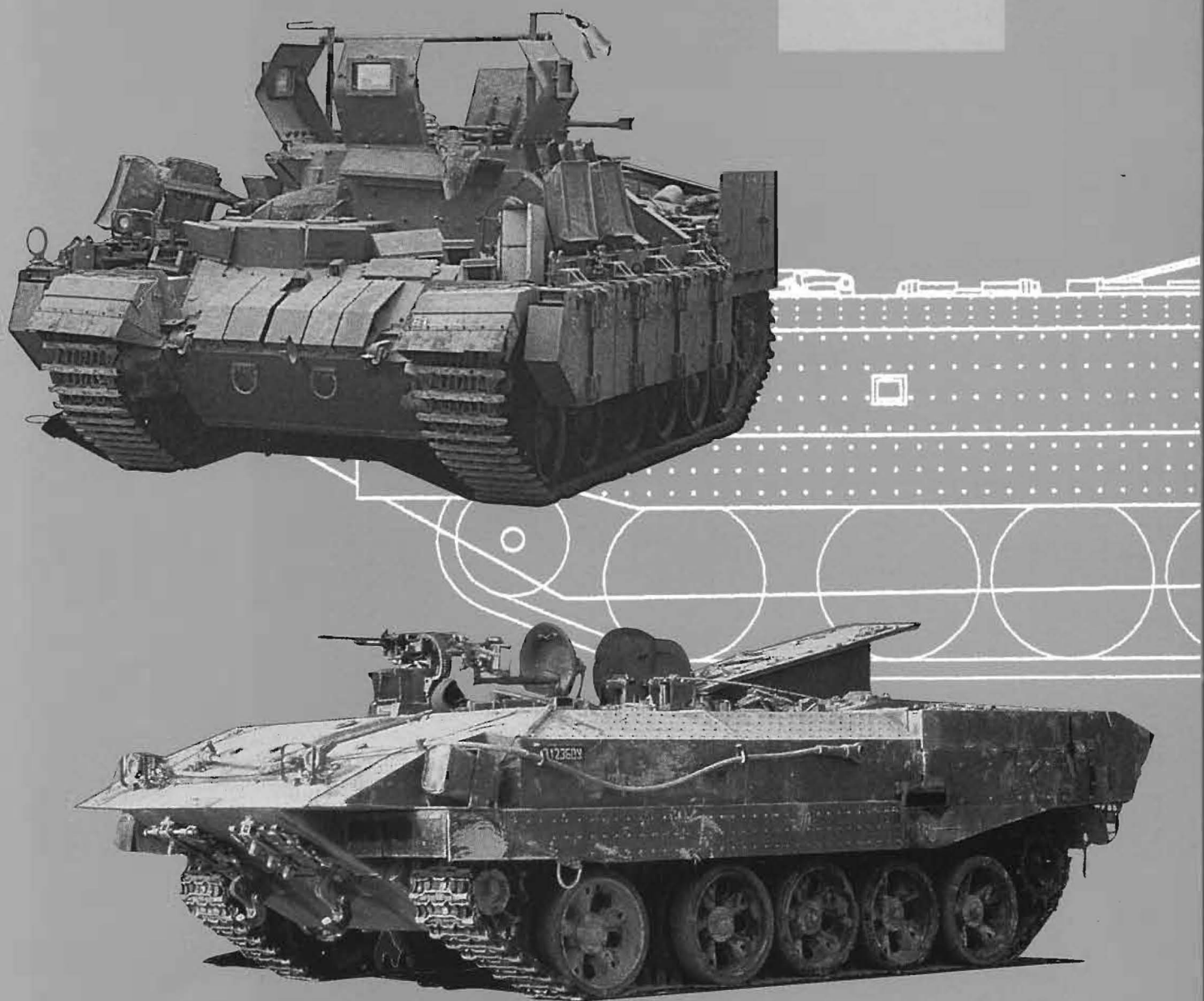
military briefs

2

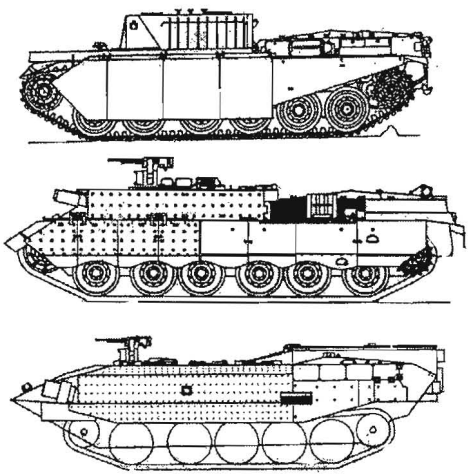
Israeli Tank Based Carriers



Marsh Gelbart

Military Briefs No.2

Israeli Tank Based Carriers



Marsh Gelbart

ISBN 0-9577586-1-8

First published in Australia in 2000 by
Mouse House Enterprises®,
PO Box 1174,
Woden ACT 2606,
Australia.

Email: mousehouse@start.com.au
Website: www.webone.com.au/~myszka

Cover design by George Micallef of Drawn Conclusion Designs.
Edited by Nicole Elizabeth Myszka

Printed by Panther Publishing & Printing
66 Barrier Street
FYSHWICK ACT 2609
AUSTRALIA

For Helen who inexplicably prefers ballet to tanks.

Acknowledgments
The author would like to acknowledge the enthusiastic assistance given by Sean Curtis. Zvi Gera of Nimda Co. Ltd, Anthony Maguire. Nafi Segal, Christopher Foss, Sampo Mikkalo. Ludovic Bertrand, Magnus Bergstrom, P.M van Wijk and the IDF Spokesman's office

Books in preparation:
IDF Improvised Armoured Vehicles and Jeeps
IDF Half Tracks
ANZAC M113s

1. A Sherman armoured ambulance. An extensive conversion, the Sherman ambulance involved removing the tank's turret and relocating the engine to the front.

CONTENTS

←**2.** A Magach 7 and a late model Nagmachon on patrol in Southern Lebanon (Anthony Maguire).

→**3.** A closer look at late model Nagmachon in Southern Lebanon. Note the rear stowage basket, heavy coating of mud on the wheels and the thick armoured side skirts (Anthony Maguire).

Mouse House Enterprises welcomes corrections and additional information to its books. If you have any additional images of Israeli or Australian armour in service and would like to share them with other interested enthusiasts please contact us at PO Box 1174, Woden ACT 2606, Australia or by Email: mousehouse@start.com.au. Corrections notified will be placed on our website in an erratum page www.webone.com.au/~myszka. Vehicles used in Vietnam by the Australian Military Forces are of particular interest, as this has not been covered in any depth in the past.

ISRAELI TANK BASED CARRIERS

Background

Israel stands alone amongst modern military powers in its choice of troop carrier for its mechanised infantry. In defiance of accepted doctrine, the Israelis have not adopted infantry fighting vehicles (IFVs) as their main infantry carrier. They have instead introduced a series of heavily protected carriers based on the hulls of surplus tanks. The culmination of this process is the Achzarit ("little cruelty"). The Achzarit is a unique heavily protected heavy assault carrier and will be the focus of this book. As a companion vehicle, the Israelis have adopted a similarly configured, highly survivable, combat engineer vehicle known as the Puma.

Why did the Israelis turn their back on the IFV? After all, modern IFVs such as the Bradley, CV90, Marder and Warrior are impressive fighting machines, with mobility comparable to that of the main battle tanks (MBTs) they accompany. Conventional IFVs also pack considerable firepower, often mounting turrets equipped with a 25-40mm cannon. These weapons give them an effective punch against enemy infantry and light armour. The Bradley and Desert Warrior also carry anti-tank guided missiles, giving them the capability to defend themselves effectively against MBTs.

However, not all is rosy. IFVs usually only have sufficient armour protection to allow them to survive hits from rounds of not exceeding machine gun calibre and from shrapnel. Although appliqué armour suits are available to increase the limited protection that conventional IFVs offer their passengers, the Israelis feel that the prevailing design concept behind the IFV is flawed. Whilst IFVs have a similar battlefield signature to MBTs, their capacity to survive punishment is very much lower. This discrepancy exists despite the fact that an infantry carrier, by virtue of its function, is exposed to greater risk than a tank. A tank can command an objective by fire from some distance, whilst an infantry carrier may be called upon to traverse a fire zone in order to deliver its infantry onto that same objective. What the Israelis desired was a heavy armoured personnel carrier - an assault carrier - that could survive that traverse, with a chance of survival at least as good as that of an MBT. It is principally because of this factor that the Israelis rejected orthodox IFVs as their primary mechanised infantry vehicle.

The Israeli Defence Force's (IDF), assessment of conventional IFVs had identified a series of further shortcomings. Firstly, manned turrets take up space that should be used to carry extra infantrymen - after all, this is the basic function of the IFV. Secondly, the sheer size and bulk of manned turrets increases the battlefield signature of the IFV - the old axiom "tall soldiers lead short lives" holds true for armoured vehicles as well as men.

Israel developed heavy infantry carriers after the 1982 Lebanon War as a direct consequence of the casualties suffered by its mechanised infantry in that engagement and resulting dissatisfaction with the M113 APC. Some Israeli infantrymen preferred not to travel in the M113, considering them to be a death trap. Despite appliqué armour the M113 remains vulnerable to infantry light anti-tank weapons. The problem was, what should the replacement of the M113 be? Those IFVs available for purchase such as the Bradley were considered too expensive and, although better protected than the M113, still lacking in survivability.

There is non-attributable evidence that the Israeli armaments firm Rafael trialed a locally modified Bradley IFV. This beast, referred to as the "Heavy Bradley", had its complex turret removed and replaced with a relatively simple overhead weapons system (OWS). A weighty suite of appliqué armour arrays, both reactive and passive, was applied to the hull. The "Heavy Bradley" was rejected on grounds of cost and over concerns that its running gear would not cope with the combination of extra weight and the rough local terrain. Consequently, the decision was made to convert obsolescent tanks to heavy infantry carriers.

Kangaroos, Pumas and other exotic beasts

As there was no existing vehicle in service, which matched Israeli requirements, they were forced to develop a heavy assault carrier from scratch. Kangaroo carriers offered a potential solution. The concept of Kangaroo carriers dated back to the later stages of World War 2 when the British army modified the turretless hulls of obsolete Sherman and Canadian Ram tanks to carry infantrymen into battle. The Kangaroo offered superior protection than the half-tracks or Bren Carriers then in service.

The Israelis themselves had converted obsolete Sherman tanks, removing the turret and fitting the vehicles out as armoured ambulances. Although never used as infantry carriers, the Sherman armoured ambulance demonstrated that the Israelis had the design and industrial base to build Kangaroo carriers should they so wish.

The IDF introduced a series of stopgap Kangaroo conversions for use by infantry and combat

engineers. The exact chronology and design history of these vehicles is unclear, available information contradictory and at times seems to involve deliberate misinformation. This is understandable given the IDF's understandable paranoia around security.

It is however clear that the IDF removed the turrets from some of their obsolescent Centurion MBTs and built new fighting compartments with an angular superstructure, over the space where the turret race once existed.

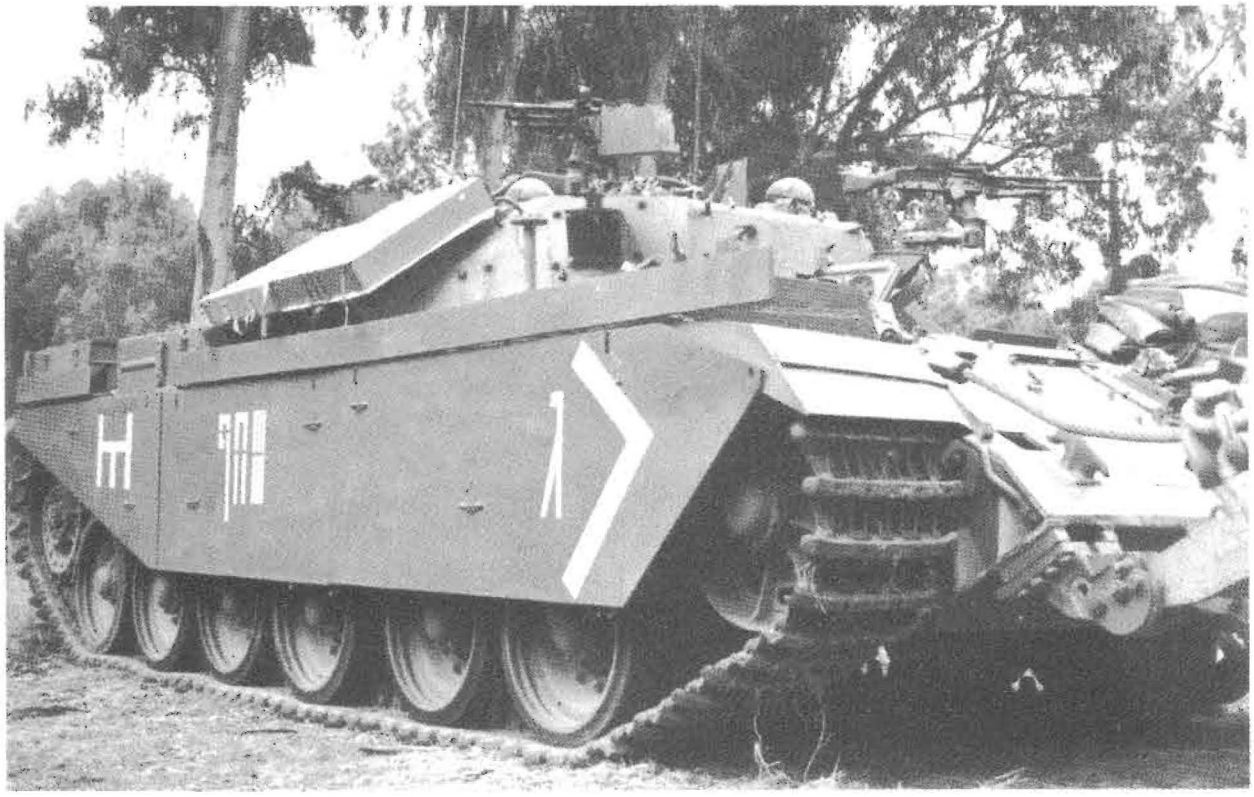
Table 1: Timeline and flowchart for Israeli tank based carriers.

Centurion	**Centurion**	**T-55**	**Merkava**
As the upgraded Centurion was withdrawn from front line service, hulls became available for conversion.		Hulls available, serviceable and relatively cheap.	With its front mounted engine, an ideal configuration for conversion.
Nagmashot (circa 1983) The initial impetus for the Nagmashot was as a heavy carrier for infantry, rather than as a highly survivable counter-insurgency vehicle.			Rumoured experimental heavy assault carrier (circa early 1980s) Reported to have had excellent potential. Cancelled due to cost.
Nagmachon (circa late 1980s) Various upgrades to the Nagmashot rationalised into a standardised vehicle. In essence a highly survivable counter insurgency carrier.	**Puma** (circa late 1980s) The vehicle is optimised for combat engineers.	**Achzarit** (circa 1989) Optimised for use by assault infantry. The vehicle has a rear mounted exit.	
Nakpadon (circa mid 1990s)For use in high threat counter- insurgency environments. Uses latest generation passive armour.			Further Merkava based developments? (late 1990s) Anecdotal references to a new carrier with petal shaped armour arrays.

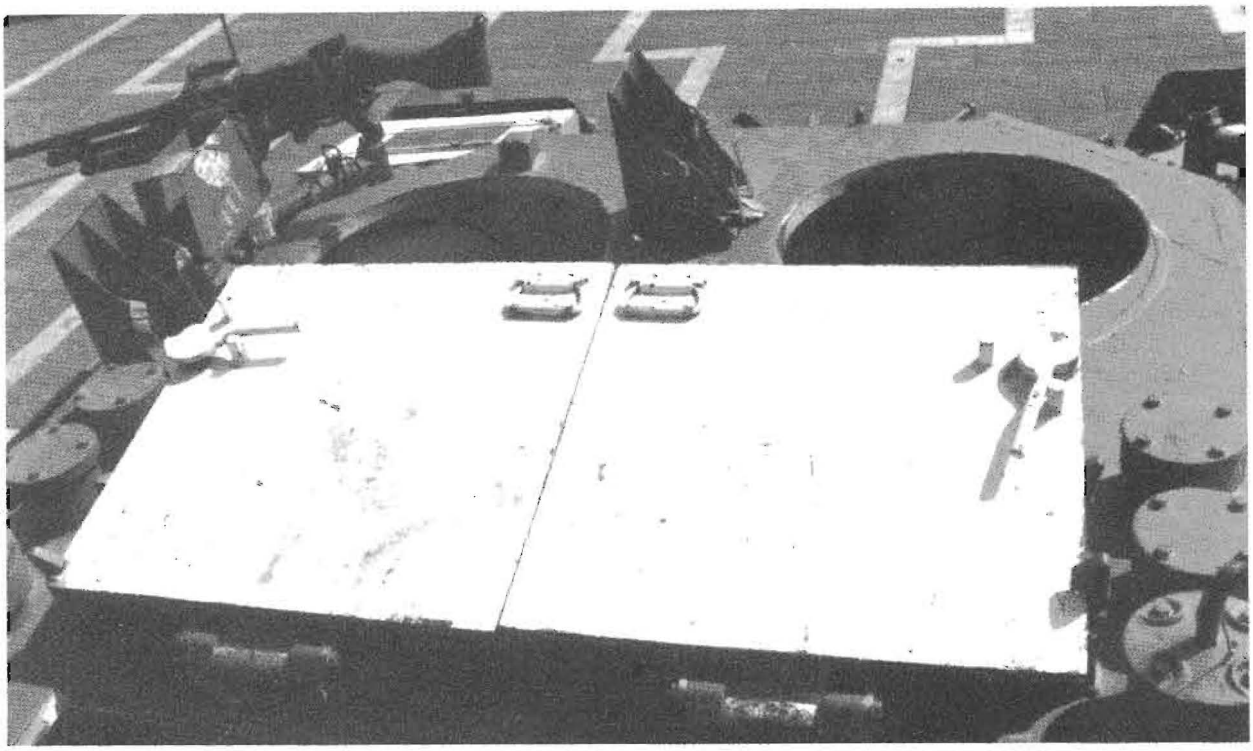
Nagmashot

Early Centurion conversions known as the Nagmashot appeared in the early 1980s. Its major disadvantage was the lack of an adequate rear hatch to the fighting compartment, one that allowed infantry to debus under fire and in tactical situations. Consequently, the six-man infantry squad normally carried would have to disembark over the side of the machine hull. This precluded the Nagmashot from being use against a sophisticated enemy, capable of coordinating artillery strikes in a fast moving combined arms battle. Infantry would be too vulnerable to artillery air bursts. Instead, the machine's was most often seen functioning as an infantry carrier in the counter insurgency environment of the Lebanese security zone. The main armament was three or four pintle-mounted FN 7.62mm machine guns. On occasions, machines were fitted with one or more 12.7mm machine guns in lieu of the FN weapons.

4. An early Nagmashot. The vehicle's built up superstructure is lower than the fighting compartments found on later machines. Interesting points of note are: different crew helmet types, mine walking shoes on the side of the crew compartment, coiled camouflage net and the adaptor plate for attaching the mine rollers to the Centurion hull (IDF Spokesman).

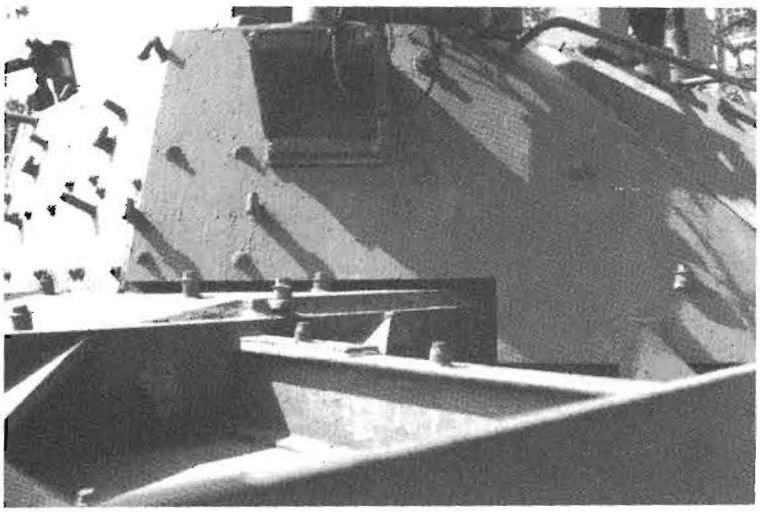


5. The same early variant of Nagmashot. Note that studs have been fitted for adding reactive armour blocks to the superstructure, but none have been fitted. From right to left the tactical markings are as follows: the front pointing chevron indicates 2nd Company, the Hebrew character (gimel) indicates the 3rd Platoon, The three character word spells "shachaf" meaning seagull and the last marking is the tactical marking for combat engineers (IDF Spokesman).

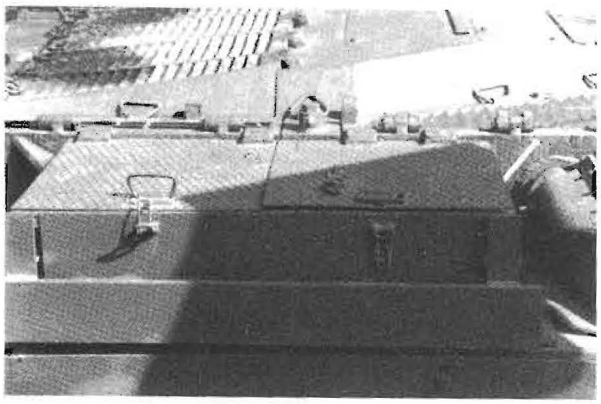


6. The top of the crew compartment with the top hatches open and painted white on the interior surface. Items of interest are the ready racks ammunition box holders and multiple antennae mounts (Nafi Segal).

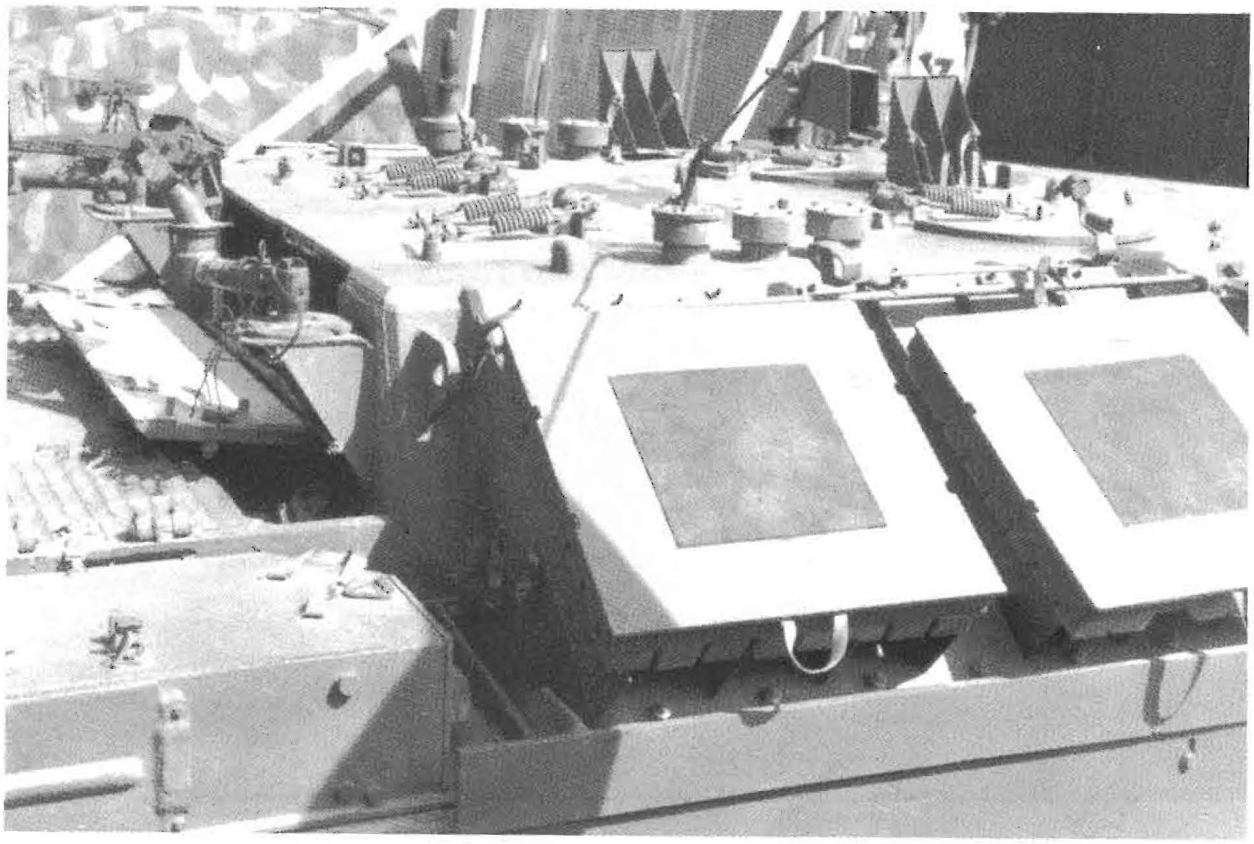
7. A close up of a Nagmashot's right front corner with machine gun mount and the numerous Blazer Explosive Reactive Armour (ERA) attachment points (Nafi Segal).



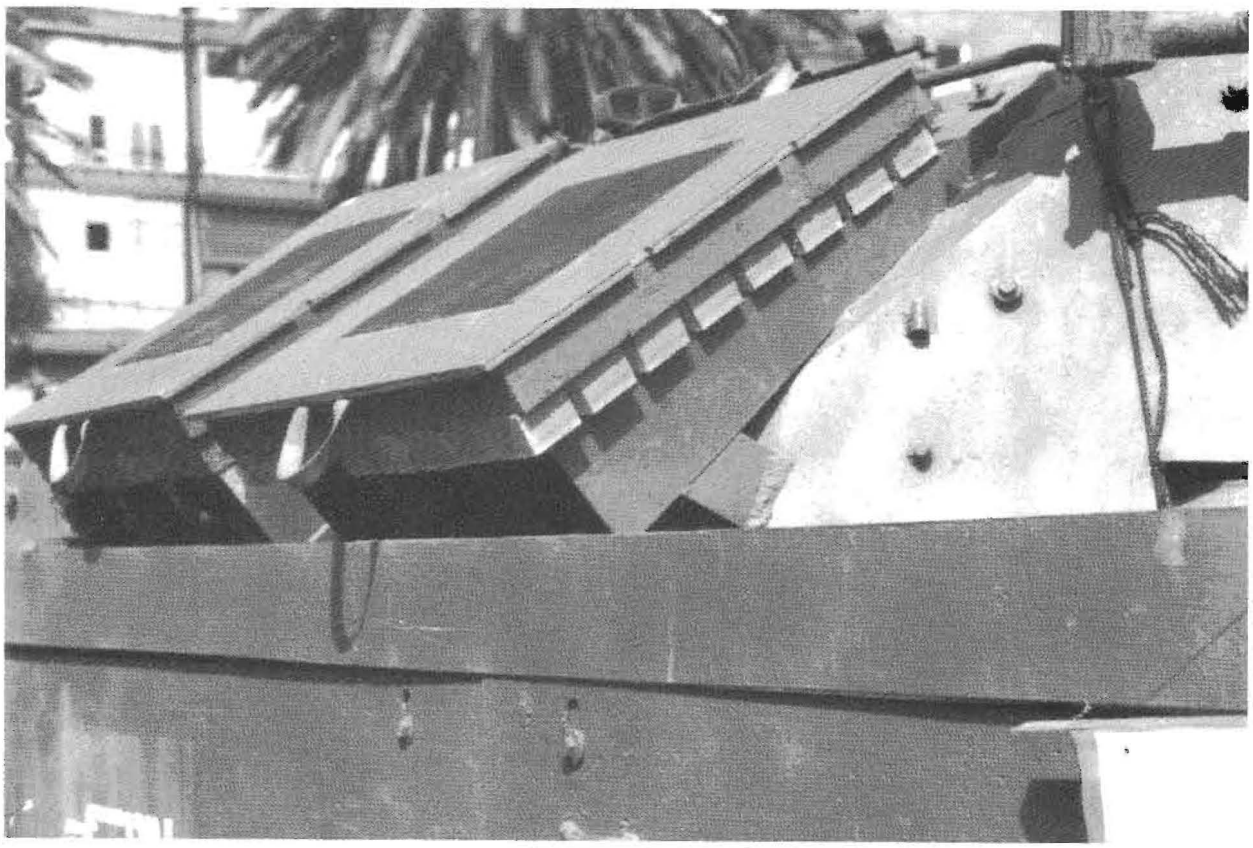
8. Close up view of a Nagmashot front left machine gun mount and extra bracing for the side skirt mountings (Nafi Segal).



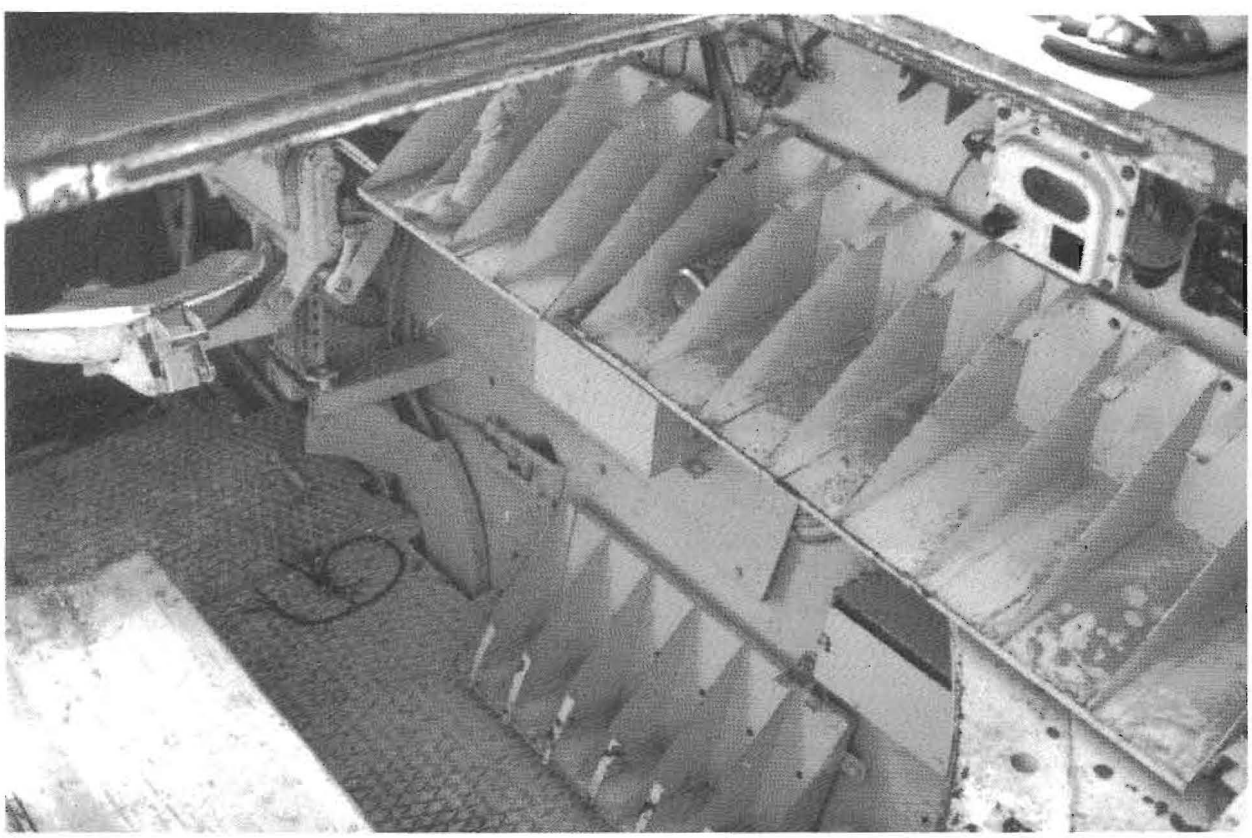
9. The right side stowage bins. Note the exhaust stains on the engine louvres (Nafi Segal).



10. A top view of the crew compartment. Note the mine walker pads and the side of the compartment and the smaller rear opening hatches also painted white on the interior surfaces (Nafi Segal).



11. The mine walker pads are attached to the metal dividers that separate the Blazer ERA blocks (Nafi Segal).

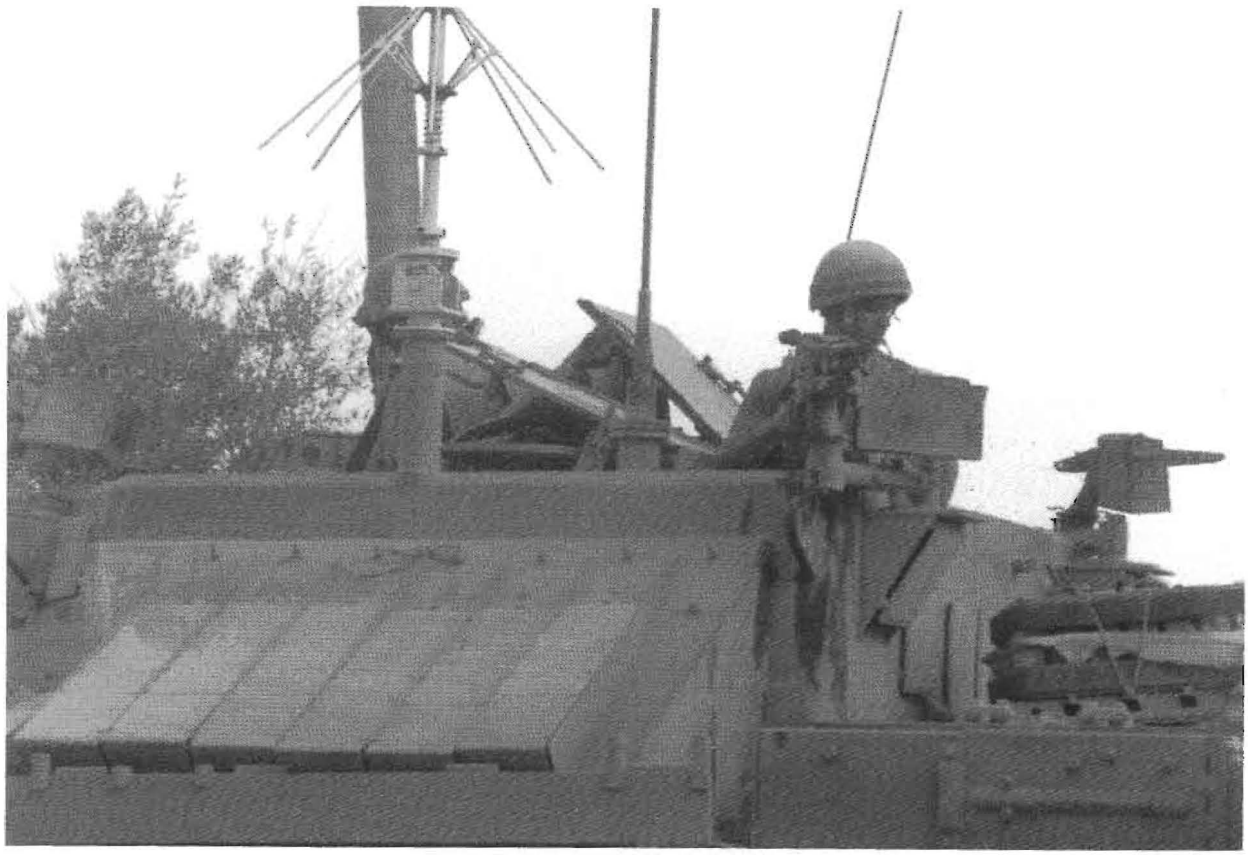


12. An interior view of the Nagmashot. The commander's seat can be seen in the top left corner of the photo and the crew bench in the bottom left. The massive machine gun ammunition storage is also clear (Nafi Segal).

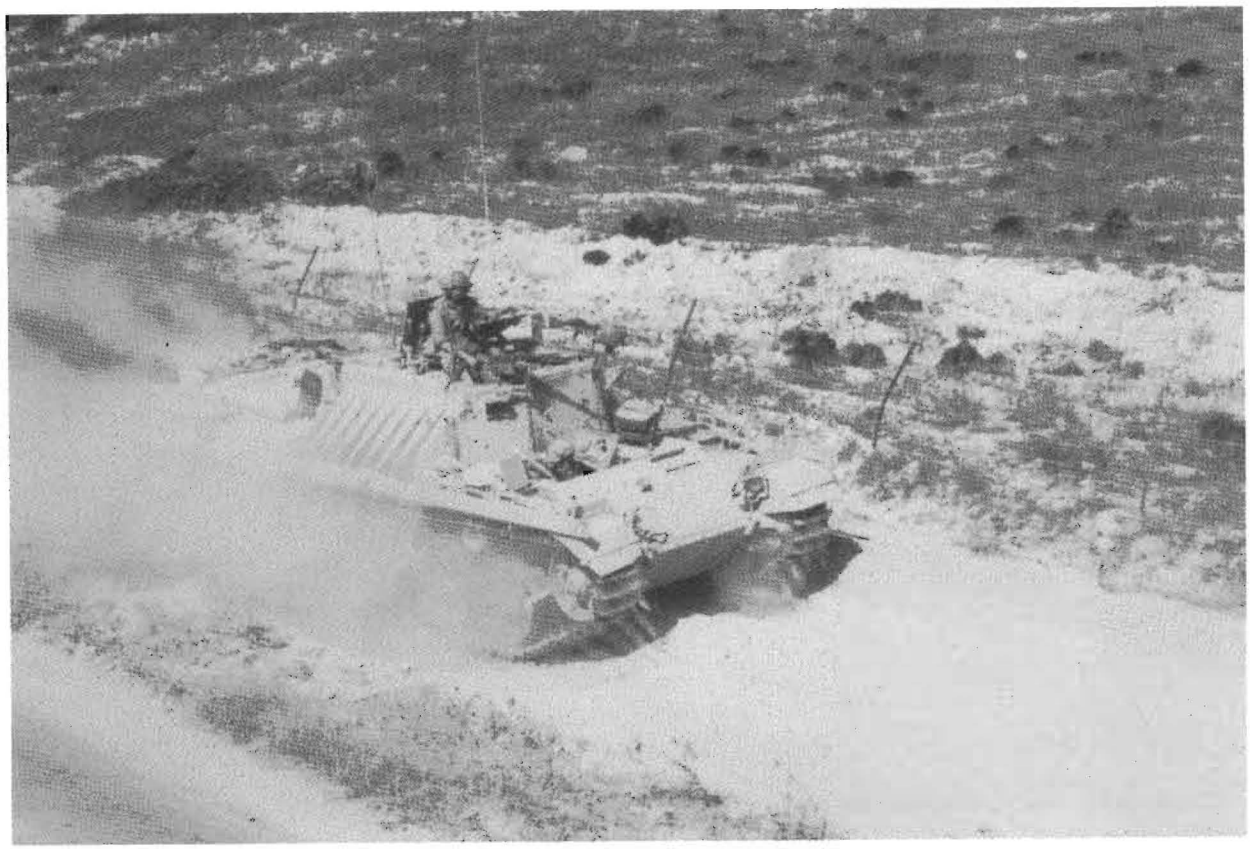
13. A late version Nagmashot. Only one FN Mag and only a few Blazer ERA blocks are visible (Nafi Segal).

14. A late version Nagmashot with a slightly raised roof over the side sloping armour (Nafi Segal).

15. Another view of the same vehicle from the side with standard Centurion armoured side skirts. Note the extensive antennae array (Nafi Segal).



16. A late version Nagmashot. The crew compartment is basically a vertical walled box with external sloping armour plates onto which Blazer ERA blocks are mounted. This also shows a closer view of the antennae array plus mine walking shoes/pads on the rear engine deck (Nafi Segal).



17. A very dusty late model Nagmashot returning from a patrol. Note the rather bulky frontal superstructure and the lack of side-skirts and the terrain (Sean Curtiss).

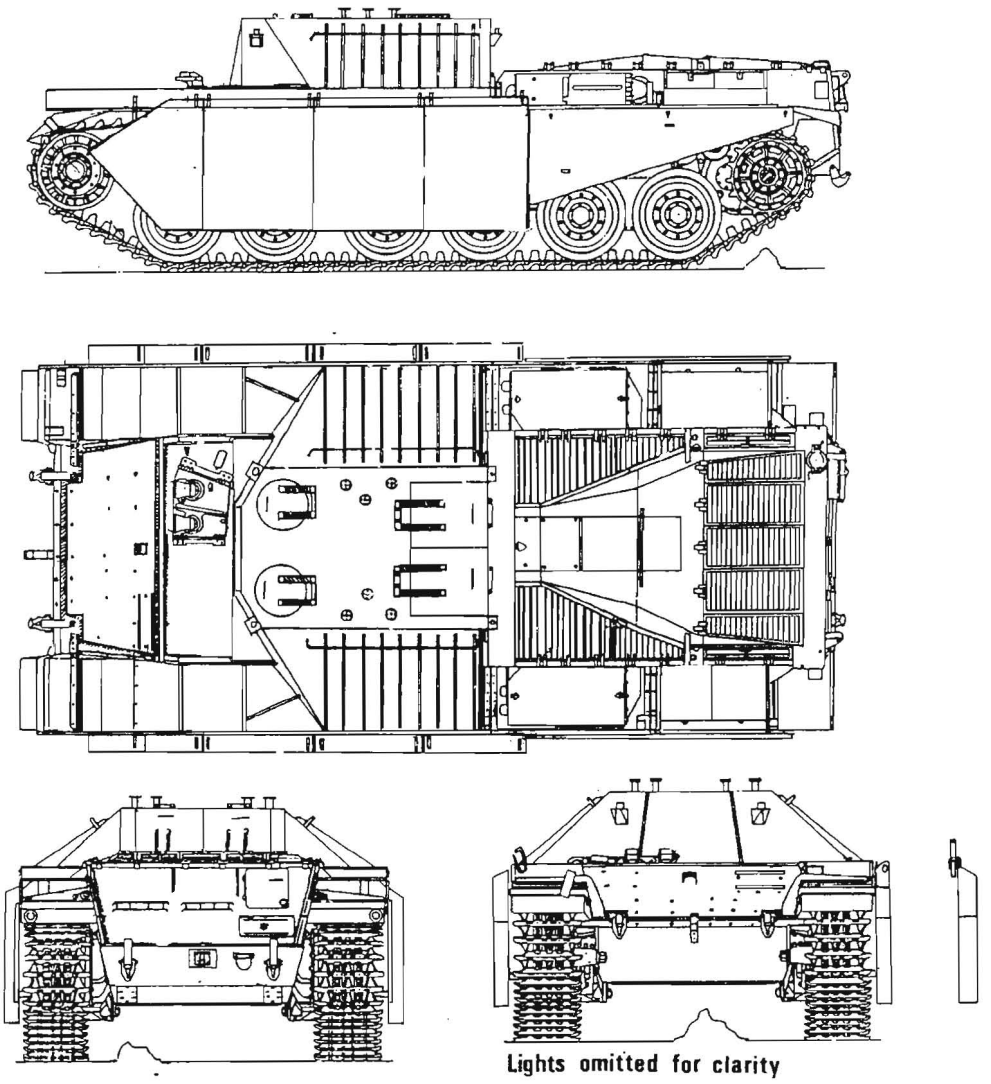
18. A late version Nagmashot in Southern Lebanon, June 1988. Note the 50 calibre machine gun on its short mount (Anthony Maguire / Magnus Bergstrom).

19. The same Nagmashot partly obscured by smoke and dust. The purpose of the impressive antennae cluster is unknown. The crew has applied rough blobs of green and red brown paint to their helmets (including the Type 602 ballistic helmet) as a rudimentary camouflage or for recognition purposes. Note that this Nagmashot has the exhaust cowls at the rear of the engine deck (Anthony Maguire / Magnus Bergstrom).

20. The same Nagmashot. Two 7.62mm license built FN Mag machine guns are carried along side of the 12.7mm Browning machine gun (Anthony Maguire / Magnus Bergstrom).

21. A Nagmashot from the rear. Note how exposed the rear facing crewman and infantryman are (Anthony Maguire / Magnus Bergstrom).

22. A Nagmashot driver and crew compartment. Note the various lengths of tubing used as mounting points for the Blazer ERA, the additional armour plate on the glacis and the external fire extinguisher pull handle. (Nafi Segal).



Early version Centurion Nagmashot. | **1/76 scale** | **©John Myszka**

Nagmachon

Some years after the Nagmashot entered service in the early 1980s (probably in the late 1980s) the IDF introduced a similar vehicle, the Nagmachon. Whilst the initial impetus behind the Nagmashot was the creation of a heavy assault carrier, the Nagmachon was designed from the start for use in counter insurgency operations. The Nagmachon is comparable to the Nagmashot, but is equipped with a rather larger and bulky, roofed fighting compartment, the superstructure of which carries heavy appliqué armour arrays. As well as a comprehensive suit of reactive armour, some appliqué passive protection may also be employed. At the rear of the fighting compartment there are two roof hatches which open rearwards and a somewhat confined rear hatch which allows infantry to disembark, but only after crossing the engine decking.

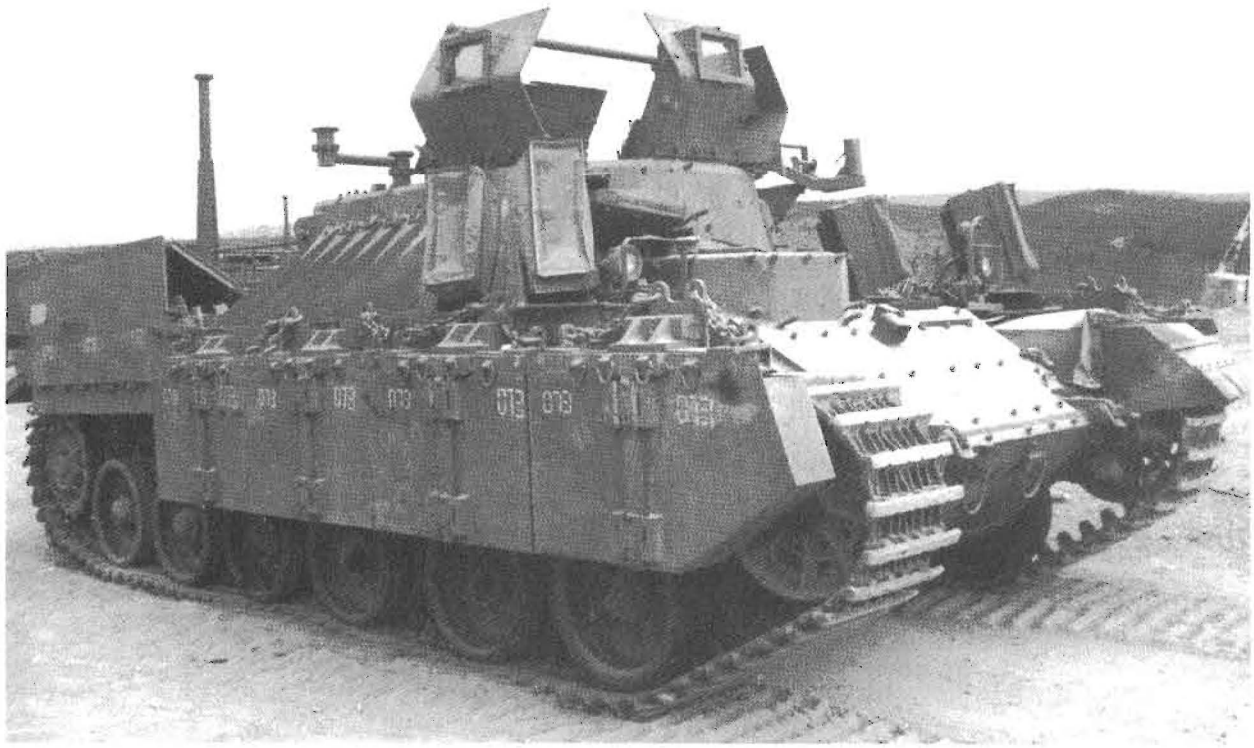
The Nagmachon is fitted with particularly formidable side skirts, the rearmost pair being hinged to lock upwards to protect soldiers disembarking from the rear of the fighting compartment. The vehicle also has improved protection against mines, its underbelly being re-enforced. As part of their policy of rolling evolution and upgrading of all its armoured vehicles, the Israelis modified some of their Nagmashot with a similar, crude if effective, roofed superstructure. The Nagmashot in essence metamorphosed into the Nagmachon. This can make the two vehicles very difficult to tell apart, although the Nagmachon tends to be fitted with more extensive reactive armour protection.

The roof of the Nagmachon's troop compartment is fitted with three metal shields, each with ballistic glass vision blocks. The shields allow infantry to fire their pintle mounted 7.62 machine guns with a degree of protection. They are being retrofitted to earlier heavy carriers and also to the latest Israeli upgrade of the M 113 APC, known as the Classic.

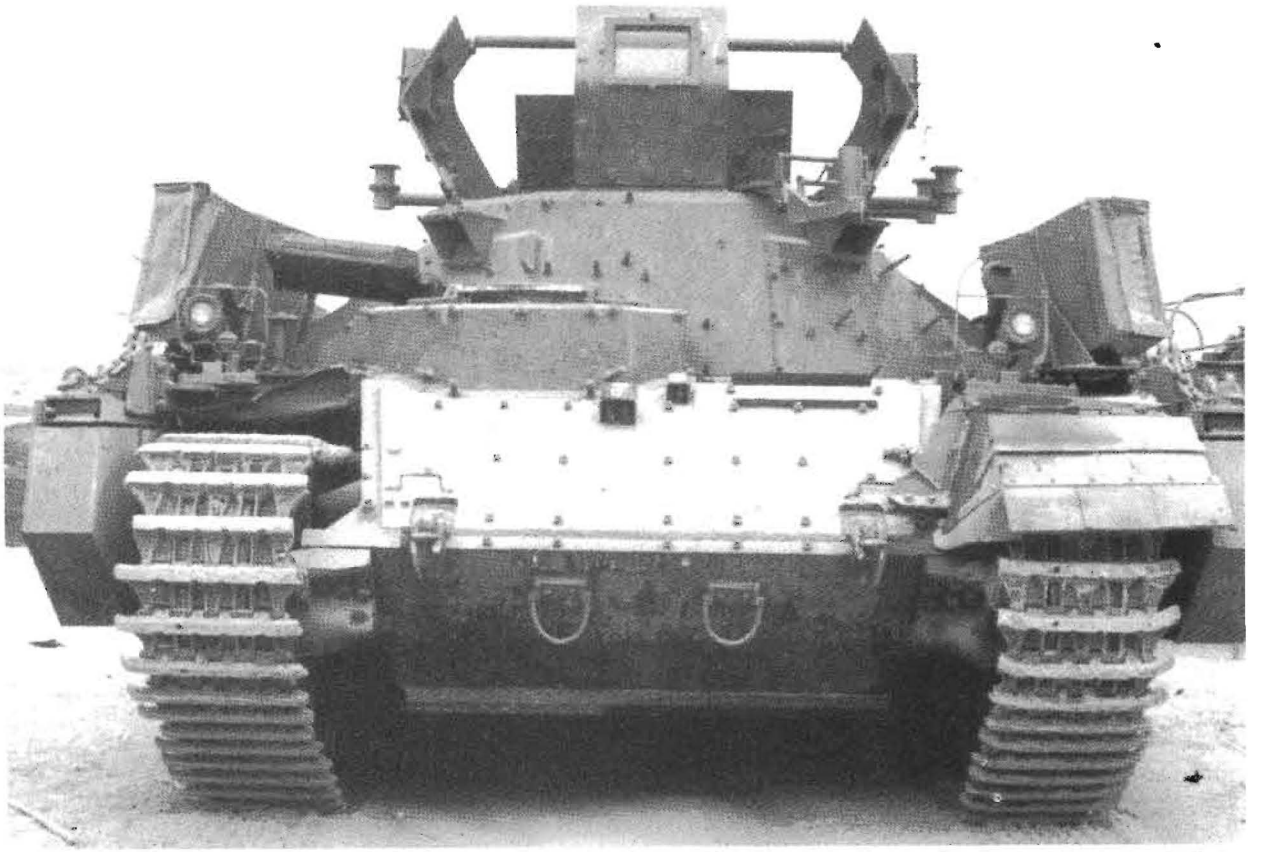
The Nagmachon is fitted with four (rather than the more common two) TAAS CL-3030 instantaneous self screening smoke grenade launchers. Some of the vehicles are equipped with launch canisters larger than the familiar CL-3030. Ten rather than six grenades may be carried within each of the larger launchers. It is possible that at least some of the Nagmachon's launchers are fitted with antipersonnel grenades rather than smoke canisters.

Previously it had been thought that some early Nagmachons had been built upon the hull of M48 tanks. However all available photographs show Centurion based vehicles. When the IDF decided to retire its Centurion fleet from duty as MBTs, several hundred vehicles became available for conversion. Conversely, they decided to retain the M-48 and renovate them to Magach 7 standards.

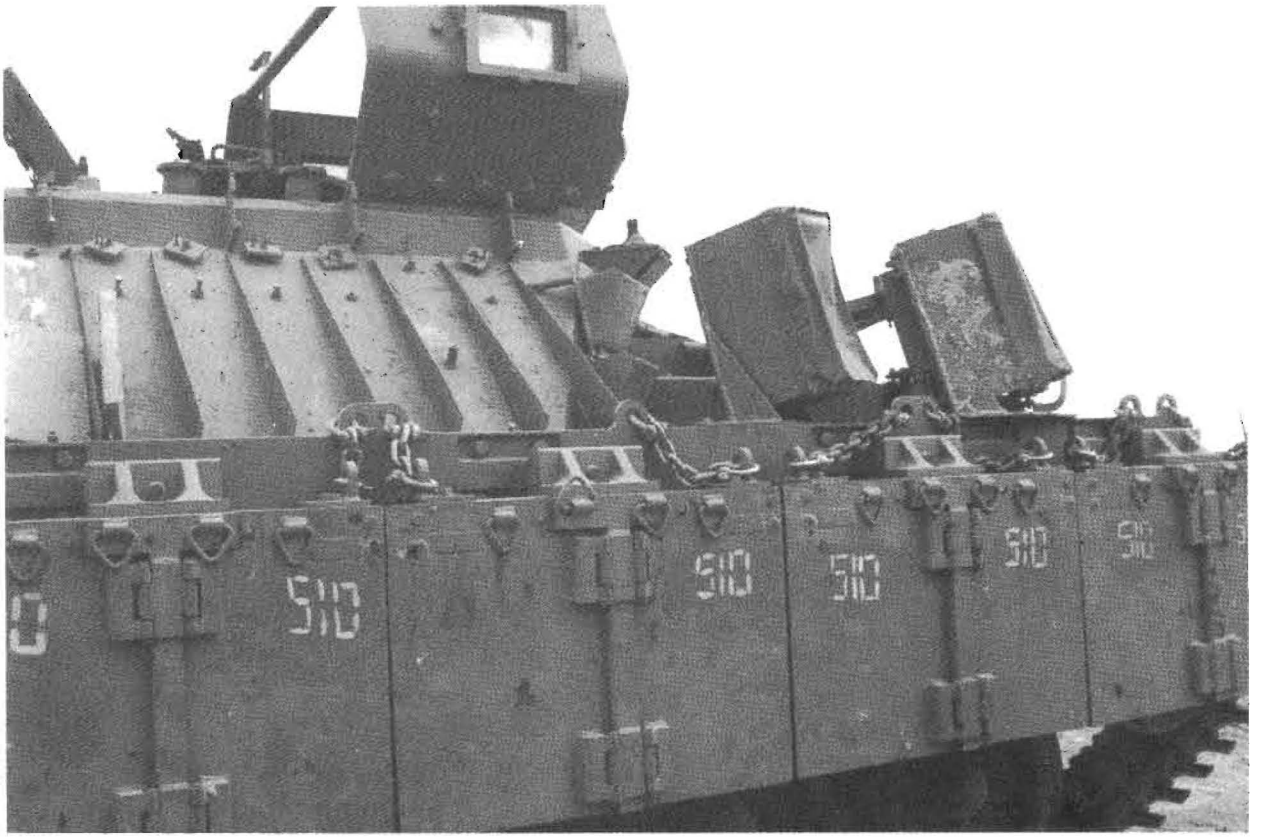
23. Two Nagmachon carriers. The one nearest the camera has some, but not all, of its reactive armour bricks attached to the hull and glacis. Note the heavy RPG proof side-skirts.



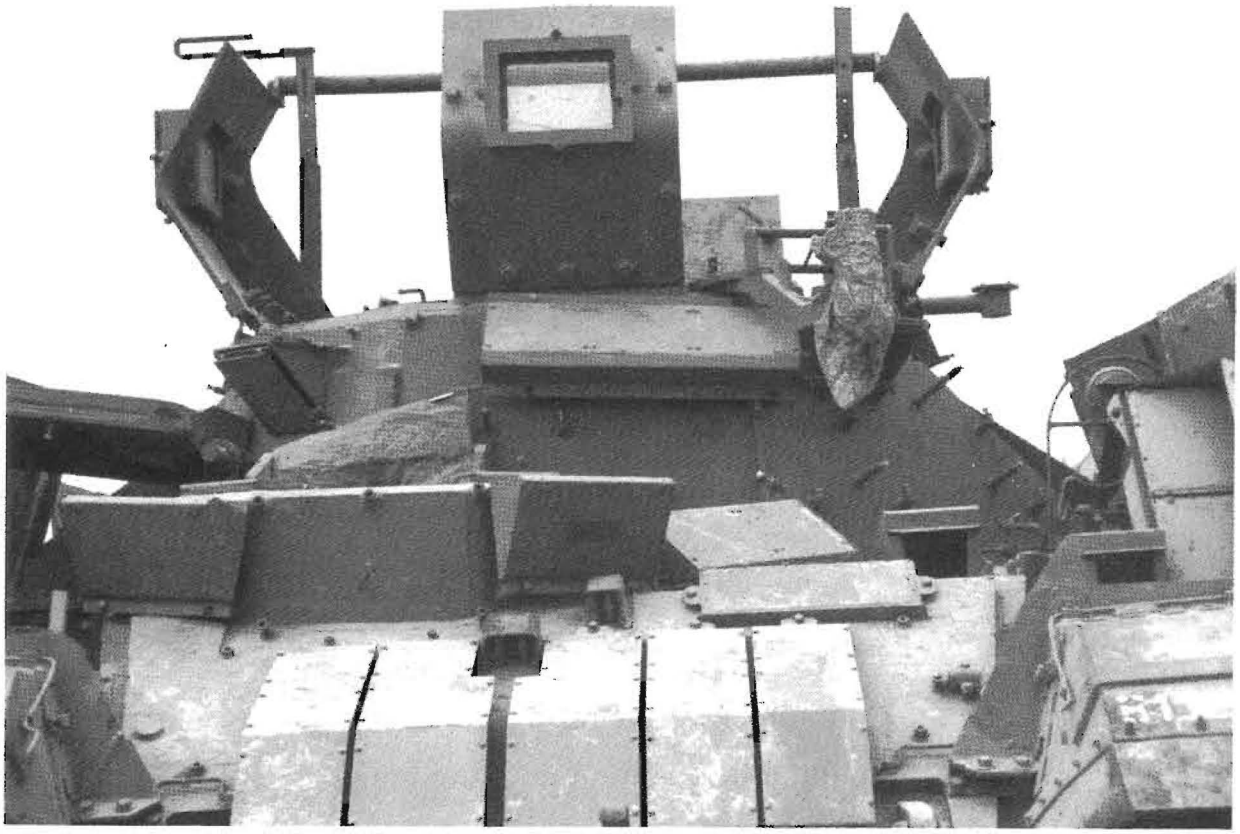
24. A Nagmachon in close up, without its normal applique reactive armour. The studs for attaching the reactive armour can be made out on the vehicle's glacis and superstructure. The vehicle carries four TAAS CL-3030 smoke dischargers. Note the built up driver's position and heavy side opening hatch.



25. A Nagmachon from the front. Not all of the reactive armour bricks have been attached. The sheer bulk of the machine and additional hull armour is noteworthy.



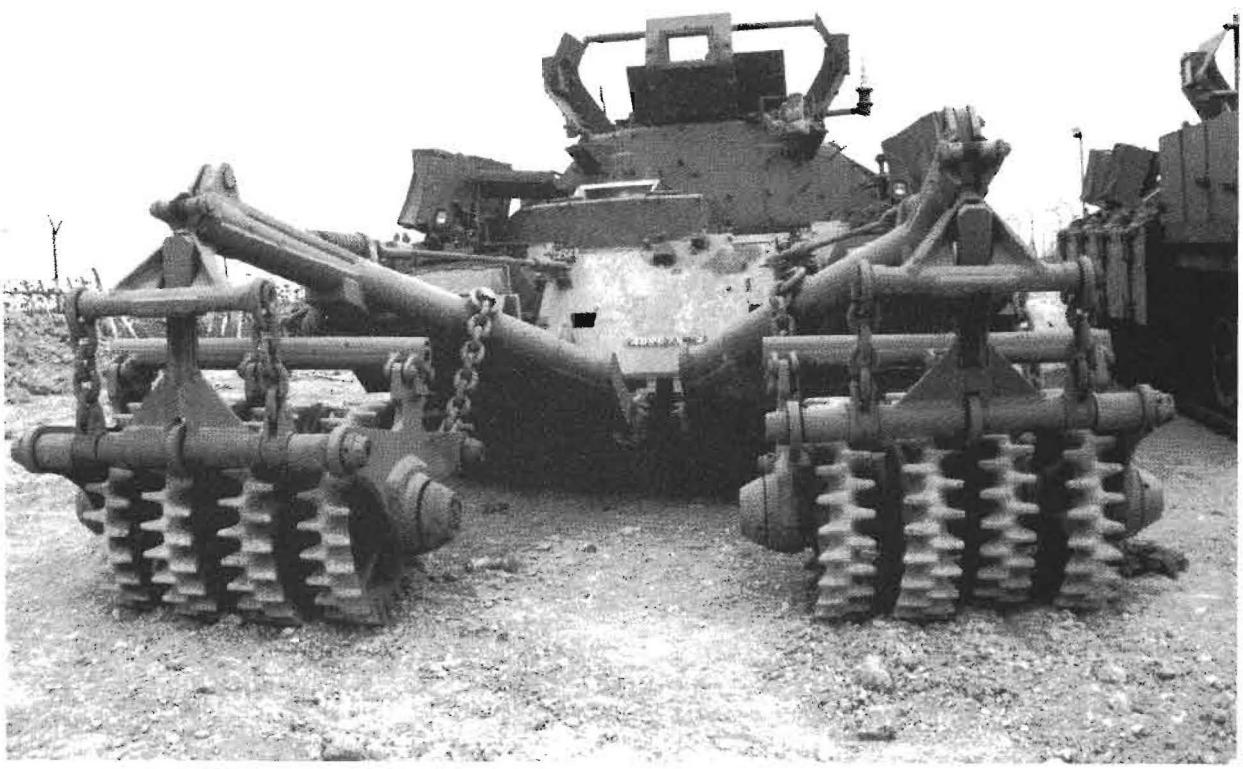
26. A Nagmachon from the side. The "gills" on the machine's flanks can be fitted with additional reactive armour blocks. Note the heavy-duty hinges utilised by the massively thick side-skirts.



27. Nagmachon from the front, in close up. To the left of the glacis is the extra armour used to protect the driver and his vision blocks.

28. A rear view of the Nagmachon demonstrating how the last pair of side-skirt sections can be swung upwards. This is may be done to protect casualties carried on stretchers lashed to the vehicles rear decking. Note the generally untidy, cluttered appearance of the vehicle.

29. A Nagmachon from the front. No appliqué armour, other than the side-skirts, is attached. Note the extra belly armour (possibly 2 layers).



30. A Nagmachon fitted with RKM mine rollers. The adaptor plate registration number is 409075ש.

31. A close up of how the mine rollers are fitted to the hull using an adaptor plate. The two small red painted boxes fitted to the glacis protect the manual triggers of a fire extinguishing system.

32. A Nagmachon on a yellow tank transporter trailer. Points to note are: rear mounted antennae, numbering on the side skirts, gunshields, rear stowage basket and smoke dischargers.

Nakpadon

In the 1990s some Centurion based Kangaroo carriers were rebuilt to a new standard known as the Nakpadon. As in the case of the Nagmachon, the new carrier was specifically designed and optimised for work in high intensity counter insurgency warfare, exactly the situation existing within Israel's troubled security zone along the Lebanese border. The vehicle is equipped with an M27 style cupola to improve the commander's situational awareness.

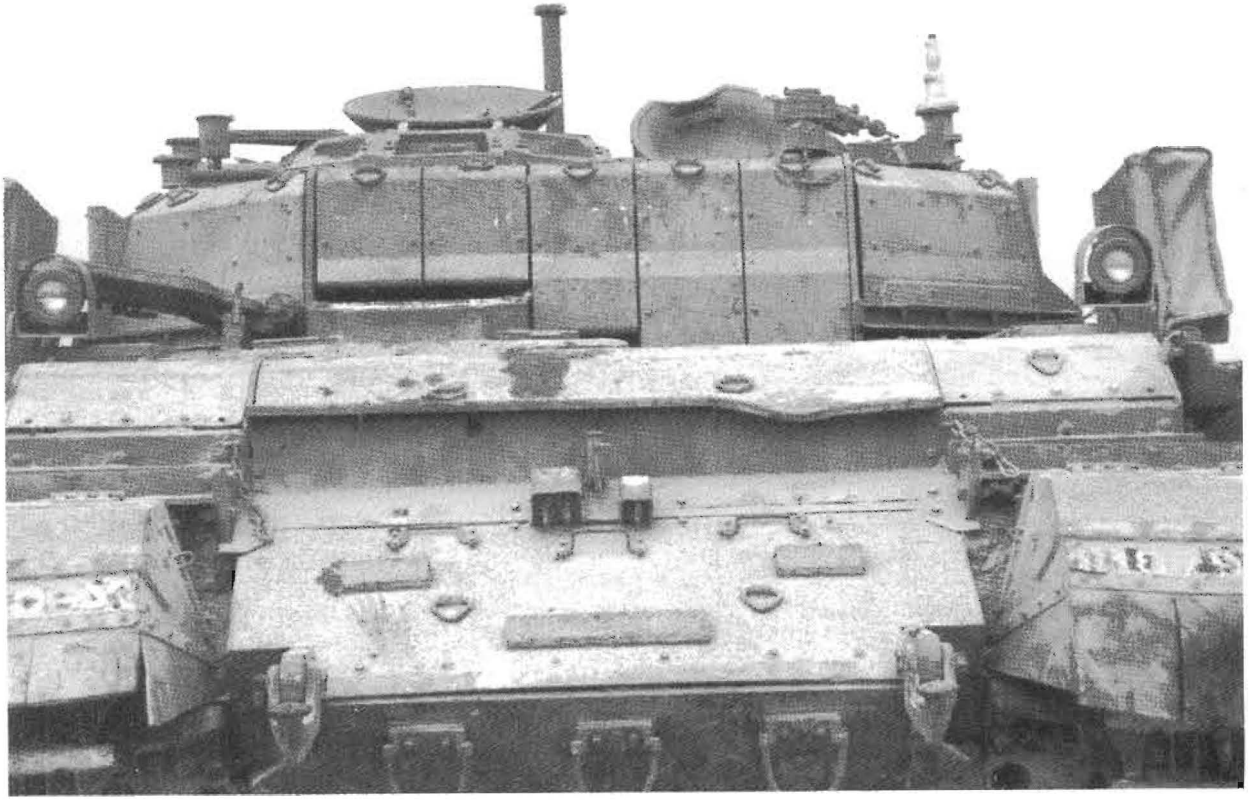
When compared to earlier heavy carriers, the Nakpadon uses passive armour rather than appliqué reactive armour as the basis of its improved survivability. Passive armour modules, rather than the reactive armour bricks used on the Nagmachon, are attached to the fighting compartment. The modules are of considerable depth as can be seen in photos of the Nakpadon without the module array in place. The passive armour utilised appears similar to that employed by the Magach 7 MBT. Like the Nagmachon, the Nakpadon incorporates reactive armour in its massive, corrugated side skirts. In both machines, these heavy-duty skirts cover the first four pairs of road wheels. The final pair of rearmost skirts is of a lighter construction and hinged so that they may be swung upward and locked into place in a vertical position. Positioned in this manner, the skirts provide a degree of cover for casualties carried on the engine decking. In addition, the vertical skirts allow some protection for soldiers disembarking from the rather confined rear hatch of the fighting compartment. The Nakpadon when compared to the Nagmashot has superior frontal and lateral protection. Extra belly armour is fitted as protection against mines on the Nakpadon.

Both the Nagmachon and Nakpadon are weighty machines, the latter probably weighing as much as 55 tonnes. The Nagmachon retains the upgraded Centurion's 750hp AVDS diesel while the Nakpadon uses the 900hp AVDS 1790-6A powerpack of the Merkava 1. The current suspension used by the vehicles is a hybrid, based on the old Centurion system, but incorporating hydraulic bump stops provided by the Israeli firm Kenetics. Whatever the case, the front four road wheels typically show excessive wear. The road wheel tyres being almost totally destroyed by excessive thermal and mechanical loading. Presumably when the funds become available Merkava style suspension and all steel road wheels will be fitted.

33. A prototype Nakpadon in barracks. Note the large ammunition box holder at front left, possibly for a Mk.19 40mm grenade launcher (C. Foss).

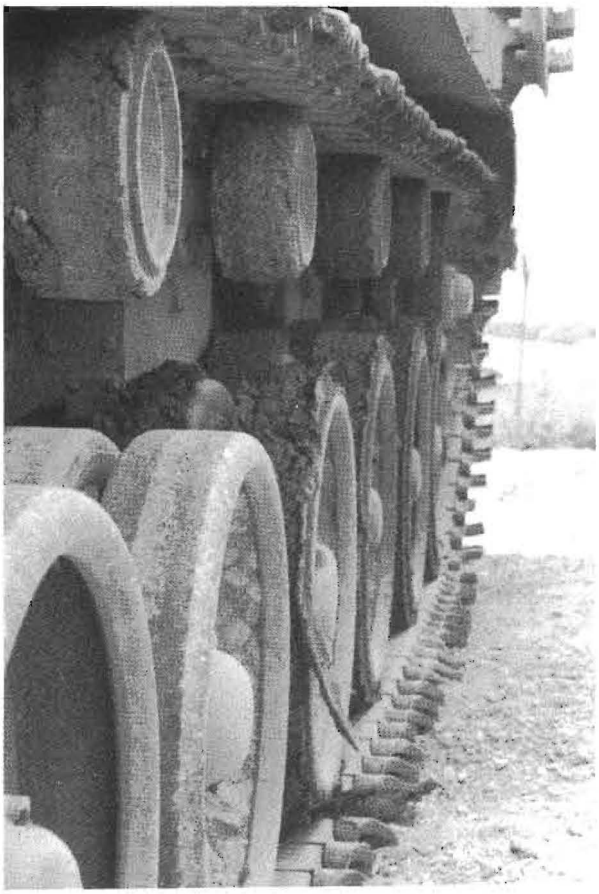
34. A Nakpadon from the front. Passive armour arrays appear to be fitted to the hull front and glacis. The nature of the applique armour modules fitted to the fighting compartment superstructure is unknown. The tactical marking painted over the modules in the form of a band, is a shade of sky blue.

35. A Nakpadon from the front and side. The side-skirts are even more massive than those of the Nagmachon. Note their distinctive ridged appearance.



36. The Nakpadon close up from the front. The vision blocks under the commander's cupola are visible. Note the handles attached to the removable modular armour blocks.

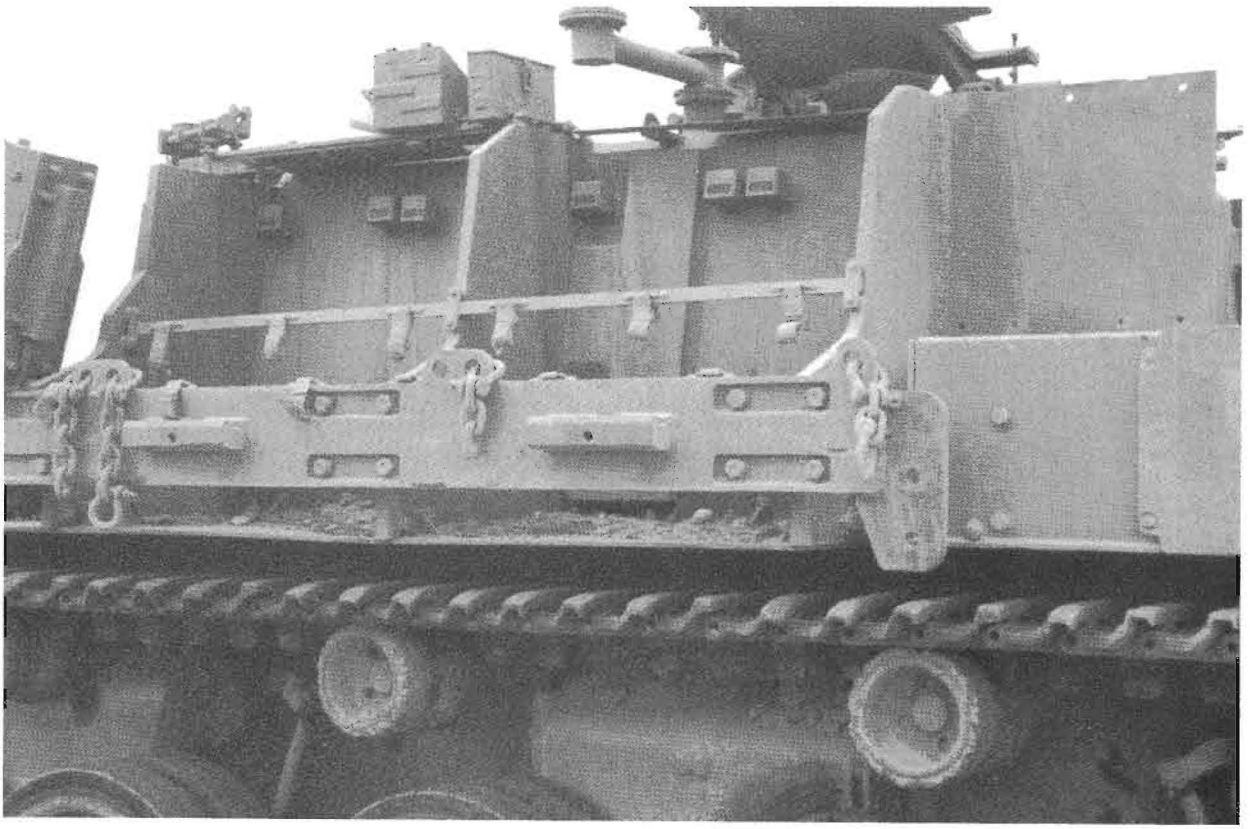
37. A female instructor lectures a group of paratroopers on the Nakpadon's characteristics. Note the vehicle carries two TAAS CL-3030 smoke dischargers compared to the Nagmachon's four.



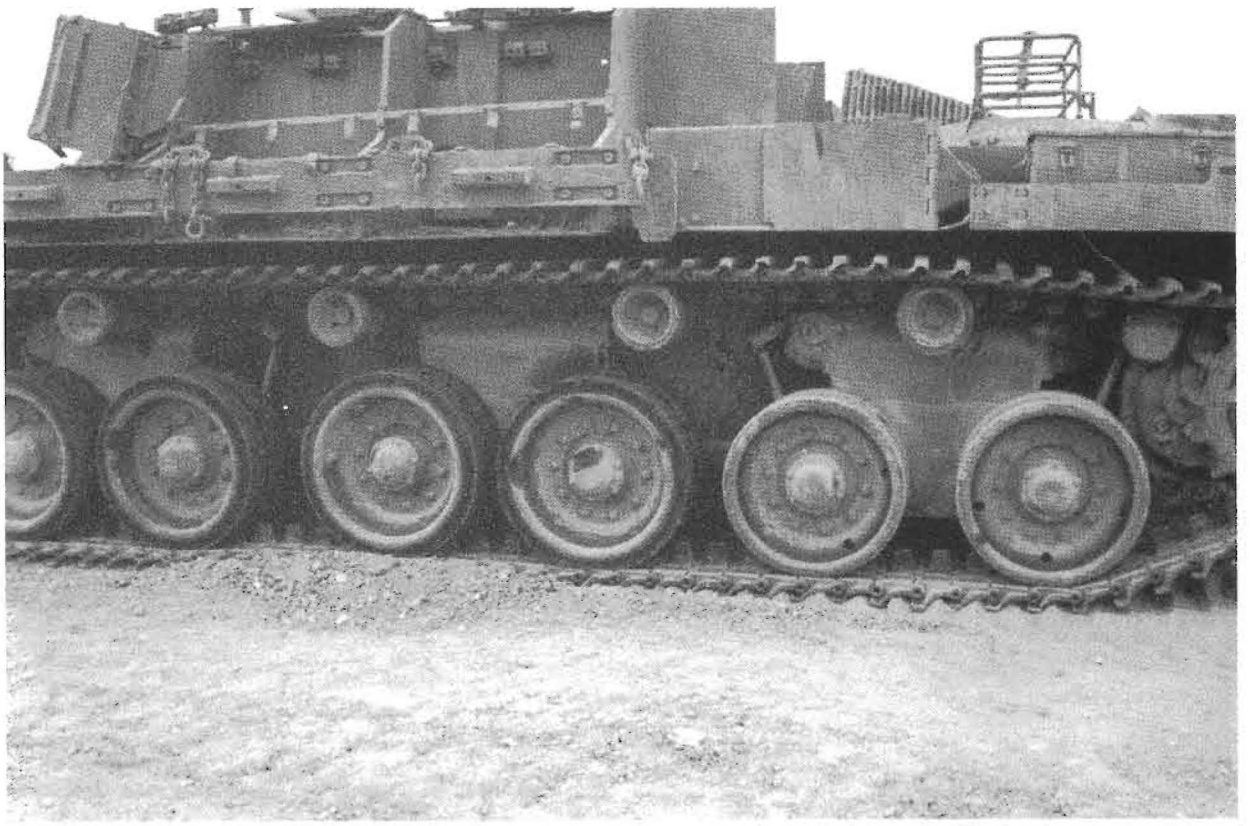
38. A Nakpadon from the rear. The prominent antennae may be used to interfere with the triggering of radio-controlled roadside bombs, or may detonate such devices prematurely.

39. The removal of a Nakpadon's side-skirts allows a good view of the road wheels. Note the extensive wear to the rubber rims of the road tyres. If finances were to allow it, then a Merkava type suspension system with the recently introduced all steel road wheels, would produce superior and more durable running gear.

40. The "Naked Nakpadon". A Nakpadon with all its modular applique armour and side-skirts removed.

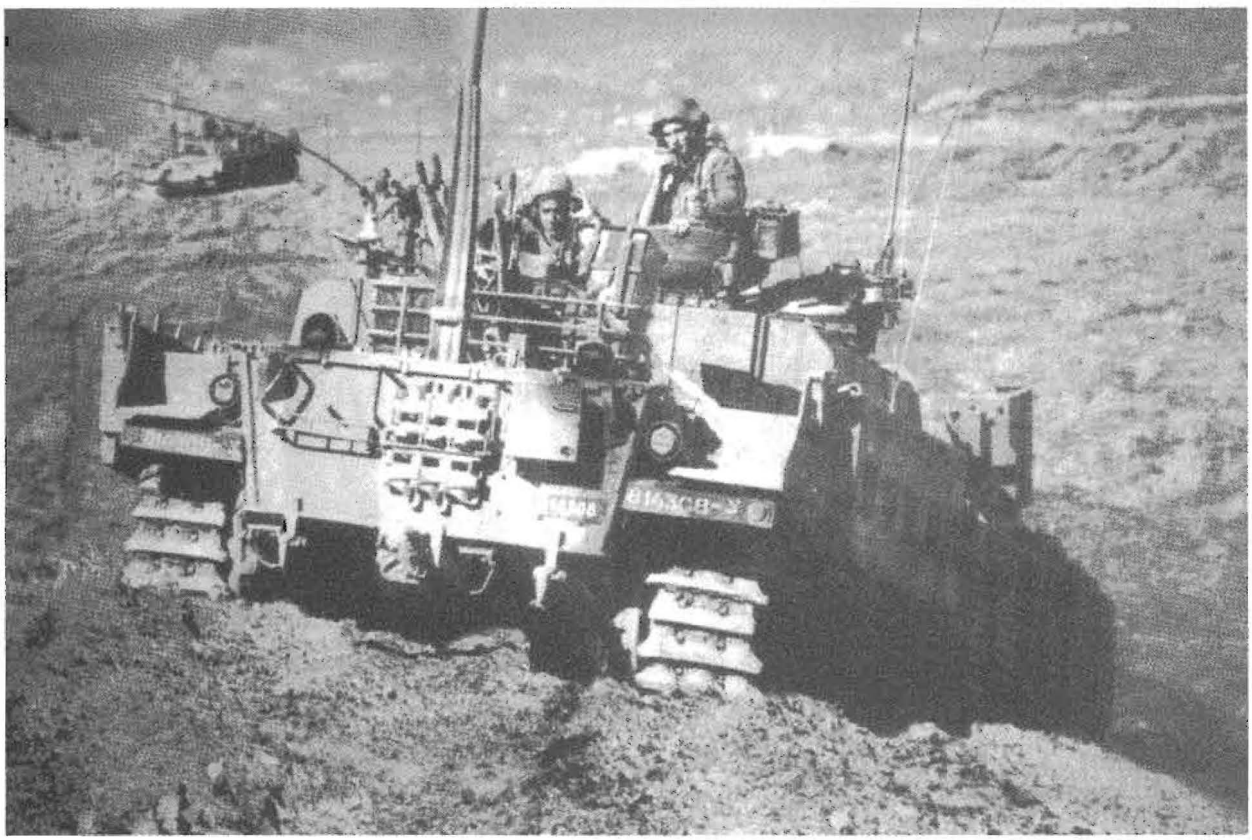


41. The "Naked Nakpadon" in close up. The brackets for attaching and holding the modular armour in place can be seen. The sheer depth of the area into which the armour slots, the sideways aerial mount (mid top of photo) and side opening horizontal rear hatch are noteworthy.



42. The "Naked Nakpadon" from the side showing what is thought to be a hybrid running gear based on that of the Centurion.

43. The "Naked Nakpadon" from the right rear.



44. A Nakpadon on patrol, descending a slope in hilly country. Another Nakpadon is seen on the next ridge (P.M. van Wijk).

Puma

Re-workings of Centurion based Kangaroos in the late 1980s led to the Puma. The Puma is an improvement over some of its predecessors. However, the Puma did not meet all the criteria for a heavy assault carrier. Like the Nagmashot, Nagmachon and Nakpadon, the vehicle lacks a rear door from the fighting compartment. Infantry disembarking from the machine have to do so from roof hatches, resulting in a less than ideal situation when dismounting under fire. Because of the lack of a rear hatch, the Puma is used as a combat engineer vehicle rather than an infantry carrier.

In its role as a combat engineer vehicle the Puma is a formidable opponent. The machine enables combat engineers to operate in areas where vehicles with less protection would come to grief. The prime function of the Puma is to clear routes through heavily defended fire zones, giving armoured formations freedom for manoeuvre. To make this possible the Puma is equipped to mount RKM mine rollers. These are based upon the Russian KMT-5 but offer better performance. It is thought that some Pumas have been fitted with rocket launched, explosive-hose, mine clearing systems. These appear similar in concept to the British Giant, however the Puma mine clearing systems may utilise fuel air explosive similar to the US CATFAE system.

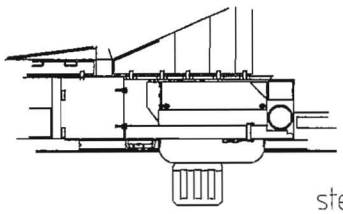
The Puma's survivability is based upon an appliqué armour suite. This consists of reactive armour side skirts and latest generation passive armour arrays applied to the glacis and other vulnerable points. There is at least one example of a Puma with additional protection provided by Toga (steel mesh) standoff armour around its storage panniers, but this is not a standard feature.

It is likely that early variants of the Puma used the same powerpack as the upgraded Centurion known as the Sho't: General Dynamics Land Systems AVDS-1790-2A diesel engine and Allison Transmission CD-850-6 transmission. Later Pumas are fitted with the powerpack of the Merkava 1, the AVDS -1790- 6A engine and upgraded CD-850-6 transmission. Whatever powerpack is used, the IDF appear more than satisfied with the vehicles' mobility. Heavy-duty Merkava tracks are being installed and it is probable that on later vehicles the suspension has been upgraded to that of the Merkava 1.

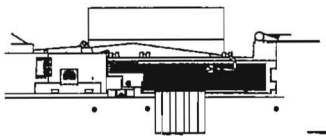
Like all the IDF's tank based carriers, firepower is optimised for use against enemy infantry. Three 7.62mm machine guns are fitted. Two are mounted on simple pintle mounts and the third on a Rafael Overhead Weapons Station (OWS). The OWS can be fired remotely from under armour and manually with the gunner exposing his upper body. In addition, at least one roof mounted 60mm mortar is carried for use against infantry.

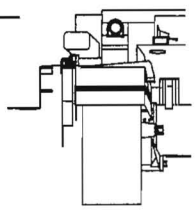
The IDF fielded an impressive combat engineer vehicle with the Puma, but it still was left with a series of makeshift heavy infantry carriers. These carriers appear to be pragmatic, stopgap designs, built to meet an urgent operational need. A more sophisticated and capable vehicle was required and this resulted in the Achzarit.

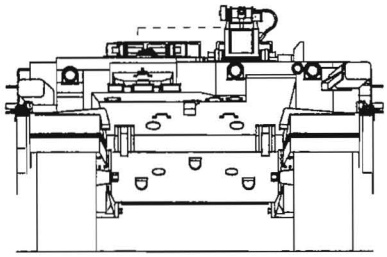
45. A Puma from the side. The central side-skirt panels appear to be ill fitting. The Puma's tactical marking on the far right is a generic symbol for combat engineers. Further markings from left to right indicate that the Puma is the 2nd vehicle of the 1st Platoon, 3rd Company. The ink "black box" in the background (censored at the request of the IDF), obscures an unusual engineering vehicle.

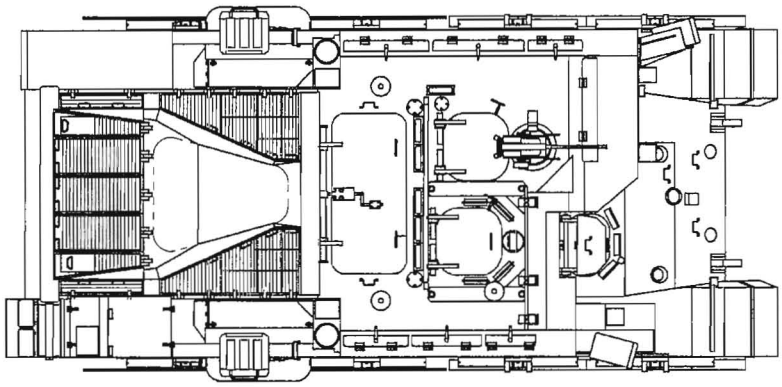


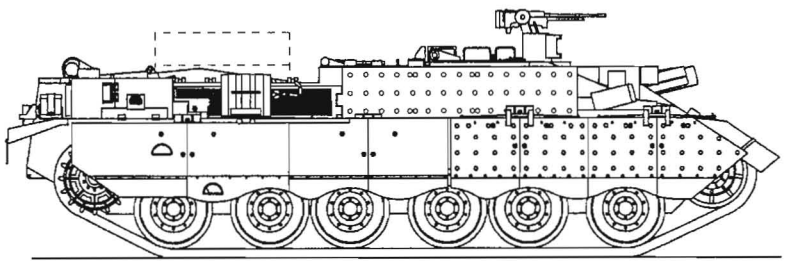
step folded down

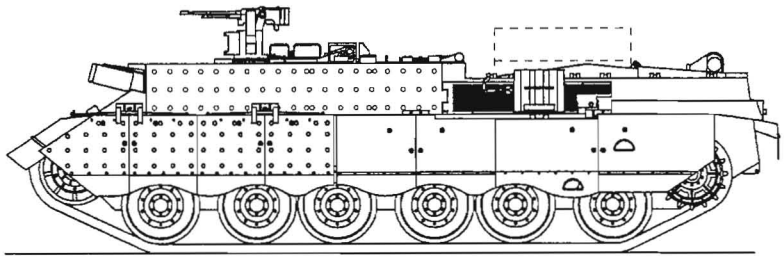


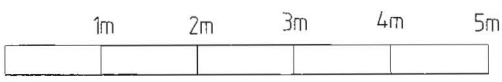




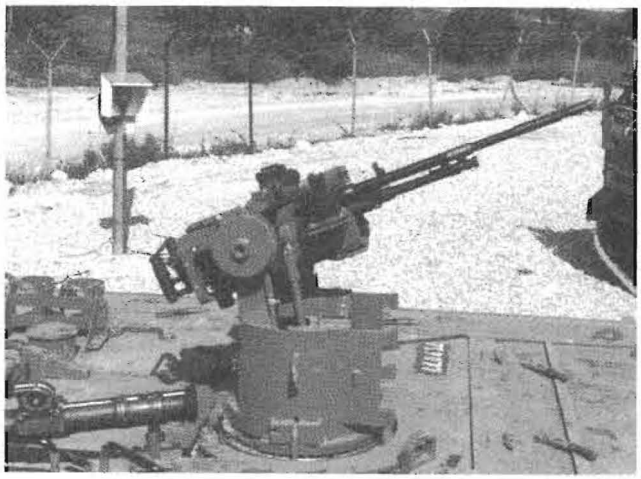


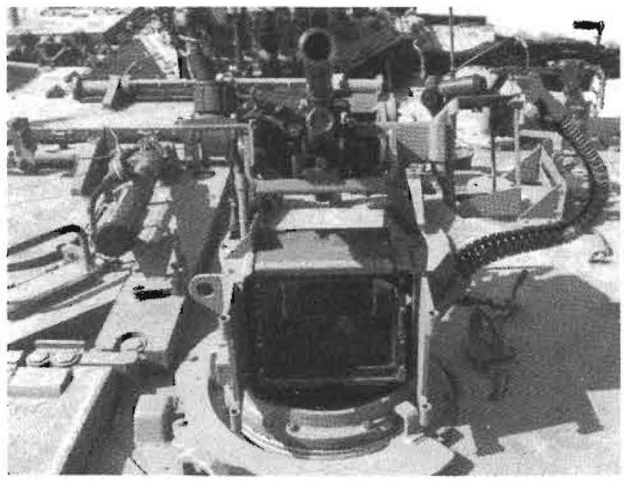




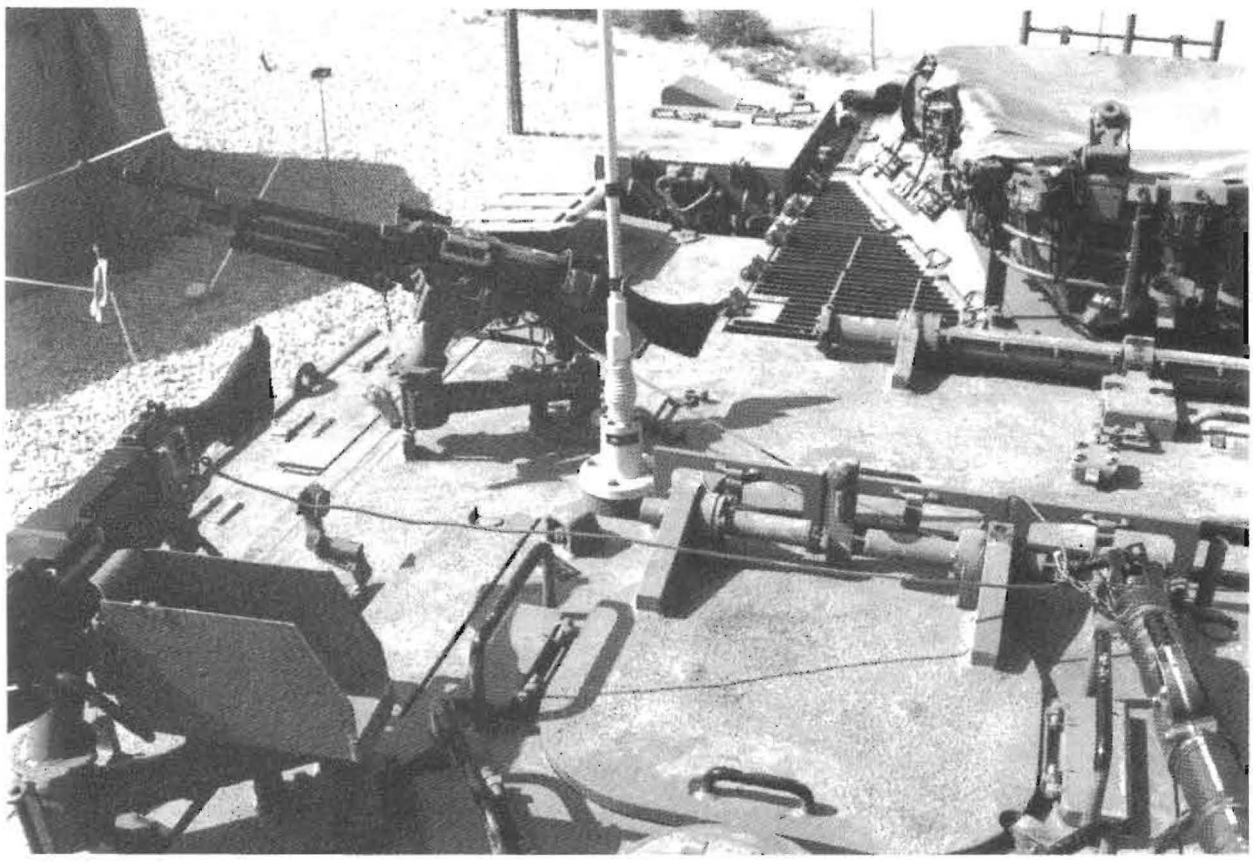


PUMA Combat Engineer Assault Vehicle	1/76 scale	© Ludovic Bertrand



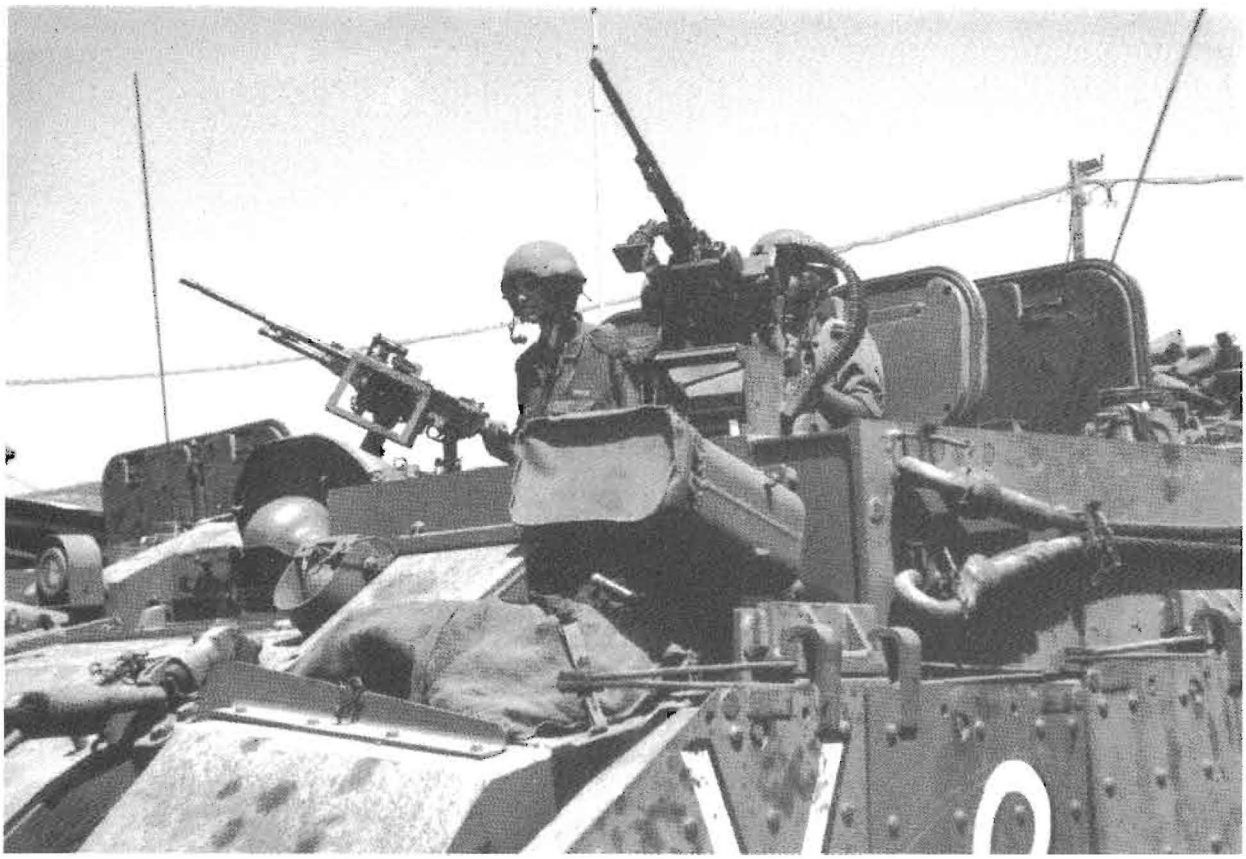


46. Views of the Rafael Overhead Weapons System (OWS) as fitted to the Puma (Nafi Segal).

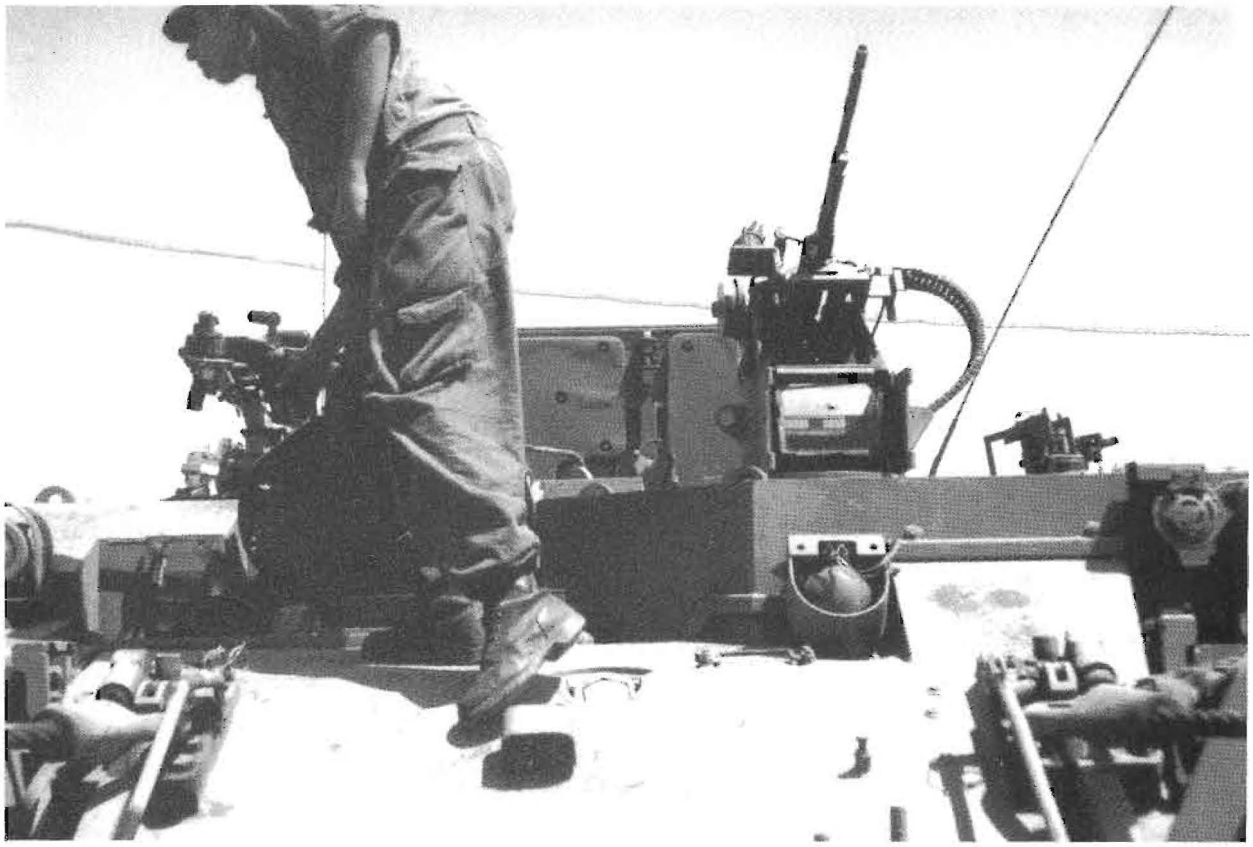


47. A Puma's rear right side. Note the machine gun mounts for FN Mags, rear free standing stowage cage, to the bottom left of the picture a 60mm mortar and the non skid surface (Nafi Segal).

48. The Puma, an Israeli Kangaroo style conversion of a Centurion MBT into a combat engineer vehicle. The Puma is currently used alongside the Achzarit and has similar levels of armoured protection and identical weapons including a 7.62mm machine gun mounted on a Rafael OWS and additional machine guns on pintle mounts. This particular example is fitted with an RKM mine roller. The tactical markings appear to show a vehicle belonging to the 2nd Platoon of the 3rd Company, the latter designation indicated by the downward pointing chevron.



49. The same vehicle close up, specifically the heavy reactive armour side skirts. The Israel Military Industry smoke dischargers are fitted horizontally rather than vertically it is on most other Israeli AFVs. They seem marginally larger than the standard CL-3030 models normally used.



50. A close up of the Rafael OWS from the front. The glacis plate is heavily reinforced with appliqué passive armour.

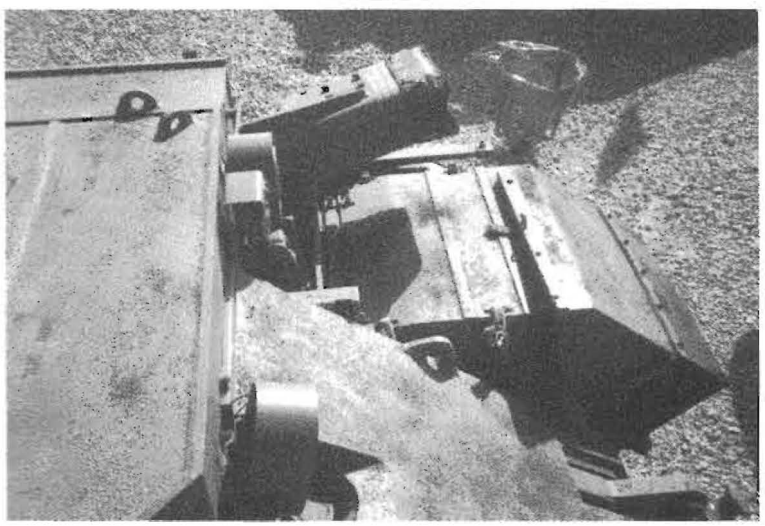
51. A Puma from the rear. Note the extensive stowage frames and basket.

52. Another view of the Puma conversion of the Centurion MBT. The Puma is a somewhat less sophisticated Kangaroo conversion than the Achzarit however, it make a formidable combat engineer vehicle

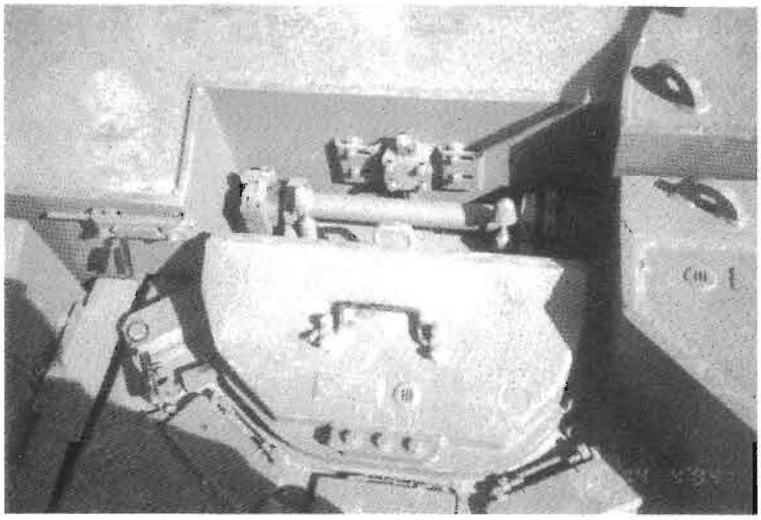
53. A Puma with RKM mine rollers attached from the front right. The rollers are an intimidating and noisy presence.

54. A Puma with RKM mine rollers from the front.

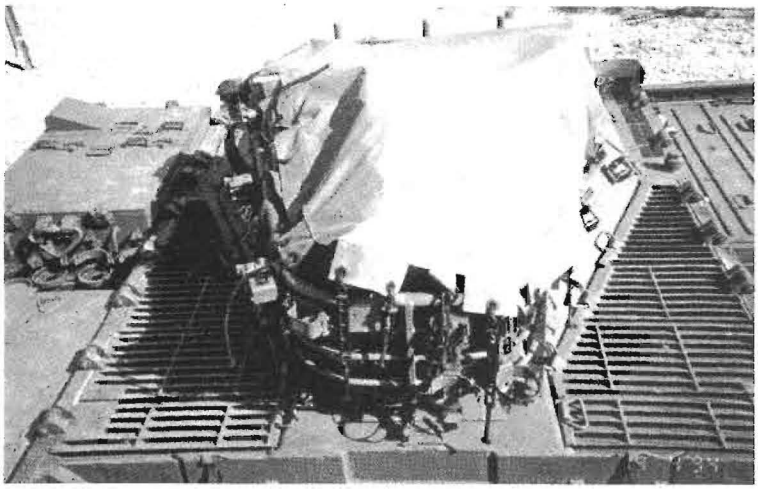
55. Puma right front track, driver's hatch, smoke discharger and L shaped machine gun mount (Nafi Segal).



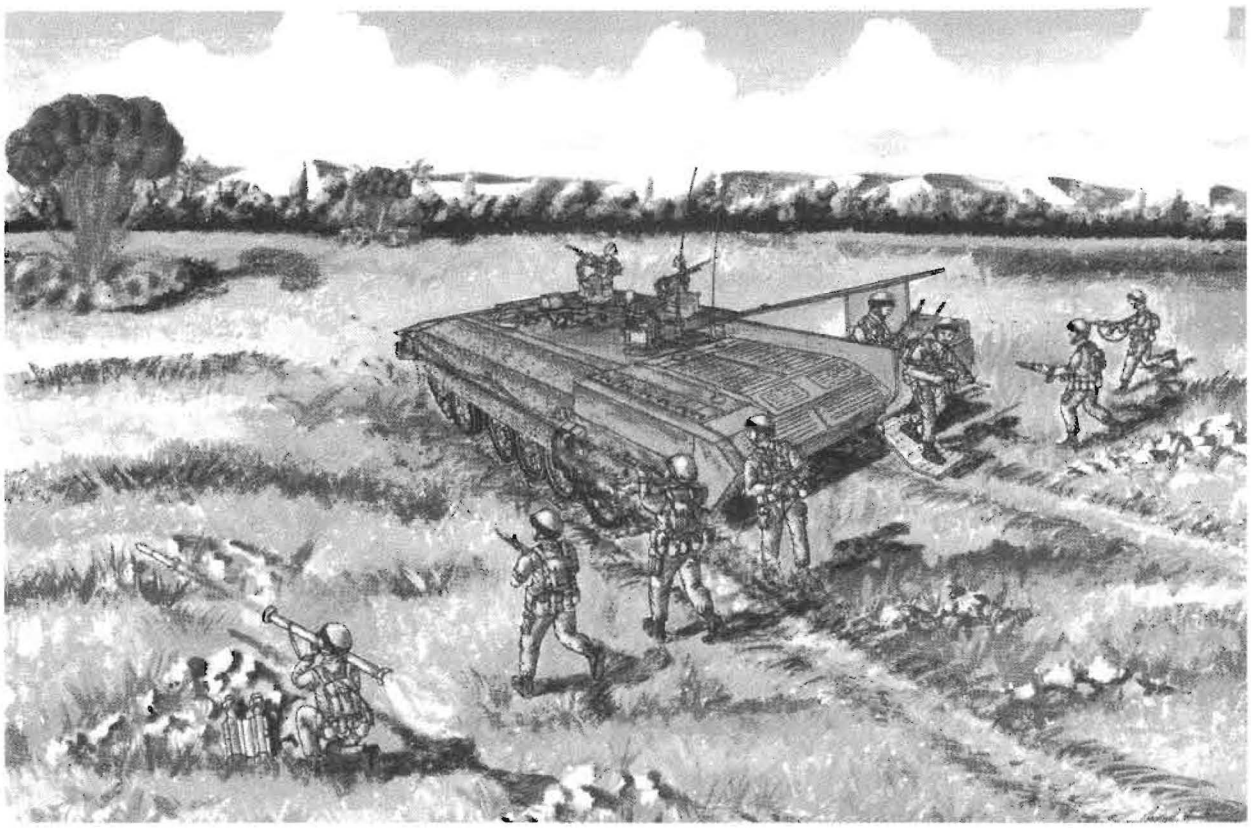
56. Puma left front track (Nafi Segal).



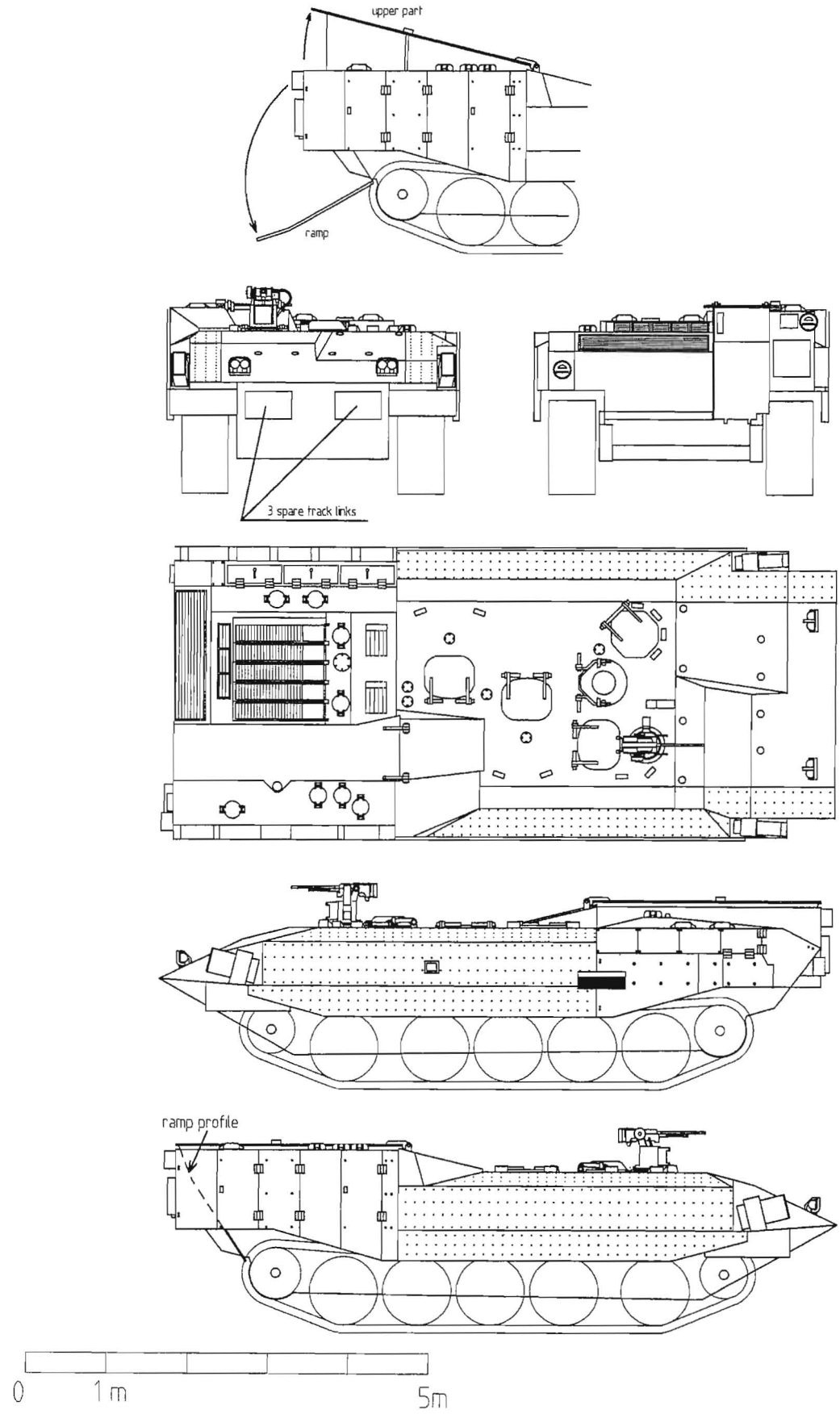
57. A closeup view of the Puma drive's hatch. The raised circle with three dark lines indicates third generation armour (Nafi Segal).



58. Puma engine deck stowage basket (Nafi Segal)



59. An early Nimda publicity material, showing a different weapons fit to what actually emerged in service (Zvi Gera of Nimda Co. Ltd)



Achzarit Armoured Personnel Carrier	1/76 scale	© Ludovic Bertrand

From Project Samovar to the Achzarit

The perfect solution for a survivable infantry carrier would have been to base it on the Merkava MBT, which entered Israeli service in the late 1970s. This outstanding MBT's front-engined configuration lends itself to conversion into a heavy assault carrier. Indeed it is believed that the IDF experimented with turretless Merkavas as assault carriers shortly after the MBT went into service. However expense and the need to put as many Merkava MBTs in service as quickly as possible, put the concept of the Merkava based assault carrier on hold.

A cheaper solution was found in IDF storage depots. In the wake of the 1967 and 1973 wars, the Israelis had at hand many hundreds of captured T-54 and T-55 tanks. Some of these tanks, were successively upgraded and up-gunned. They entered into Israeli service as the Tiran. The most sophisticated of these renovated vehicles was the Tiran Model S. This machine incorporated a new engine, the Detroit Diesel 8V-71T diesel of 650 hp and a semi-automatic Allison transmission. The company responsible for installing the new power train - under the codename Project Samovar - was NIMDA, Israel's premier military powerpack specialists. Given NIMDA's demonstrated expertise, it was given responsibility for the development of the new heavy assault carrier. Prime areas of concern were the design and instillation of a new powerpack and any necessary hull modifications.

The rationale for using the T-54/55 family as the basis for the Achzarit was as follows.

- Availability. Several hundred T-54/55 hulls in varying degrees of repair - in addition to those tanks converted to the Tiran standard - were in IDF hands.
- Suitability. The thick armoured shell of the basic T-55 offered good protection and the hull's almost perpendicular sides allowed good usage of existing volume.
- Cost effectiveness. Sound use of surplus, obsolescent hulls.

NIMDA started work on the Achzarit in the early 1980s; by 1987 the first pre-production machines were being trialed. The Achzarit most probably entered into service as early as 1989.

Configuration

The Achzarit is a low slung fighting machine with a height of 2 meters, based on the turretless hull of the T-54/55. The hull sides have been built up and overhead protection for the crew has been provided. The engine is mounted transversely. When viewed from behind, the powerpack is at the left rear of the vehicle. The transverse mounting has allowed space for a narrow corridor leading to a hydraulically powered clamshell rear hatch and ramp. This device allows soldiers to embark or disembark one at a time. Viewed from the rear, the fighting compartment of the Achzarit is laid out as follows. The three-man crew is seated at the front of the machine: to the left there is the driver, in the centre the commander and to his right the gunner's station. Each of the three crew members has his own hatch and vision blocks, whilst two more hatches are available for the passengers. It is notable that the pre-production Achzarit had seven hatches, perhaps it was judged that this superabundance compromised overhead protection.

Up to eight infantrymen can be carried in the passenger compartment, although the normal loading is seven. There is a simple padded bench, capable of seating three or four men, to the rear left of the compartment, situated in front of the engine block. Just to the right/rear of this bench is a single foldable seat. Three more individual folding seats are placed along the right side of the vehicle. On one machine that the author has boarded, there appeared to be an alternate seating arrangement of a second simple bench.

Survivability

The Achzarit is by far the best protected infantry carrier in service and can withstand both HEAT and kinetic energy projectiles that would destroy conventional IFVs. In particular the Achzarit will survive strikes from infantry light anti-tank weapons, such as the RPG family and similar Western systems. At 44,000kgs the machine is exceptionally heavy for an infantry carrier. In fact 14 tonnes of the vehicles weight is made up of the additional, advanced, armour which is incorporated into its design. This gives some indication as to its high degree of protection. The material used on the glacis and front flanks of the vehicle, is similar in appearance to the composite, passive armour of the Merkava 3. Whilst protection has been concentrated on to the frontal arc, a high level of protection extends back most of the length of the vehicle to cover the passenger compartment.

The Achzarit has been carefully designed so that component parts contribute to its overall survivability. Diesel fuel cells to the rear right and left sides of the passenger compartment act as spaced armour. The vehicles rear sides are covered by armoured mesh plates. (Between the actual armoured shell of the rear sides of the vehicle and its armoured mesh plates, there is a narrow space used for storage for such items as stretchers, water containers, etc.). The left rear of the Achzarit is protected by the mass of its powerpack. Further protection to the crew and passengers is offered by a Spectronix fire detection and suppression system using Halon gas. Crew and passengers are provided with individual NBC protection equipment.

The fitting as standard of two TAAS CI-3030 instantaneous, self-screening, smoke grenade dischargers, increases survivability. Additionally the Achzarit can inject a fuel aerosol into its engine exhausts in order to produce a smoke screen.

Firepower

The prime target of the vehicle's armament is enemy infantry, not light armour. Accompanying tanks are expected to engage enemy armour leaving the Achzarit free to concentrate on its prime mission: to carry infantry safely through zones beaten by enemy fire. The main offensive weapon mounted on the Achzarit is the Rafael Overhead Weapon System. The Rafael OWS weighs only 160 KGs and has a minimal internal footprint. The standard weapon of the Rafael OWS is the FN 7.62 M240 machine gun. This can be fired remotely, the gunner completely under armour, or fired manually with the gunner's head and shoulders out of his hatch. When firing the OWS from under armour, the gunner uses a periscope with a sight of ×1 magnification and a twenty-five degree field of view. A brilliantly illuminated, collimated, red ring comprises the aiming aid. Fixed to the right of the main sight is an elbow sight with ×8 magnification and ballistic range scale. This allows the gunner to traverse and engage a target swiftly and instinctively. Both sights are night vision capable - second generation image intensification is fitted as standard, whilst thermal imaging is a rather more expensive option.

In their early hand drawn publicity material, Nimda showed the Achzarit as having three Rafael OWS stations. The vehicles in service have just the one OWS, but carry up to three other FN 7.62 machine guns on simple pintle mounts. The Achzarit can also carry at least one roof mounted 60 mm mortar capable of firing illuminating, smoke or anti-personnel rounds.

Mobility

The fact that NIMDA managed to install a transversely mounted engine in a space compact enough to allow a rear access corridor, was no mean feat. The initial production model utilises the Detroit Diesel 8V-71 TTA diesel of 650 hp. The engine is combined with the Allison XTG-411-4 transmission. It is not known what engine was used in trial models of the Achzarit but it was of an alternate design, the engine deck having a different appearance. The power pack fitted to the Achzarit in service, is based on that used by the M109 self-propelled gun widely used by the Israelis. This has the advantage that army mechanics are familiar with the Achzarit's engine.

The downside to the initial powerpack chosen for the Achzarit, is that it gives the machine a power to weight ratio of only 14.77 hp/t. More powerful engines could have been fitted, but the funds were lacking. Given their operational environment, the Israelis have always felt that high power to weight ratios were not their most important consideration. However, since the Merkava 3 MBT has a power to weight ratio of 19.35 hp/t, it became clear that a power increase for the Achzarit would be advantageous. Consequently NIMDA has introduced into service the Achzarit 2 with a more powerful engine of 850 hp, giving a power to weight ratio of 19.31 hp/t. The new engine - the 8V-92TA/DDC III - is coupled to the XTG- 411-5A transmission. Mechanics working on the original model, pointed out to the author the obvious fact that the machine was slightly under powered. They were much happier with the Achzarit 2. IDF users of the Achzarit 2 state that the new engine doesn't give them a marked increase in speed, but does give greatly improved acceleration.

The Achzarit exhibits excellent cross country mobility thanks to its modified suspension. This has been upgraded from the T-54/55 original and now incorporates hydraulic bump-stops and modified torsion bars manufactured by the Israeli firm Kinetics. NIMDA state the machine is fully amphibious, presumably being powered through water by its tracks. Rather than amphibious, it is much more likely that the vehicle has excellent ability to cross water obstacles. It is not known what degree of preparation is required before the machine can attempt a major water obstacle.

Achzarit in service

Achzarit battalions are made up of some 36 standard machines and one command variant. The command variant is distinguishable by the lack of a Rafael OWS, and the provision of extra antennae necessitated by its additional communication equipment. An organic component of Achzarit battalions is a section of four M113 APCs manned by unit mechanics. All of the mechanised infantrymen photographed during the course of producing this book, belonged to the Golani Brigade. The Golani Brigade, the IDF's premier infantry unit, was the first to be equipped with the Achzarit. It has since been distributed to other front line units. The author estimates that 300 to 400 of the heavy assault carrier are in service.

In addition to front line units the IDF's main mechanised infantry training centre in the central Negev desert is equipped with the Achzarit. The Achzarits observed at the training base were mainly the original model, with a small number of the more powerful 850 hp variant. One difference in appearance between Achzarits based on the Golan and some of those in the Negev, was the adoption by the latter of extended front dust guards above the front idler. It is not known if this

is a standard modification for desert use, or a modification adopted by the training unit.

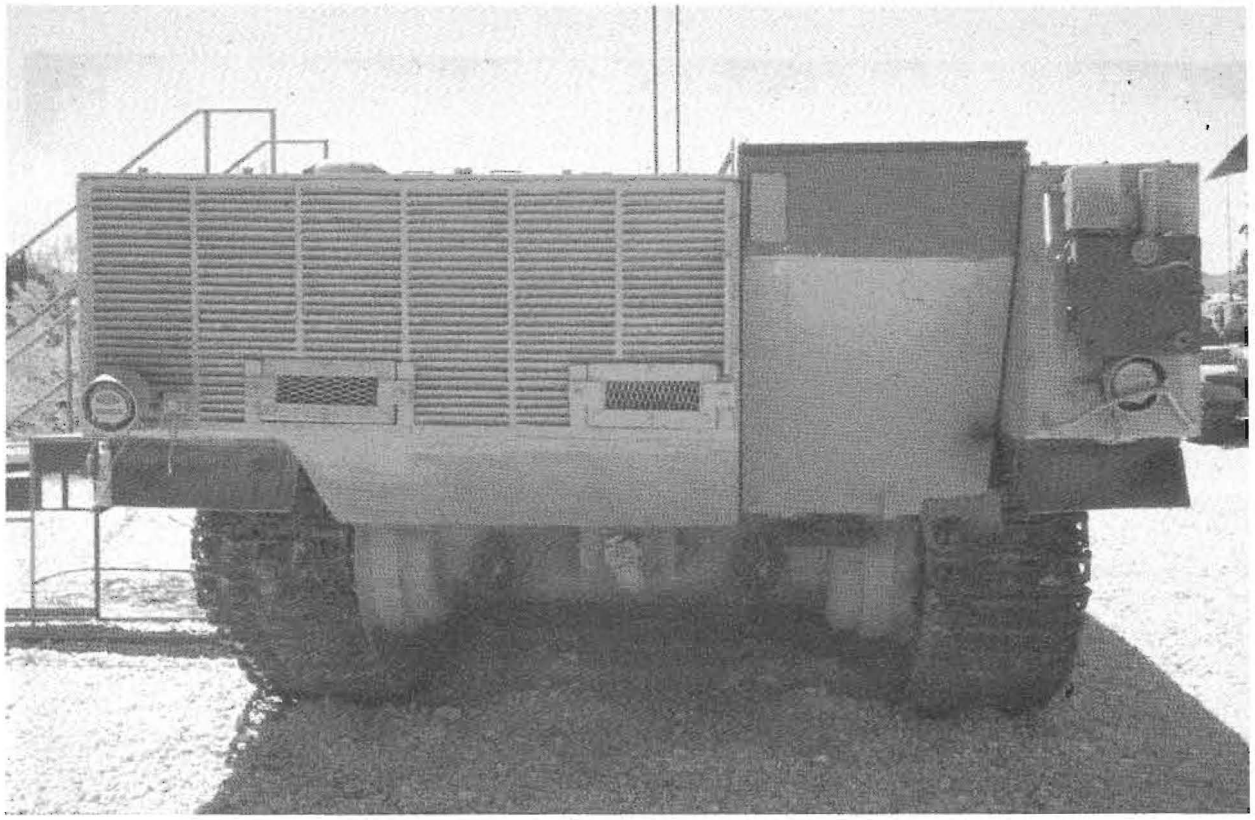
In observed training, the Achzarit tended to work in groups of three. When assaulting an objective the three machines take up mutually supporting positions to lay down fire; fire positions are shifted frequently. During the actual assault two machines peel off and approach the objective at speed, from unexpected angles, taking advantage of terrain. The third machine remains on over-watch before itself moving forward. When infantry disembark, the machines are still on the move, albeit slowly. The long exit ramp allows the soldiers to maintain a sure footing as they leave the moving vehicles. Despite the narrow exit hatch, infantry alight from the Achzarit surprisingly rapidly. The actual disembarkation is reminiscent of a stick of paratroopers exiting from an aircraft. One potential disadvantage of the clamshell exit ramp is that raising it increases the silhouette of the vehicle and could telegraph to an enemy that troops are about to disembark.

Conclusion

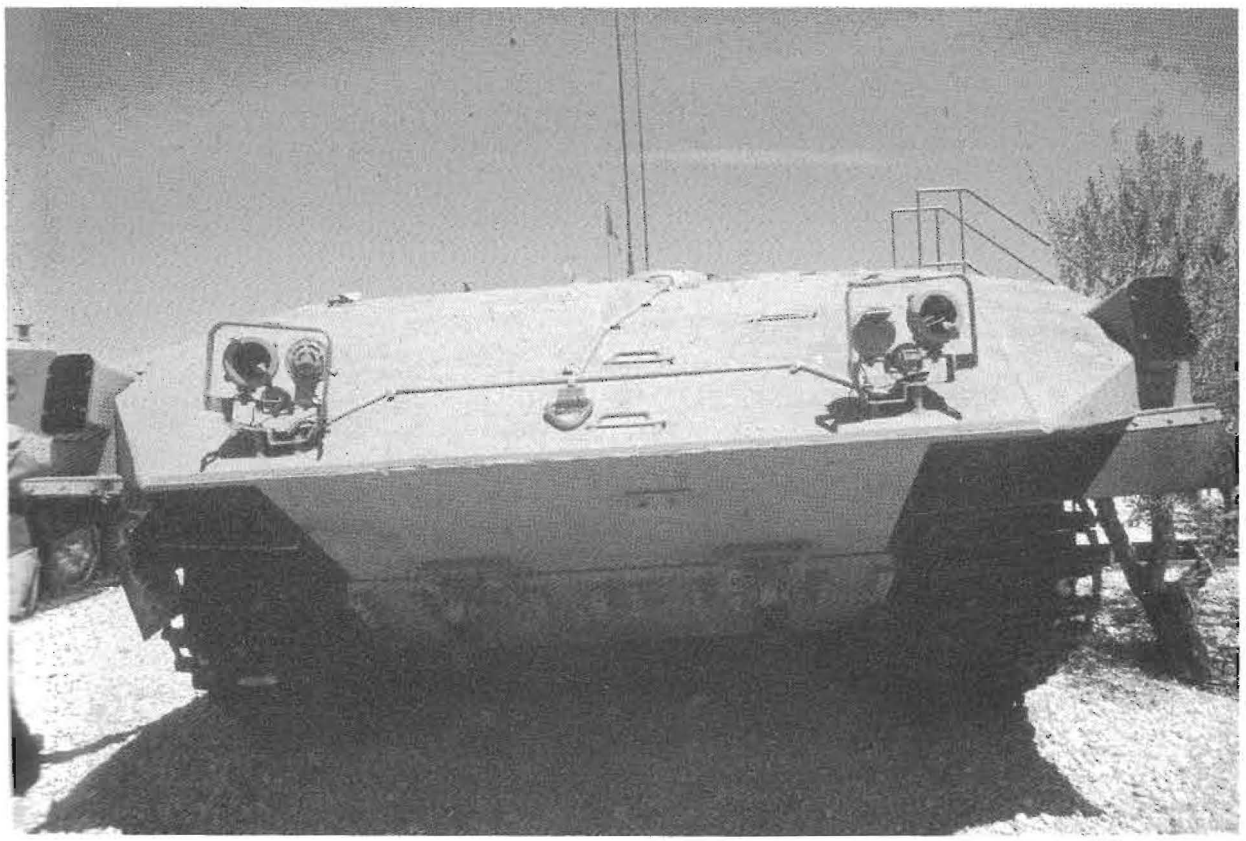
The Achzarit is an impressive machine, one born of necessity tempered by pragmatism. The IDF's considerable battlefield experience, coupled with an increasing reluctance by Israeli society to accept heavy casualties, has led to survivability of AFVs being given priority. As a result, the IDF have introduced a cost effective, heavily protected assault carrier. The Achzarit offers tactical options beyond those of a standard IFV. In general the author found IDF personnel well pleased with the Achzarit. Certainly for the foreseeable future it is the most survivable infantry carrier in service anywhere in the world. The Achzarits' battlefield companion the Puma is a highly effective frontline combat engineer vehicle. The Nagmashot, Nagmachon and highly specialised Nakpadon will probably be reserved for counter insurgency work. Their lack of a rear hatch making them unsuitable for conventional infantry tactics.

It will be interesting to see if other armies take on board the Israeli experience of heavily protected infantry carriers. It appears that Russia may bring into service its T-55 based carrier the BTR-T. This is similar in concept to the Achzarit but again lacks a rear hatch. The Israelis have revitalised the debate around transporting mechanised infantry. Soon they may not be the only source of innovative heavy carriers.

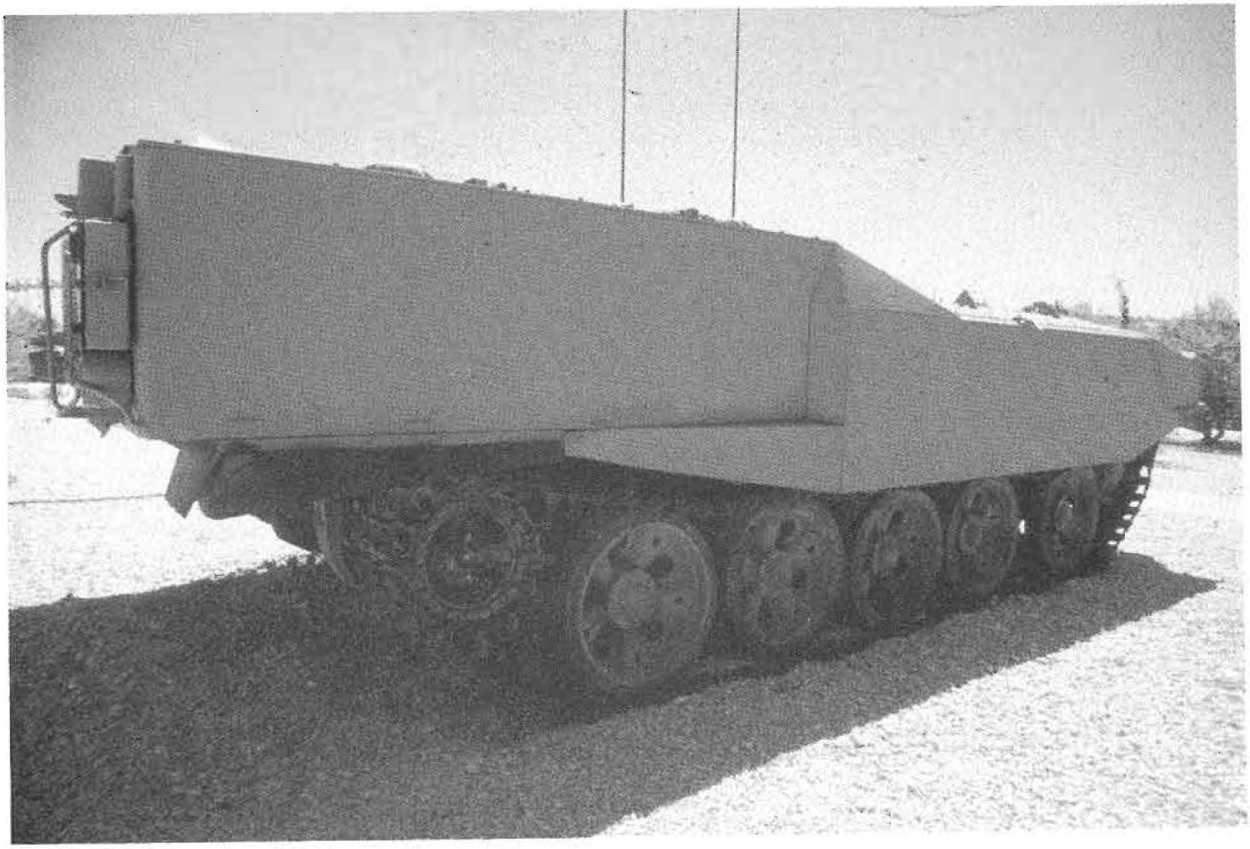
60. A very basic conversion of a damaged T-55 into an open topped infantry carrier. The vehicle is believed to be a one of few transformations for the South Lebanese army, in whose colours it is painted.



61. A rear view of an Achzarit pre-production prototype. Compare the very different engine grill configuration with that of the Achzarit in-service (Photo 76). Note that in common with many other Israeli armoured vehicles, grab handles, lubrication nipples, hinges and parts requiring frequent maintenance are painted in red to ease identification.

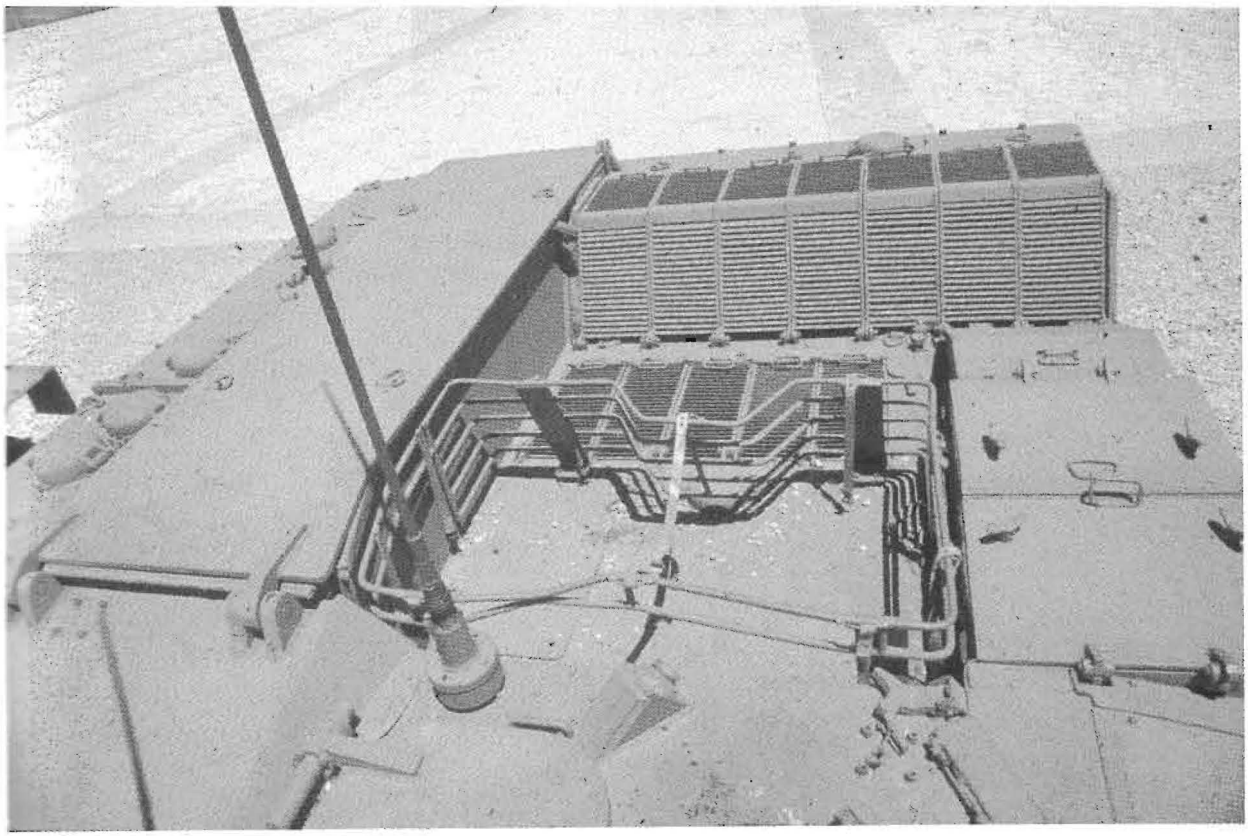


62. A front view of an Achzarit pre-production prototype. Note the bulged surface of the left side of the glacis.



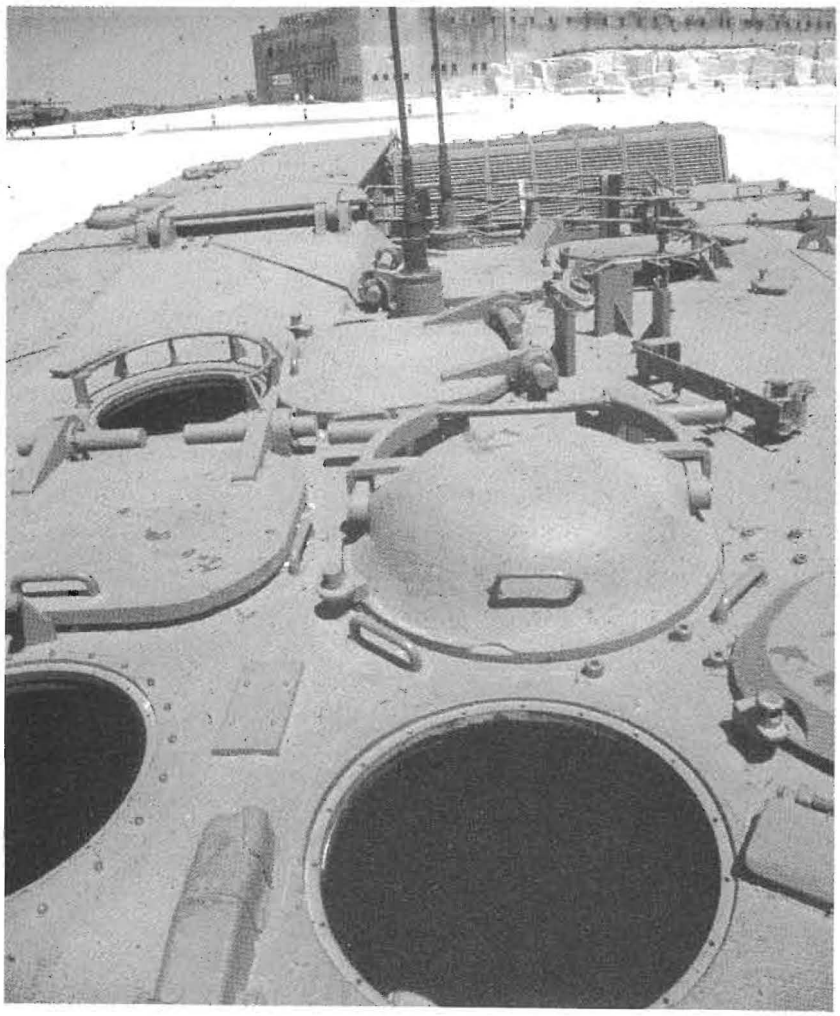
63. An Achzarit pre-production prototype viewed from the right rear. Note the smooth surface of the armoured flanks of the vehicle compared to those of in-service variants of the Achzarit.

64. An Achzarit pre-production prototype from the front right. This earlier vehicle shows some quite complex ballistic shaping for its glacis and rear sides which it shares with the production vehicle.

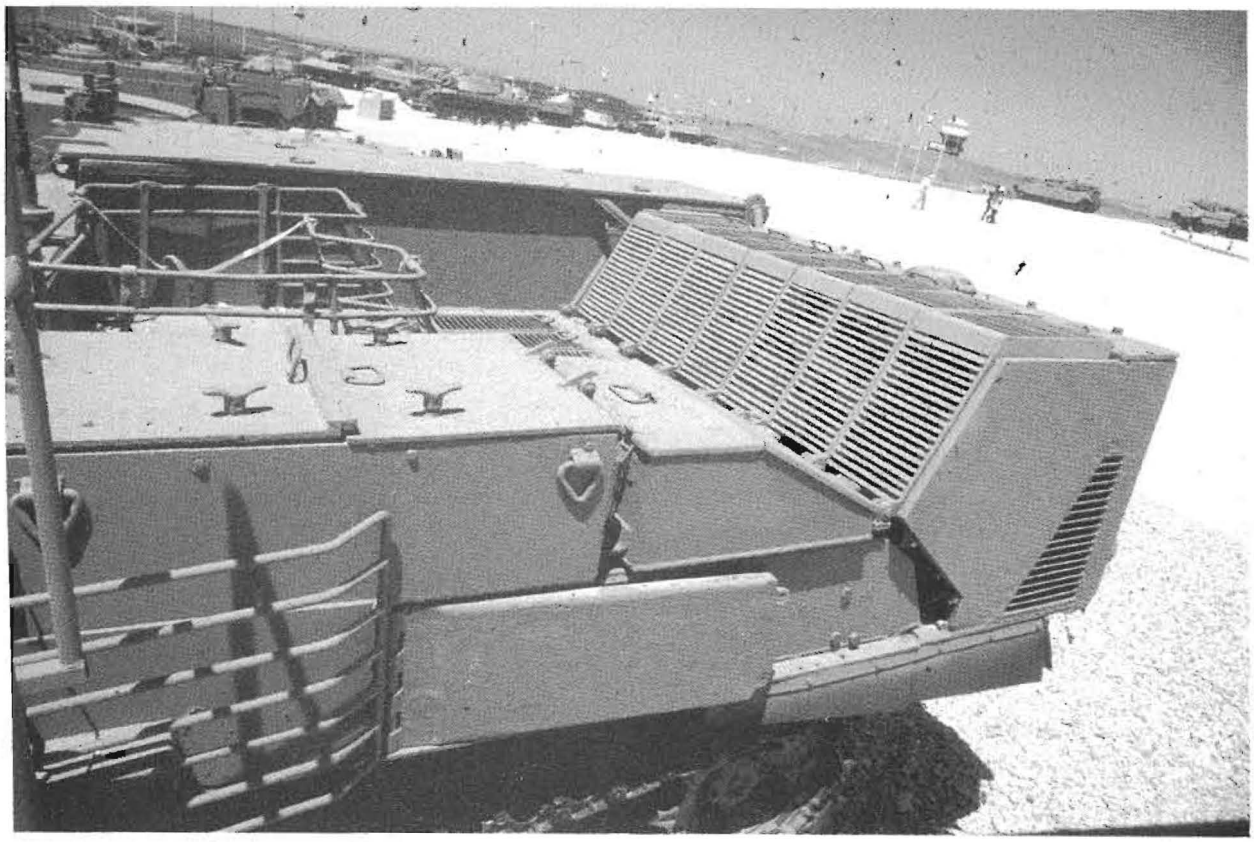


65. The roof of the Achzarit pre-production prototype looking towards the rear. Note the different shape of the engine deck and radiators when compared to production vehicles. Also mark the altered position of the basket used for kit stowage when compared to Achzarit in-service.

66. The roof of an Achzarit pre-production prototype looking forward. The vehicle has additional crew hatches when compared to the production vehicle.

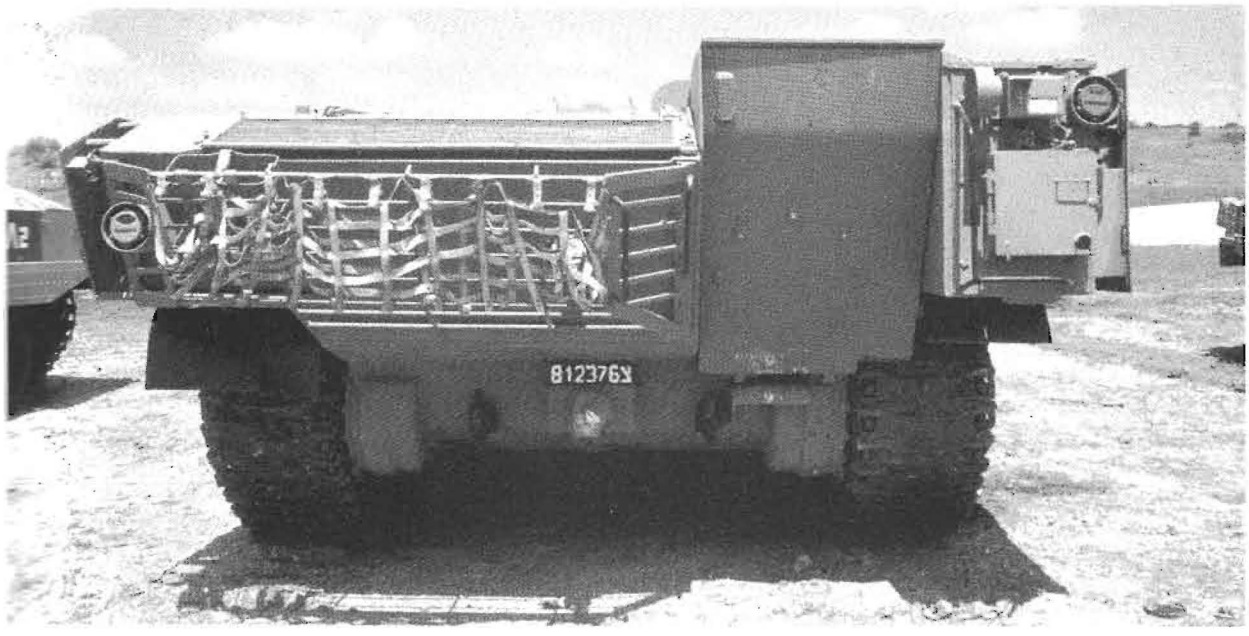


←**67.** An Achzarit pre-production prototype, alternate view of roof looking towards the engine deck. The battered building in the background is the old Police fort at Latrun, now the site of the Israeli Defence Force's armoured corps museum.



68. An Achzarit pre-production prototype's engine radiators are in a different set up to that of service vehicles.

69. The rather battered interior of Achzarit pre-production prototype viewed through driver's hatch. Note the basic similarity of this vehicle with the in-service model.



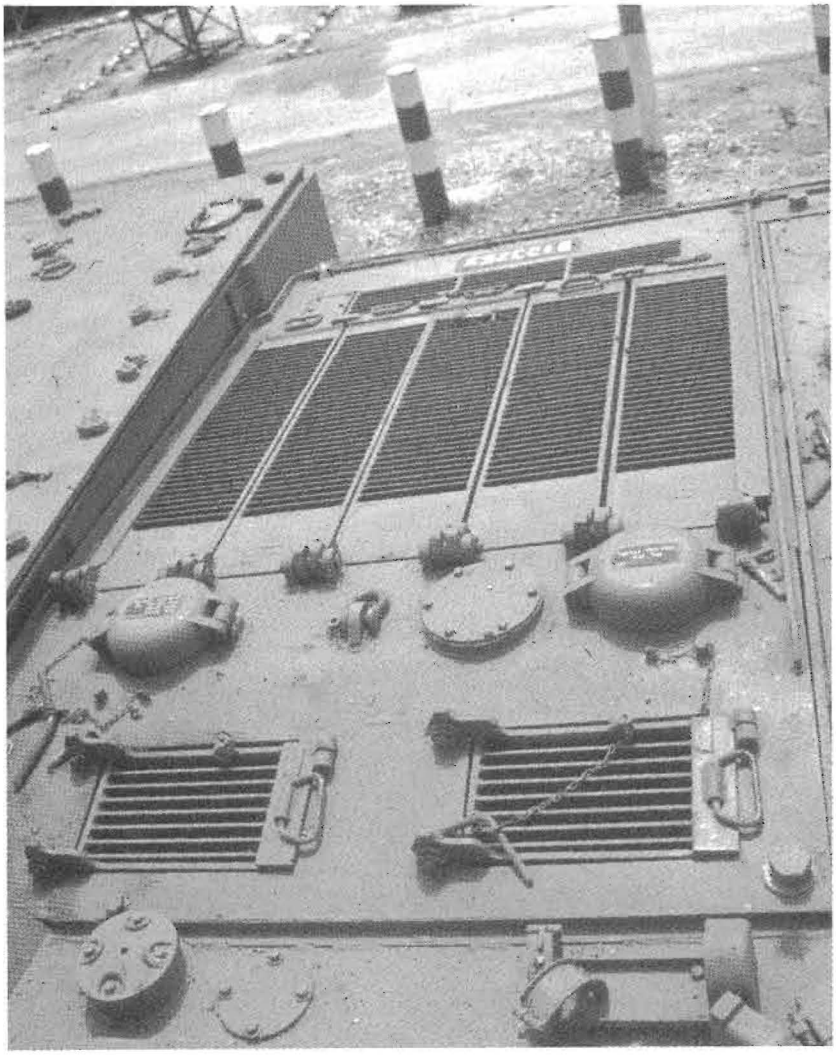
70. An Achzarit production vehicle viewed from the rear. Its profile differs from that of the prototype, in addition, its basket has been moved to the vehicle's rear. Compare this to photo 61. Photographed in the Golan Heights

71. An Achzarit production vehicle from the rear left. The view shows the distinctive gap between the armoured shell of the hull and the Toga appliqué, stand-off armoured mesh which is applied to the vehicles rear flanks. The space is used for stowing gear. Photographed on the Golan Heights.

72. An Achzarit production vehicle viewed from the front right. Note the distinctive bulge on the left side of the glacis. Also note two 7.62 FN machine guns, the one to the left over the gunners station is mounted in a Rafael OWS, one on the right above the commanders hatch, is pintle mounted on an L shaped arm. Photographed in the Negev Desert.

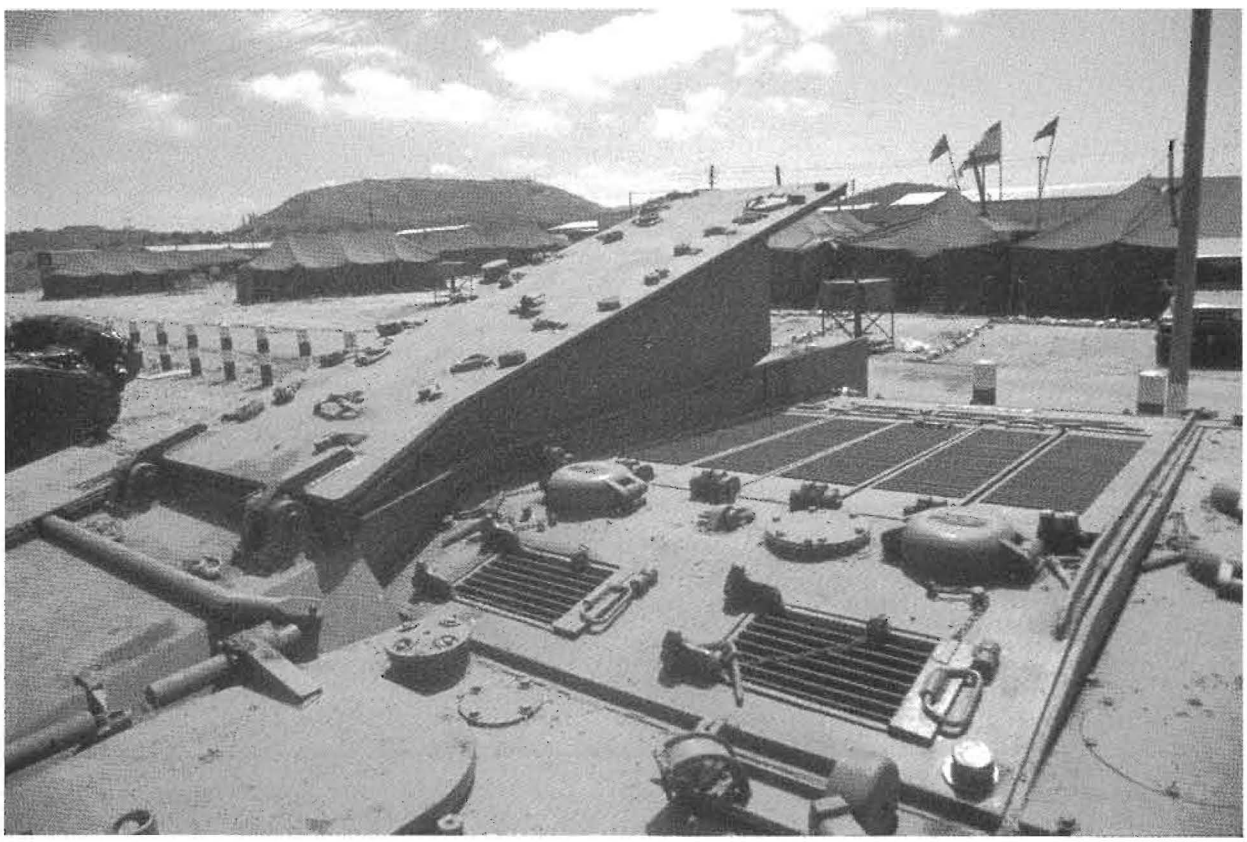
73. An Achzarit production vehicle viewed from the side. Notice how Toga armour is applied to the vehicle's rear flanks. The main tactical marking on the vehicle's side is unusual in that a black background has been painted under the white number and chevron. The markings indicate that the vehicle is the second platoon of the fourth company. Photographed on the Golan.

74. An Achzarit production vehicle viewed from the right front. The vehicle has its clamshell access hatch in the open position, and is having its track replaced. Photographed on the Golan.

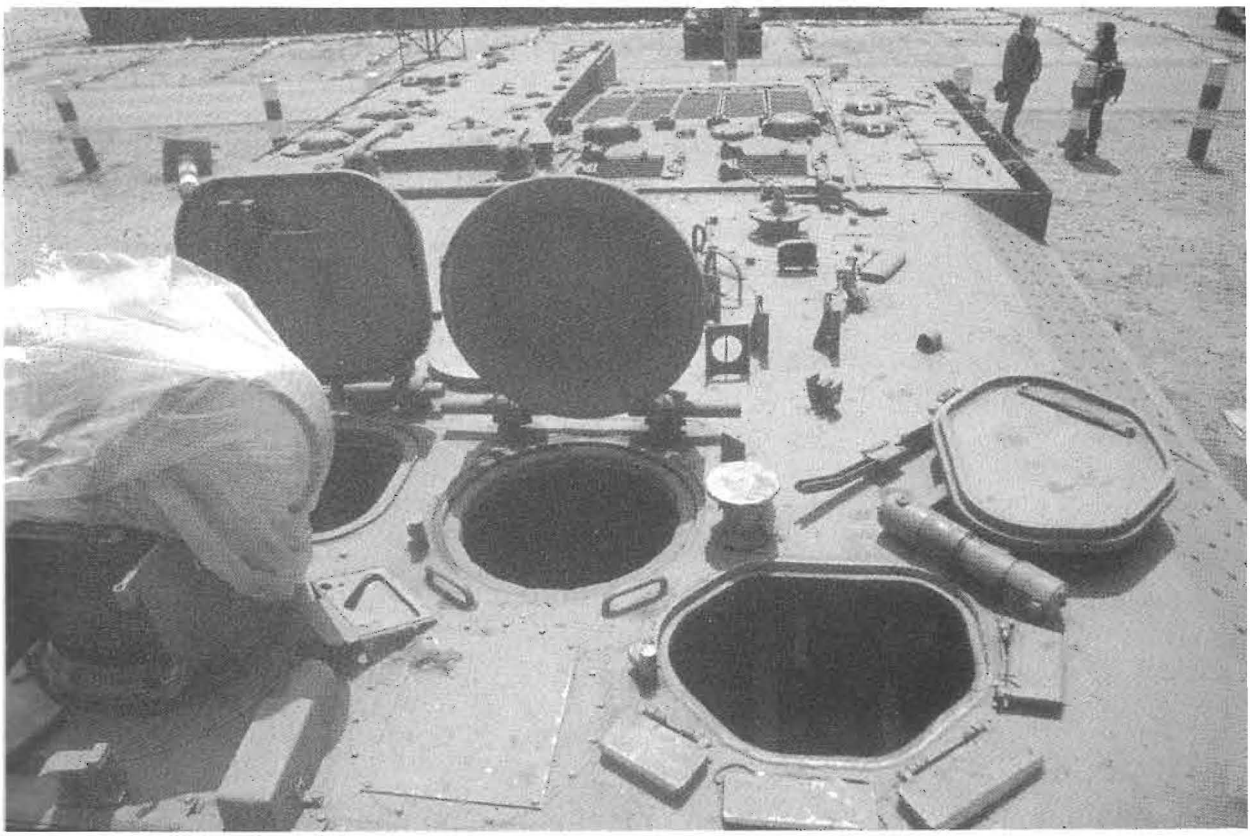


←75. An Achzarit production vehicle viewed from the vehicle's roof looks towards the engine deck. Compare this to photo 59. The barely visible inscriptions on the POL filler caps indicate that the right cap is for checking the level of, and for refilling, the engine coolant. Photographed on the Golan.

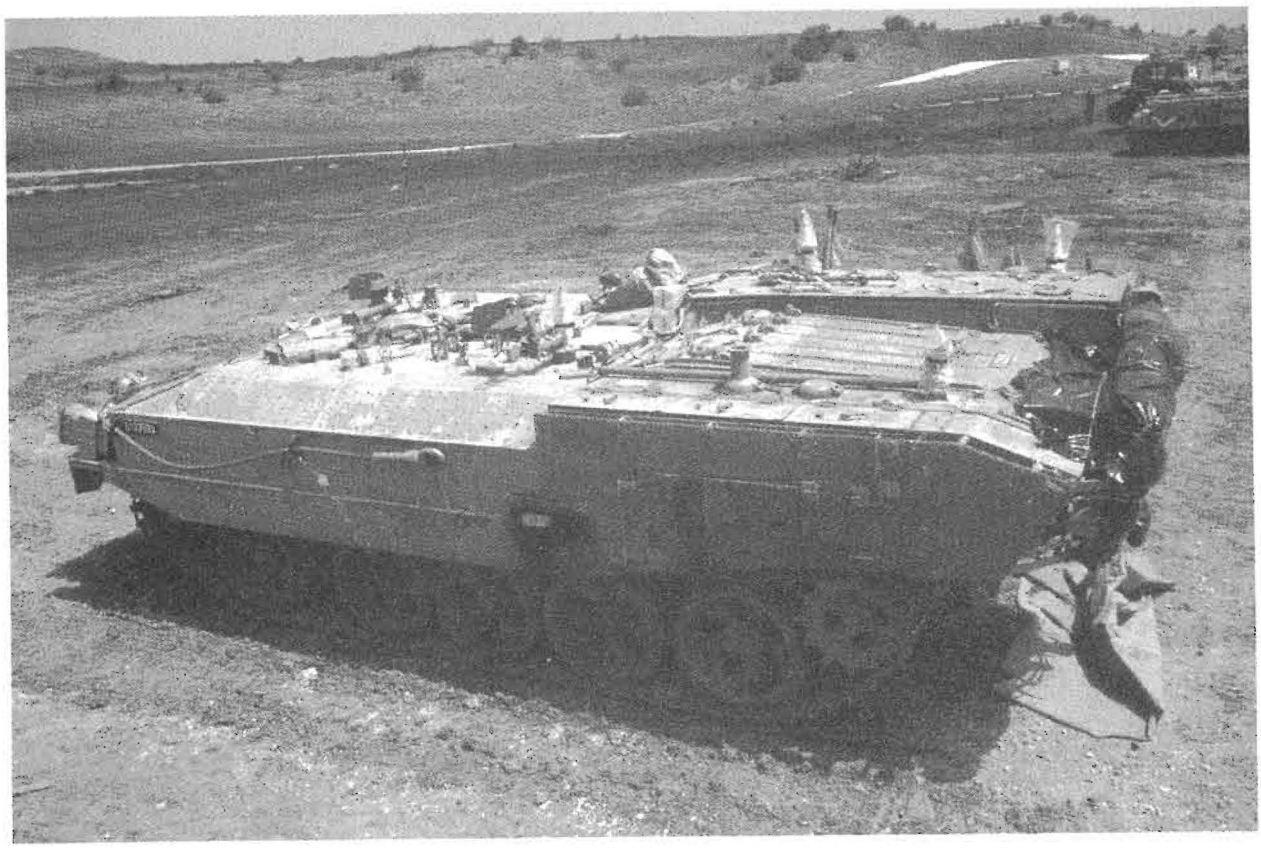
↓76. An Achzarit production vehicle viewed from its roof looking towards the rear and the side of its open clamshell access hatch. Note the volcanic Tel (hill), typical of those which dominate the cease-fire line with Syria, in the background. Photographed on the Golan.



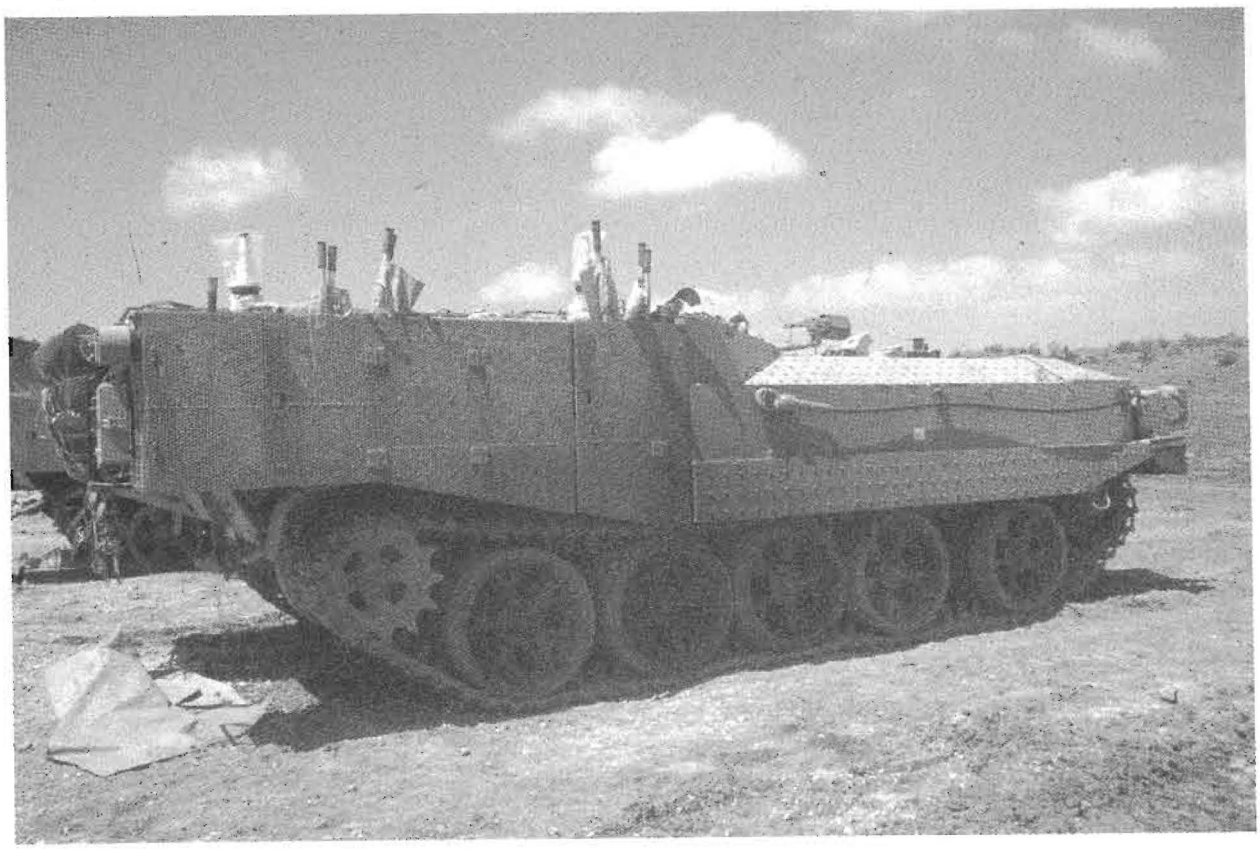
77. The roof of an Achzarit production vehicle looking towards the rear. This view shows the front hatches' belonging from left to right, gunner, commander and driver, with the latter hatch is ringed by vision blocks. The Rafael OWS has been bagged in plastic to protect it from a rain and dust. Photographed on the Golan.



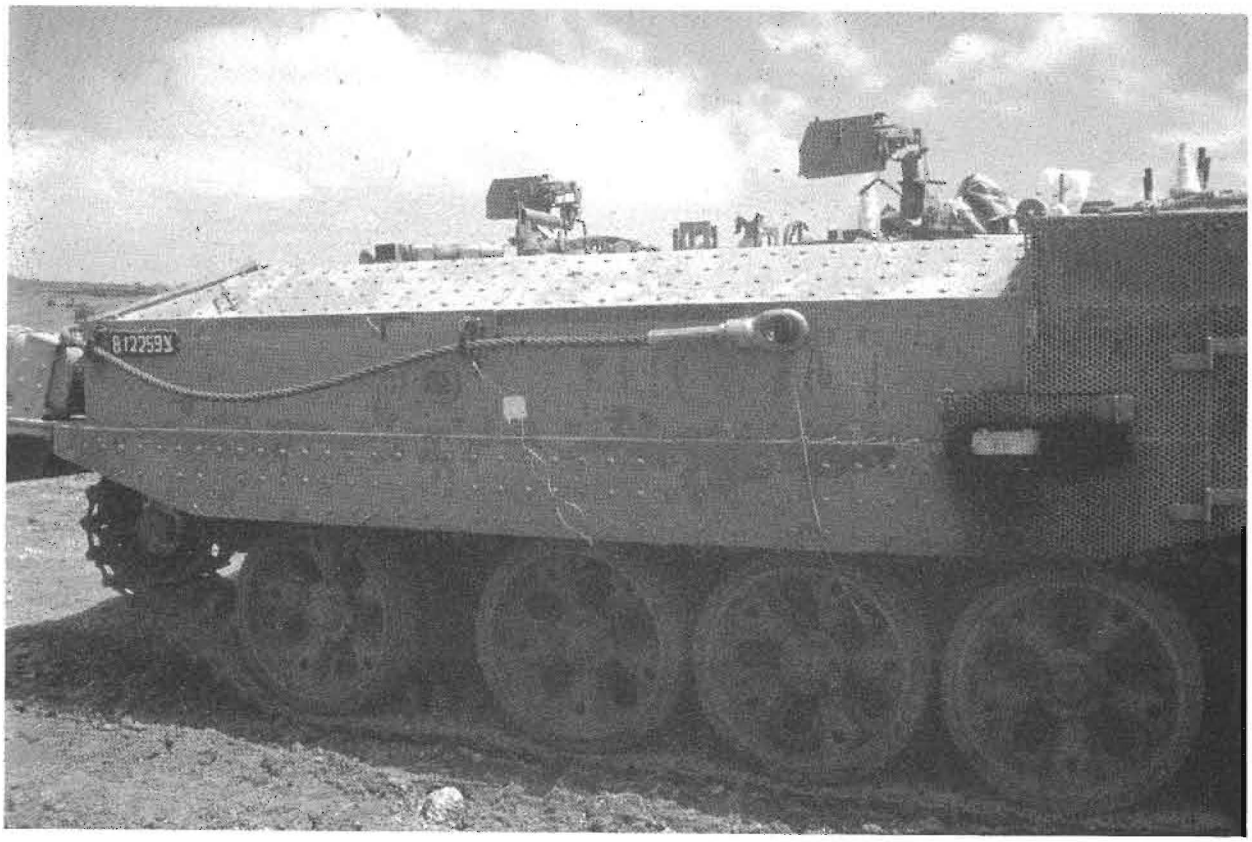
78. The roof of an Achzarit production vehicle looking towards the rear. In this view the clamshell access hatch is open. Note the clutter formed by ammunition box brackets, aerial mounts, fuel filler caps, etc. Photographed on the Golan.



79. The command variant of the Achzarit from the left side. It is distinguishable from the standard machine by the lack of a Rafael OWS and the additional radio antenna fitted to cope with the extra communication equipment carried. Note the L shaped machine gun mount at the commander's hatch. Photographed on the Golan.

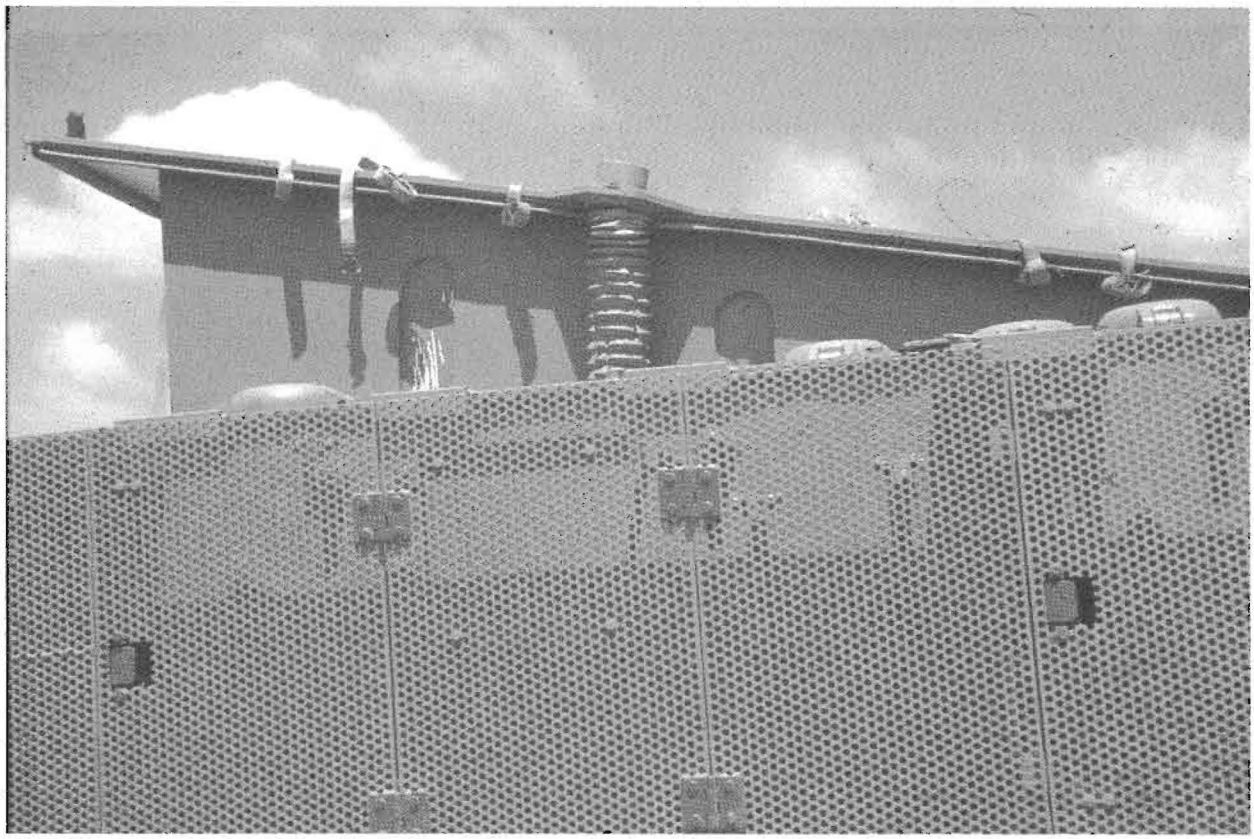


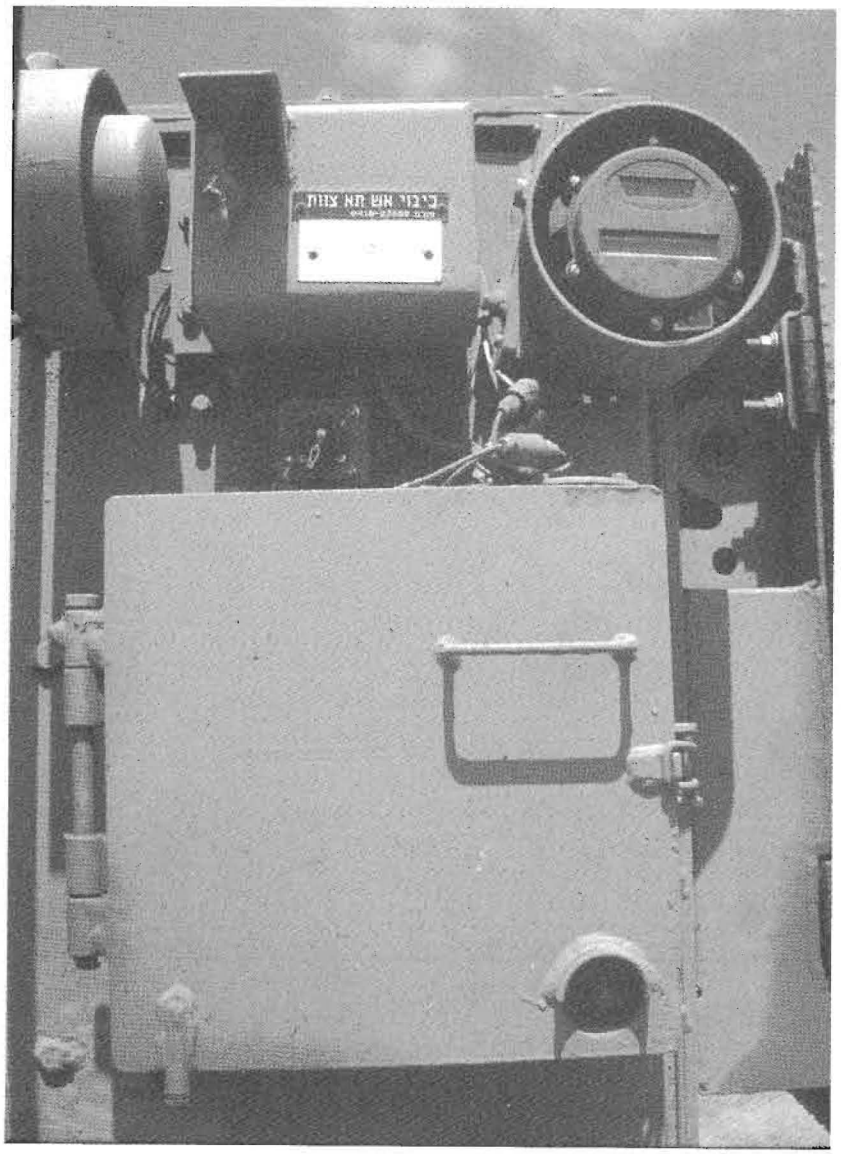
80. Command variant of the Achzarit (812259ש) viewed from the right side. Note and the untidy stowage of stretchers. All Achzarits are fitted for, and most carry, the heavy tow cables mounted on the vehicle's flanks. The hinges on the Toga armour are painted red. Photographed on the Golan.



81. The command variant of the Achzarit, viewed from the left side, shows the heavy rivets associated with the vehicle's appliqué armour. Of interest is the marked carbon staining around the engine exhaust. Photographed on the Golan.

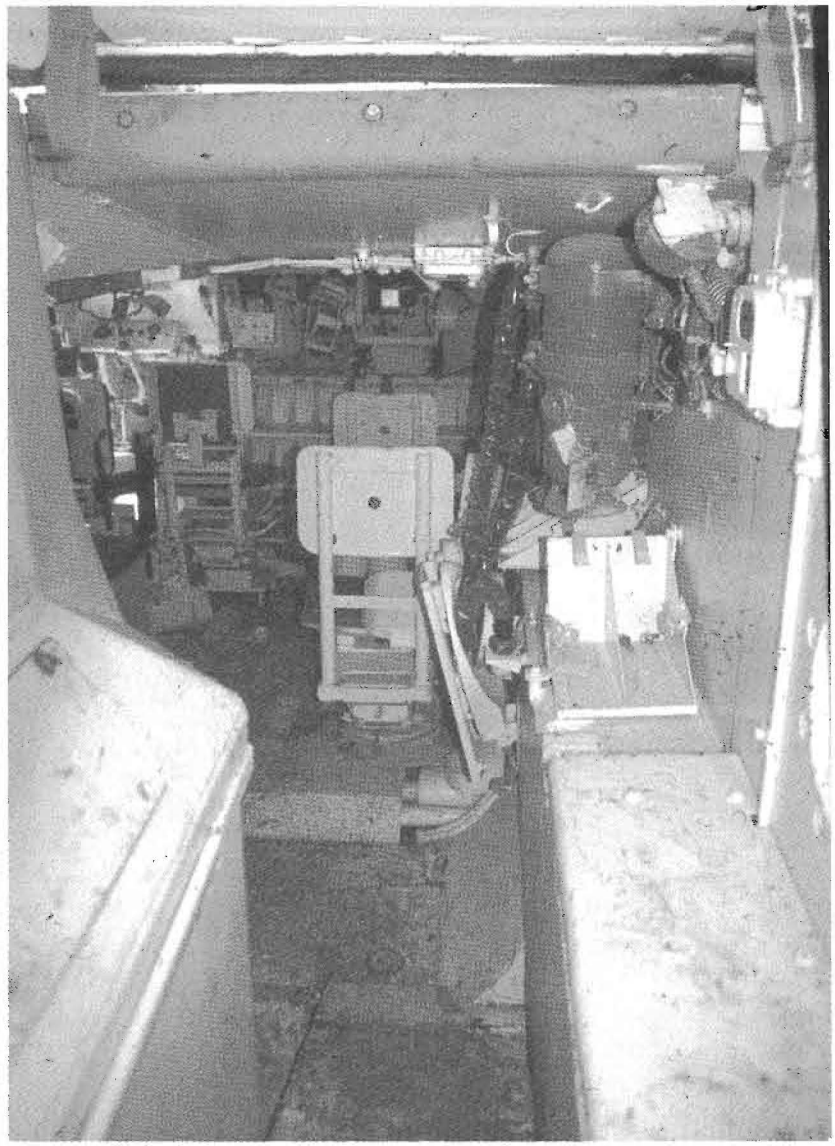
82. An Achzarit production vehicle viewed from its front, having tracks and wheels replaced. Note the plastic sheet covered Rafael OWS. Photographed on the Golan.





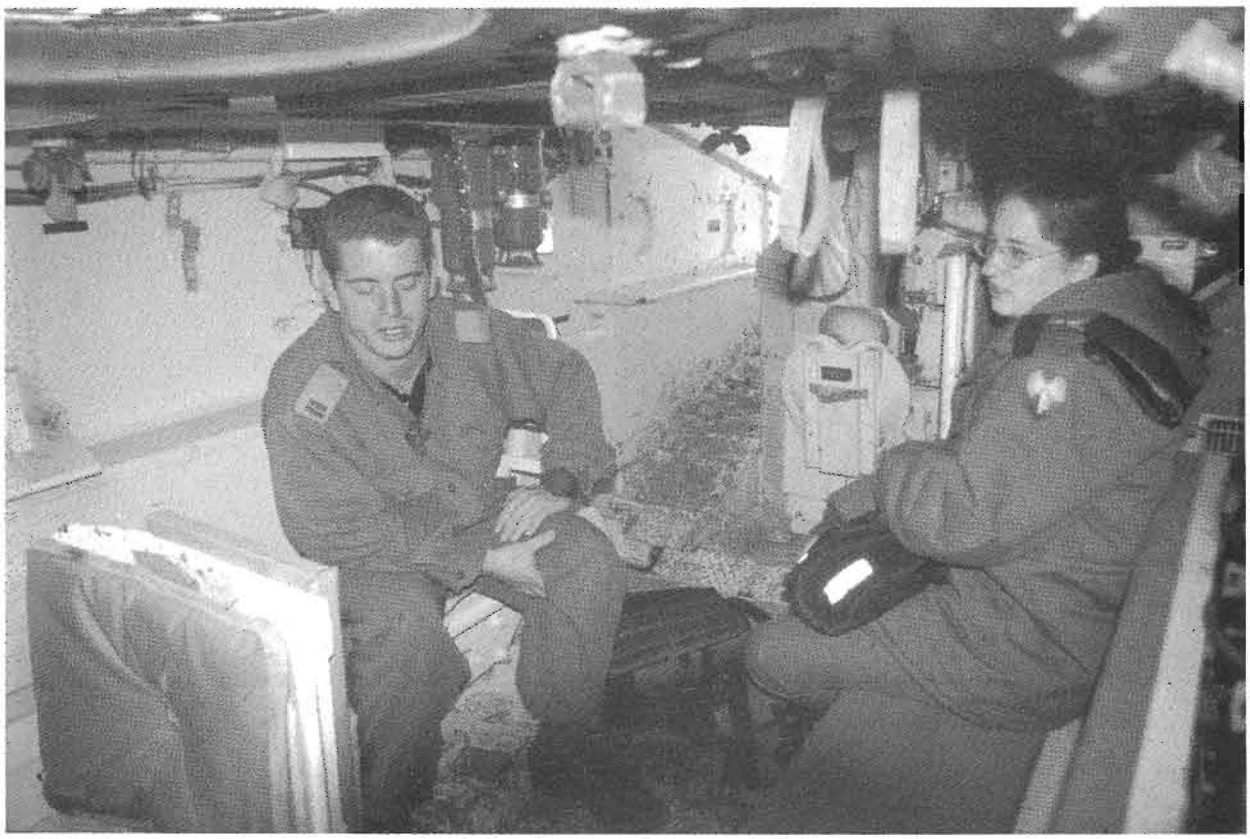
↑83. A close up of the hydraulic mechanism that opens the Achzarit's rear clamshell access hatch. Also note the Toga appliqué mesh armour.

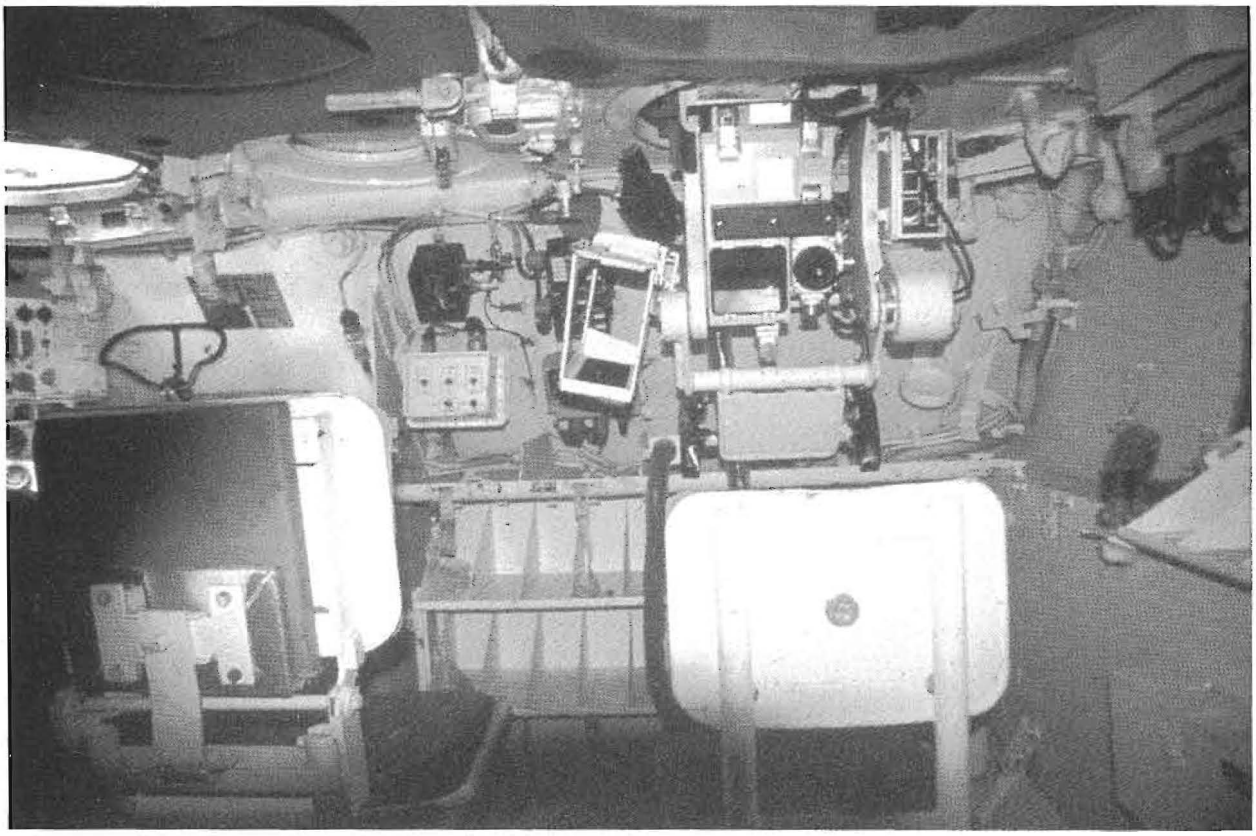
← 84. A close up of equipment mounted to the right of the clamshell rear access hatch. To the top left is a handle that allows the normally automatic fire suppression system, to be manually initiated.



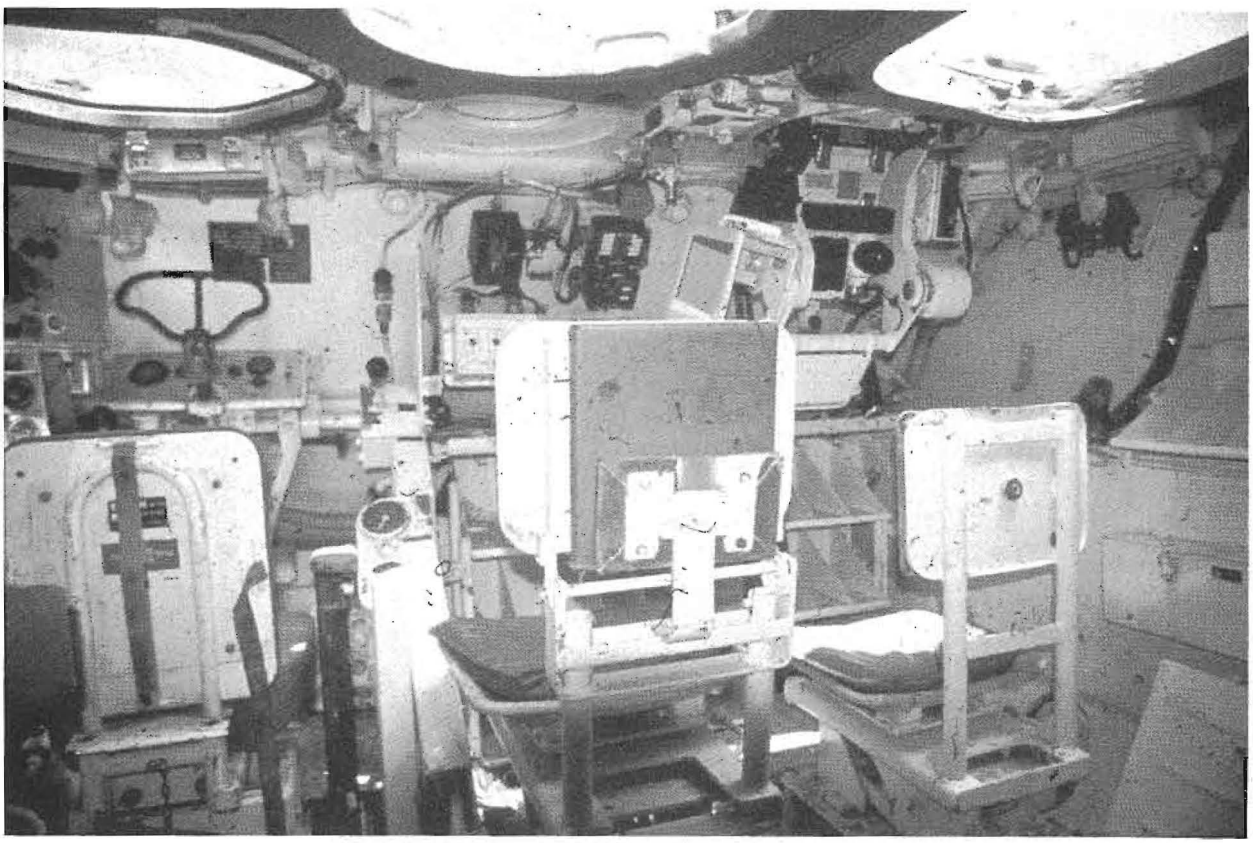
→85. The interior of a production Achzarit. The photograph was taken from within the rear clamshell access hatch looking forward to the gunner's station. The Spectronix fire extinguisher system is evident. Note before any photography of the interior of the machine was permitted, ammunition stowage and some electronic items were removed.

↓ 86. A unit commander and press officer sit and chat in an Achzarit interior. Note the exit hatch to the left rear and the Spectronix fire suppression / extinguishing system mounted by the exit.

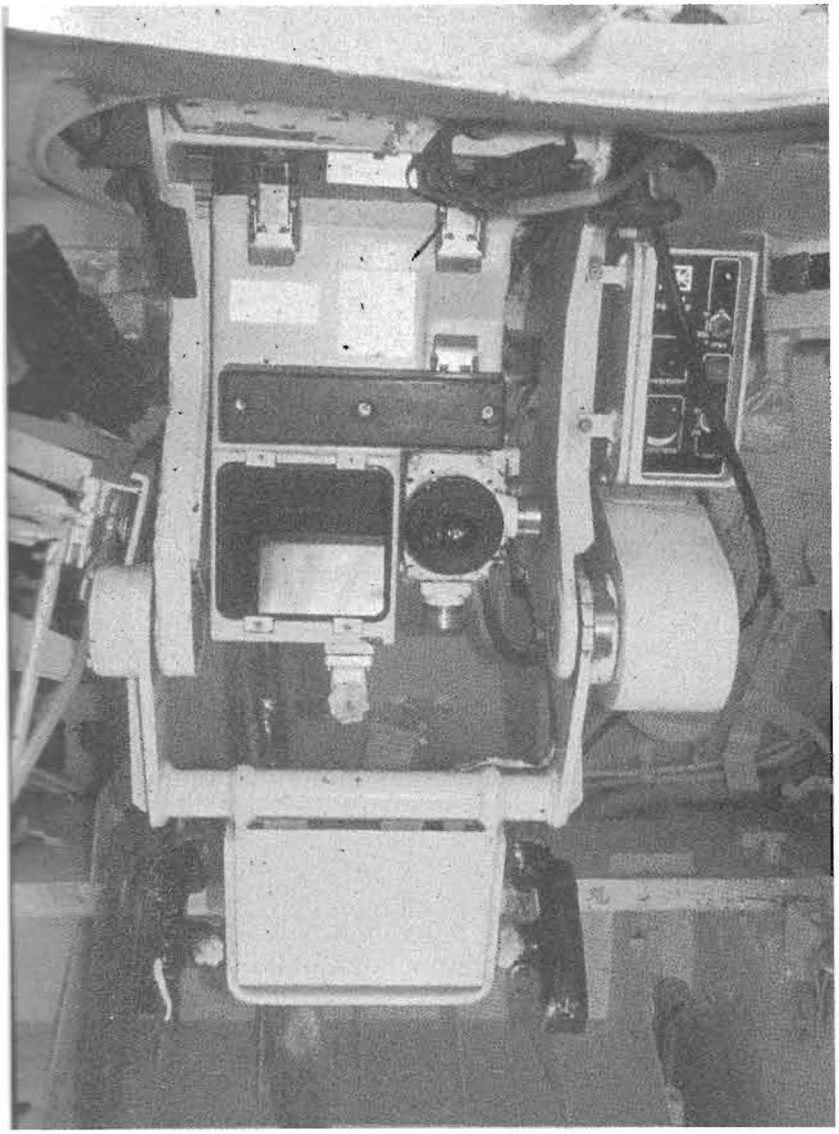




87. The interior of production Achzarit viewed from the rear looking forward to the gunner's station (on the right) and the commander's station. The driver's steering wheel can be seen on the left.

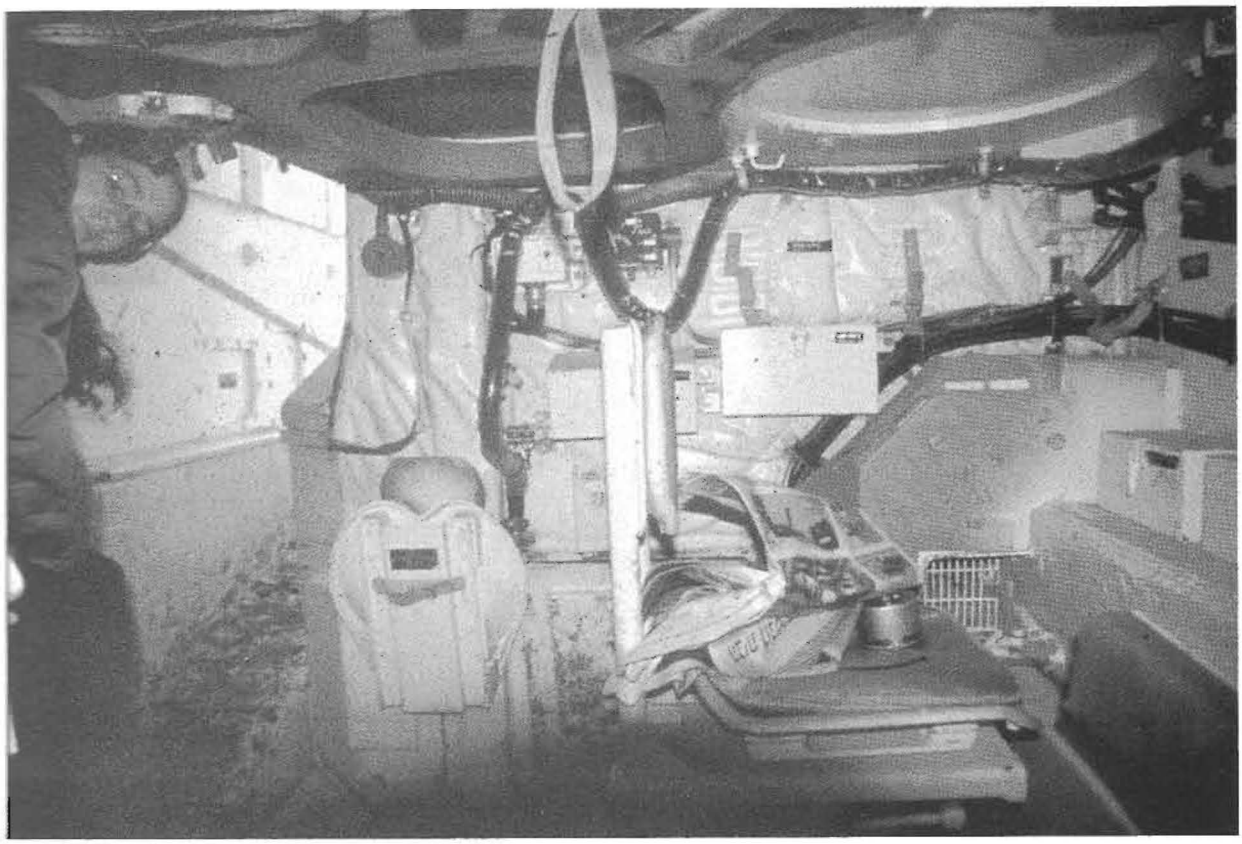


88. The interior of a production Achzarit viewed from the rear. From left to right the photograph shows the driver's, commander's and gunner's stations.



←89. The interior of production Achzarit. A close up of the Rafael Overhead weapon System gunner's station. The main unity sight is mounted centrally over the control grips, the ×8 elbow sight is located to the right.

↓90. The interior of a production Achzarit, looking towards the rear exit. The large bore corrugated black hose, attached to the vehicle's interior roof at its rear right side, is thought to be part of the vehicles NBC system. Apart from the rather untidy interior, observe the bench and two foldable seats.



91. An Achzarit on the ranges. The Rafael OWS is being fired remotely from under armour. Photographed in the Negev.

92. An Achzarit viewed from the side, negotiating a steep slope. Note that the fourth road wheel appears to have suffered greater wear and tear than its companions. Photographed in the Negev.

93. An Achzarit charging towards the camera. The Rafael OWS has had its machine gun removed. The lower glacis has two sections of spare track fitted. Note the TAAS CL-3030 smoke dischargers fitted to the side of the glacis.

94. A dusty Achzarit in the field viewed from the side. Note rear access clamshell door is open.

95. Dusty Achzarit viewed from the right front. Note the sections of spare track are missing allowing a clear view of the brackets fitted to hold them. Photographed in the Negev.

96. An Achzarit on the move with the commander out of his hatch. Note the steel rope foot rest, positioned by the first road wheel, allows easier access to the vehicle's roof.

97. A well protected Achzarit with heavy additional armour grafted on to the basic T-55 hull shape.

98. An Achzarit at speed. Note the commander straining to hear incoming radio messages.

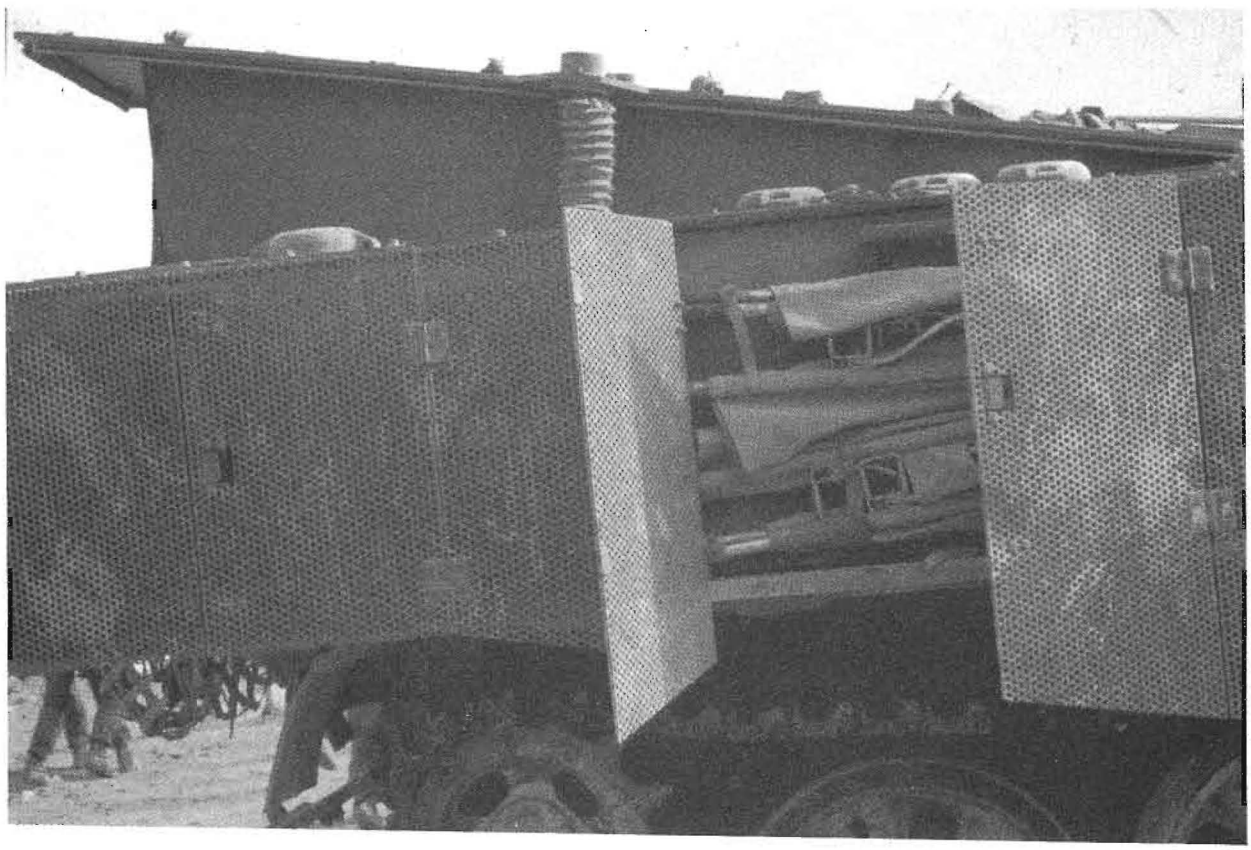
99. An Achzarit on the move during training with predominantly female crew. The vehicle has had the machine gun removed from the OWS. Photographed in the Negev.

100. An Achzarit about to run the photographer down! Some of the vehicle's occupants (commander, gunner and infantry section commander) are all perched precariously out of their hatches. Note the black-painted extensions to the dust guards are fitted directly above and to the sides of the front drive sprockets.

101. An Achzarit viewed from the front. The lower slope of the glacis is shown to advantage, as are the heavy duty towing hooks and the spare track links.

102. A stalled Achzarit misses the live fire exercise. Note its generally cleaner appearance to its dust caked compatriots. Just visible on the right upper flank of the machine is the Hebrew inscription stating that the "tow cables should be stowed here." The discreet inscription is repeated on the left upper flank.

103. Two Achzarits photographed from the rear. The rear exit hatches of the vehicles are open and accompanying infantry have temporarily dumped their helmets, webbing and flack jackets.



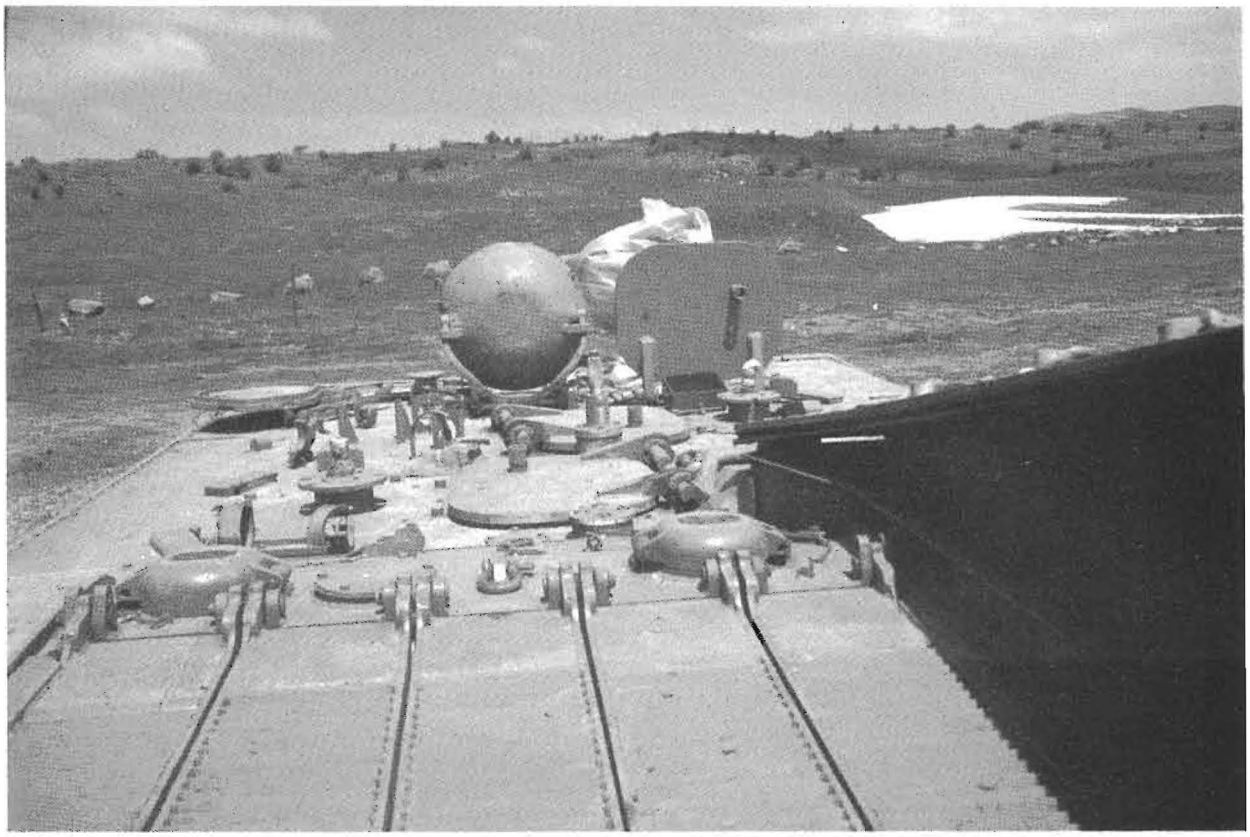
104. Close up of storage space behind the Toga armoured mesh to the rear of the vehicle. In this case the space is used to store foldable stretchers.

105. The rear of an Achzarit with an open entry hatch. The photo shows the rather long ramp portion of the hatch. The ramp is corrugated, allowing infantry using the hatch a more secure footing.

106. An Achzarit rumbles by. Note the large size of the external stowage basket.

107. A stationary Achzarit with a black coloured tarpaulin attached to one side for shade. Note the tarpaulins are deliberately set up to give the same angular silhouettes of the sprawling Bedouin tents found in the region. At a distance this disguise is surprisingly effective.

108. An Achzarit on a tank carrier; photographed at Rosh Pina Junction, northern Galilee.



109. The roof of an Achzarit viewed from the engine deck looking forwards. Note the rather cluttered appearance of the roof with its multiplicity of hatches, ammunition case brackets, and aerial mounts, etc.

110. An Achzarit at speed during a training exercise in the Negev.

111. Two Achzarits at rest in the Negev. Note the wire step at the bottom of the side skirt.

Achzarit Crew

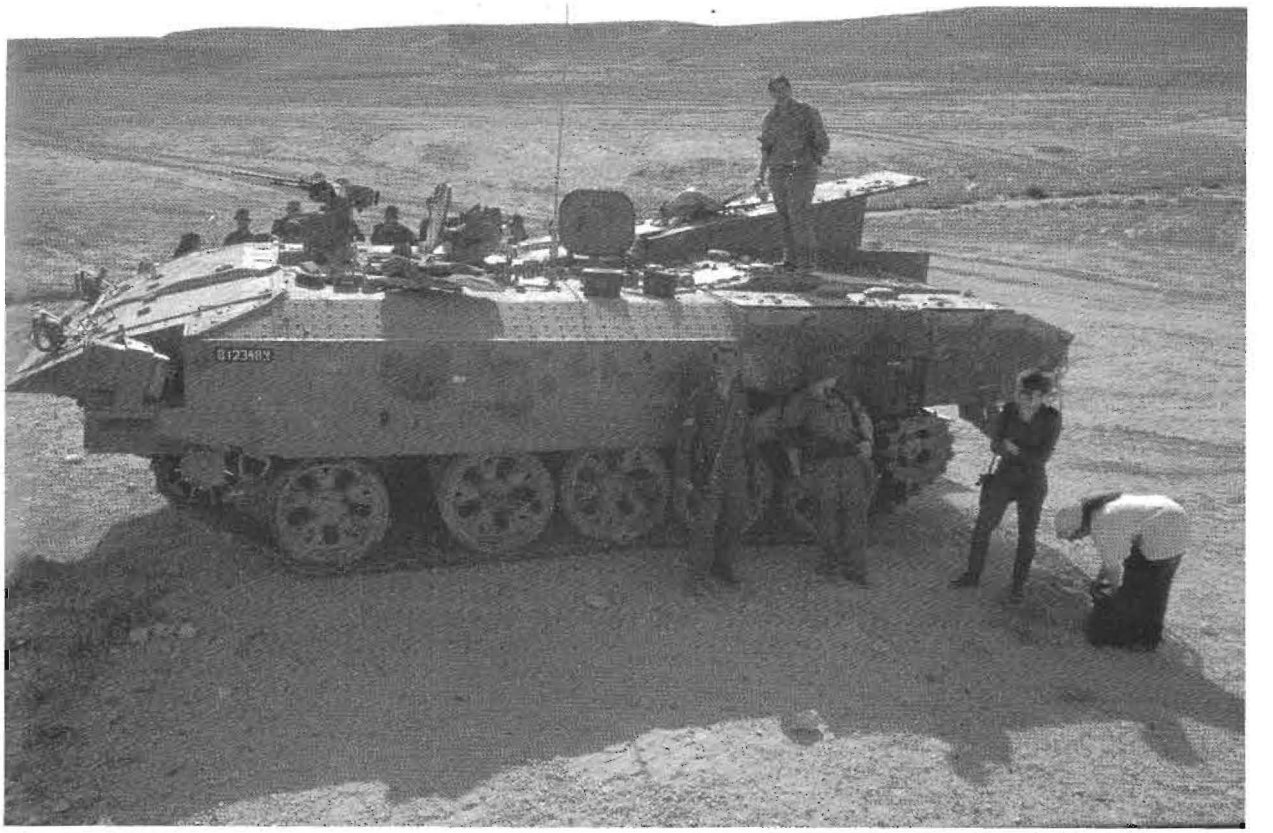
112. A dusty female instructor in front of an Achzarit. Most female instructors observed during a visit to this training base have shaved their heads - this is strictly against regulations - and wear bandannas. Note the corporal's chevrons.

113. A close up of a female Achzarit commander and gunner. The OWS machine gun has been dismounted from its bracket. The photograph shows to advantage the ring of vision blocks belonging to the driver's station. Note the number plate style.

114. A soldier has a snack next to a stationary Achzarit. He is wearing the floppy, outsized, camouflaged helmet cover currently issued to IDF combat soldiers. Note the ad-hoc manner of attaching the tarpaulin to the machine.

←**115.** An infantryman entering an Achzarit.

➔**116.** A smiling infantryman enters an Achzarit. Note the folding stretcher stored in the external webbed stowage bin.

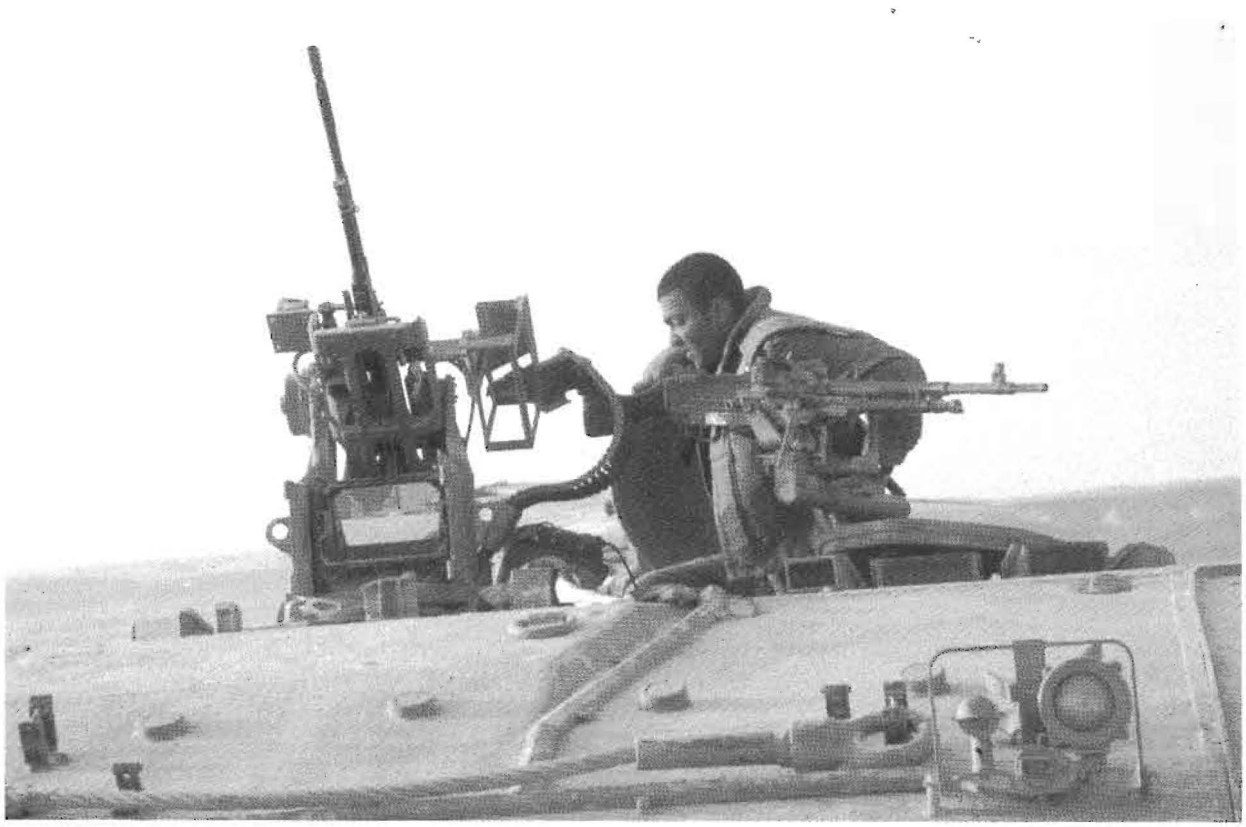


117. The predominantly female crew and infantry take a break by the side of their Achzarit. Note the vehicle is missing its tow cables.

118. Through a haze of dust an Achzarit's crew await orders. Note the signal flags folded by the base of the OWS.

←**119**. The front view of the Rafael OWS and a female instructor. All Achzarit crew are issued with OR-602 helmets. The large optical block for the OWS sight can be seen below the gun.

➔ **120.** An Achzarit crewmen and armament. The vehicle commander is standing by his 7.62mm FN machine gun mounted on an L shaped mount, the Rafael OWS behind him.



121. A good view of the ammunition storage and feed mechanism of the Rafael OWS. Note the angle iron cover for the light cables and the light cluster.

122. An Achzarit crewman walks by infantrymen resting on his vehicle's glacis.

123. The crew and infantry of an Achzarit with a stalled engine watch the progress of a fire exercise. Note the disposition of the heavy dust on the vehicle and roadwheels.

124. An Achzarit crew and passengers pose for the camera. The infantrymen are mainly armed with the M16A2, some of which are fitted with the Elbit Falcon miniaturised "Head up Display" red dot sight.

125. Infantrymen dismounting from a moving Achzarit.

126. Infantrymen deploying between two Achzarits.

Israeli Defence Force - Company markings

The IDF has used large white chevrons on the sides of their armoured vehicles since the early 1960s. There remains some controversy about what they actually mean but it seems that they are company markings. The large white "v"s are generally seen on side skirts or on turrets on main battle tanks. They appear is several styles including white outlined in black, whilst others are applied more hurriedly.

Throughout this book on this type of vehicle they appear as follows;

Front of vehicle ←←←←←	>	1st Company
	<	2nd Company
	V	3rd Company
	Λ	4th Company

1 The first public display of the **Nagmashot** in the mayoral square in Tel Aviv. Note the Company chevron and the engineer symbol towards the rear of the armoured side skirts. This vehicle's name is *Ayit (vulture)*
(Nafi Segal)

2 Close up of rear plate of an early ***Nagmashot 8170268.*** Note the black track links, some red painted parts and blue mine walking shoes. The exhaust stains on the rear deck are quite prominent.
(Nafi Segal)

3 A later version **Nagmashot** with its slightly raised roof. The crew appears to have spilled oil on the crew compartment to absorb and darken the inevitable dust. This vehicle has the large antennae array and exhaust cowls.
March 1998
(S. Mikkola)

Nagmachon 818789 fairly clean in overall Sinai grey. The vehicle is equipped with a full suite of Blazer ERA and bulletproof shields with blue/green armour glass. This type of vehicle generally carriers four rather than two sets of smoke dischargers. **(C. F. Foss)**

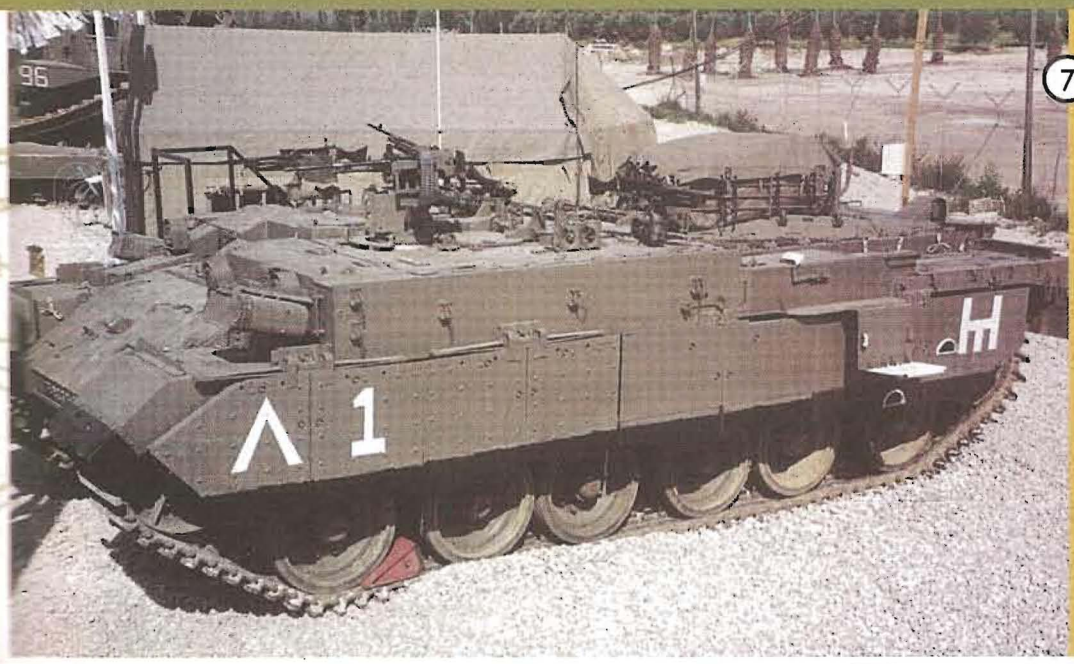
4

5

A **Nakpadon** (left) and a **Nagmachon** side by side at a base in the Negev where soilders train before they go on active duty in this type of vehicle.

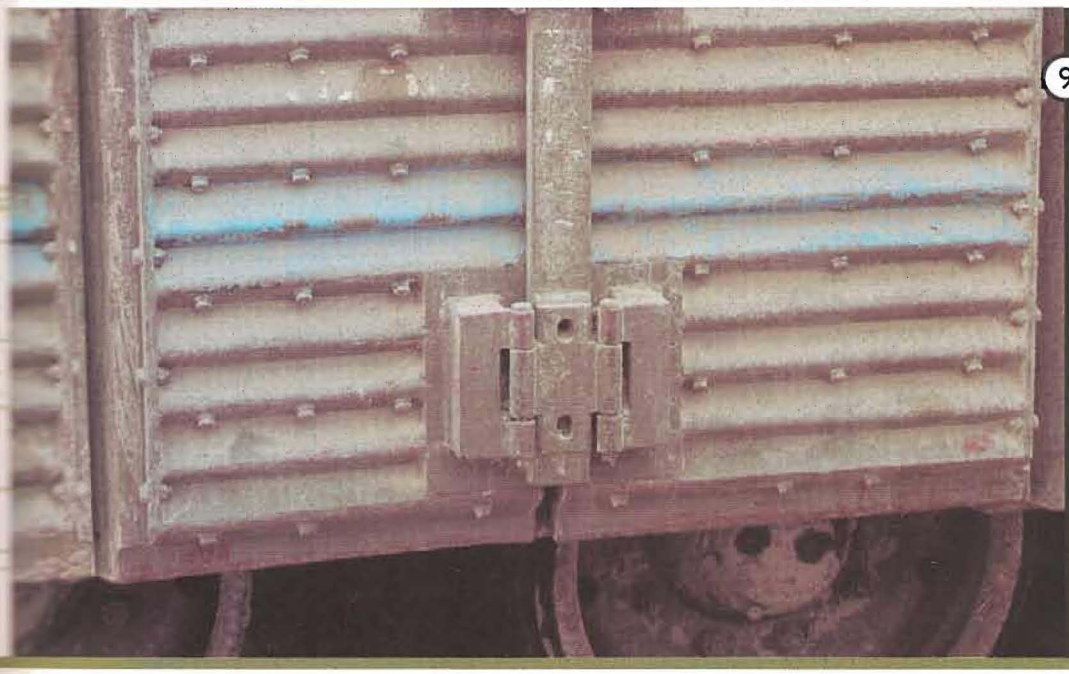
Front view of a **Puma** armoured engineer assault vehicle. Note the non slip paint used for much of the vehicle **(Nafi Segal)**

6



7 Overall view of the Puma showing the rear-folded step to assist access to the top of the vehicle. Standard markings for 4th Company 1st platoon and the engineer symbol **(Nafi Segal)**

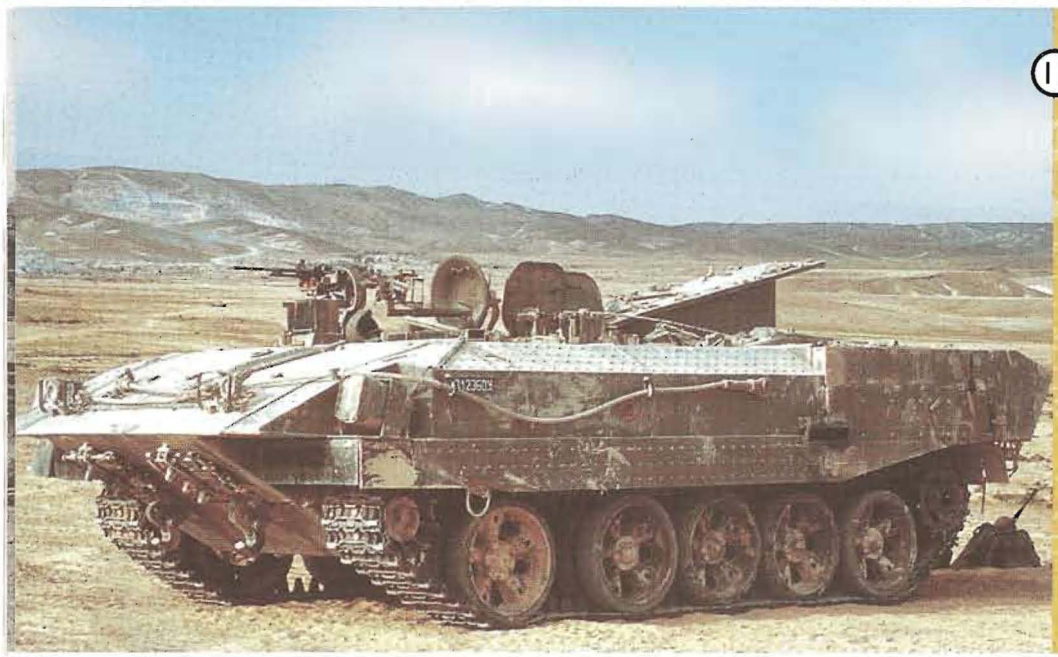
8 Paratroopers enter the **Nakpadon.** The side skirts are prominent in this view. Note the rear section of the side-skirts can be hinged upwards, protecting crew working on the engine deck.



9 Close up of the Nakpadon's side-skirts. The painted sky blue tactical marking around the fighting compartment's superstructure is repeated around the skirts.

10

Command variant of the **Achzarit** in the Golan. It is distinguishable from the standard vehicle by the lack of the Rafael OWS and the extra radio antennas **812259**.



11

A dusty **Achzarit** in the Negev. Note that the rear clamshell door is opened. The sides obviously collect less dust than the horizontal surfaces.

12

An **Achzarit** coming back from a day of training with its female instructors (front) and male infantry commander in the rear. The vehicle is painted in Sinai Grey plus a liberal coating of dust. Note the protected electrical conduit between the front lights and the centre of the glacis.