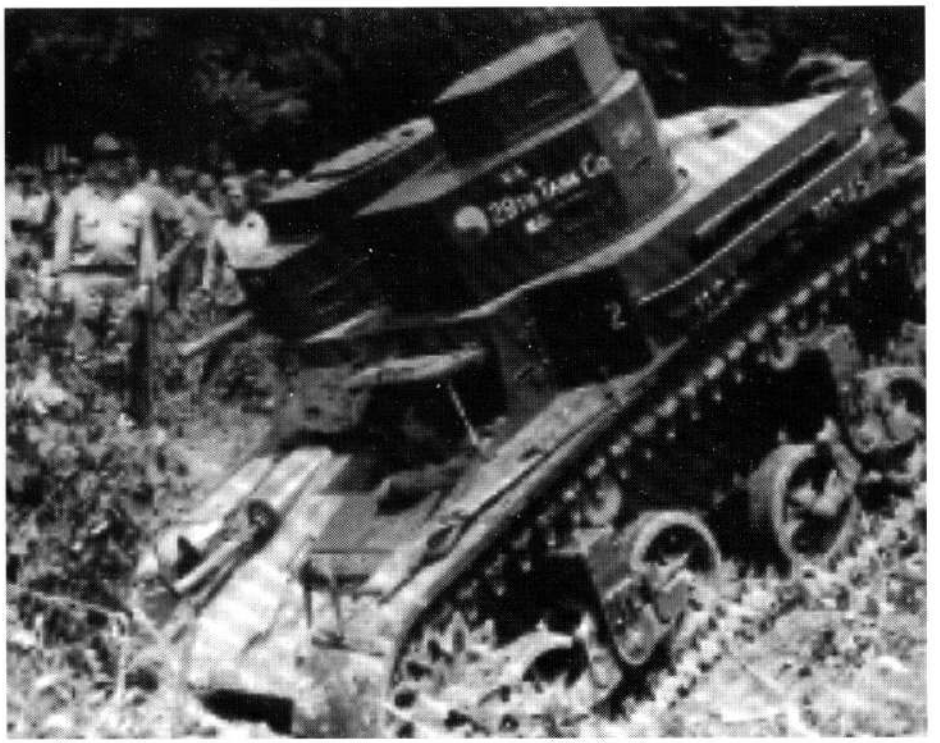
*M2A1 light tank, 1936, belonging to 7th Tank Company, 7th Division Regular Army. Note company tactical marking on sponson. Note patch above tank emblem (full color 7th ID patch).*

In addition to these tactical markings, the tanks were still required to be marked with the unit identification markings in accordance with AR 850-5. As described earlier, these markings were painted on the sides of the turret(s) and normally consisted of a painted color rendition of the divisional shoulder sleeve insignia with the company designation stenciled in white three inch letters on a single line to its right.[25] The top and bottom of the markings were bordered by one half inch thick white lines the length of the markings. These were, by far, the most common markings seen on the M2 Series of light tanks.

It should be remembered that the Infantry (Tanks) insignia was still authorized as an alternative marking for tanks, and at least two Regular Army tank companies, the 7th and the 11th, continued to paint the their tanks with that insignia.

The 11th Tank Company, Hawaiian Department, painted the Infantry (Tanks) emblem in white on the front of each of the side sponsors and then detailed them in black. On the outside of each turret on their M2A2 and M2A3 light tanks was painted a fourteen inch wide, white diagonal stripe which ran from back to front and upon which was painted an eight inch tall vehicle number in black and an eight inch diameter, full color unit patch outlined in black.[26]

The 7th Tank Company, on the other hand, painted the emblem on the outside of each turret, with the company number painted



*M2A2 light tank belonging to 29th Tank Company, 29th Division, Virginia National Guard, circa 1937. Nore markings on turret, as well as on sponson and air cleaner.*

in white underneath. However, unlike the 11th, they also used the geometric figure tactical markings, which were painted on the front of the sponsors. The company continued to mark their tanks in this manner until after the unit was absorbed by the 68th Infantry Regiment (Light Tanks) in early 1940.[27]

Because of the tight budget during this time period, many units were not fully equipped and, in many cases, only the first platoon of a tank company was supplied with a full compliment of tanks. In the case of National Guard tank companies, many received only one or two tanks for training, these being nearly always the M1917, until additional M2 series light tanks became available in the late 1930s on the eve of WWII.

Three years after the Army's two existing tank regiments were redesignated as Infantry Regiments (Tanks), they also adopted the new geometric pattern tactical markings, but with a twist. In the 66th regiment, because of the regiment's size, each company was given a color scheme for their markings in order to differentiate between the various companies within the regiment. These colors have not, as of yet, been identified exactly, the colors known to have been in use during that time period include red, green, blue, yellow, orange and white. When the markings were applied, light colored numbers and letters were used on the dark colors and dark colors on the light. In several photographs and movies shot in 1940, light tanks of the 2nd Battalion are marked "IV66" on the forward sides of each turret in four inch white letters and numbers.[28]

The 67th Infantry Regiment (Medium Tanks) took a different approach to marking its vehicles. Consisting of only a single company: Company F, the 67th was the Army's only regular medium tank unit. Originally part of the 2nd Tank Regiment, F Company had always marked its vehicles with the unit crest on both sides. When it became a medium tank company in the mid-1930s, its tanks continued to be marked in that fashion, but using a smaller version (twelve to fourteen inches tall) of the crest. The adoption of the geometric marking system in about 1935 was also reflected in the markings of the 67th Infantry. The unit appears to have used a combination of the standard markings and some homegrown marking. The geometric figure used on a particular vehicle would be repeated twice on each side, with the left most figure containing the company letter "F", and the right most figure containing the vehicle's linear company number. The background color of the figures appears to be yellow, but could also be a light blue. In some cases "67" would also appear on either side of the vehicle near the top in white three inch numbers, centered between the two geometric figure markings. The registration numbers were applied in the normal fashion on either side of the vehicle. The unit crest was painted between the two geometric figures on either side of the vehicle, but was usually only about six to eight inches tall and in full color. On one of the T4 Medium Radio Tanks, a series of red and white stripes was painted around the top of the vehicle, each stripe approximately three inches wide. The crest continued to be used on tanks assigned to F Company, 67th Tank, until the introduction of the M2 Medium Tank in 1940.

In early 1940, as a result of both the recent Army maneuvers in 1939, and the outbreak of war in Europe on September 1, 1939, the Infantry branch was directed to gather their tanks together to form a provisional Tank Brigade.[29] This brigade was made up of the 66th Infantry Regiment (Light Tanks) and 68th Infantry Regiment (Light Tanks), which had been activated especially for these maneuvers, and also included the 67th Infantry (Medium Tank) Regiment, which contained the only medium tanks used during the maneuvers.[30]

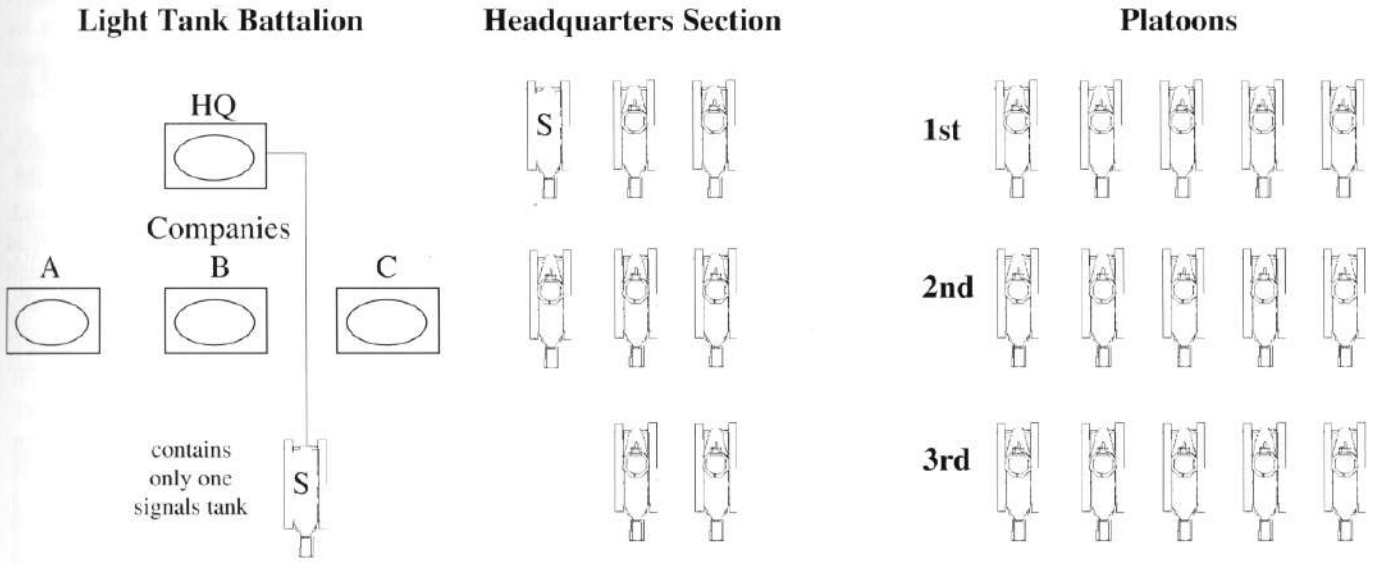
The 66th and 68th Infantry Regiments (Light Tanks) were armed with combinations of M2A1, M2A2, and M2A3 light tanks, while the sole medium tank company, Co. F, 67th Infantry Regiment (Medium Tanks) was partially armed with the recently introduced M2 Medium tank. In May of 1940, the Provisional Tank Brigade participated in the

**Light Tank Company**
**1935 - 1940 Tactical Markings**

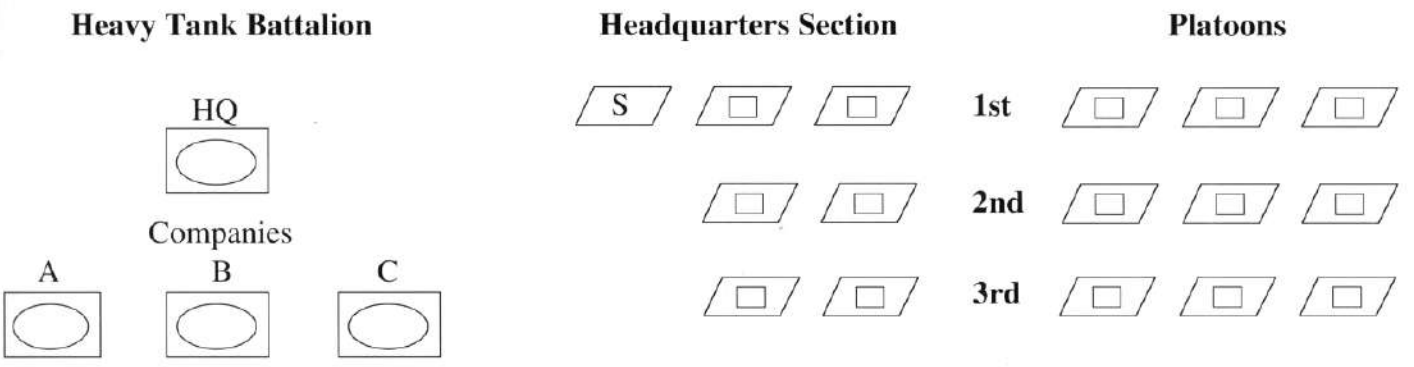
| 1st Platoon | 2nd Platoon | 3rd Platoon | HQ Platoon |
|---|---|---|---|
| 1 | 1 | 1 | C |
| 2 | 2 | 2 | S |
| 3 | 3 | 3 | |
| 4 | 4 | 4 | |
| 5 | 5 | 5 | |


*T4 and T4E1 medium tanks from F Company, 67th Infantry Regiment in action. Note doubled markings on sides of hull. Also note unit crest on turrets of T4s in the background, circa 1937.*

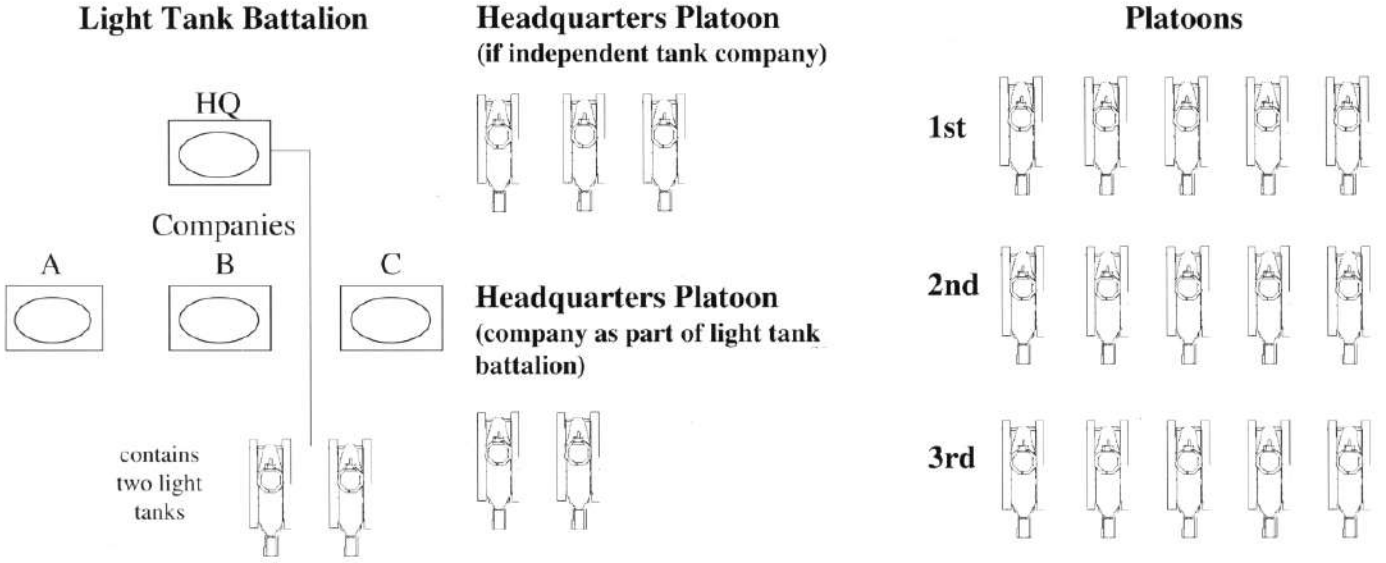
# Light Tank Organization - 1917-1935




# Heavy Tank Organization - 1917-1936




# Light Tank Organization - 1935-1940




Note: Tank silhouettes are not indicative a a particular vehicle type, only the quantity.

Louisiana Maneuvers along side the 7th Cavalry Brigade (Mechanized) from Fort Knox.

Photographs and existing film footage from the 1940 maneuvers indicate that each of the light tank companies assigned to the provisional tank brigade was given a two color combination for their company markings. In addition, some of the recently brigaded independent tank companies still retained their company markings, most notably the 7th Tank Company, which retained its Infantry (Tanks) marking on their tank turrets. A photograph of the 1 st Battalion, 68th Infantry (Light Tanks) shows several M2A3s marked with the geometric tactical markings, but are marked additionally on the sides of the turrets with "B-68 Inf" between two thin lines.

The tactical markings noted on tanks used during the 1940 maneuvers include the standard white with black outline, as well as what appears to be medium blue with a white outline. Intermediate colors, such as red or yellow, with dark numbers and outlines have also been noted. An interesting feature, seen only on tanks used during the 1940 Maneuvers, is a large white square painted on the rear of both engine air cleaners, apparently for visibility and safety purposes.[31] The squares measured approximately 12" on each side. In this late period the tactical markings on the light tanks were painted on the front of both sponsors and on the outside rear of each turret. The medium tanks were marked in a similar fashion with the markings painted on the front of the hull, just below the driver's window, on the access doors at either side of the hull, and on the rear of the hull superstructure. The unit markings, mandated by regulations, do not appear on the tanks used during the maneuvers, probably as a deception measure.

On July 10, 1940, the Armored Force was established, ending armor's long, intimate, association with the Infantry and, conversely signaling the beginning of the end for the Cavalry. The activation of the 1st and 2nd Armored Divisions from the 7th Cavalry Brigade (Mechanized) and the Provisional Tank Brigade ushered in a new era of tactical markings for American tanks.

# ENDNOTES

[1] National Defense Act Approved 3 June 1916 as Amended by Act Approved 4 June 1920, Washington, DC, GPO, 1920, pg. 15.

[2] Camp Meade, Maryland, became Fort George G. Meade in 1928.

[3] 1st Tank Regiment was formed in 1929 from the 15th, 16th, and 18th Tank Battalions while the 2nd Tank Regiment was formed from the 17th and 19th Tank Battalions.

[4] Untitled Pamphlet, General History, Production, and Weapons System Data and Tank Corps Training c1920, Author Unknown, COL. Viner Collection, Patton Museum; M1917 Light Tank was also known as the Six-ton Special Tractor, Model 1917.

[5] Manual for the Quartermaster Corps, 1916 with changes to 1917, Vol. I, GPO, 1917, pg. 485.

[6] Specifications for Interior Painting of Tanks, OMT 470.8/1330 dated Jan 20, 1920. This memo mentions several options in the painting of interiors, but specifically mentions that normal practice was to paint the interior white with the doors painted OD. Other options included painting it all OD, or all but the turrets OD.

[7] Proposed Authorization to Use Varnish on Surfaces Normally Painted Olive Drab, Item 7173, Sub-Committee on Mobile Artillery, Aug. 17, 1928. Approved Aug. 23, 1928. This memo covered *ALL* types of Ordnance equipment, including tanks specifically.

[8] Based on photographs supplied by Mr. Mark Beveridge, Dwight D. Eisenhower Library. A series of shots also exists of a single tank which climbed Pike's Peak in Colorado in 1920.

[9] AR 850-5 Marking of Equipment, Vehicles, and Property, War Department, 15 May 1926 "8. Tractors and Tanks.a) These vehicles may be marked as prescribed in paragraph 6... b) Such markings are not required but, if used, must be uniform throughout the unit." their light tanks.

[10] Photographs of tanks assigned to the 40th Tank Company (Cal NG) and the 3rd Tank Company RA, both taken in the late 1920s and early 1930s show this variation.

[11] Tank Notes, Volume IV, Number 1, July 1927, Tank School Library Camp Meade, pg. 44. This system was based on one in use at Fort Benning, but Benning's system was not specifically described by the article.

[12] Location nomenclature for the M1917 Light Tank is taken from Handbook of the Six-Ton Special Tractor Model 1917, War Department Book No. 1995, c1919. In this case, the tower is the turret cupola.

[13] Tank Notes, Volume IV, Number 1, July 1927, Tank School Library, Camp Meade, pg. 44. The front of the tank was marked on the plate above the driver's feet, the rear number was painted on the either side of the rear of the engine compartment.

[14] Photographs of the 66th Infantry (Light Tanks) clearly show that the stripe markings were still being used by the 1st Battalion. The vehicle numbers also continued to be painted in the company colors, the dark colors being shaded in white.

[15] This description is based on photographs taken in 1929-1931.

[16] Photograph of four tanks of the 1st Tank Company, c1930. Courtesy of Mr. Mark Beveridge.

[17] AR 850-5 Marking of Equipment, Vehicles, and Property, dated 25 September 1936. It specifically prescribes the placing of registration numbers on all Army owned vehicles.

[19] The 1st Tank Regiment was redesignated at the 66th Infantry Regiment (Light Tanks) while the 2nd Tank Regiment was redesignated at the 67th Infantry Regiment (Heavy Tanks).

[20] In April 1936, the Ordnance Committee recommended canceling the requirement for the Heavy Tank. This was approved on 7 May 1936.

[21] Table of Organization and Reference Data 1939, Command and General Staff School, Fort Leavenworth, Kansas, 1939.

[22] Ibid.

[23] The 66th Infantry Regiment (Light Tanks) was composed of two active tank light battalions, each having three line companies, while the 67th Infantry Regiment (Heavy, later Medium Tanks) consisted of only one active company; Company F.

[24] In AR 850-5, all markings were applied in either white or black paint. It would seem that most units continued this practice with their tactical markings.

[25] AR850-5 Marking of Equipment, Vehicles, and Property, dated 25 September 1936, It specifies makeup and placement of unit markings.

[26] B&W Photograph taken of the 11th Tank Company, November, 1940 Schofield Barracks, Hawaiian Islands, Patton Museum Library Collection.

[27] Provisional Tank Brigade in the Louisiana Maneuvers, 1940, 8mm B&W transferred to VHS, Patton Museum Library Collection.

[28] B&W films transferred to VHS format. Provisional Tank Brigade in Louisiana Maneuvers, 1940, and training film, T55-145, dtd 1940, Armored Combat Vehicles, Patton Museum Library Collection.

[29] Col. Alvan C. Gillem Jr., Conference of 2nd Armored Division October 7, 1940, G-3 Conference file, War Dept. General Staff Records, NA RF 165.

[30] The 67th Inf. (Medium Tanks) consisted on a single company of M2 series medium tanks. The 68th Inf. (Light Tanks) was made up of the 1st, 2nd, 3rd, 4th, 6th, and 7th Tank Companies, consolidated especially for these maneuvers. The 66th Inf. (Light Tanks) was not reinforced, and consisted of only the two existing battalions.

[31] B&W film transferred to VHS, Provisional Tank Brigade in Louisiana Maneuvers, 1940.

# The 251 Calliope

## The Facts Behind an Unusual Vehicle

**By**
**Michael Eastes**

The July 1987 issue of *Journal of Military Ordnance* featured photographs and a brief description of a Sherman Calliope rocket system mounted on an Sd.Kfz. 251 halftrack. The author, Robert Merkiv, conjectured that this was an obscure German modification. The truth is somewhat different.

My father, Winston B. Eastes, was a sergeant in the U.S. Army's 7th Armored Group. The 7th Group was used in a variety of roles and had a number of configurations during the war, usually consisting of two tank battalions and various add-on units. At one point, Dutch and Belgian troops were even assigned to the command.

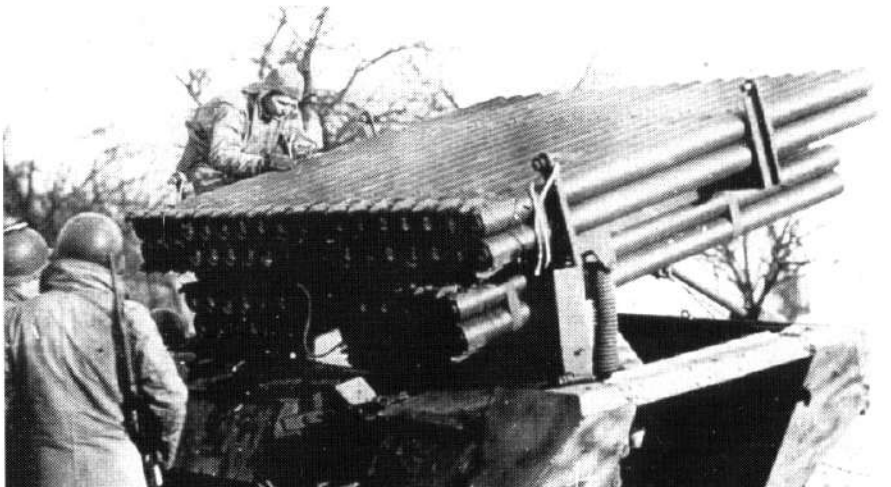
The unit that spent the longest time in the Group was the 743rd Tank Battalion. Shortly before the Ardennes offensive, the 743rd was partially equipped with the T-34 Calliope rocket system. For a special task, seventeen Shermans and three captured German halftracks were reconfigured to carry the launchers. My father's narrative tells the story.

*"... within a few days, we moved out of the Roer or near the Roer and I can't think of the name of that little town, Munsingladbach, I think is the name of it.*

*We loaded, we had seventeen tanks from one of the battalions and they put these rocket, sixty-barrel rocket launchers on top of them. I'm sure that you have seen pictures of them in the movies or somewhere. We had to prepare the shells, the rockets for them and we stayed in a house up there in Munsingladbach for about a week, me and about eight or nine other guys and we had to put these rockets together and they were about the size of 155mm shell, I think is about the same diameter. They were about eight inches, six, or eight inches and we had to put the firing rings and stuff on them and get them ready to load into these launchers. We loaded them up in the launchers and they knew or they had a suspicion that the Germans were going to break out across the Roer.*

*This was before the Battle of the Bulge. We had the rockets ready to go and we moved up where we could see over the Roer river. We had three German halftracks and seventeen tanks that made twenty vehicles with sixty rounds of rockets on each one and we had to dig the left . . . we pulled in headed north with the tanks facing north and had to dig under the left tread to lower them so that the arc of the rockets would be, in other words they couldn't raise the rocket launcher high enough where they could shoot where they wanted to shoot. So they lowered the tracks to make the angle steeper. We got them ready to go and they fired the sixty times twenty rounds in sixty seconds and they all went into those woods over there. We never did know what happened over there, I mean what become of it. They did just a bunch of firing and explosions is all we know. Then, I was in one of the halftracks and had a little button hooked up. A little firing button with a gauge on it and we had a telephone in each vehicle with a wire running from up at the front and when they said fire, we fired. You would watch your counter to be sure that you got them all out, if you didn't, if you'd stop, you'd have a round hung up in there. These old halftracks had to be towed out there and we just left them sit. We had to get on the back of a tank to get out of there. But it was exciting, boy those damn rockets were really something."*

While the Germans certainly made innovative use of captured equipment, these vehicles were a case of Yankee ingenuity.



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# The World's Best Tanks

## *(Let the controversy begin!)*

By
Gregory Fetter
Senior Defense Analyst

Ever so often, the Weapons Group of Forecast International is asked to provide its assessment of the tanks that are in production worldwide. While any such assessment is subject to personal, doctrinal, nationalistic and other factors, when compared to other assessments by other knowledgeable observers, it can be useful. Even though one analyst's number one tank may be rated as number three by another analyst, a general ranking will eventually develop. It is hoped that the following ranking will be useful to readers; it is a reasoned analysis, based on technical factors, user reports, and doctrines of the tank-developing nation. The only criteria for selection is that, as of early 1998, the tank must be in production (such as the Leclerc) immediately available for production (such as the M1A2 Abrams), or soon available for production (such as the Black Eagle).

While any ranking of this type can be subject to numerous inputs, it must be remembered that when all is said and done a tank must do three things: move, communicate and shoot.

Based on the above, the criteria for the selection process includes the following:

• Level of mobility - the power-to-weight ratio.

• Lethality - the combination of firepower (the size and capability of the main armament) and fire control (the target sighting, acquisition and ranging components), as well as the associated computerized equipment to generate the fire control solution and properly lay the main armament for a first-round hit. Regarding the main armament, the Russians have long had the largest-caliber tank cannon in operational service; they have also maintained the lead in the firing of anti-tank missiles through their tank cannon. While the tank cannon of the West have been a little smaller in terms of caliber, this has been offset by their superior battlefield performance — most recently demonstrated in the Second Gulf War.

• Fightability- ergonomics and habitability. While a tank must have easy-to-use controls over all its fighting-related operations, the crew also essentially uses the tank as its "home" in combat. A cramped interior or the lack of some small feature like a beverage warmer can have a significant effect on moral and, hence, combat performance. While somewhat difficult to describe, general information on this important parameter is revealed over time. Examples include the cramped interiors of some well-known (Russian and AMX 30) tanks as well as improperly designed/positioned components in others (Challenger 1), or difficult to operate controls in still others (M47). An increasingly important parameter in judging the fightability of a tank is whether it includes an automatic loading system for the main armament. While the Russians pioneered this technology, early Russian automatic loading systems tended to "eat the arms" of Russian tankers. But they have long been on the positive side of the learning curve with this technology, which still exists in only a few Western tanks.

• Survivability - this includes the type and amount of armor protection, general design (including interior design and silhouette) and, most recently, active defense systems.

**The Best - Leopard 2A5**

This German product of Krauss Maffei is generally regarded by most observers as the best overall tank in the world. This potent tank has been greatly improved in the latest A5 (Improved) version, maintaining the lead that it has held for some time. The Improved version of the Leopard 2 was originally developed for the British Army's Challenger replacement program. While it lost out in that competition to the new Challenger 2, the tank was further improved to the A5 level for the Swedish competition for a new tank, which it subsequently won. As of early 1998, Krauss Maffei remains convinced that it has the best tank in the world and that it can defeat any other tank in a fair competition. The improvements over the standard Leopard 2 include a greatly increased level of protection; while the automotive performance has suffered a little because of the increased weight, the power-to-weight ratio is still acceptable and the MB 873 Ka 501 diesel engine, among the best in the world, can be uprated. The turret has been redesigned with a much higher level of protection, and all-electric gun control and stabilization equipment has been installed. New fire control components, along with changed locations within the turret, have greatly improved the already excellent level of fightability of this tank. The "hunter-killer" tactics so necessary in successful tank engagements have been made much easier in the improved model of the Leopard 2. While the Leopard 2 has again maintained its ranking over the M1 (in the A2 model), the gap between the two tanks is exceedingly small; in our rankings, the Leopard 2 beat out the M1A2 partially based on proven components and overall performance, including information that has been learned from recent competitions.

**Second Place - M1A2**

With the addition of the Commander's Independent Thermal Viewer, the Abrams tank card finally compete in the all-important hunter-killer mode of fighting on the same level that the Leopard 2 has long been capable of doing. The Inter-Vehicular Information System adds a significant capability that is lacking in most other tanks; in point of fact, with regard to the communications task, due to the level of interconnectivity, the M1A2 beats out the Leopard 2 hands down. In addition, the level of protection in the A2 is among the best in the world. The M1 is still the only tank in production in the world that uses a vehicular gas turbine as its prime mover (the Russians have apparently given up on this technology with the T.80 program, the T.90 has a diesel engine). While the merits of the vehicular gas turbine versus the diesel continue to be argued, it appears that no other nation in the world will be ready to adopt this technology for some time, if ever. Research has always indicated that the basis of this is the higher fuel consumption of the gas turbine engine compared to the modern diesel engine. While on paper and in laboratory operations the vehicular gas turbine has a superior specific fuel consumption rate, in operational practice, the modern diesel wins in this characteristic. However, while no M1 ever ran out of fuel in the Second Gulf War, the lines of fuel bowsers following the M1 units were there for all to see. The performance of the engine in the M1 is not questioned; many nations feel that the associated support of the vehicular gas turbine-powered Abrams is just too much for them to afford. It is worthy of note that for the ongoing competition to supply Turkey with a new tank, a diesel engine (the MTU Euro Powerpack) has finally been fully integrated with the Abrams. The present bustle-mounted auxil-

iary power unit installation is adequate, alleviating the concerns over the earlier externally mounted unit. But by far the main factor favoring the Abrams in our rankings is its sterling performance in the Second Gulf War.

**Third Place (only by a hair) - Type 90**

More than a few analysts have described this Japanese tank as being the best in the world, arousing some rather heated comment by other analysts and military observers. However, this was earlier in the program when it was shrouded in a higher level of security than now, even though there are still a number of technical details that have not been released about this tank. One factor contributing to the mystery regarding this tank is the fact that, even in early 1998, outside of military circles, the Type 90 is essentially unknown in the world. There are several reasons for this, the first being that Japanese have never been noted as being at the forefront of tank design. Contributing to the lack of identity is the fact that the contractor Mitsubishi Heavy Industries, as well as the Japanese government, have given only a minimal amount of publicity to this tank. However, the all-electric Type 90 is thoroughly modern and sophisticated; even more advanced in the areas of fire control and vehicle electronics than the highly publicized Leclerc, Leopard 2A5 and M1A2 While no official or company sources have commented on it, there have long been stories circulating in military and industry circles that a lot of German (especially advanced Leopard 2) technology was incorporated into the Type 90. The tank certainly looks a lot like the Leopard 2 and the Leopard 2's Rheinmetall Rh 120 120 mm cannon (manufactured under license in Japan) is the main armament of the Type 90. However, as opposed to the Leopard 2, the Type 90 features an automatic loader and a three-man crew. But it is the fire control suite and advanced vehicle electronics that really make the Type 90 a world-beating tank. The well-known Japanese prowess in electronics has been exploited to the fullest extent in the Type 90. While details remain clouded in secrecy, the fire control suite has an automatic target tracking capability and it has long been rumored that some sort of target recognition/queuing and/or threat prioritization capability is incorporated in the suite. The fightability (crew ergonomics to some) of the Type 90 is stated by most sources to be excellent, although the tank is considered cramped by some Western analysts. This is a reflection of the Japanese design philosophy, probably based on anthropomorphic studies. The tank's level of protection is highly sensitive but is stated by most observers to be among the best in the world, with the armor suite composed of advanced design ceramic and composite armor. However, the most recent information indicates that the actual level of protection is optimized to the perceived threat and is not up to the level of tanks designed to fight in Western Europe. The 1,119 kilowatt (1,500 horsepower) Mitsubishi IOZG diesel engine is also of advanced design, and the 50 tonne Type 90 has a power-to-weight ratio that places it roughly equivalent to the rest of the world's top tanks. All these things (as well as others) considered, the Type 90 is one of the top operational tanks in the world today.

**Fourth Place (again, by a hair) - Leclerc**

Even though the new Challenger 2 has longer-proven automotive and other components, the high degree of electronics in the French tank prompt us to rate it just above the British product. The record of operational use and its performance in competitions also rates this tank just a little better than Challenger 2. The main selling points of the all-electric Leclerc are the advanced electronic systems (including an advanced-design fire control system and databus), the three man crew with an automatic loading system for the 120 mm CN 120 cannon, and the advanced SACM VOX 1500 diesel engine with integral gas turbine. The French tank also has a modular-type armor suite than can be changed as the threat evolves. The Leclerc beat out the Challenger 2 (as well as the M1A2) in the United Arab Emirates competition. But it should be noted that the Emirates funded the integration of a new engine, specifically the German Euro Powerpack featuring the MT 883 diesel engine. The Emirates are also very interested in a new 140 mm tank cannon developed by the French; in fact, this cannon has already been demonstrated to the Emirates.

**Fifth Place - Challenger 2**

The Challenger 2 is so vastly improved over the original Challenger that it could be called a new tank. This is despite the fact that, except for the integration of the superior TN54 gearbox in the Challenger 2, the two tanks are essentially the same below the turret ring. Even though the Challenger 1 had an excellent record (including the longest-range kill in tank history) in the Second Gulf War, the tank was lacking in the all-important area of fightability — mainly due to the poor design of the turret and some problems in fire control components. These problems have been put right in the Challenger 2 turret; it has been totally redesigned, with the fire control and other components moved and now placed for maximum crew efficiency. In addition, a 1533 databus, new electronic components and new fire control components, some essentially the same as used in the Leclerc and the M1, have been integrated with the Challenger 2. While the new L30 high-pressure tank cannon is still a rifled piece, it can deal with anything that moves. All explosive ammunition is stored below the turret ring. In keeping with the British Army doctrine favoring a high degree of protection, the Challenger 2 is fitted with the second-generation Chobham armor and is one of the best-protected tanks in the world.

**Sixth Place (once again, by a hair) - Black Eagle (modernized T.80U)**

This tank is not one of the original models of the T.80 (which were powered by what was apparently a lamentable modification of a helicopter turboshaft engine), but a greatly enhanced version of the U model, albeit still powered by a vehicular gas turbine with the bugs hopefully wrung out. The entire T.80 program represents a continuation of the "high road" in Russian tank development; many lessons learned from the T.64 program have been incorporated in the T.80. A major factor in the high ranking is the new 135 or possibly 140 mm tank cannon, replacing the long-lived 2A46 125 mm smoothbore tank cannon. This was the deciding factor in rating this tank slightly higher than the T.90. Thus, with the Black Eagle, the Russians can still claim to have the largest-caliber tank cannon in the world, although the exact status of the Black Eagle program is still not clear. The advent of this new tank cannon is accompanied in the Black Eagle by a new bustle-mounted automatic loading system, replacing the old under-turret system which is not isolated from the crew compartment — a significant hindering factor in survivability. This new tank cannon almost certainly retains the capability to fire anti-tank and anti-helicopter guided missiles, maintaining the Russian lead in this area of military technology. Featuring a new, lower silhouette and what the available evidence indicates is the latest generation of heavy-type Kontakt 5 explosive reactive armor, the Black Eagle appears to be a compact, efficient and very potent tank. However, knocking this tank from a higher position in the top ten is the fact that, during recent operations against dissident forces in the Russian Federation, the T.80 (of which the Black Eagle is essentially an improved model of) received some severe criticism for poor workmanship and quality

control. Some reports indicate that the level of mechanical failures was unacceptable in any modern armored force. And there has been continued criticism of the vehicular gas turbine technology of all the T.80 models, although it seems that in the latest versions of the tank (including the Black Eagle), the Russians are finally getting the technology put right. However, the greatest criticism of the T.80 overall was its vulnerability to a variety of rather crude weapons. Given the level of opposition in the recent fighting, critics of the tank wonder how it would have fared against a well-equipped and determined foe. Once these questions and the other details of the Black Eagle (including the fire control suite) become known, a better assessment of this tank will be possible.

**Seventh Place - T.90**

This tank, being standardized by the Russian Federation, is the latest manifestation of the T.72 design, so different that it warrants a new designation. Powered by the V-84-1 diesel engine, the T.90 is essentially a further improved T.72BM. The T.90 features the Kontakt 5 explosive reactive armor suite, day/night thermal imaging system integrated with the computerized 1A45T fire control suite, laser warning device, and the new Shtora-1 countermeasure system which is effective against infrared guidance systems. The 125 mm 2A46M1 cannon can fire a full range of ammunition, including the 9M119 Refleks laser guided missile. However, questions about the T.90 tank's survivability in combat and concerns regarding overall quality control place this tank somewhat lower in our ratings. Like the T.72, the T.90 is also more cramped inside compared to most Western tanks; this reduces the level of fightability. It should also be noted that the T.84, manufactured by Ukraine, is in many ways quite similar to the T.90; it too is powered by a diesel engine.

**Eighth Place - Type 88**

This Korean tank has been described as a baby M1; actually, the tank was designed by the same people who designed the M1. But the Type 88 uses a diesel engine and different fire control components, some equal to or even superior to those used in the M1. Its main drawback compared to the other tanks in our ranking is that it mounts the M68 105 mm tank cannon. However, for the Korean's threat scenario, the M68 is adequate; firing the latest pattern penetrator ammunition, this cannon has an anti-armor performance essentially equal to the baseline anti-armor performance of the Rh 120/M256 120 millimeter tank cannon. In any event, this criticism is becoming moot as the contractor, Hyundai, has integrated the M256 with the Type 88, and production of this newest version of the Type 88 tank is soon to get under way. With the changes in the fire control suite and the larger cannon, the 120 mm version of this tank will most likely be rated higher in our next analysis of this type.

**Ninth Place - T.72**

. . . But only in its latest production models such as the BM. While originally developed along the "low road" of lower sophistication and proven components, the latest models of the T.72 compare favorably in some areas with some of the tanks rated higher. The latest versions of the T.72 (called Shilden for export) feature the same 2A46 125 mm tank cannon as the T.80 and T.90. An automatic loading system (albeit mounted under the turret, which reduces its ranking in terms of survivability) is also used in this tank. The 2A46 tank cannon in the late model T.72 can also fire the 9K120 SVIR laser-guided antitank missile. However, the T.72 is still an early-sixties design that can be improved only so far. The level of protection, even with the highly touted explosive reactive armor, is not quite up to the level of the tanks we have rated higher. Like all Russian tanks, the T.72 is more cramped inside compared to most Western tanks, reducing the level of fightability. It's saving grace is that it has been modified and manufactured in steadily advanced models; it is still a very potent tank that is offered at a unit price that is much lower than the competition.

**Tenth Place - Merkava Mark III**

While some analysts have called the Mark III Merkava the best tank in the world, our analysis of this tank places it in the lower ranks of the top ten tanks available today. The Israeli Merkava, but only in its latest Mark III manifestation, comes in last in our latest ratings, although some caveats are in order. The Mark III version of the Merkava, with the MG251 120 mm main armament, is certainly a formidable tank. It also has a fairly advanced level of vehicle electronics and fire control, the latter including a threat warning system. Due to its unique design and advanced modular armor, its level of protection overall is possibly the best in the world. This tank also incorporates several features that are entirely unique. However, the Merkava is, by Western European standards, somewhat deficient in teens of battlefield mobility due to a rather anemic power-to-weight ratio, which is much lower than what is considered acceptable in most other leading tank-developing nations. Overall, the Merkava reflects the unique requirements and doctrine of Israel; to that nation, the Merkava represents the best balance of the factors noted at the outset of this article. While the Merkava has never been sold on the export market, the Mark III is now being offered to Turkey. The longstanding and well-known geopolitical situation of Israel is mostly responsible for the lack of export sales, but in actuality, the Merkava is outside the mainstream of tank development in the world.

**Chinese Tanks**

There are no Chinese tanks in our ratings. Chinese tank design has long been based on the Russian T.55, and thus the long series of Chinese tanks from the Type 59 right through the Type 79 have essentially been successively improved versions of the T.55. The People's Republic of China first broke this trend with the Type 80. Succeeding tank designs have been more advanced, with the latest Type 90-II representing major advances in overall design, including the integration of some Western technology. However, the Type 90-II has not yet entered serial production and the earlier designs do not compare favorably with the tanks described above.

**Conclusion**

This assessment is largely based on technology; however, there are several other factors which affect the performance of any given tank in battle. Logistics are very important; if no replenishment ammunition or fuel is brought to the tank, it is useless no matter how technologically sophisticated it is. An unquantifiable but very important factor is crew motivation. But probably the most important factor is training, TRAINING, TRAINING. Time and time again, it has been proven that the level of training is probably the most important parameter in the performance of any given tank in battle. Even a mediocre tank, given a highly trained crew, can perform well in combat. Probably the best example of this is the Challenger 1 in the Second Gulf War. Even though the overall performance of this tank in NATO's Canadian Cup competitions was very poor, before the British Army's Challengers went to battle in the Second Gulf War, the levels and rates of training skyrocketed. Live-fire shootings were greatly increased, as were combined unit operations. The result was an excellent performance, including the longest-range tank-to-tank kill in history.

# MO Specials

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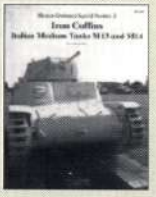
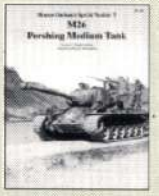
M88 Armored Recovery Vehicle

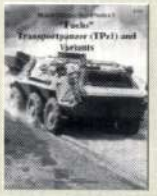


M13/14 Italian Tanks



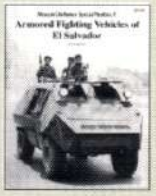
M26 Pershing

German Elefant

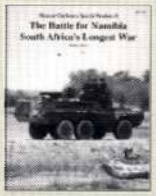


TPz1 Fuchs

Postwar T-34/85

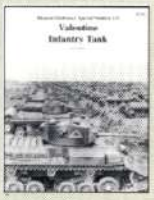


AFVs of El Salvador



War in Namibia

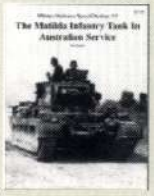
M1A1/A2 Abrams



Valentine Infantry Tank

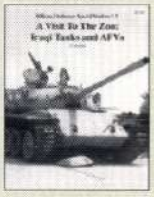
Sd. Kfz. 231 (8-wheel)

Israeli Merkava II/III

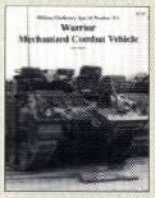


Australian Matildas

Waffentrager Wiesel



Iraqi Tanks & AFVs



British Warrior MCV

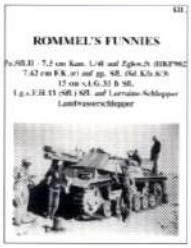
M18 Hell Cat

Wespe

British Firefly

IS-3 Stalin

Dutch YPR765

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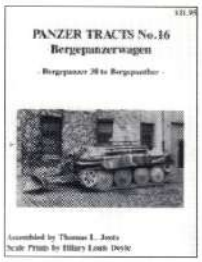


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# AN/MLQ-34 TACTICAL JAMMER

## *Gulf War Tested!*

Imagine yourself the Iraqi T-72 company commander, nervously awaiting the arrival of a wave of American Abrams. You have heard nothing of how the war is going, and you have not seen your air force in weeks.

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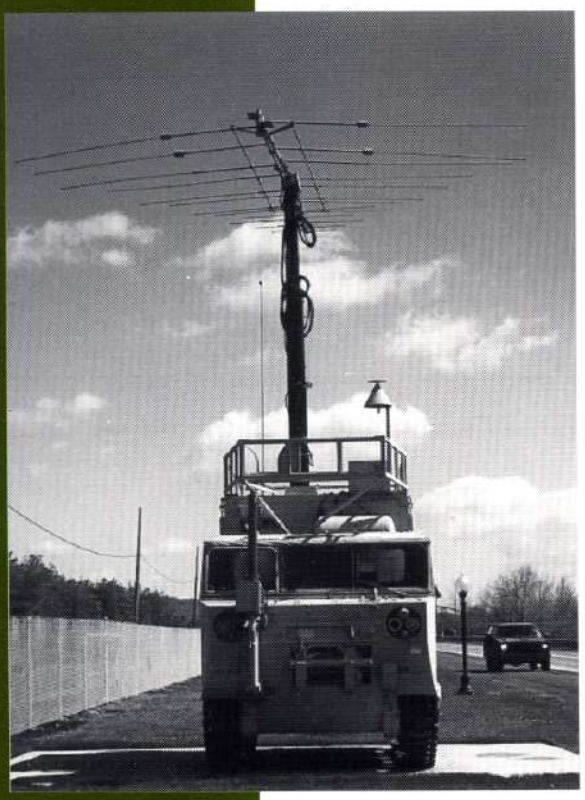
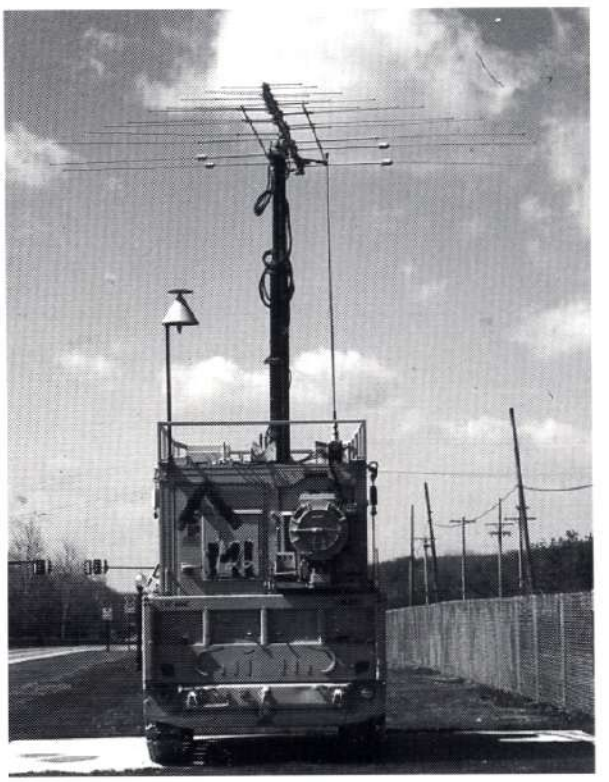
Only static. . .


Built in 1987 on a M1015A1 Electronic Warfare Systems Carrier (which is a modified M548 ammunition carrier), this Electronic Warfare VHF communications jamming system was used by the 501st MI BN during Desert Storm. The AN/MLQ-34 is normally found at Division and Corps level.

The markings on the Tobyhana Army Depot vehicle's windshield were in black; SPC RON SMITH on the driver's side, SGT DOWSE opposite. The serial number was 2350-01-136-8745.





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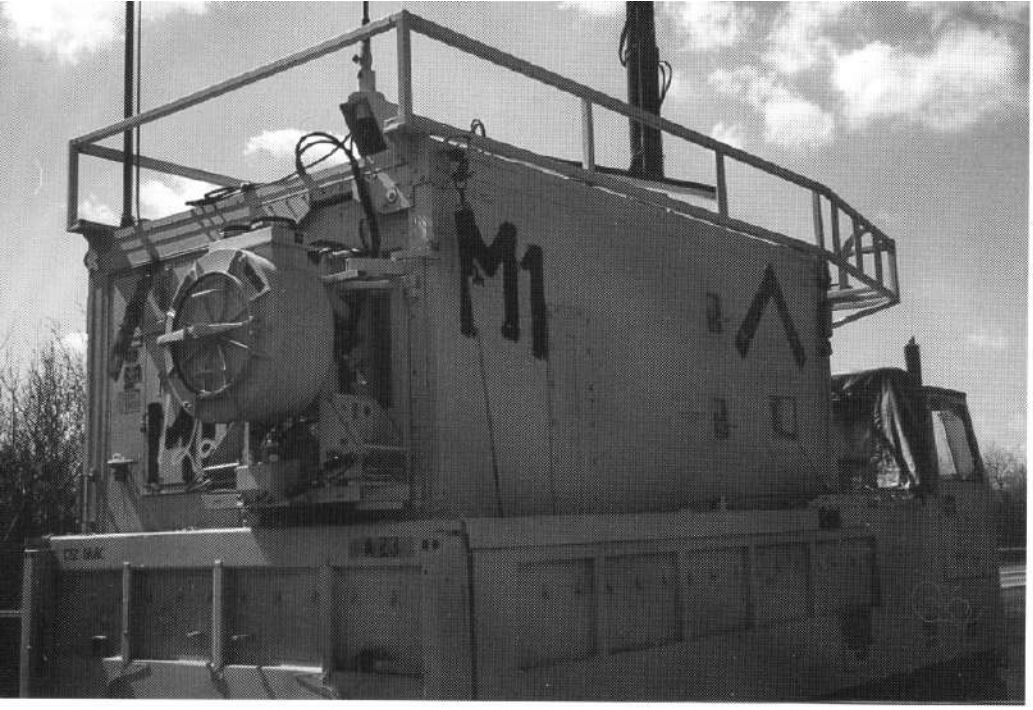
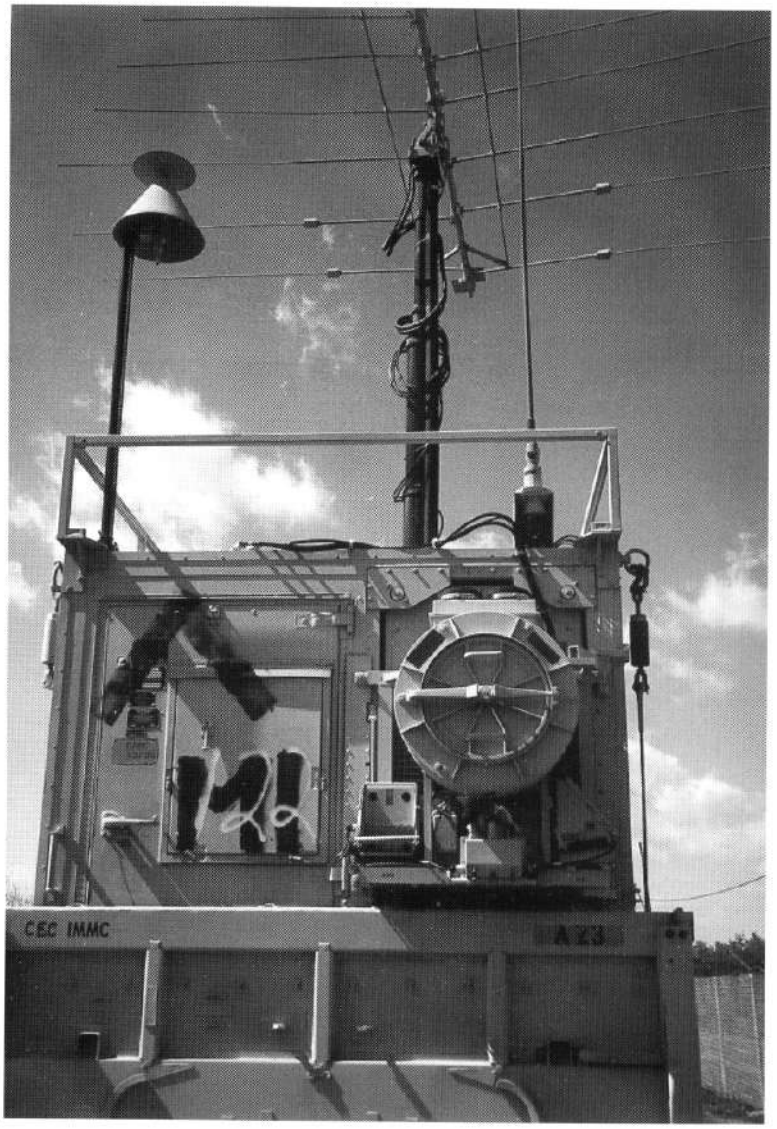
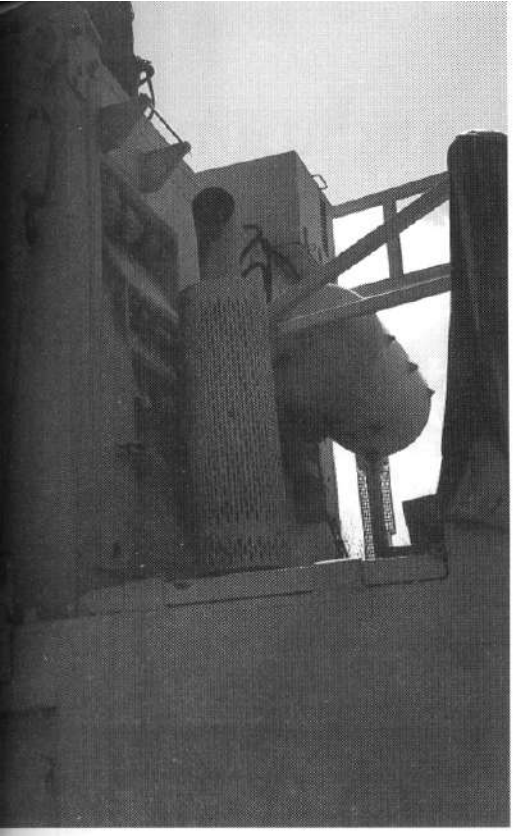
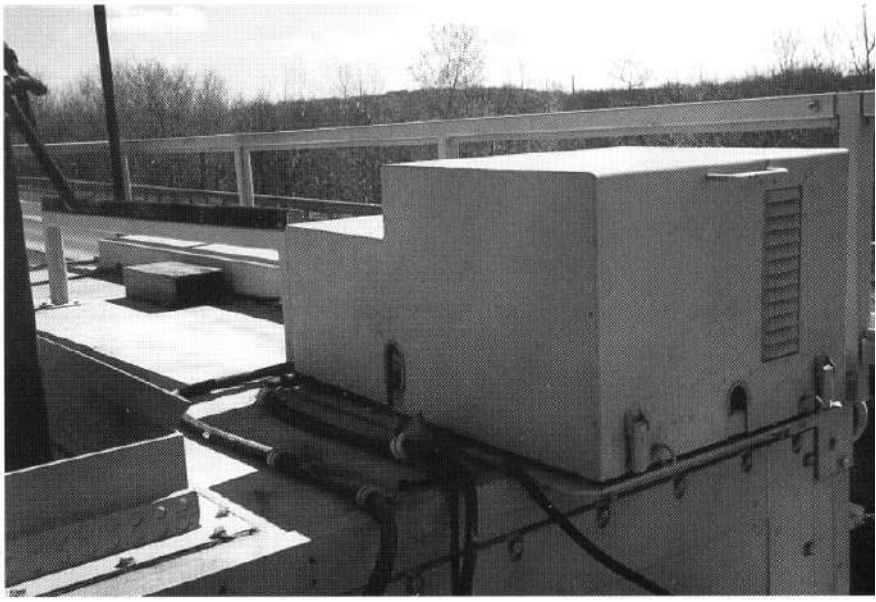
Adam Geibel




*A view from the right rear. The location of the folding step can be seen on the side of the cargo carrier. Many of the Gulf War marking still exist.*



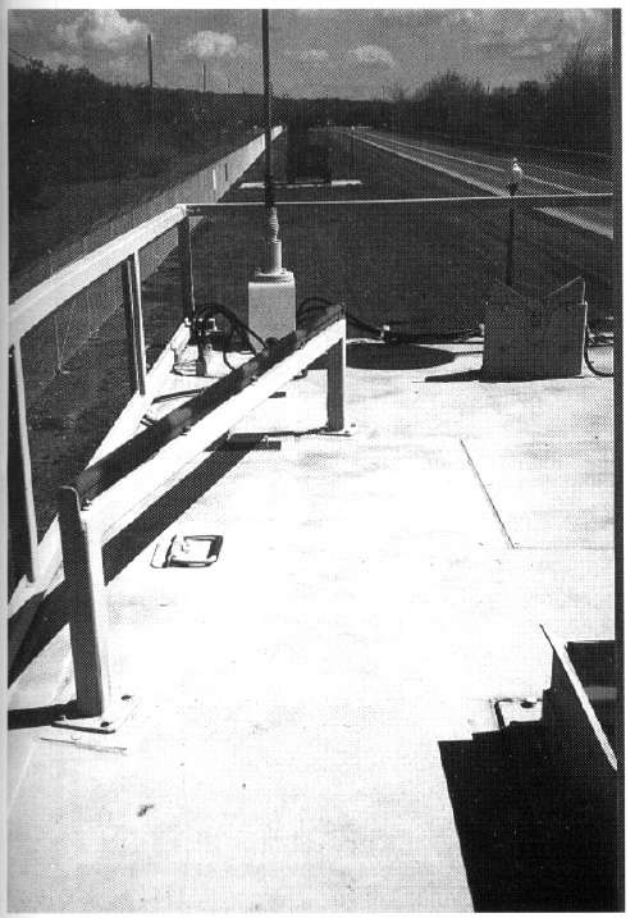


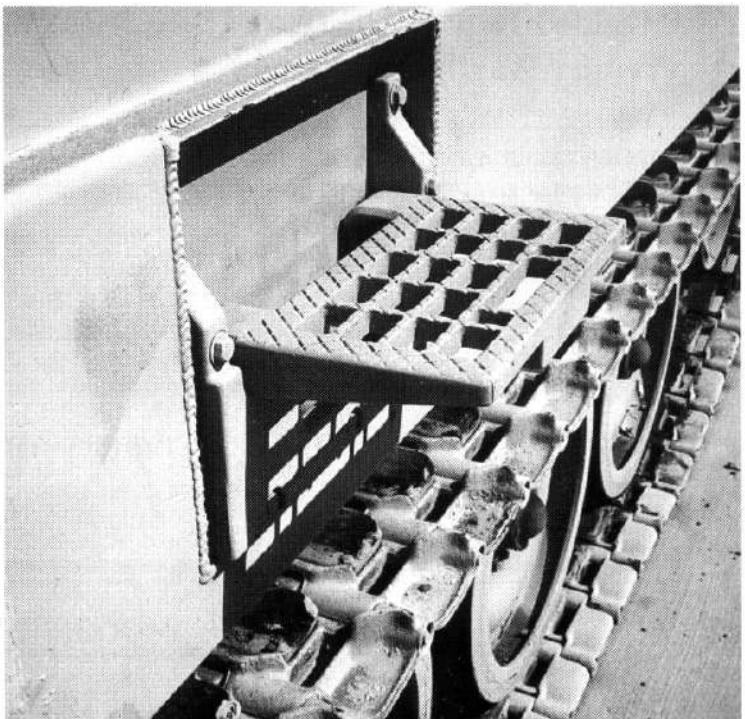


ABOVE: *The exhaust and muffler in the space between the cab and the shelter box.*

LOWER RIGHT: *A folding step, one per side.*

OTHER PHOTOS: *An assortment of photos illustrating the roof configuration.*





# The Ordnance Museum Foundation

## Executive Director's Corner

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

FELLOW MEMBERS;

As reported in the last issue, the 3-D graphics presentation is complete and the Action Committee is developing the fundraising program for industry. The strategy is to "try it out" on selected firms in the Baltimore area for both soliciting and feedback on how to make the presentation more effective. The improved program will then be presented to major corporations nationally for significant fund raising. We are interested in your suggestions and contacts in corporations that would be receptive to our cause. Please drop me a note if you have any possible contacts.

The Annual Meeting was held on March 7th. We reviewed the 1997 accomplishments and Foundation statistics (members, financial, and programs). The Board members up for reelection were voted in for another term. If you would like to receive a set of the handouts, please let me know and I will be happy to send you a set.

The Foundation had a table at the Maryland Arms Collectors Association show in Baltimore, Maryland on March 21 and 22. We thank the Association for the donation of the table. We met a number of collectors and hope to see a significant number of them joining the Foundation.

We plan to have a table at the Armed Forces Day event at Aberdeen on May 16, 1998. We will be located in the Military Vehicle Rally and flea market field (this activity is from May 14 to 17) as we were last year. So if you are at the event, please stop by and say hi!

Rich Carnegie Chairman - Board of Trustees



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*The memorial building rises dramatically at the end of a tree-lined driveway. Passages from the Koran are inscribed in the black along the outside. Other inscriptions can be found lining the inside as well.*

# Martyr's Memorial

## Jordan's Tribute to it's Military

*By*
*Jeff McKaughan*

If you ever have the opportunity to visit Jordan, the list of sights, historic and otherwise, to see would be huge. Jordan is a country with a great past and much of that history has been preserved in one fashion or another. For any history or military enthusiast, the Martyr's Memorial should be on your list.

Opened on July 25, 1977 on the Silver Jubilee of the crowning of King Hussein's ascension to the throne, the memorial pays tribute to the soldiers that have fought and died in the service of Jordan from the days of the Arab Revolt to the present.

The grounds are dominated by the square, windowless building which houses the displays that tell the history of Jordan. Inside there are three 'wings' to the presentation. Each wing is a ramp that leads upward until reaching the top of the building. Display cases along the wall are filled with artifacts, maps, photographs, and documents that explain and chronicles the events of the Arab Revolt, the history under the British Mandate, through to the creation of the modern Jordan. All of the information is provided in well-written English.

At the top of the building is the Peace Garden. In the center of this open-air garden is an elevated area, which encircles a single olive tree symbolizing peace (the olive tree is also the tree of life). Along three of the surrounding walls are black marble-like panels that have the names of those servicemen and women who have died. Although early March during my visit, the colors of the garden were obvious. In shades of black, red, green, and white the colors duplicate those of the Jordanian flag.

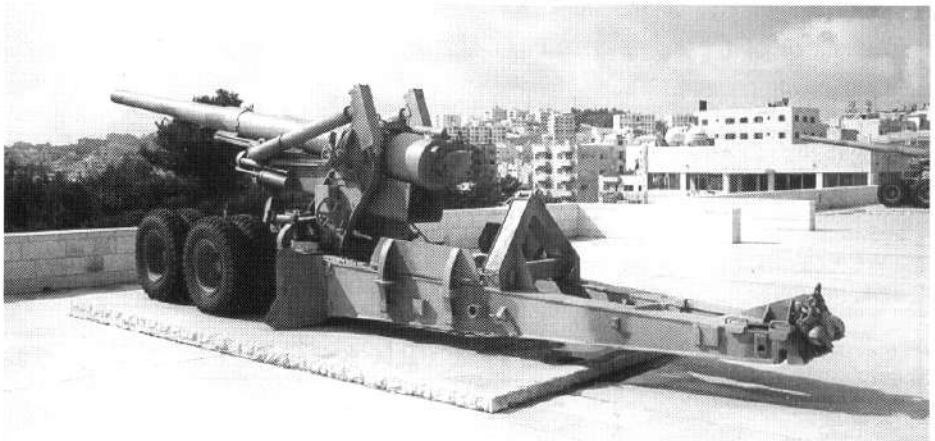
Although the Martyr's Memorial should not be confused with a military museum, there are a number of vehicles on display, including, the Saladin and Marmon-Herrington armored cars, several field artillery pieces including the 155 mm 'Long Tom' and the 25 pounder, and a 17 pounder anti-tank gun. The lineage to British equipment can easily be seen. There are also numerous great photos of action and equipment throughout the history of the Kingdom. There was also a tank, what appeared to be an M47 although it was heavily tarped as it was very close to some heavy construction equipment.

Expansion of the facility is underway as this issue goes to press. The foundation and wall reinforcements for a 'service building' were in progress. This building will house food services and restrooms, along with other offices. Two other areas are also in the planning; the Peace Plaza and a Tolerance Plaza. While it is not my impression that there is any intention to turn the Martyr's Memorial into a military museum, the expansion plans can only allow more of Jordan's history to be shown and displayed.

Sometimes it's too easy to visit a museum and come away with many photos, but not much of a true understanding for the significance of what you photographed. The Martyr's Memorial shows you history in a very well-done and understandable manner while at the same time paying a fitting homage to those the Memorial is meant to honor.

Situated on the northern side of Amman, the Martyr's Memorial is located at Gate 4 of the Sports City Complex along the road to Zarqa. It is easy walking distance from hotels such as the Marriott, Le Meridien, and the Regency.

I would like to thank Salam Gammoh for my personal tour and insight into the Memorial and also to COL Mejhem Al-Kadim, the Memorial's director, for our brief meeting.



*One of two imposing 155 mm 'Long Tom' guns that keep vigilance over the memorial from the front pavilion. The memorial sits atop one of the highest hills in this part of Amman.*

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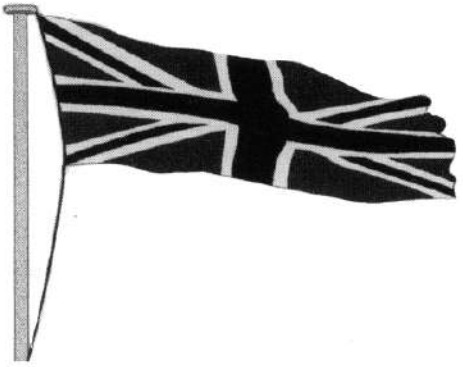

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