

AUTOCAR
INDIA

ROAD TEST
Number 235

Arjun Main Battle Tank

Price (ex-Avadi)

Rs 14.2 crore

Top speed 70 kph

0-50kph 14.75 sec

Litres per km 6.5

For Hydro-pneumatic suspension, 'Kanchan' armour, user-friendly systems

Against Unproven in battle, no air-con system

DESIGN & ENGINEERING

★★★★★★★

CONTEMPORARY BUT HEAVY DESIGN, WITH ALL THE BELLS AND WHISTLES

Every military machine, fighter aircraft, battle ship or tank, is basically a weapons platform, meant to move a means of destruction as quickly as possible to the enemy. An essential part of the Mobility, Firepower, Protection triad that governs MBT design, the chassis has to get it there at top speed, and also protect it. The Arjun's chassis or hull is made up of what is called Rolled Homogenous Armour or RHA. In addition, the world's leading MBTs use additional multi-layered armour that consists of a specially designed sandwich structure.

The Arjun's 'Kanchan' armour is close to the British 'Chobham' system, possibly the best in the world. Developed by the Defence Metallurgical Research Laboratory (DMRL) in Hyderabad, this material is said to consist of composite steel, special alloys and ceramic bonded together. The differing densities puts a penetrating projectile off course, and the shell loses energy. This armour has been tested in combat like situations, and has fared really well. Surprisingly, ride quality is vital to a tank too. Tanks now engage targets while on the move, and a good ride prevents the gun from oscillating.

The Defence Research and Development Organisation (DRDO) developed a hydro-pneumatic suspension system that uses compressed nitrogen as a springing agent, with hydraulic shock absorbers used to damp resonance. Currently only one other frontline MBT, France's LeCLerc, utilises the system effectively, but DRDO claims to have mastered the system, giving the Arjun a crucial edge, both in terms of platform stability as well as crew comfort. The progressive suspension is soft earlier in its travel and hardens when pushed. Plus, each wheel is an individual unit, meaning the tank can sustain a hit, lose a couple of wheels and still limp home.

The Arjun Main Battle Tank costs Rs 14 crore, but you can't have it even if you have the money; it's on sale to only one demanding customer, the Indian Army. You can't get it insured, even a 'heavy' licence won't get you behind the wheel and decent service, we assure you, will be impossible.

So why are we doing a story on the Arjun MBT? Our mostly homegrown Main Battle Tank, which will soon be entrusted with keeping the wolves from our door, is a phenomenal machine.

Spec-to-spec, a match for anything currently made around the world, the Arjun is a frontline MBT built to be the ultimate predator and tank-killer. What you are about to get is an exclusive peek at the awesome power and systems that come together to turn this beast into one of the most destructive machines in the world.

The Main Battle Tank is the premier land-based weapon system, which can make or break the success of a military campaign. It has been so since the early days of the Second World War, when German Panzer divisions ran rings around every other force in continental Europe. And so to kill the tank, was born the tank-killer. Twice as heavy, twice as well protected with twice the firepower, these were the machines that dictated the balance of power. And it is these tanks that have become the main battle tanks of today.



ARJUN

Extraordinary by any stretch of that grabbed our attention by the



MAIN BATTLE TANK

Imagination, the Indian-made Arjun Main Battle Tank is a machine of scruff and had us wishing we were behind the wheel. And they agreed!



The turret 'floats up' when in stabilised mode; the 120mm gun can slew through 90 degrees in just two seconds and fire on the run.

ENGINE, GEARBOX & PERFORMANCE



**AWESOME V10 POWER
PACK EXPENSIVE,
EASY ON SERVICE TOO**

With a combined weight of 58.5 tonnes, the Arjun needs some serious muscle to help it get going. The initial plan was to develop a low cost, indigenous 1500bhp air-cooled motor, but the project was shelved as it would have taken too long to develop the engine fully.

The new power-pack, as the engine, transmission and differential are called, may not be Indian, and may be horrendously expensive at Rs 3.8 crore a pop (without duty) but the Indian Army loves it. It is made by

famous heavy-engine maker MTU of Germany, who also supply the powertrain for Germany's Leopard 2, the French LeClerc and the export version of the M1 Abrams. MTU, incidentally, was founded by Karl Maybach of uber-limo fame. The colossal 40-litre V10 that sits behind the turret sends out a brutish 1400bhp via a four-speed semi-automatic transmission, and it even has a torque converter. A seriously large piece of kit, this 39,700cc monster is about the size and height of the average dining table. Two watermelon-sized turbos garnish it on each side, with massive suitcase-sized intercoolers and air filters packed along the flanks. Torque is 445.6kgm (an Ikon makes 13!), huge in isolation, but only sufficient when you see how much weight that torque has to shift.

Importantly, the powertrain is easy to service: the entire 5.2-

tonne unit can be lifted out of the rear and replaced by another one in the field in 45 minutes. Tanks also need to wade and snorkel, and the Arjun is no slouch in this area. It can 'shallow ford' up to a height of 4.5 feet without preparation, and can duck under rivers not more than seven feet deep after the tank has been sealed, the big diesel breathing through the commander's hatch.

ON THE ROAD



**THE MERC S-CLASS OF
TANKS, IT EVEN HAS
DECENT PERFORMANCE**

Imposing is an extremely mild word for the Arjun. Almost four metres wide, with a hull that's shoulder high, the Arjun dwarfs even everyday trucks – it's almost 10 metres long. It's a colos-

sal mass of hard, unyielding steel that feels as solid as the side of a mountain – you wouldn't even make a micro-dent in its side with a sledgehammer. The Arjun is so high, you need to unhook a foot-peg to get a leg up to the top of the hull, before you climb down to the driver's seat through what is basically a manhole. The enormity of the task ahead only sinks in once you're seated, staring blankly at a tiny rectangular slit of light, your only field of view. It's like trying to steer a bungalow around, seated in a manhole. And this isn't even a big battlefield: we're just outside the tank garages, with other tanks, trees and buildings to steer clear of. Thankfully the controls are not the normal tank push/pull fare, with throttles for each of the tracks. The Arjun has a pretty



Arjun burns rubber at the CVRDE track at Avadi in Chennai; performance good for 67 Esteems; where's that infernal taxi – BOOOOM!





Gunner's night and day sights.



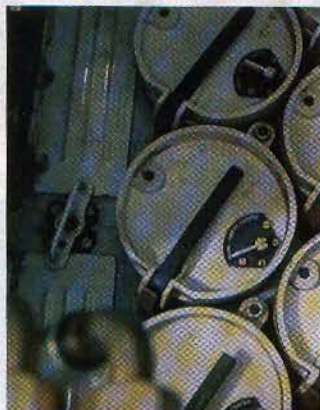
Squeezing into the driver's seat.



Autocar V-Box gets lost on turret; live shells stored inside the turret; ammo loader can shovel 6-8 rounds a minute into the breach.



Gunner's day-and-night sight and yoke; steering wheel, brake (centre) and accelerator pedal - easy



straightforward half steering wheel, accelerator and brake pedals. The big diesel comes alive with a shudder that rocks even this monster, and that's when the butterflies start. Someone has just told me that the Arjun costs Rs 14 crore, there are 1400 horses under my right foot and I don't think 58 tonnes will handle very well – without wheels that steer.

I select first on the fiddly-looking gearbox, get my right foot slowly off the brake and gingerly squeeze the accelerator. The entire mass of the tank lurches forward with a surprising amount of enthusiasm, as I struggle to get a perspective on the road ahead, even though I've lifted the seat up and am peering over the hull. With "Easy, this thing is big" on repeat mode in my head, I progressively push the throttle and select second. Lots of engine rpm and boom instantly get converted to lots of forward motion. The tank, now in semi-automatic mode, gallops forward

with a growl from the MTU unit. I will never again write, "Feels agile for its weight" in a road test again: the steering is a revelation. Turning the wheel makes the tank slow one track, while the other carries on at the normal speed. This instantly shifts tank bodily in the direction you steer, as if a giant hand has held the tank and pointed in the right direction. And it even darts the other way, as soon as you give it a quarter twist of the wheel. Also unbelievable for a vehicle this heavy is the braking: there's a pair of massive discs at the rear, but the majority of the braking is handled by a retarder that works with the torque converter to reverse power and torque. The scientists at CVRDE in Chennai were so confident of their mount, they even let us figure it with our V-Box. The zero to 40kph time of nine seconds is pretty impressive for something that weighs as much as approximately 67 Maruti Esteems... OK, you do the math.

But it was out on the range that the Arjun really impressed. It powered up hillocks with ease, languidly spanned massive trenches that would have swallowed two Safaris whole, and tackled broken ground with disdain. Even big dips or massive boulders didn't seem to affect the plush ride. A big Daimler-Benz engine as well as the magic carpet ride of an S-class – this was just too much. It even made light work of spinning around its own axis in pivot mode – with the massive rear differential spinning both tracks in opposite directions.

STANDARD EQUIPMENT

★★★★★★★★★
LASER-GUIDED FIRE CONTROL SYSTEM COULD BE VERY EFFECTIVE, BUT NO AIR CON

We didn't fire a shell but actually got behind the controls of the main weapon system, the

120mm gun, and the laser and infrared-aided Fire Control System, recently improved along with the hardware suppliers.

Sat on the gunner's stool, at the feet of the commander, the gunner can either use his day-sight or an infrared one at night. Before you engage a target, you have to place the turret into stabilised mode, in which it literally floats up like a hovercraft with a suspension of its own. This seems to work really well, and the tip of the gun remains absolutely still, however bumpy the terrain. The gunner uses an aircraft-like yoke, which elevates the gun and swings it around. Once a type of shell and target is selected, the gunner activates the laser and presses the fire button – as simple as that. The real hard work is done by the ballistic computers. They gather information on the distance to the target from the laser, take into account the wind velocity, air temperature, air pressure and type of ammu-

Performance and specifications

Engine

Type MTU Friedrichshafen – MB 838 Ka 501
Layout V10, 39,700cc, four-stroke, turbocharged, inter-cooled
Max power 1400bhp at 2400rpm
Max torque 446kgm at 1800rpm
Specific output 35.26bhp per litre
Power to weight 23.93bhp per tonne
Torque to weight 7.62kgm per tonne
Installation Rear, transverse, rear-wheel drive
Bore/stroke 170/175mm
Max. engine speed 2590rpm (full load)
Engine weight 5280kg

Ignition and fuel Indirect diesel injection

Gearbox
Type 4-speed, semi-auto with torque converter
Number of gears 4 forward, 2 reverse
Maximum speeds (kph)
Cross country 40kph
2nd reverse 30.16kph
1st reverse 14.63kph
4th 69.8kph
3rd 45.14kph
2nd 30.16kph
1st 14.63kph

Acceleration from rest (Surface dry)

Kph	Sec
Manual	
10	1.96
20	3.59
30	6.02
40	9.55
50	14.75

Steering
Type Double radii hydro-mechanical
Suspension

Type Hydrogas - pneumatic springs with hydraulic dampers

Track pitch 183.5mm

Braking system

Type Hydromatic retarder on automatic gearbox, supplementing

friction brakes (discs)

Armament

Gun 120mm rifled
Ammunition 39 rounds
Secondary armament
Co-axial machine gun 7.62mm
Anti-aircraft machine gun 12.7mm

Fire control system

Type Electro-hydraulic
Max slewing 45 degrees per second
Survivability

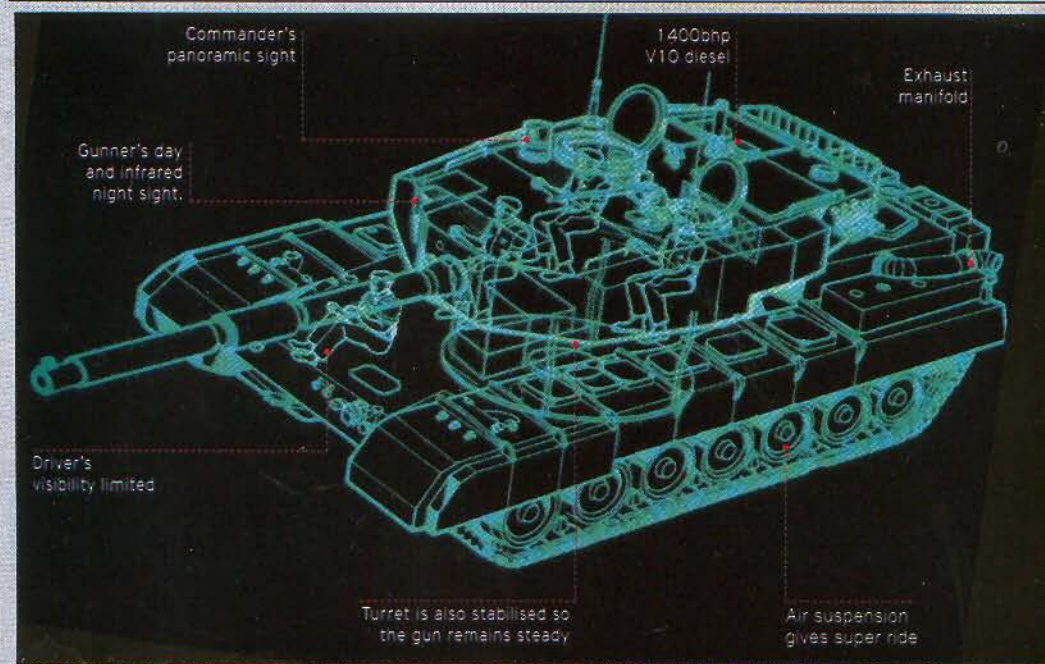
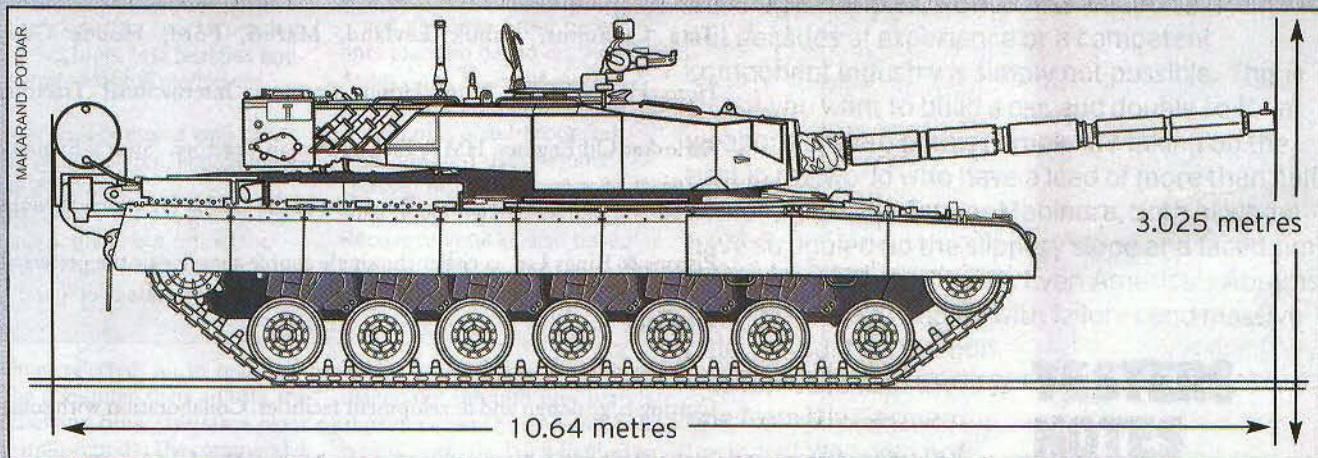
Armour protection Kanchan composite

SGDs 12 numbers (six on each side)

General

Crew Four - commander, driver, gunner, loader

Body Main battle tank **Overall height with gun mount** 3.025 metres **Width** 3.868 metres **Ground pressure** 0.84kgf/cm² **Combat weight** 58.5 tonnes
Obstacle crossing (vertical) 0.91 metres **Trench** 2.43 metres **Gradient** 35° **Ground Clearance** 450mm



Fuel consumption

ltr/km

20
15
10
5
0

6.5

Tank capacity: 2000 litres
 Maximum range: 307.69kilometres



The performance figures were taken at CVRDE Avadi, Chennai. AUTOCAR INDIA tests results are protected by world copyright and may not be reproduced without the editor's written permission

TALKING TO DR HANUMANNA, DIRECTOR, CVRDE



What was the biggest challenge you faced with Arjun? Undoubtedly system integration. Getting all the systems to work together, the optics, electronics, hydraulics, etc. Finetuning and optimising requires a lot of experience and expertise, apart from dedicated tools, test facilities and knowledgeable manpower.

The project took a long time to be completed, approximately 20 years? Actually we did it pretty quick, given our infrastructure, limits on testing and the changing requirements.

Also certain embargos after our nuclear test, like for the gunsight also delayed the program by a year or so. All this time spent also means that we have mastered certain areas like the hydro-pneumatic suspension, armaments, ammunitions, fire control computers and various electrical systems, optics and opto-electronic instruments which are totally indigenously.

What is the Arjun's future? It is going to be a numbers game. Once the dedicated assembly and integration setup is ready and quality tank flow is established, the Arjun will become the mainstay of the Indian Army. We also have other variants planned based on the Arjun. Tank EX is the Arjun turret on a T 72 chassis, and the Bhim is a self-propelled 155 gun that uses Arjun's chassis. Also a Bridge Layer Tank and a Armour Repair & Recovery Vehicle, also based on Arjun chassis, are planned.

...nition selected, all in real-time. The computer then adjusts the offset and fires. This takes place in milliseconds. The commander sitting above the gunner has his own 'panoramic sight', which rotates through 360 degrees. He can select another target while the 120mm gun is taking a shot, lock onto it and then 'hand it over' to the gunner with a press of a button — as the turret automatically aligns itself with the new target.

The Arjun's favourite weapon is the lethal fin-stabilised armour-piercing sabot, basically a very high energy dart that explodes out of the barrel at almost five times the speed of sound; it carries more energy than a 10-ton truck travelling at 120kph. Upon impact, this very high density tungsten projectile concentrates all its energy into the area of a one-rupee coin, and bores deep into its target with all that energy behind it. FSAPDS rounds like these have been known to penetrate more than 10

inches of steel and even bore diagonally through gun barrels at over a 2.5km range. The other type of shell, the High Explosive Squash Head, carries explosives of varying hardness for both soft and hard targets. An Anti-Tank missile has also been successfully fired from the barrel of the Arjun, with no changes needed. It is lethal beyond a range of four kilometres at night and six during the day, and can be aimed by another tank or soldier somewhere else on the battlefield.

FUEL ECONOMY

★★★★★★★★★
THIS GIANT HAS SOME SERIOUS THIRST BUT THEN IT WOULD

We couldn't test this, so we asked the engineers, who said happily, "6.7" Well, that sounded wonderful, better than an S-class in the city, until we realised they meant 6.7 litres per kilometre. Oh...hence the 2,000-litre fuel

THE AUTOCAR INDIA VERDICT



THE Arjun MBT project took 30 years to see fruition. Completed using expensive, foreign-made components, critics say the project could have been done faster and better. But this project, as originally conceived, was nothing short of an impossible dream. Building a complex, world-class weapon system without decades of experience or a competent component industry is simply not possible. This is true if you want to build a car, and doubly so for a weapons system of this complexity taking on the best in the world who have a lead of more than half a century. Just ask Tata or Mahindra, both of whom have struggled up the slippery slope and faced similar problems and criticism. Even America's Abrams tank was initially riddled with failures and massive delays. And then the gun was replaced with the one from the German Leopard! We could not verify the effectiveness the Arjun as a weapons platform, we cannot tell you how effective the gun or armour are, but if what is claimed is true, then it's been worth the effort. The Arjun may not be the tank Indian planners had hoped for, but what it is, however, is a stepping stone, possibly a very effective one. Could India buy the American M1A2 Abrams or the German Leopard II? No — these are almost twice as expensive and not for sale, especially not to India. This then, may be the next best thing. Plus, of course, it's the most blood-curdling, most powerful and simply massive vehicle we have ever driven. Here's looking at you Pervez — through crosshairs.

TESTERS NOTES

- Finding a parking spot is sometimes difficult, but you'll never get towed.
- We wanted an aircon, one was developed but the Army said no.
- Cupholders missing, but several shellholders make up for this.

Thoroughly modern main battle tank that, with some TLC, could be a world beater ★★★★★★

8/10